Ethnogynecological study of traditional therapeutic plants used by the indigenous communities: A case study from District Gujrat Punjab, Pakistan

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Research

Abstract

Background: The present study aimed to evaluate the indigenous knowledge and use of medicinal plant species to treat different gynecological diseases by local people. Indigenous people use medicinal plants to treat various gynecological disorders.

Methods: Ethnomedicinal data was collected from 110 randomly selected local informants through semi-structured questionnaires as well as face-to-face interviews. These data was quantitatively analyzed using various ethnobotanical indices such as family importance value, relative frequency of citation, use value (UV), fidelity level (FL), informant consensus factor (ICF), Jaccard index (JI), and ANOVA.

Results: A total of 59 plant species belonging to 24 families were recorded which were used to treat various 40 gynecological disorders. The informants documented the maximum number of plants used for irregular menstruation (15 spp.), followed by leucorrhea (11 spp.), gonorrhea (7 spp.), and abortion (5 spp.). The dominant family was Apiaceae (5 species). The dominant growth form was herbs (57.63%), while the common plant part used in remedies preparation was leaves (26%). Most people use medicinal plants in the form of extract (25 %), followed by decoction (17 %). The plant species with maximum use value was recorded for *Ricinus communis* (0.97), followed by *Mentha viridis* (0.96), while the highest RFC value was reported for *Cuminum cyminum* (0.69). The maximum ICF value was reported for vomiting, emmenagogue, and sexual issues (0.99%).

Conclusion: This is the first-ever quantitative study focusing mainly on ethnoecological uses of medicinal plants from the district Gujrat, which emphasize the significance of traditional herbal plant remedies used for primary health care needs. The results of this study would serve as a baseline for advanced pharmacological and phytochemical screening pertaining to gynecological disorder.

Keywords: Medicinal plants, gynecological disorders, Traditional knowledge, fidelity level; Gujrat, Pakistan

Background

Medicinal herbs play a significant role in basic healthcare due to their lower cost, fewer side effects, and lower toxicity than current allopathic medications (Rehman *et al.* 2023). About 80% of the local people of rural areas of Pakistan are still dependent on therapeutic plants. (Sadeghi & Mahmood 2014: Khan *et al.* 2021). Traditional medicines are an excellent alternative for primary healthcare in developing nations due to the lack of basic health facilities (Hu *et al.* 2020). The indigenous communities have been preparing medicine from the available therapeutic plants, which are widely used to treat women's diseases. Indigenous people depend on medicinal plants because of their effectiveness, lack of basic health facilities, and ethnic preferences (Khattak *et al.* 2012). The traditional knowledge of indigenous plant species plays an important role in the discoveries of many vital modern drugs. Almost 25% of herbal drugs in modern medicines are obtained from plants (Tufail *et al.* 2020). The ethnomedicinal surveys of indigenous plants play an important role in the discoveries of new herbal drugs (Ahmad *et al.* 2017). Ethnomedicinal research is crucial in the use of medicinal plants in the development of herbal medicine(Mahmood *et al.* 2013).

Ethnogynecology is a newly developed field that deals with the use of medicinal plants to heal gynecological disorders. Ethnogynecology is a traditional way of addressing health problems for women. Medicinal plants used to cure gynecological disorders such as menstruation, abortion, menopause, leucorrhea, glandular abortion, and infertility problems have been reported in some areas of this region's ethnic groups (Patel & Patel 2012). It has been stated that 18 % of the global burden of sexual and other reproductive health problems (Kaingu *et al.* 2011). One of the leading causes of death inwomen giving birth is postpartum hemorrhage, which accounts for 25% of all deaths. This condition is characterized by excessive blood loss within the first 24 hours following childbirth (Tunçalp *et al.* 2013; Bain & Premi 2019). Today surgery, non-steroidal analgesics, and allopathic anti-inflammatory drugs are the most frequently used treatments for gynecological problems. These treatments are effective but frequently come with unwanted side effects, such as hysterectomy-related sexual issues, digestion issues, skin rashes, and, more seriously, drug-related kidney, liver, and heart issues, especially when medications are taken for a long period. (Jan *et al.* 2020).

Menstrual disorders are usually not seen by global health organizations as important health concerns. These conditions demand effective, safe medicines because they can disturb the regular work of women. Women in several locations around the world (Latin America, Africa, and Asia) prefer traditional medicine because of the poor availability of analgesics and sanitation (VanAndel *et al*. 2014). Pakistanis' rural women often face gynecological disorders, even throughout the pregnancy, because of poor living conditions, starvation, and intense physical labor. In the country, there are 6, 000 flowering plants, 600 of which are used for medical purposes (Jima & Megersa 2018). "Midwives, " a native female health practitioner, has exceptional traditional skills in dealing with women's difficulties. To heal ailments, the "Midwives"rely heavily on medicinal plants and plant-derived treatments (Tareen *et al.* 2010).

There are very limited reports on ethnogynaecology (Sahu 2011); while many reports on ethnomedicinal and ethnobotanical knowledge are available across the world (Qureshi *et al.* 2009; Sadeghi & Mahmood 2014). Some ethnomedicinal studies have been carried out to study the role of herbal treatment in women's health and reproductive health ailments (Dhingra *et al.* 2009; Sadeghi & Mahmood 2014). Similarly, little literature is available about therapeutic plants used by rural women for curing gynecological disorders. There is very little work carried out in Pakistan and the whole world (Siddique and Alam 1998; Rahman 2014;Tripathi et al. 2010; Sarkhel 2014; Dash and Satapathy 2016; Jan et al. 2020; Jan et al. 2022; Malik et al. 2021; Rehman et al. 2022a). Furthermore, due to modernization and the lack of interest of the younger generation in traditional knowledge, which is declining rapidly, ethnoecological knowledge may vanish if not properly recorded (Khan & Ahmad 2015). Therefore, if not appropriately documented, ethno gynecological knowledge may be diminished (Aziz *et al.* 2018; Rehman *et al.* 2022a). The objectives of this research are (i) To record ethno medicinal data on traditional herbal remedies used for the treatment of gynecological diseases in the District, of Gujrat. (ii) To quantify qualitative and quantitative characteristics of the medicinal plants to treat women's diseases from the study area by using various indices.

Material and Methods

Study area

The District Gujrat is located between 32 ° 34' /N 74° 005 '/ E. Gujrat is an old Pakistani city situated between the Jhelum and the Chenab rivers, two renowned rivers. It borders on Jammu and Kashmir to the north-east; the Jhelum River to the north-west; the Chenab River to the east and southeast and separates it from the districts of Gujranwala and Sialkot; and the district of Mandi Bahauddin to the west. The average temperature is 23.6 ◦C. Jun and July are the warmest months, while December and January are the coldest months. Gujrat has three tehsils: Sarai Alamgir, Gujrat, and Kharian (Fig.1). The district is covering

a total area of 864225 acres. The total agricultural area is 572911 acres, with 378503 acres being irrigated and 194408 acres being rainfed. A total of 5173 acres are covered with forest. The average rainfall is 880 mm (Majeed *et al.* 2023).

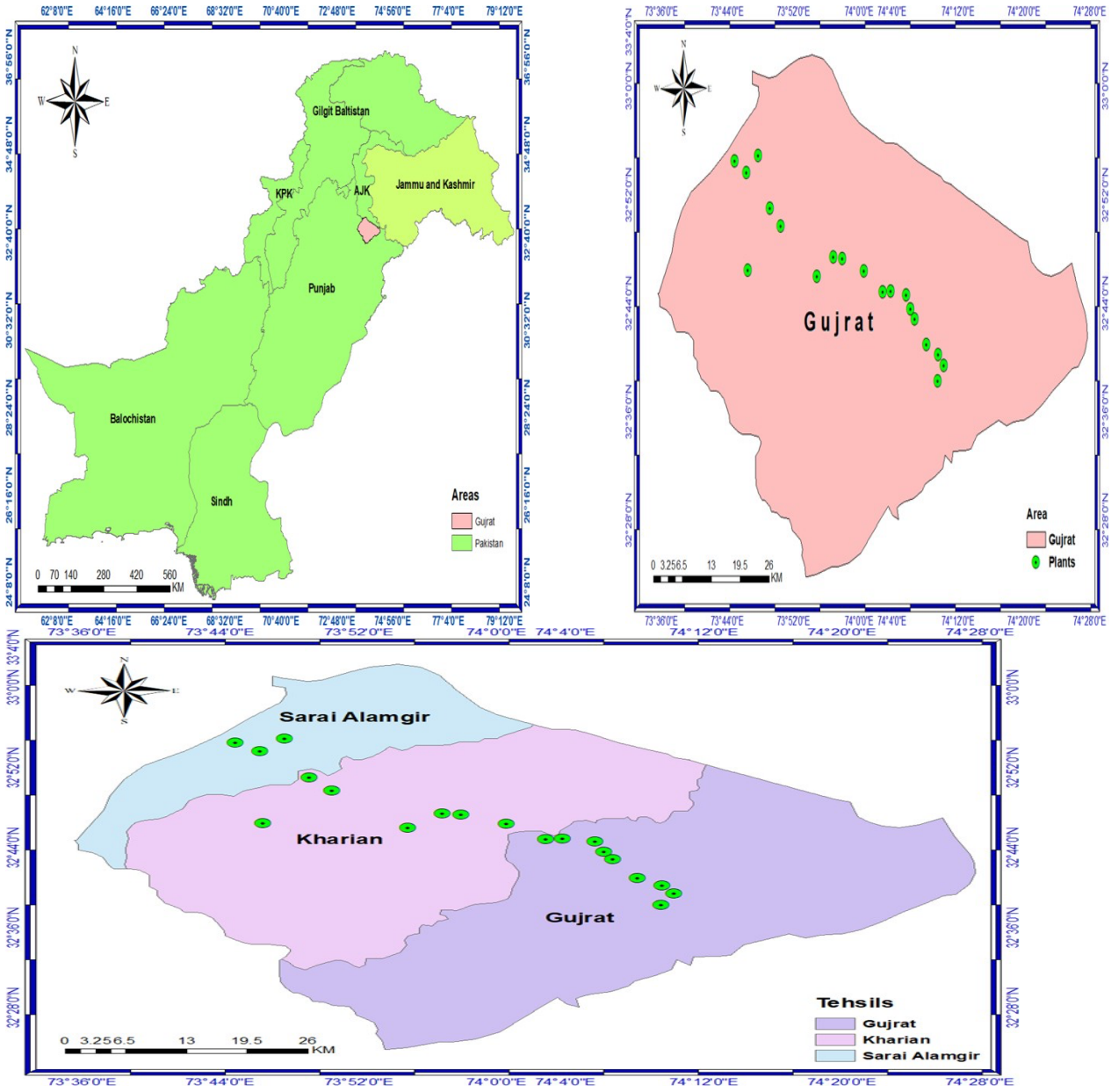

Figure 1 Map of the study area

Data Collection

The research work was conducted from September 2021 to May 2022. Field interviews were conducted with local inhabitants particularly women and herbal practitioners locally called Hakeem's, through semi-structured questionnaires as well as face-to-face interviews. The respondents were selected randomly. The questionnaires documented the information about demographic information (age, gender, education, and occupation) and local names, parts used, mode o preparation, route of administration and diseases treated demographic features of the informants, local names of plants, parts used, availability, route of administration of plants and diseases treated.

Identification and preservation of plants

The collected plant specimens were identified by Professor Dr. Rahmatullah Qureshi and confirmed with the flora of Pakistan (Nasir & Ali 1970-1989; Ali & Nasir 1989-1991; Ali & Qaiser 1993-2022). The collected plant specimens were pressed, dried, poisoned, and mounted on herbarium sheets according to herbarium techniques (Rehman *et al.* 2022a). The specimen was kept in the herbarium of PMAS – Arid Agriculture University Rawalpindi for future reference.

Quantitative data analysis

ANOVA was used to examine the informant's socio-demographic data. Independent and one-way samples' P-values of 0.05 or less in the T-test were regarded as significant. Different quantitative ethnobotanical indices, including frequency of citation, relative frequency of citation, fidelity level, informant consensus factor, use value, and Jaccard index were used to analyze the data.

Relative frequency of citation (RFC)

To evaluate the most popular used plant species and to identify the degree of traditional knowledge about the use of medicinal plants in the study, the citation frequency (FC) is employed.

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

This index is created by dividing the quantity of respondents in the survey by the total number of informants (Vitalini et al. 2013).

Use value (UV)

UV is used to figure out how many informants tell us about the specific plant species used to treat different ailments (Bahadur et al. 2020).

$$UV = u/n$$

Where u is the number of participants who indicate various plant uses, while n is the number of informants. The UV ranges from 0- 1.

Fidelity level (FL)

For the treatment of various ailments, the FL displays a preference for one plant species over others. The formula is used to calculate FL:

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

Where NP is the number of informants that have defined specific disease medicinal species and N is the sum of informants who employ plant species to cure particular ailments (Kayani et al. 2014).

Informant consensus factor

The consent of the informant was examined to ensure that respondents agreed on the use of plants to cure different groups of ailments. To calculate the ICF vale, the following formula was used (Heinrich et al. 1998):

$$ICF= Nur - Nt /Nur – 1$$

Nur = usage-reporting for selected diseases group, Nt = species employed for the treatment of different diseases within that group. ICF values vary from 0 to 1, where the value (close to 1) indicates that the selection of plant species is made by means of well-defined criteria or information (Kayani et al. 2014).

Jaccard index (JI)

The Jaccard index (JI) is evaluated in comparison with previously published Allied, Regional, and Global Research Studies by applying the following method, determining the percentage of the plant species referenced and their medicinal use.

$$JI = c \times 100/a + b - c$$

Where "a" is the number of A region plants, "b" is the number of B region plants and "c" is the number of A and B common plants. "b" (González-Tejero et al. 2008).

Analysis of variance (Anova test)

To analyze the informant's socio-demographic data ANOVA One-way and independent samples T-test, P-values of 0.05 or less were considered significant. This test was performed through SPSS software (Chaachouay et al. 2019).

Result and Discussion

Demographic feature of informants

A total of 110 informants were interviewed, out of which 17(15.45%) were men and 93 (84.55%) women (midwives). Although the test (independent T-test) did show a significant difference (P=0.02) between male and female informants on the number of medicinal plant species they listed and associated uses reported, women have more knowledge about the treatment of medicinal plants against gynecological diseases than men. Our result agreed with (Rafique *et al.* 2021 Birjees *et al*. 2022). Participants were 47 herbalists, followed by 37 professionals, and 26 housewives (Table 1). There was a significant difference (P=0.03) between the traditional healer and indigenous people which shows that the traditional healer contains more information about medicinal plants for the treatment of gynecological disease through ages (Nelly *et al.* 2008). The highly educated class (37.27 %) was found to have a higher prevalence of indigenous knowledge, followed by the illiterate population (15.45%), secondary level and undergraduate level (13.64% each), middle level (10.91%) and primary level (9.09%). The relationship between educational level and native knowledge was thus significantly different (P=0.000). As a result, we can see that as the level of study grows, the use of medicinal herbs diminishes (Birjees *et al.* 2022).

The data on age reveals that the use of plant-based therapies in the treatment of gynecological problems was more common in the elderly (58.18 %) and was decreasing in the younger generation. The difference in indigenous knowledge between age groups was significant (P=0.000). Because they have most of the ancestral knowledge that is part of the oral tradition, the oldest respondents provide more accurate information. As a result, there is a loss of knowledge about medicinal plants, which can be justified by the mistrust of certain young people, who, due to the effect of modernization and exotic culture, are reluctant to believe in herbal medicine. Traditional medicinal knowledge that has been passed down from generation to generation is currently in danger, astransmission between older and younger generations is not always maintained (Lahsissene *et al.* 2009; Bauzid *et al.* 2017; Yaseen *et al.* 2015).

Table 1. Demographic information

Variable	Categories	Number of informants N= 110	Percentages (%)	P-Value
Gender	Male	17	15.45	0.02
	Female (midwives)	93	84.55	
Informants category	Herbalist	47	42.73	0.03
	Professionals	37	33.64	
	Housewives	26	23.64	
Age groups	25-35	6	5.45	0.000
	36-45	12	10.91	
	46-55	28	25.45	
	>56	64	58.18	
Educational level	Illiterate	17	15.45	0.000
	Primary level	10	9.09	
	Middle level	12	10.91	
	Secondary level	15	13.64	
	Undergraduate level	15	13.64	
	Graduate level	41	37.27	

Diversity of medicinal flora

A total of 59 medicinal plant species belonging to 34 families were recorded which were commonly utilized to treat various 40 gynecological disorders in District Gujarat's local communities (Table 2). The dominant family was Apiaceae (5 species), followed by Asteraceae and Fabaceae (4 species each), Malvaceae, Brassicaceae, Solanaceae, Moraceae (3 species each), Chenopodiaceae, Myrtaceae, Euphorbiaceae, Lamiaceae, Poaceae (2 species each) (Table 2). Our result agreed with the previously published literature (Ahmad *et al.* 2014; Ajaib *et al.* 2014; Parvaiz 2014; Wariss *et al.* 2014; Umair *et al.* 2019; Tufail *et al.* 2020). In the current study, the dominant growth form was herbs (58 %), followed by trees (30%) and shrubs (12%). This result is similar to the previously published literature (Ibrar *et al*. 2015; Maqsood *et al.* 2022; Rehman *et al.* 2022a).Herbs often have a high amount of bio-active compounds (Lulekal *et al.* 2013), are easily available and have ample growth in wild conditions. Similar to other studies carried out by (Uniyal *et al.* 2013), easy availability of herbaceous plants or medicinal plants, valuable curing action, and low cost of the medical care system are the main factors for the preference and advancement of herbal medicine in the economically backward pastoral communities (Konno 2004) (Figure 1).

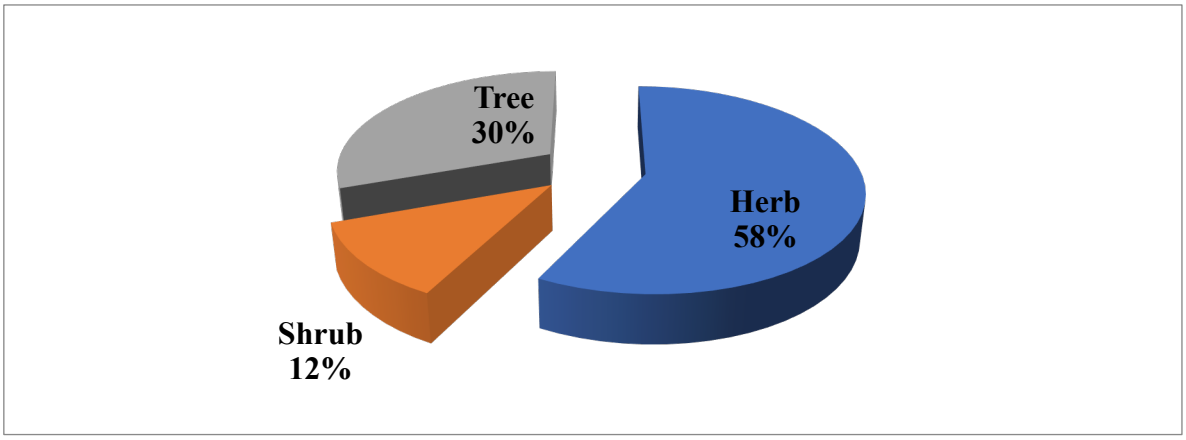

Figure 2. Growth forms used for the treatment of gynecological diseases

Table 2. List of traditional medicinal plant with botanical name, common name, family name, growth form, and part used recipe, gynecological diseases, RFC, UV, and FL value.

Family	Botanical name/ Voucher No	Vernacular name	Recipes	Growth Form	Part used	Ethnogynecological uses	Comparative study	FC	RFC	UV	FL
Alliaceae	*Allium cepa* L. SK-75	Piaz	Extract	Herb	Bulb, Seed.	Slim the abdomen, Aphrodisiac, menstrual pain	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	55	0.50	0.82	100.00
	Allium sativum L. SK-77	Tom, uzha	Decoction	Herb	Bulb	After delivery, blood cleansing (to promote the expulsion of "dead blood" and lochia)constipation aftergiving birth	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	61	0.55	0.93	98.36
Amaranthaceae	*Achyranthes aspera* L. SK-76	Kurshaka, putkanda, Geshkay	Juice	Shrub	Whole plant	Gonorrhea, painful delivery	10, 20, 30, 40, 50, 60, 70, 80, 90,100, 110, 120, 120, 130, 140, 150, 160, 170, 180	22	0.20	0.77	90.91
	Amaranthus viridus L. SK-65	Jungli phulai	Cooked	Herb	Leaves	Leucorrhea	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	32	0.29	0.75	90.63
Anacardiaceae	*Mangifera indica* L. SK-67	Anbe	Juice	Tree	Fruit	Aphrodisiac	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	37	0.34	0.95	83.78
Apiaceae	*Coriandrum sativum* L. SK-71	Geshnizh	Cooked	Herb	Fruit	Diuretic, gestational edema	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	27	0.25	0.85	100.00
Apiaceae	*Cuminum cyminum* L. SK-73	Spin zira	Dried	Herb	Seeds	Postpartum pain, gastric	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	76	0.69	0.86	100.00

	Daucus carota L. SK-93	Ghasoon, gajar, Gazara	Extract	Herb	Seed	smooth delivery, abnormal stoppageof menses	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	34	0.31	0.88	91.18
	Foeniculum vulgare Mill. SK-79	Khawazha walani, Kagilani, Raz, Kagu	Dried	Herb	Seeds, Leaves, fruit	Postpartum pain, galactagogue, menses pain, vomiting, regulatethe menses, lactiferous, Menstruation additive, menopause hotflashes,	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	71	0.65	0.94	100.00
	Trachyspermum ammi L. SK-80	Sparakai, Ajwain, Sperkay	Decoction	Herb	Seeds	After birth, promoting the expulsion of "deadblood" and lochia, irregular postpartum discomfort, and gastric reflux	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	76	0.69	0.74	98.68
Apocynaceae	*Nerium indicum* Mill. SK-82	Khar-zahreh	Dried	Shrub	Leaves, flower	Abortion	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	23	0.21	0.91	86.96
Asclepiadaceae	*Calotropis*170, 180*procera* (Aiton) Dryand SK-91	Tirkha pan/ Pulhar pan, Ak, Spalmay	Extract	Shrub	Whole plant	Abortifacient that promotes the expulsion of "deadblood" and lochiaafter delivery. Menstrual cramps, uterine complications, andLeucorrhea	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	23	0.21	0.61	86.96
Asteraceae	*Eclipta*170, 180*alba* (L.) Hassk SK-93	Sofed banghra, Skha Botay	Extract	Herb	Whole plant	Miscarriage	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	29	0.26	0.76	86.21

	Calendula officinalis L. SK-92	Hamishe bahar	Powder	Herb	Flower	Irregular menstrual	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	12	0.11	0.67	91.67
	Conyza canadensis L. SK-66	Paleet	Infusion	Herb	Whole plant	Painful menstruation	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	11	0.10	0.64	72.73
	Tagetes erecta L. SK-69	Satveerga, Gainda, Nacha Gulay	Oil	Herb	Leave, Roots	Muscular pain & swelling of body, Irregular menstruation	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	31	0.28	0.77	80.65
Bombacaceae	*Bombax ceiba* L. SK-68	Simbal	Decoction	Tree	Roots, gum, flow er	Leucorrhea , amenorrhea	10, 20, 30, 40, 0, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	11	0.10	0.82	81.82
Brassicaceae	*Brassica rapa* L. SK-72	Sheljem	Extract	Herb	Leaves	Cure gynological disorders andhepatitis A, B and C.	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	33	0.30	0.85	90.91
	Brassica campestris L. SK-74	Sarson	Oil	Herb	Leaves, Seeds	Mastitis	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	67	0.61	0.87	100.00
	Capsella bursa-pastoris (L.) Medik SK-78	Kiseh keshish, Bambesa	Decoction	Herb	Whole plant	Irregular menstrual, sedative	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	34	0.31	0.91	88.24
	Cannabissativa L. SK-81	Banga	Oil	Herb	Leaves and bark	Gonorrhea, pregnancy	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	15	0.14	0.87	100.00

Cannabaceae	*Chenopodium ambrosioides* L. SK-84	Arunpale	Infusion	Herb	Leaves	Delivery pain	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150160, 170, 180	23	0.21	0.83	91.30
Chenopodiaceae	*Chrysenthemum parthenium* (L.) Schultz-Bip SK-83	Gul-e-daudi	Tea	Herb	Flowers	Help to cureAbnormal menses	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	41	0.37	0.83	97.56
	Convolvulusarvensis L. SK-85	Perwatai, Pryvatay	Extract	Herb	Whole plant	Sexual debility, menses	10, 20, 30, 40,50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	21	0.19	0.90	95.24
Convolvulaceae	*Momordica charantia* L. SK-88	Karella	Extract	Herb	Roots	Abortion	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	60	0.55	0.92	91.67
Cucurbitaceae	*Thuja orientalis* L. SK-86	Cheelai	Extract	Tree	Leaves	Used in excessive menstrual cycle.	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	23	0.21	0.57	91.30
Cupressaceae	*Cyperus rotundus* L. SK-87	Delloca	Roasted	Herb	Whole plant	Menses	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	19	0.17	0.68	89.47
Cyperaceae	*Euphorbia parviflora* L. SK-89	GandaBotay	Powder	Herb	Leaves	Leucorrhea	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	31	0.28	0.84	80.65
Euphorbiaceae	*Ricinus communis* L. SK-94	Arand, Jalabotu kham, harnoli	Oil	Shrub	Fruit, Seeds, roots	Stop the menses, leucorrhea, constipation, Period pain, contraceptive, easy delivery, abortion	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 018	70	0.64	0.97	92.86

	Acacia nilotica L. SK-96	Kikar Tree	Powder	Tree	Leaves, bark, pod	Gynae, gonorrhea, leucorrhea, female impotency	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	41	0.37	0.76	100.00
Fabaceae	*Bauhinia variegata* L. SK-95	Kachnar	Extract	Tree	Flo wers	Enhance lactation	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	22	0.20	0.77	86.36
	Cassia fistula L. SK-97	Granjawanr/ pools	Cooked	Tree	Fruit	Easy delivery,	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	41	0.37	0.93	95.12
	Mentha viridis L. SK-99	Podina	Decoction	Herb	Leaves	Menses	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	71	0.65	0.96	100.00
Lamiaceae	*Ocimum basilicum* L. SK-98	Neazboo/naezboi	Extract	Herb	Seeds	After arrival, Encouraging the expulsion of "dead blood" and lochia	10, 20, 30, 40, 50, 60, 70, 8090, 100, 110, 120, 130, 140, 150, 160, 170, 180	45	0.41	0.91	88.89
	Abelmoschus esculentus L. SK-90	Bhindi	Cooked	Herb	Fruits	Gonorrhea	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	33	0.30	0.79	93.94
Malvaceae	*Abutilon indicum* L. SK-100	Peeli booti	Extract	Shrub	Whole plant	Gonorrhea, Leucorrhea, gynae, abortion	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	44	0.40	0.80	90.91
	Hibiscus rosa-sinensis L. SK-111	Shoe flower	Extract	Shrub	Flower	Cure white discharge, treat irregular periods	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	34	0.31	0.88	94.18

	Azadirachta indica L. SK-101	Neem, nim	Decoction	Tree	Leaves, seeds	Control irregular periods, stopexcessive menstrual bleeding, emmenagogue	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	57	0.52	0.89	100.00
Meliaceae	*Melia azadirachta* L. SK-103	Bakana, dhariak	Extract	Tree	Bark , fruit s gum, roots	Gonorrhea, leucorrhea, emmenagogue	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	68	0.62	0.81	100.00
	Prosopis cineraria (L.) Druce SK-102	Jandi or Jand or kunda	Crushed	Tree	Leaves, bark, flow ers and pods	Heal cuts, use forbirth control, bloodor protein loss, and painful menstruation	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	32	0.29	0.69	100.00
Fabaceae	*Ficus carica* L. SK-104	Anzar	Dried	Tree	Fruit	Sexual weakness, leucorrhea	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130140, 150, 1 60, 170, 180	58	0.53	0.78	100.00
Moraceae	*Ficus religiosa* L. SK-105	Peepal	Leaf extract	Tree	barkand fruit	Cure white discharge	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	51	0.46	0.90	98.04
	Ficus benghalensis L. SK-107	Bargad, Burr	Powder	Tree	Latex	Sexual weakness	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	61	0.55	0.77	91.80
	Eucalyptusglobulus Labill. SK-106	Lachi	Oil	Tree	Leaves, stem	Menses	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	23	0.21	0.83	86.96
Myrtaceae	*Psidium guajava* L. SK-108	Amrud	Tea	Tree	Leaves, bark	Expulsions of placenta	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	33	0.30	0.82	90.91

	Oxalis corniculata L. SK-107	Khatimithiboti, Trokay	Juice	Herb	Leaves	Vomiting	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	36	0.33	0.92	83.33
Oxalidaceae	*Phyllanthus emblica* L. SK-109	Alam, Lashora	Powder	Tree	Seed, fruits	Aphrodisiac, leucorrhea, Vaginal cancer, ovarian infection	10, 20, 30, 40, 5060, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	69	0.63	0.80	81.16
Phyllanthaceae	*Piper nigrum* L. SK-112	Kaali Mirch	Powder	Tree	Fruit	Aphrodisiac	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	26	0.24	0.81	100.00
Piperaceae	*Saccharum munja* Roxb. SK-110	Munja	Decoction	Herb	Root	Birth control.	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	17	0.15	0.65	64.71
Poaceae	*Triticum aesativum* L. SK-115	Ghandum	Cooked	Herb	Seeds	To keep the bodywarm after birth, strengthen thebackbone, waist, and uterus.	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	11	0.10	0.82	90.91
	Punica granantum L. SK-113	Beechil (tomaw), Anar	Dried	Tree	Pericarp, flowers	Menses pain and back pain, leucorrhea	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150160, 170, 180	54	0.49	0.81	92.59
Punicaceae	*Rosa demascena* L. SK-114	Ghulab	Crushed	Shrub	Leaves	Uterine hemorrhage and menstrual bleeding	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 18	42	0.38	0.83	92.86
Rosaceae	*Citrus aurantium* L. SK-116	Nimbo	Juice	Tree	Fruit	Infection of the fetes	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	25	0.23	0.84	80.00

Rutaceae	*Datura stramonium* L. SK-118	Daturoo, Daltora	Juice	Herb	Leaves	Breast inflammation	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150160, 170, 180,	13	0.12	0.77	84.62
Solanaceae	*Solanum nigrum* L. SK-119	Mako, Kachmachu	Decoction	Herb	Leaves	Menorrhagia	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	21	0.19	0.62	100.00
	Solanum xanthocarpum Burm. f SK-117	Mokri	Decoction	Herb	Whole plant	Promote Conception in female	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	14	0.13	0.86	92.86
	Urtica dioica L. SK-122	Bichchuboti	Decoction	Herb	Fruit, seed, leaf	Fertility	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180	13	0.12	0.85	84.62
Urticaceae	*Zingiber officinale*Roscoe. SK-123	Adrak	Powder	Herb	Roots	Blood pressure, regulate menses, Wound Healer and Pain Killer after Pregnancy	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 12, 130, 140, 150, 160, 170, 180	16	0.15	0.88	93.75
Zingiberaceae	*Tribulus terrestris* L. SK-121	Bhukhra, Markundai	Extract	Herb	Leaves	Gonorrhea	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	68	0.62	0.79	100.00
Zygophyllaceae	*Tribulus terrestris* L. SK-121	Bhukhra, Markundai	Extract	Herb	Leaves	Gonorrhea	10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180,	68	0.62	0.79	100.00

(0)= Similar use to previous report: (●) = Dissimilar use to previous reports: (Δ) = Use not reported in previous report

1= (Khan *et al.* 2016), 2= (Amjad *et al.* 2020), 3= (Gunes *et al*. 2017), 4= (Cakilcioglu *et al*. 2011), 5= (Jadid *et al.* 2020), 6= (Idm'hand *et al*. 2020), 7= (Awan *et al.* 2021), 8= (Hu *et al.* 2020), 9= (Mahmoud *et al*. 2020), 10= (Bahadur *et al.* 2020, 11=(Aziz *et al.* 2018), 12= (Rahman *et al.* 2014) , 13= (Taïb *et al.* 2021), 14= (Panmei *et al.* 2019), 15= (Sukumaran *et al*. 2021), 16= (El-Mokasabi *et al*. 2018), 17= (Chaachouay *et al*. 2019), 18= (Akhter *et al.* 2016)

Plant parts used and preparation of remedies

Local communities rely on customary practices and traditional knowledge when using medicinal plants. Various plant parts are thought to be beneficial for various treatments. Nearly all plant parts are used as remedies for gynecological disorders in the local communities of the district. The most dominant usage form were leaves (26%), followed by fruits (15%), seeds (14%), flowers (11%), wholeplant (9%), roots (8%), Bark (7%), pods (3%), bulb and gum (2%), stem, latex and pericarp 1% (Figure 2). Our result is similar to the previously published research work (Umair *et al.* 2017; Majeed *et al.* 2020; Ajaib *et al*. 2021; Rehman *et al*. 2022a; Rehman *et al.* 2022b). The leaves collection and medicine preparation from leaves are so easy as compared to the other parts of the plant. For this reason, leaves are commonly used in herbal remedies (Telefo *et al.* 2011).The removal of leaves from the therapeutic plants can cause less injury as compared to the removal of other plant parts (Kadir *et al*. 2013).The high utilization of leaves in folk remedies preparation is also documented in other study areas (Akhtar *et al*. 2013; Hachi *et al.* 2015; Shah *et al.* 2016). Leaves show the highest percentage because the reason that is the primary photosynthetic organ that contains a high concentration of secondary metabolites, essential oils, and phytochemicals. These metabolites are effective in the treatment of a variety of diseases.

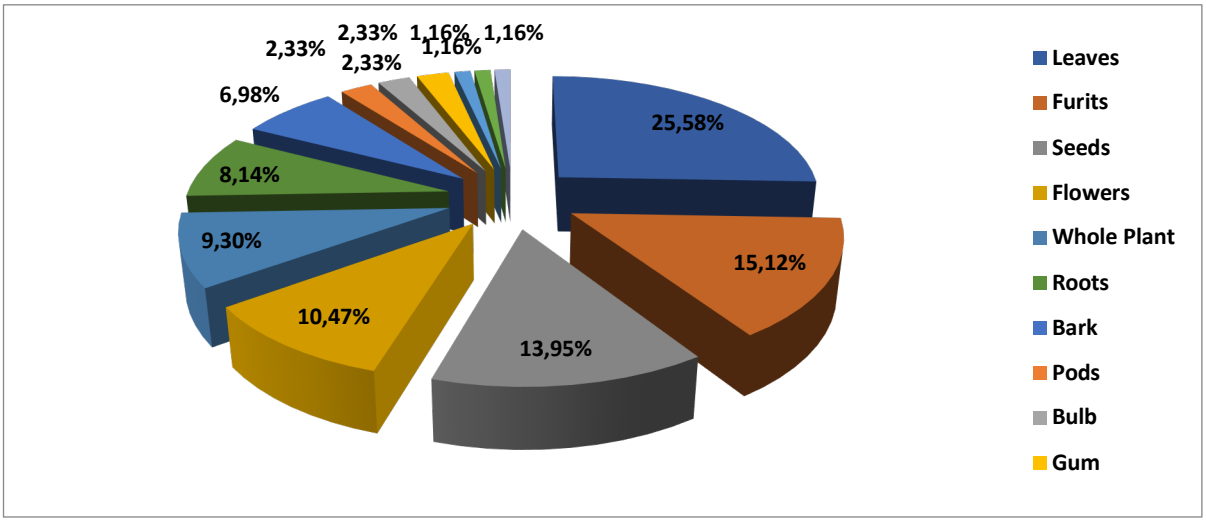

Figure 2. Plant part used in herbal medicine

The modes of application vary concerning the plant part used and the disease treated. A total of 11 modes of application were identified in the local communities. Most people use medicinal plants in the form of extract (25 %), followed by decoction (17 %), powder (12%), cooked, juice, oil (9 %), dried (8 %), tea, infusion, crushed (3 %) and roasted (2%) (Figure 3). It was reported in the literature that therapists mostly used medicinal plants in the form of decoction (Farooq *et al.* 2014; Maqsood *et al.* 2022). Similarly, decoction and powder were documented as the most commonly used methods for preparing herbal medications in previous literature (Gurdal and Kultur 2013; Bano *et al.* 2014)

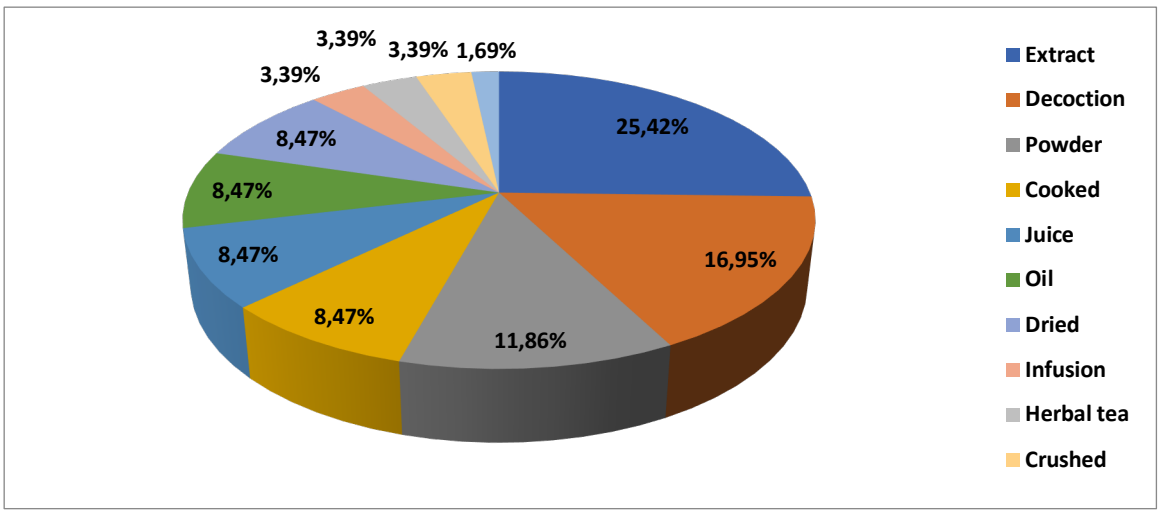

Figure 3. Mode of preparation of herbal recipes to treat gynecological diseases

Local plants used for the treatment of gynecological disorders

Local communities have a broad range of indigenous knowledge about traditional medication based on indigenous plants for primary health care system (Rekka *et al.* 2013). During this ethnogynecological study, 40 different gynecological diseases were reported, which were treated by using 59 therapeutic plants (Figure 4).The common gynecological disorders in the research area was irregular menstruation, which was treated by using 15 plant species, followed by leucorrhea (11 species), gonorrhea (7 species), abortion and menstrual pain (5 species each), aphrodisiac, easy delivery and lochia (4 species each), sexual weakness and postpartum pain (3 species each).

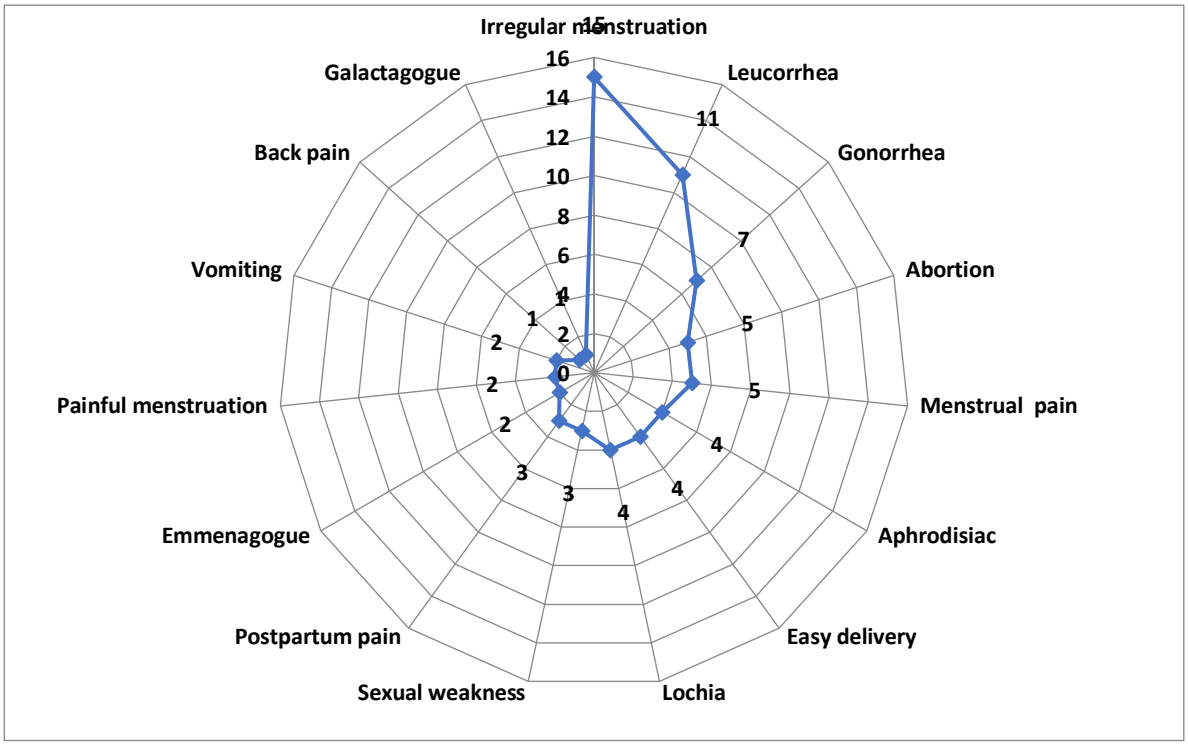

Figure 4. Gynecological disorders treated by using indigenous plants.

Use Value (UV)

In the current study UV values ranging from 0.57 to 0.97. The species having high use value were *Ricinus communis* (0.97), *Mentha viridis* (0.96), *Mangifera indica* (0.95), *Foeniculum vulgare* (0.94), *Allium sativum & Cassia fistula* (0.93), and *Momordica charantia* & *Oxalis corniculata* (0.92) (Table 2). Due to their widespread distribution and local herbalists' awareness of them, the reported plants have a high use value, making them the first choice and most suitable for treatment. However, the medicinal plant species with low UV were *Thuja orientalis* with 0.57 used values. According to Aziz *et al.* (2018), *Foeniculum vulgare* and *Cannabis sativa* both have a good use value for treating gynecological problems. Similarly, *Foeniculum vulgare* was listed by Bhatia *et al.* (2015) as one of the medicinal plants with a good use value for treating gynecological problems.

Relative frequency citation (RFC)

Relative frequency citation is a method for determining which plant species are most frequently used to treat particular human ailments. In the current study, the RFC value ranges from 0.10 to 0.69. The highest RFC value was recorded by *Cuminum cyminum* (0.69), while the lowest RFC values were recorded by *Tribulus terrestris, Conyza canadensis,* and *Bombax ceiba* (0.10) each (Table 2). Higher RFC usage values for ethnomedicinal plants suggest that most locals were familiar with these plant species. To determine the active components of plants with a high RFC value and extract those components for use in medication, those plants must be evaluated for phytochemical and pharmacological research *Taraxacum officinale* was named as the most widely used medicinal plant species by Tali *et al.* (2019) in their study on plants. Inhabitants of the study area are familiar with the use of *Foeniculum vulgare* for the treatment of dysmenorrhea, hot flashes associated with menopause, breastfeeding difficulties, and infertility.

Fidelity level (FL)

FL is used to determine which plants are the most popular with local informants for ethnobotanical purposes. The plants with (100%) FL values were *Acacia nilotica, Allium cepa, Azadirachta indica, Brassica campestris, Cannabis sativa, Coriandrum sativum, Cuminum cyminum, Ficus carica, Foeniculum vulgare, Melia azadirachta, Mentha viridis,* and *Piper nigrum*; while, *Conyza canadensis* had the lowest FL value (72.73%) (Table 2). The fidelity level is used to identify plant species that local people frequently use as remedies for a range of ailments. Contrary to earlier research, which was carried out in the Indian state of Jammu and Kashmir's Udhampur district found that*Trigonella foenum-graecum* had the highest fidelity level value for amenorrhea (Bhatia *et al.* 2015). Maximum FL value reveals the uniqueness and maximum use of a plant species for a specific ailment (Shil 2014)

Informant consensus factor (ICF)

ICF was used to identify medicinal plants used by residents of the district of Gujrat to cure a group of gynecological disorders (Table 3).The ICF value range from 0.94 to 0.99 (Table 3). The highest ICF value (0.99) was reported for sexual Problems, contraceptive, and emmenagogue. The maximum ICF value for these diseases shows that local people greatly prefer medicinal plants for curing these ailments. In other studies, the highest ICF value was reported for emmenagogue (Jan *et al.* 2020). The lowest ICF value (0.94) was reported for sedative. According to the findings, 59 herbs are utilized to treat 12 gynecological illnesses. Gonorrhea, leucorrhea, abortion, delivery trouble, aphrodisiac, menstrual pain, sexual problem, contraceptive, sedative, lochia, emmenagogue, and vomiting were among the gynecological illnesses. The outcome of the study supported by the earlier research conducted by (Balamurugan *et al.* 2018).

Table 3. ICF values of gynecological diseases

Use categories	Nur	Nt	Nur-Nt	Nur-1	ICF
Gonorrhea	234	7	227	233	0.97
Leucorrhea	501	11	490	500	0.98
Abortion	153	5	148	152	0.97
Delivery Problem	274	7	267	273	0.98
Aphrodisiac	187	4	183	186	0.98
Menstrual pain	391	11	380	390	0.97
Sexual Problem	140	3	137	139	0.99
Contraceptive	70	2	68	69	0.99
Sedative	34	3	31	33	0.94
Lochia	197	4	193	196	0.98
Emmenagogue	125	2	123	124	0.99
Vomiting	107	2	105	106	0.99

Jaccard Index (JI)

Ethnobotanists use Jaccarda Index (JI) for making a comparison of documented research species with the previously published literature from nearby areas (Khan *et al.* 2016). Regarding this, 18 earlier published studies were reviewed from adjoining to study area and other parts of Pakistan and international levels. Results of our study showed that the similarity percentage ranges from 0.00% to 23.33% while the dissimilarity percentage ranges from 0.00% to 23.80%. The value of Jaccard Index (JI) ranged from 1.13 to 16.12% (Table 4). The highest degree of JI was calculated for (Khan *et al.* 2016, Bahadur *et al.* 2020, Aziz *et al.* 2018) with JI values of 16.12%, 11.11%, 11% respectively. The reason for the high JI value is due to the same cultural and ecological norms. The lowest values of JI were calculated for the studies of [Chaachouay *et al.* 2019, Hu *et al.* 2020, Cakilcioglu *et al.* 2011] with JI values 1.13%, 2.79, 2.79] respectively. The reason for the low JI value is the difference in cultural values, ecological factors, and species diversity. It may be due to the great distance between the two study areas reducing the exchange of ethnomedicinal information among people.

By taking novelty into account, it was reported that about 18 plant species with ethnomedicinal relevance are reported for the first time from district Gujrat. District Gujrat has never before had reports of these species. These plant species include *Abelmoschus esculentus, Amaranthus viridis, Brassica rapa, Chrysenthemum parthenium, Conyza Canadensis, Cyperus rotendus, eucalyptusglobulus, Euphorbia parviflora, Mentha viridus, Nerium indicum, Piper nigrum, Prosopis cineria, Rosa demascena, Sachharum munja, Solanum xanthocarpum, Tagetes erecta, Thuja orientalis* and *Tribulus terrestris.*

Conclusion

This study focuses on rural women's health and healing. In pastoral areas, modern health facilities are not available or insufficient. Rural people (Traditional healers and Midwives) have traditional knowledge of herbal remedies for treating gynecological disorders. In the study area, 59 therapeutic plant species are used to treat various 40 different types of gynecological disorders. The present survey provides baseline information for future phytochemical, pharmacological, and clinical research in the field of gynecology. Therefore, it is necessary to focus on the recorded plant species to identify new bioactive compounds for the treatment of gynecological diseases. Furthermore, there is a need for awareness among the local community of the research area concerning the sustainable use of therapeutic 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).

Ethics approval and consent to participate: This study was authorized by the Department of Botany, PMAS-Arid agriculture University Rawalpindi, Pakistan. All participants provided oral prior informed consent.

Consent for publications: Not applicable.

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Conflicts of Interest: The authors declare that there are no conflicts of interest in this article.

Data Availability statement: 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.

Author's contribution: Salihah Khadim collects the field data, Khafsa Malik and Rahmatullah Qureshi supervised this work, Sabith Rehman and Misbah participated in data analysis and the final revision of the manuscript. All the authors approved the final manuscript after revision.

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Table 4. Comparison of present study with previous studies at neighboring, regional and global level

Previousstudy	Total documented species in previous studies	No. of plant species with similar use	No.ofplant species with dissimilaruse	No. of plant species commonin bothareas	No. of plant species found only in aligned area	Species only in study areas	% of plant with similar use	% of plants with dissimilar uses	JI	Citations
Sara-i- Alamgir	49	6	9	15	34	44	12.24	18.36	16.12	(Khan *et al.* 2016)
Hrighul, Azad Jammu & Kashmir	150	4	5	9	141	50	2.66	3.33	4.5	(Amjad *et al.* 2020)
KaraisaliTurkey	129	2	8	10	119	49	1.55	6.20	5.61	(Guneset al. 2017)
MadenTurkey	88	3	1	4	84	55	3.40	1.13	2.79	(Cakilcioglu *et al.* 2011)
Ngadisarivillage, Indonesia	30	0	7	7	23	52	0	23.33	8.53	(Jadid *et al.* 2020)
Tarfaya Province, Morocco	130	1	14	15	115	44	0.76	10.76	8.62	(Idm'hand *etal.* 2020)
Jhelum valley, Azad Kashmir, Pakistan	113	1	8	9	104	50	0.88	7.07	5.52	(Awan *et al*. 2021)
Guangxi, China	456	3	11	14	442	45	0.65	2.41	2.79	(Hu *et al.*2020)
Nigeria	21	0	5	5	16	54	0	23.80	6.66	(Mahmoud *et a*l. 2020)
Peshawar valley, Pakistan	71	0	13	13	58	46	0	18.30	11.11	(Bahadur *etal.* 2020)
Pak-Afghan border area	52	11	0	11	41	48	21.15	0	11	(Aziz *et al.* 2018)
Dinajpur District, Bangladesh	30	7	0	7	23	52	23.33	0	8.53	(Rahman *et al.* 2014)
Algeria	63	0	6	6	57	53	0	9.52	5.17	(Taïb *et al.* 2021)
NortheastIndia	145	0	10	10	135	49	0	6.89	5.15	(Panmei *et al.* 2019)
WesternGhats, India	138	0	12	12	126	47	0	8.69	6.48	(Sukumaran *et al.* 2021)
Eastern Region of Libya	179	2	8	10	169	49	1.11	4.46	3.47	(El-Mokasabi *et al.* 2018)
Morocco	30	0	1	1	29	58	0	3.33	1.13	(Chaachouay *et al.* 2019)
Gilgit, Pakistan	47	4	0	4	44	55	8.51	0	3.92	(Akhter *et al.* 2016)

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