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Original Article

# Traditional phytomedicines for gynecological problems used by tribal communities of Mohmand Agency near the Pak-Afghan border area

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ABSTRACT

Medicinal plants play a vital role in the human health care system of tribal communities and in the treatment of various gynecological problems. This study is an effort to document important medicinal flora used for the treatment of gynecological problems by indigenous people living in a tribal region near the Pak-Afghan border. The main objective of the study was to establish a clear profile of indigenous knowledge and practices from the unexplored tribal territory. Data were collected through semi-structured interviews and group discussions. The data were analyzed through Use Value and Factor of Informant Consensus. A total of 52 medicinal plants were recorded from the area; the most widely accepted were *Withania somnifera* (L.) Dunal (94 Use Value), *Foeniculum vulgare* Mill. (93 Use Value), *Prunus domestica* L. (91 Use Value), *Myrtus communis* L. (91 Use Value), *Cannabis sativa* L. (91 Use Value) and *Nigella sativa* L. (90 Use Value). A high consensus factor was recorded for menses-related problems (0.95). The root was the main part used (23% plants), followed by the leaves (20% plants), whole plant (18% plants), fruit (18% plants), and seed (13% plants). A total of 21 plants were used to treat menses-related problems, followed by sexual problems (ten plants), leucorrhea (nine plants), gastric problems (seven plants) and amenorrhea (seven plants). Knowledge related to ethnogynecological treatments is restricted to midwives and traditional healers. In conclusion, the documented flora that is particularly important to medicinal plants may be researched in the future to discover new pharmaceutical, neutraceutical and other pharmacological agents against gynecological complaints.

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## Introduction

Ethnogynecology is a traditional approach that addresses women's health care problems. A number of medicinal plants are being used to cure women problems related to menses, abortion, menopause, gonorrhea, leucorrhoea, delivery complaints and infertility. It has been reported that sexual and other reproductive health issues account for 18% of the total global disease load (Kaingu et al., 2011). Today, in modern societies, gynecological problems are usually treated with allopathic medicines, surgery, and non-steroidal anti-inflammatory drugs, which pose risks to the fetus at the gestation stage or the entire pregnancy period (Lawal et al., 2013). Menstrual disorders are generally not perceived as major health concerns by global health organizations. These ailments require effective, safe medications because they can disrupt women's daily activities. Due to limited access to analgesics and sanitary facilities, women in various localities across the globe (Latin America, Africa or Asia) prefer traditional medicines (van Andel et al., 2014).

The rural women of Pakistan frequently experience gynecological problems due to poor living standards, famine, and extensive physical work even during pregnancy. The country has a diversity of six thousand flowering plants, of which six hundred are used for medicinal purposes (Nasir and Ali, 1971–1991). A local health practitioner known as "*Daiya*" possesses tremendous traditional knowledge to treat women problems. The "*Daiya*" primarily utilize medicinal plants and plant-derived medicinal products to treat the ailments (Tareen et al., 2010). A traditional

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lifestyle and lack of proper access to modern health facilities motivate rural women to consult nearby midwives and traditional healers (Qureshi et al., 2009). There is very little literature regarding ethnomedicinal uses by rural women for the treatment of gynecological disorders. Moreover, due to the introduction of allopathy and recent modernization, knowledge is decreasing rapidly because the younger generation is not taking an interest in learning these valuable practices and healing techniques. Hence, ethnogynecological knowledge may become extinct if not properly documented.

The current study was performed in Mohmand Agency, Federally Administrated Tribal Areas (FATA), Pakistan. The region is dominated by the Pashtun tribe, with low economic status, poor infrastructure and a lack of modern facilities (Murad et al., 2013; Adnan et al., 2014a). Many women in the area seek treatment from traditional healers for a variety of complications associated with the female reproductive organs. Such knowledge has not been documented previously from the study region. Hence, the present study was designed to document the ethnogynecological uses of medicinal plants and highlight candidate plants for further pharmacological investigations. The present research will provide baseline information for future research studies regarding phytochemistry, pharmacology, and the conservation of the plants used by the indigenous communities.

## Material and methods

### *Study area*

The Mohmand Agency is a part of FATA and is located near the Pak-Afghan border region (Fig. 1). The area is comprised of rugged mountains with barren slopes and extends along the Kabul river bank. The Agency shares its borders with Afghanistan (Northwest), Khyber Pakhtunkhwa province (East), the Khyber Agency (North) and the Bajaur Agency (South). The area is populated by the Pashtun tribe, and due to their tribal nature, the economy is primarily pastoral and agrarian. The total irrigated land is approximately 1000 $km^2$. FATA consists of a single university, which was recently established the requirements of the entire region. In the study area, there is one available bed in the hospital per 2179 persons, compared to one bed per 1341 persons in the settled areas of the country. A great proportion of the population is partially devoid of modern health facilities; however, a number of herbal practitioners known as “hakims” are located in the territory.

### *Data collection*

An ethno-gynecological survey was performed between June and October 2016. During this time, the identification of plant species is easy due to flowering. Regular field visits were conducted in June to target the informants, while ethnobotanical data were gathered in the other four months. Fieldwork was performed using a Participatory Rural Approach (PRA). PRA is considered an effective, popular approach in botanical studies. In the approach developed by Chambers (1992), the indigenous population actively participates and describes the methodologies and patterns of their interaction with environmental and natural resources. The collection of indigenous knowledge and the survey were based on direct interactions with local respondents in the study area (Mahmood et al., 2013). Under PRA, information was gathered through semi-structured interviews, meetings and group discussions. Informants were selected through a snowball technique. Seventy-five key informants (50 males and 25 females, including house wives, midwives and traditional healers) were selected and belonged to different age groups (Table 1). Informants were selected based on their good reputation in the field of traditional medicine. Interviews were conducted in the local language, “Pashto”. Mr. Amir Hasan Khan was the local resident of the study area familiar with the native dialect of the Pashto language.

Prior to interviews, the main theme of the study was presented to each informant. Mr. Amir Hasan Khan stayed with the informants to document ethnogynecological medicinal practices. The ethnogynecological data were documented, including plant botanical name, local name, family name, part used, mode of preparation and drug administration method (*e.g.*, juice, paste, decoction, powder). Through semi-structured interviews, information about gender, age, profession background and knowledge of the herbal recipes for gynecological problems were recorded. The initial documented results were recorded for each respondent for the possible feedback. Additionally, group discussions were arranged to clarify and validate the field data. Semi-structured questionnaires were subjected to harmonization using free interviews and informal conversation (Huntington, 2000). Gender and age differences were considered, and interviews were taken individually and collectively. There were certain cultural barriers preventing females from participating in interviews, but the investigated female informants gave their consent. All respondents and focal individuals in the study area gave permission to publish and protect the data on traditional medicines that they provided.

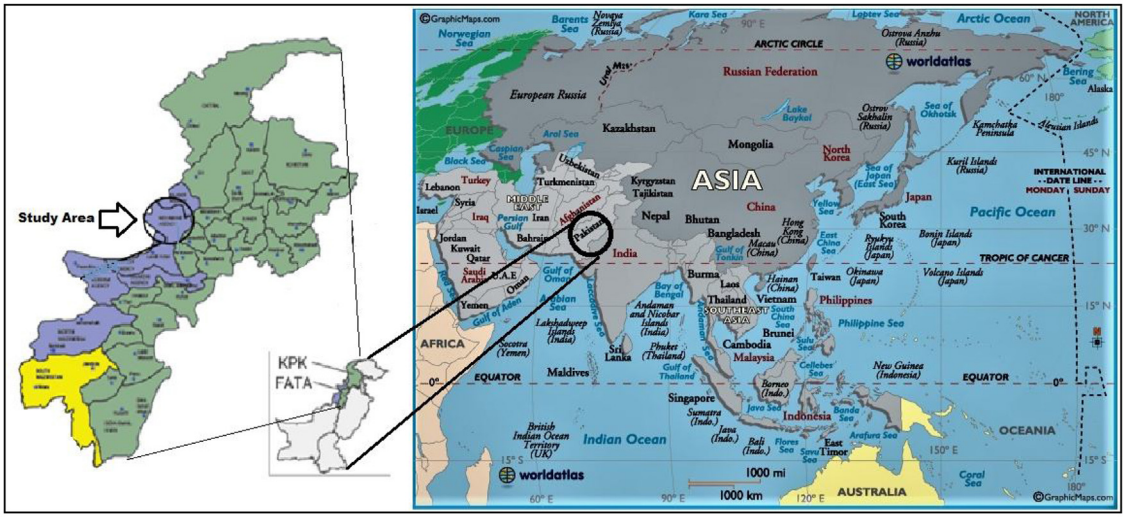


**Fig. 1.** Showing the location of Pakistan and the study area. Image courtesy of worldatlas.com.

**Table 1**
Demographic characteristics of the informants.

| Variable | Categories | No. of persons (*n*) | Percentage (%) |
|---|---|---|---|
| Informant category | Traditional healers | 40 | 53.33 |
| | Indigenous people | 35 | 46.66 |
| Gender | Male | 50 | 66.66 |
| | Female (house wives and midwives) | 25 | 33.33 |
| Age (male) | 35–50 | 24 | 32 |
| | 50–65 | 21 | 28 |
| | More than 65 | 5 | 7 |
| Age (female) | 50–70 | 25 | 33 |
| Education level | Illiterate | 30 | 40 |
| | Primary | 4 | 5.3 |
| | Middle | 7 | 9.33 |
| | Secondary school level | 12 | 16 |
| | Higher secondary (Hakims) | 18 | 24 |
| | University level (Hakims) | 4 | 5.33 |

Ethical guidelines recommended by the International Society of Ethnobiology were firmly followed during the course of the survey.

*Taxonomic verification*

The documented medicinal plants were identified by Muhammad Adnan from the Department of Botany, Kohat University of Science and Technology, Kohat. The plants were mounted and preserved on herbarium sheets, assigned vernacular names and tagged with a voucher number for each species and were deposited at the Department of Botany, Kohat University of Science and Technology. Taxonomic problems regarding the correct name and updated systematic position were verified using "The Plant List" (www.theplantlist.org).

*Data organization and analysis*

Data were arranged and organized by using Microsoft Excel (2007). For each species, Use Reports (UR) were counted. UR can be defined as the utilized part of a plant species for a particular disease mentioned by an informant.

*Use value (UV)*

This index was used and applied to demonstrate the relative importance of each taxa used by local communities. The use value (UV) was calculated as:

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

where *Ui* is the number of uses reported by each respondent for a given species, and *N* shows the total number of respondents taking part in the survey (Phillips and Gentry, 1993).

*Factor of Informant Consensus* (Fic)

Ethnobotanical data collected during field visits were evaluated and analyzed through UR and Factor of Informant Consensus (*Fic*), as described by Trotter and Logan (1986). Factor of Informant Consensus were calculated using the following formula:

$$Fic = \frac{Nur - Nt}{Nur - 1}$$

where *Nur* represents the number of use reports recorded from respondents for a particular disease category, while *Nt* refers to the number of taxa used for a particular illness by all informants. The maximum value for the index is 1 and the minimum value is 0.

## Results and discussion

*Ethnogynecological knowledge and indigenous communities*

During the survey, it was found that ethnogynecological knowledge is restricted to older female community members, midwives and herbal practitioners locally known as Hakims. All female respondents reporting such knowledge were housewives, possibly because in remote areas of Pakistan, women are primarily confined to the home according to customs and religious restrictions. The female informants, including the midwives, were between 50 and 70 years old (Table 1). During informant selection, it was reported that the younger generation is completely unacquainted with traditional therapies and takes no interest in gaining the knowledge. The female informants selected for the study had no schooling. In rural areas, girls are expected to become wives, mothers, and housekeepers; hence, little attention is paid to their formal education, particularly higher education. Even at primary and secondary levels, access is restricted, retention rates are low, and facilities remain abysmal. However, traditional healers locally known as "hakims" have higher secondary and university levels of schooling (Table 1). The expertise of these hakims could be justified by their professional degrees, diplomas and experience gained from other hakims. Furthermore, the low literacy rate, lack of medical facilities, and poor economic status are the main factors for the locals' dependence on medicinal plants. It was specifically noted during the survey that people who do not use herbal therapies have a positive attitude toward ethno-gynecological knowledge. The women in the study area consider traditional therapies that are safer and more effective than modern drugs, which is why they generally consult traditional healers for gynecological problems rather than modern health practitioners. The pregnant women have more trust and faith in medicinal plants and often have concerns for their unborn child's well-being (Nordeng and Havnen, 2005). In the case of emergency, women are also brought to nearby local dispensaries or shifted to other settled areas. Strikingly, knowledge related to the traditional remedies of gynecological problems is disappearing; in the event of the deaths of older community female members, the knowledge will be lost. Hence, there is a dire need to prioritize the conservation of this traditional knowledge from extinction in the near future (Mahmood et al., 2013).

*Important medicinal plants*

Tribal communities have diverse knowledge of traditional medicines related to plants for their basic healthcare needs (Rekka et al., 2013). In the current study, 53 medicinal plants were recorded that were used to treat gynecological ailments by indigenous communities in the study area (Table 2).

**Table 2**
Medicinal plants and their uses in the treatment of gynecological problems.

| Family | Botanical name | Local name | Part used | Method of administration | Disease treated | Reported by | | | UV |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | M | F | H (Male) | |
| Amaranthaceae | *Amaranthus spinosus* L./SBBUS-74 | Azghkay | Whole plant | Decoction | Amenorrhea | – | – | + | 0.56 |
| Amaranthaceae | *Amaranthus viridis* L./SBBUS-75 | Gunhar | Whole plant | Decoction | Menstruation | – | – | + | 0.67 |
| Apiaceae | *Ammi visnaga* (L.) Lam./SBBUS-76 | Spairkay | Fruit | Infusion | Regulate the menses, uterus infection | – | + | + | 0.7 |
| Apiaceae | *Eryngium biehersteinianum* (M. Bieb.) Nevski/SBBUS-77 | Yakandaz | Whole plant | Powder + milk | Sexual tonic, backache | – | + | – | 0.55 |
| Apiaceae | *Foeniculum vulgare* Mill./SBBUS-78 | Kagilani | Leaves, fruit | Orally | Menses pain, vomiting, regulate the menses, lactiferous | – | – | + | 0.93 |
| Apiaceae | *Bupleurum falcatum* L./SBBUS-79 | Ziwarbotay | Whole plant | Decoction | Regulate the Menses | – | + | – | 0.51 |
| Apiaceae | *Heracleum candicans* Wall. ex DC./SBBUS-80 | Skhwara | Roots | Powder | Regulate the menses | – | + | – | 0.62 |
| Arecaceae | *Cocos nucifera* L./SBBUS-81 | Cofra | Fruit | Decoction + ghee | Lactiferous | – | + | – | 0.49 |
| Arecaceae | *Phoenix dactylifera* L./SBBUS-82 | Kajor | Fruit | Fruit + milk | Anemia, backache, aphrodisiac sexual tonic | – | + | – | 0.69 |
| Asphodelaceae | *Aloe barbadensis* Mill./SBBUS-83 | Zuqam | Leaves | Powder + milk | Abortifacient, start menses, amenorrhea, contraceptive | – | – | + | 0.56 |
| Asteraceae | *Calendula arvensis* M.Bieb./SBBUS-84 | Damberguly | Flower | Powder + water, infusion | Pain during menstruation, irregular menstrual cycles | – | – | + | 0.73 |
| Asteraceae | *Carthamus oxyacantha* M.Bieb./SBBUS-85 | Polikareeza | Seed oil | Oil | Used against itching | – | – | + | 0.29 |
| Asteraceae | *Artemisia parviflora* Roxb. ex D.Don/SBBUS-86 | Kharkalich | Seed | Powder + water | Abdominal pain, menstrual disorders | – | – | + | 0.41 |
| Asteraceae. | *Achillea millefolium* L./SBBUS-87 | Yarkand | Leaves, root | Powder + water or milk | Leucorrhea, gestational diabetes, anemia, menstrual pain | – | – | + | 0.33 |
| Bereridaceae | *Berberis lycium* Royle/SBBUS-88 | Kawary | Root | Infusion | Amenorrhea, pile, gonorrhea | – | – | + | 0.82 |
| Bombacaceae | *Bombax ceiba* L./SBBUS-89 | Simbal | Roots, gum, flower | Powder + milk | Amenorrhea, leucorrhea | – | – | + | 0.59 |
| Brassicaceae | *Nasturtium officinale* R.Br./SBBUS-90 | Termera | Leaves | Decoction | During delivery relax uterus muscle | – | – | + | 0.32 |
| Caesalpiniaceae | *Caesalpinia bonduc* (L.) Roxb./SBBUS-91 | Katranj | Seeds | Decoction | Leucorrhea, menstrual disorders | – | + | – | 0.81 |
| Cannabaceae | *Cannabis sativa* L./SBBUS-92 | Bong | Seed, leaves | Powder + water | Abdominal pain, gonorrhea, pregnancy, female impotency | – | – | + | 0.91 |
| Colchicaceae | *Colchicum autumnale* L./SBBUS-93 | Zafran | Bulb | Powder + water | Leucorrhea | – | – | + | 0.8 |
| Convolvulaceae | *Convolvulus arvensis*L./SBBUS-94 | Perwatai | Whole plant | Powder + milk | Sexual debility, menses | – | – | + | 0.73 |
| Elaeagnaceae | *Elaeagnus angustifolia* L./SBBUS-95 | Sinjoor | Gum | Gum + oil | Hair tonic | – | – | + | 0.44 |
| Euphorbiaceae | *Ricinus communis* L./SBBUS-96 | Arand | Fruit | Boiled in gee and mixed with sugar than used | Completely stop the menses, leucorrhoea, constipation | – | – | + | 0.68 |
| Fabaceae | *Acacia farnesiana* (L.) Willd./SBBUS-109 | Viilayatikikat | Bark, Gum | Powder + ghee | Leucorrhea | + | + | + | 0.78 |
| Fabaceae | *Acacia modesta* Wall./SBBUS-110 | Palusa | Gum | Powder + flour + ghee + milk | Backache after delivery | – | + | – | 0.41 |
| Fabaceae | *Arachis hypogaea* L./SBBUS-97 | Moong phali | Seeds | Orally | Lactiferous | – | + | – | 0.76 |
| Fabaceae | *Glycyrrhiza glabra* L./SBBUS-98 | Khwagawaly | Root | Powder + milk | Lactiferous, constipation, digestive problem | – | – | + | 0.58 |

Table 2 (*Continued*)

| Family | Botanical name | Local name | Part used | Method of administration | Disease treated | Reported by | | | UV |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | M | F | H (Male) | |
| Fabaceae | *Butea monosperma* (Lam.) Taub./SBBUS-99 | Palay | Gums<br>Fruit, Root<br>Flower, Gums, Bark | Powder + ghee + sugar<br>Powder + water<br>Powder + water or milk | Backache, weakness, gonorrhea<br>Anthelmintic<br>Gonorrhea | – | – | + | 0.84 |
| Fabaceae | *Lotus corniculatus* L./SBBUS-101 | Fathi Khani | Whole plant | Powder + milk | Urine problem, sexual tonic, backache, | – | – | + | 0.44 |
| Geraniaceae | *Geranium wallichianum* D.Don ex Sweet/SBBUS-102 | SraZela | Roots | Powder + milk | Menses regulate, leucorrhoea | – | – | + | 0.85 |
| Hypericaceae | *Hypericum perforatum* L./SBBUS-103 | Sheen chai | Fruit, shoot | Infusion | Irregular menstruation, prolapsed uterus | – | + | – | 0.72 |
| Juglandaceae | *Juglans regia* L./SBBUS-104 | Ghoz | Bark, fruit | Orally | Cleaning teeth, sexual tonic, gynae, | – | – | + | 0.56 |
| Lamiaceae | *Ajuga parviflora* Benth./SBBUS-105 | Bugle | Leaves, roots | Powder + water | Amenorrhea | – | + | + | 0.61 |
| Lamiaceae. | *Leucas cephalotes* (Roth) Spreng./SBBUS-106 | Gomma | Whole plant | Powder + water | Skin diseases | – | – | + | 0.32 |
| Liliaceae | *Allium sativum* L./SBBUS-107 | Ouga | Bulb | Powder + turmeric | Stimulate uterine muscles, menses, aphrodisiac | – | – | + | 0.29 |
| Menispermaceae | *Inospora sinensis* (Lour.) Merr./SBBUS-108 | Praiwatay | Leaves, Stems | Decoction | Sexual tonic | – | – | + | 0.74 |
| Moraceae | *Ficus carica* L./SBBUS-111 | Anzar | Fruit | Orally | Sexual debility, leucorrhea | – | – | + | 0.87 |
| Myrtaceae | *Myrtus communis* L./SBBUS-112 | Mano | Leaves, Roots | Powder + water | Stop the menses | – | – | + | 0.91 |
| Nyctaginaceae | *Boerhavia procumbens* Banks ex Roxb./SBBUS-113 | Mangotie | Whole plant | Orally | Menstrual flow regulation | – | – | + | 0.33 |
| Nyctaginaceae | *Mirabilis jalapa* L./SBBUS-114 | Guli Abas | Roots, leaves | Powder + water | Gonorrhea, uterine discharge | – | – | + | 0.37 |
| Paeoniaceae | *Paeonia emodi* Royle/SBBUS-115 | Mamekh | Leaves | Decoction in milk + flour + ghee | Regulation of menses, abdominal pain | – | – | + | 0.25 |
| Phyllanthaceae | *Phyllanthus emblica* L./SBBUS-116 | Alam | Seed | Powder + milk | Vaginal infection, uterus infection, Aphrodisiac | – | – | + | 0.37 |
| Pinaceae | *Cedrus deodara* (Roxb. ex D.Don) G.Don/SBBUS-117 | Nenzro | Oil | Oil | Skin diseases, cooling effect | – | – | + | 0.84 |
| Ranunculaceae | *Nigella sativa* L./SBBUS-118 | Kalwangi | Seeds | Powder + honey | Lactiferous, sexual tonic | – | + | – | 0.9 |
| Rosaceae | *Prunus domestica* L./SBBUS-119 | Alocha | Fruit | Orally | Leucorrhea, irregular menstruation | – | + | – | 0.91 |
| Rosaceae | *Rosa moschata* Herrm./SBBUS-120 | Gulab | Flower | Decoction | Start menses and anti-constipation | – | – | + | 0.29 |
| Rutaceae | *Citrus* × *aurantium* L./SBBUS-121 | Nimbo | Fruit | Extract | Uterine infection | – | + | + | 0.89 |
| Solanaceae | *Withania somnifera* (L.) Dunal/SBBUS-122 | Kotilal | Leaves, Roots | Powder + ghee + sugar | Leucorrhea, infertility, sexual tonic | – | – | + | 0.94 |
| Ulmaceae | *Celtis australis* L./SBBUS-123 | Tagho | Fruit, Bark | Decoction + ghee | Amenorrhea | – | – | + | 0.85 |
| Urticaceae | *Urtica dioica* L./SBBUS-124 | Toorbotay | Whole plant | Powder + water | Amenorrhea, leucorrhea | – | + | + | 0.82 |
| Zingiberaceae | *Zingiber officinale* Roscoe/SBBUS-125 | Adrak | Roots | Powder + water or milk | Blood pressure, regulate menses | – | – | + | 0.57 |

M, male; F, female; H, hakim; +, yes; –, no.

**Table 3**
Showing diseases categories and the Factor of Informant Consensus (*Fic*).

| Category | *Nur* (use reports) | *Nt* (no. of species) | *Fic* |
|---|---|---|---|
| Amenorrhea | 57 | 7 | 0.89 |
| Backache | 42 | 5 | 0.90 |
| Gastric problems | 77 | 7 | 0.92 |
| Lactiferous | 29 | 5 | 0.89 |
| Leucorrhea | 110 | 9 | 0.93 |
| Menses problems | 380 | 21 | 0.95 |
| Miscellaneous | 70 | 9 | 0.88 |
| Vaginal and uterine muscle contraction management | 44 | 5 | 0.91 |
| Sexual problems | 144 | 10 | 0.94 |
| Urinary problems | 37 | 3 | 0.94 |
| Uterine infection | 27 | 3 | 0.92 |

Medicinal plants were used against 28 health and pathological conditions in the study area. The most widely accepted medicinal plant species, indicated by the highest UV, were *Withania somnifera* (94), *Foeniculum vulgare* (93), *Prunus domestica* (91), *Myrtus communis* (91), *Cannabis sativa* (91) and *Nigella sativa* (90). To evaluate the local importance of any species, Phillips and Gentry (1993) proposed and devised the formula for UV. Higher UV implies the higher importance of specific plant species and *vice versa.* However, the use value cannot specify whether plant species is used for a single purpose or multiple purposes (Musa et al., 2011). In the study area, *W. somnifera* is utilized to treat leucorrhea and fertility and as a sexual tonic. *F. vulgare* is widely used for vomiting during the initial period of pregnancy, menses pain, and vomiting, as well as to regulate the menses and lactiferous. Similarly, *P. domestica* is utilized to treat leucorrhea and irregular menstruation. *M. communis* is used to completely stop irregular menses and treat other reproductive ailments in women. *C. sativa* is used to cure abdominal pain, gonorrhea, pregnancy, and female impotency, while *N. sativa* is traditionally used as a lactiferous and sexual tonic. Previously, *W. somnifera* was used for leucorrhoea, abdominal pain, tonic, urinary disorders, sexual weakness, sterility in women, aphrodisiac, and menses pain (Adnan et al., 2014b; Ahmad et al., 2014; Khan et al., 2015a; Sher et al., 2016). In other cultures, *F. vulgare* is reportedly used as a carminative and in urinary tract infections, laxative, abdominal pain, and menses pain (Akhtar et al., 2013; Khan et al., 2015a; Sher et al., 2016). *C. sativa* is reportedly used as a sedative, analgesic, diuretic (Aziz et al., 2017), and male impotency treatment (Khan et al., 2015a). *N. sativa* has reported uses as a sexual tonic, lactation, aphrodisiac, gestational diabetes, menstruation additive, abortion, and parturition uterus pain (Sadeghi and Mahmood, 2014; Aziz et al., 2017). It is generally noted that a single plant-based remedy is typically used, as indicated in the table (Table 2).

The biological efficacy of medicinal plants can be determined through the Fic value. The index is used to evaluate the consensus among the informants for traditional medications. To determine *Fic*, reported ailments were categorized into lactiferous, gastric, uterine infections, menses, backache, muscle contraction management, leucorrhea, sexual, and urinary problems, among others (Table 3).

In our study, *Fic* values ranged between 0.88 and 0.95 (Table 3). A high *Fic* value was recorded for menses problems (0.95), sexual problems and urinary problems (each 0.94) followed by leucorrhea (0.93), and gastric problems and uterine infections (each 0.92). In a study conducted by Sadeghi and Mahmood (2014), menses problems gave the highest *Fic* values. A high *Fic* value indicates that the information is shared among various informants and community members with consistency. *Fic* shows the homogeneity of the collected information and the consensus among various informants for a specific plant or part utilization for the treatment. A higher *Fic* indicates the sharing of knowledge or information, and *vice versa.*

Plant parts used to treat various ailments were the root (23%) followed by leaves (20%), whole plant (18%), fruits (18%), seeds (13%), gums (7%), and flowers (5%). In Traditional Chinese Medicine (TCM), the root is frequently utilized in herbal preparations (Ghorbani et al., 2011). The root is also the most commonly harvested plant part reported in other studies (Hussain et al., 2006; Tolossa et al., 2013), possibly because the roots remain in the soil and are easily accessible year-round. Another motif may be the easy harvest of herb roots by browsing out the whole plant. However, such harvesting activities (collected for both commercial and medicinal purposes) have a negative impact on the sustainability and conservation of medicinal plants. Previous research reports indicate that roots (30%) ranked second among the plant parts, which were frequently harvested (Lepcha and Das, 2011). The unsustainable harvest of herbaceous roots is well recognized by conservationists, who have declared that such medicinal plants as highly threatened (Verma et al., 2007).

### *Herbal therapies used in the study area*

The current investigations recorded various forms of herbal therapies in terms of their formulation and administration. Various recipes were used, mostly in powder form, and were ingested with ingredients such as milk, whey, water, honey, ghee and sugar. During the survey, it was found that women and traditional healers mostly use herbs to prepare ethnomedicines, while trees are very rarely used (Table 2). In remote areas, medicinal herbs are the main ingredients in local medicines and are considered the main rescue and first choice for medicines (Khan et al., 2011). The highest use of herbs indicates their high abundance in villages and the centuries-old traditional knowledge of the healers. The common use of herbaceous plants has also been reported in other regions of the world (Kala, 2005; Muthu et al., 2006). Herbs can grow in roadsides, home gardens, farmland, and wild habitats, and are more common than other growth forms. In contrast, studies have also reported the highest uses of trees (Maroyi, 2013; Murad et al., 2013) and shrubs in traditional medications (Moshi et al., 2012; Padal et al., 2013). Variation in medicinal plants' growth form might be associated with different socio-cultural beliefs, ecological status, and variation in the practices of traditional healers across regions or countries.

Most remedies were based on a single plant application, due to palatability, non-toxicity and the high efficacy of certain plants (Tugume et al., 2016). However, some plants were used in combination with other plants to achieve the maximum therapeutic effect. This combination justifies the phenomenon of synergism, which could be explained by the better results of such plants products. Women from the studied regions reported medicinal plants for the treatment of 28 types of gynecological ailments. Menses was found to be the most treated ailment category in the studied regions. A

total of 21 plants were used to treat menses-related problems, followed by nine plants for leucorrhea, seven each for amenorrhea, six for sexual tonic, five plants for backache and also five plants for lactiferous. The higher plant utilization for menses might be due to natural phenomenon associated with a variety of complications such as pelvic or abdominal cramps, bloating or sore breast, lower back pain, mood swings, food cravings, irritability, fatigue and headache(Sharma et al., 2008; Yamamoto et al., 2009).

Traditional medicines for the treatment of women's diseases are taken in the form of decoctions, infusions, juices, extracts, suppositories, powders, and pills. These traditional medicines are typically mixed with honey or milk to improve the taste, depending on the ailment. Detailed methods for the preparation of herbal medicines have been described elsewhere (Mahmood et al., 2013). During the current study, different methods of preparation and administration were recorded for the herbal therapies from local herbalists (hakims) at various sites, but were quite simple. Orally, herbal recipes are ingested either as a plant powder (along with water), decoction, or rarely a juice extracts. This was indicated by researchers from different parts of the world (Abbasi et al., 2013; Ridvan et al., 2015). In contrast, paste and ground herbs were extensively used to treat dermal disease. It has been reported that grinding and boiling are the most effective methods and are common therapies for the extraction of biologically active compounds (Deeba, 2009). The majority of herbal preparations involve a single plant, while some remedies were prepared through the combination of various plants. For instance, *Allium sativum* is mixed with turmeric powder and used to stimulate uterine muscles. Similarly, gum powder from *Acacia modesta* is mixed with wheat flour and used for back pain after delivery. Moreover, decoctions are made from the leaves of *Paeonia emodi* in milk and mixed with flour, which is used during irregular menses and abdominal pain. The traditional healers in the study area have told that herbal remedies formed by the combination of two or more than two plants are more potent than single plant recipes.

Previous literature has revealed that the utilization of multiple traditional herbal formulations has shown efficacy in the current era due to synergism (Zonyane et al., 2012; Sher et al., 2015). Plant drug preparation for similar or different ailments varies from individual to individual and community to community, in many cases. For example, in a study conducted by Sher et al. (2015), it was found that traditional practitioners recommended the decoction of leaves and roots of *W. somnifera* as an aphrodisiac while in our study the medicinal plants is used for the treatment of leucorrhea, to enhance fertility and as a sexual tonic.

### *Pharmacological profile of important medicinal plants*

A literature survey was conducted to gain insight into the pharmacological profile of the most frequently used plants in traditional medicines to treat gynecological problems. For instance, studies of *W. somnifera* showed that the plant has several beneficial therapeutic effects, including sedative, general tonic, anti-inflammatory, diuretic, aphrodisiac and deobstruent properties (Chopra et al., 1980; Nadkarni, 1982; Kabiruddin and Mufradat, 1955; Ali, 1997; Anonymous, 2007; Khare, 2007). One study indicated that it increases the production of semen and is utilized as a uterine tonic (Anonymous, 2007; Kabiruddin and Mufradat, 1955). Aqueous and alcoholic extracts of the plant have shown good activities against *Proteus vulgaris*, *Bacillus subtilis*, *Salmonella typhimurium*, *Escherichia coli*, *Staphylococcus auerus* and *Pseudomonas aeruginosa* as well as antihypercholesterolemic and diuretic activities (Ahmad et al., 1998; Srinivasan et al., 2001). The steroidal lactones and two basic withanolides, withaferin A and D, are considered responsible for the pharmacological actions of *W. somnifera* (Umadevi et al., 2012).

Analyzing the pharmacological potential of *C. sativa*, Ali et al. (2012) reported that the plant is biologically active against certain bacterial and fungal strains. It was observed that the plant extract has prominent activity against *Salmonella typhii*, which is a pathogenic bacterium responsible for paratyphoid fever, typhoid fever and food-borne illness. The plant is also active against both gram-positive and gram-negative bacteria and help to prevent urinary tract infections (UTI), cholecystitis, sepsis and food poisoning (Monika et al., 2014). Researchers have found that the baste fibers of this plant have antibacterial potential (Hao et al., 2014; Khan et al., 2015b). In a more recent study, plant powder has shown antibacterial effects against *E. coli* (Khan et al., 2015a,b), and this antibacterial effect is attributed to lignan and related compounds such as phenolics, alkaloids and cannabinoids (Appendino et al., 2008; Khan et al., 2015a,b).

In the same way, the stem and leaves of *F. vulgare* are traditionally used to reduce the pyrexia headache, stomach pain, indigestion, diarrhea, and vomiting in our study, as well as in other cultures (Aziz et al., 2017). Important chemical compounds from this herb include fenchone, estragole, *p*-anisaldehyde and anethole, which may have estrogenic, acaricidal and antithrombotic potential. In multiple experiments, the plant has also shown antioxidant properties (Rather et al., 2012). The compound estragole has different effects in various species as well as gender specific effects (Miller et al., 1983; Paini et al., 2010). The plant is famous among indigenous communities for the production of breast milk in human females (Agrawala et al., 1968; Mills and Bone, 2000; Abascal and Yarnell, 2008). The plant has been used as an estrogenic agent for many years and improves the libido, maximizes the reproductive cycle and facilitates delivery cases (Rather et al., 2012). Research has shown that the herb's extract can increase the concentration of the serum of follicle stimulating hormone and decreases the luteinizing hormone and testosterone (Karampoor et al., 2014). The oil of the plant is considered very effective against dysmenorrhea (Khorshidi et al., 2010). While analyzing the pharmacological potential of *M. communis*, it was found that the plant has antimicrobial and antioxidant potential (Cakir, 2004). Important chemical compounds from this plant include linalool, 1,8-cineole, eugenol, terpinene, terpineol and essential oils, which are considered effective against both gram-positive and gram-negative bacteria (Oyedemi et al., 2009; Randrianarivelo et al., 2009). Essential oil also possesses other effects, such as anti-diabetic, anti-inflammatory, anti-mutagenic, pro-apoptotic activity in cancer cells, cardiovascular and anti-atherogenicity activity against hepaticischemia, and molluscicidal, protozoicidal, and insecticidal effects (Aleksic and Knezevic, 2014).

Investigating the pharmacological profile of the fruit of *P. domestica* reveals prominent activities against *Staphylococcus aureus*, *Staphylococcus epidermidis*, and *Proteus mirabilis* (Mehta et al., 2014). One study reports that the extracts and juices of *P. domestica* have the capacity to inhibit the oxidation of isolated human low-density lipoprotein (Qaiser and Naveed, 2011). *In vitro* studies also reveal the antioxidant activity of *P. domestica* fruit peel and flesh with high content of total phenolics and flavonoids, suggesting its radical scavenging abilities (Mariäa et al., 2002; Prakash et al., 2013). Additionally, the plant has anti-hyperlipidemic activity, anticancer activity, blood-pressure lowering activity, activity against cognitive deficits related to age, anxiolytic activity, and beneficial activity related to constipation and liver disorders (Jabeen and Aslam, 2011).

The seed of *N. sativa* possesses insecticidal, anthelmintic, antimalarial, antitumor, antibacterial, antifungal, carminative, diuretic, antiseptic and digestive properties (Burits and Bucar, 2000; Ali and Blunden, 2003; Saleh, 2006; Abdulelah and Zainal-Abidin, 2007; Ali et al., 2008). In the Middle East and some Mediterranean and European countries, the seed of the plant has been used for centuries to treat sexual disorders and has mainly been utilized

as an abortifacient (Kanter, 2008; Iqbal et al., 2010). In vaginitis, the use of *N. sativa* capsules with clotrimazole vaginal cream was found to be more effective than clotrimazole vaginal cream alone. Therefore, *N. sativa* capsules are suggested for the treatment of *Candida albicans* vaginitis (Fard et al., 2015). All of the above-mentioned pharmacological studies suggest the potency of the reported species to combat gynecological problems.

## Conclusions

Residents in the study area showed a positive attitude toward the utilization of medicinal plants. Midwives and traditional healers possess traditional knowledge related to gynecological problems. In the study area, 53 medicinal plants are used to treat 28 types of gynecological complaints. Most widely accepted medicinal plants are *Withania somnifera*, *F. vulgare*, *P. domestica*, *M. communis*, *C. sativa* and *N. sativa*. Roots are the main part used in the preparation of ethnomedicinal remedies for gynecological problems. Menstrual problems were the utmost prevailing disease category treated using 21 medicinal plants in the area. The current study provides a baseline for future pharmacological research in the field of gynecology. Therefore, it is necessary to focus on the reported plants to identify new pharmaceutical against gynecological diseases.

## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that no experiments were performed on humans or animals for this study.

**Confidentiality of data.** The authors declare that no patient data appear in this article.

**Right to privacy and informed consent.** The authors declare that no patient data appear in this article.

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## Author contribution

AHK and HU collected the data. MAA and AHK wrote the draft manuscript. HU helped in the compilation of data. During revision stages, AH and EFAA contributed significantly and MA and MAA supervised all stages of this research study. MA gave technical comments on the draft manuscript and indicated grammatical and language mistakes. All authors read and approved the final manuscript.

## Conflicts of interest

The authors declare no conflicts of interest.

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## References

Abascal, K., Yarnell, E., 2008. Botanical galactagogues. Altern. Complement Ther. 14, 288–294.
Abbasi, A.M., Khan, M.A., Shah, M.H., Shah, M.M., Pervez, A., Ahmad, M., 2013. Ethnobotanical appraisal and cultural values of medicinally important wild edible vegetables of Lesser Himalayas-Pakistan. J. Ethnobiol. Ethnomed. 9, http://dx.doi.org/10.1186/1746-4269-9-66.
Abdulelah, H.A.A., Zainal-Abidin, B.A.H., 2007. In vivo anti-malarial tests of *Nigella sativa* (black seed) different extracts. Am. J. Pharmacol. Toxicol. 2, 46–50.
Adnan, M., Bibi, R., Mussarat, S., Tariq, A., Shinwari, Z.K., 2014a. Ethnomedicinal and phytochemical review of Pakistani medicinal plants used as antibacterial agents against *Escherichia coli*. Ann. Clin. Microbiol. Antimicrob. 13, http://dx.doi.org/10.1186/s12941-014-0040-6.
Adnan, M., Ullah, I., Tariq, A., Murad, W., Azizullah, A., Khan, A.L., Ali, N., 2014b. Ethnomedicine use in the war affected region of northwest Pakistan. J. Ethnobiol. Ethnomed. 10, http://dx.doi.org/10.1186/1746-4269-10-16.
Agrawala, I.P., Achar, M.V., Boradkar, R.V., Roy, N., 1968. Galactagogue action of *Cuminum cyminum* and *Nigella staiva*. Indian J. Med. Res. 56, 841–844.
Ahmad, I., Mehmood, Z., Mohammad, F., 1998. Screening of some Indian medicinal plants for their antimicrobial properties. J. Ethnopharmacol. 62, 183–193.
Ahmad, M., Sultana, S., Fazl-i-Hadi, S., Ben Hadda, T., Rashid, S., Zafar, M., Khan, M.A., Khan, M.P.Z., Yaseen, G., 2014. An ethnobotanical study of medicinal plants in high mountainous region of Chail valley (District Swat-Pakistan). J. Ethnobiol. Ethnomed. 10, http://dx.doi.org/10.1186/1746-4269-10-36.
Akhtar, N., Rashid, A., Murad, W., Bergmeier, E., 2013. Diversity and use of ethnomedicinal plants in the region of Swat, North Pakistan. J. Ethnobiol. Ethnomed. 9, http://dx.doi.org/10.1186/1746-4269-9-25.
Aleksic, V., Knezevic, P., 2014. Antimicrobial and antioxidative activity of extracts and essential oils of *Myrtus communis* L. Microbiol. Res. 169, 240–254.
Ali, A., Alkhawajah, A.A., Randhawa, M.A., Shaikh, N.A., 2008. Oral and intraperitoneal LD50 of thymoquinone, an active principle of *Nigella sativa*, in mice and rats. J. Ayub. Med. Coll. Abbottabad. 20, 25–27.
Ali, B.H., Blunden, G., 2003. Pharmacological and toxicological properties of *Nigella sativa*. Phytother. Res. 17, 299–305.
Ali, E.M., Almagboul, A.Z., Khogali, S.M., Gergeir, U.M., 2012. Antimicrobial activity of *Cannabis sativa* L. Chin. Med. 3, 61–64.
Ali, S.S., 1997. Unani Advia-e-Mufradah, 8th ed. National Council for Promotion of Urdu Language (NCPUL), New Delhi, pp. 33.
Anonymous, 2007. The Unani Pharmacopoeia of India. Part I, vol. I. Depart. of AYUSH, Ministry of Health & Family Welfare, Govt. of India, New Delhi, pp. 7–8.
Appendino, G., Gibbons, S., Giana, A., Pagani, A., Grassi, G., Stavri, M., Smith, E., Rahman, M.M., 2008. Antibacterial cannabinoids from *Cannabis sativa*: a structure–activity study. J. Nat. Prod. 71, 1427–1430.
Aziz, M.A., Khan, A.H., Adnan, M., Izatullah, I., 2017. Traditional uses of medicinal plants reported by the indigenous communities and local herbal practitioners of Bajaur Agency, Federally Administrated Tribal Areas Pakistan. J. Ethnopharmacol. 198, 268–281.
Burits, M., Bucar, F., 2000. Antioxidant activity of *Nigella sativa* essential oil. Phytother. Res. 14, 323–328.
Cakir, A., 2004. Essential oil and fatty acid composition of the fruits of *Hippophae rhamnoides* L (Sea Buckthorn) and *Myrtus communis* L. from Turkey. Biochem. Syst. Ecol. 32, 809–816.
Chambers, R., 1992. Rural Appraisal: Rapid, Relaxed and Participatory (IDS Discussion Papers 311). Institute of Development Studies, London.
Chopra, R.N., Nayar, S.L., Chopra, I.C., 1980. Glossary of Indian Medicinal Plants, vol. 191. Council of Scientific & Industrial Research, New Delhi, pp. 258.
Deeba, F., 2009. Documentation of Ethnoveterinary Practices in Urban and Peri-urban Areas of Faisalabad Pakistan. University of Agriculture, Faisalabad, Pakistan.
Fard, F.A., Zahrani, S.T., Bagheban, A.A., Mojab, F., 2015. Therapeutic effects of *Nigella sativa* Linn (black cumin) on *Candida albicans* vaginitis. Arch. Clin. Infect. Dis. 10, http://dx.doi.org/10.5812/archcid.22991.
Ghorbani, A., Langenberger, G., Feng, L., Sauerborn, J., 2011. Ethnobotanical study of medicinal plants utilized by Hani ethnicity in Naban river watershed national nature reserve, Yunnan China. J. Ethnopharmacol. 134, 651–667.
Hao, X.M., Yang, Y., An, L.X., Wang, J.M., Han, L., 2014. Study on antibacterial mechanism of hemp fiber. Adv. Mater. Res. 887, 610–613.
Huntington, H.P., 2000. Using traditional ecological knowledge in science: methods and applications. Ecol. Appl. 10, 1270–1274.
Hussain, M., Shah, G.M., Khan, M.A., 2006. Traditional medicinal and economic uses of Gymnosperms of Kaghan valley, Pakistan. Ethnobot. Leaflets 10, 72–81.
Iqbal, M.S., Qureshi, A.S., Ghafoor, A., 2010. Evaluation of *Nigella sativa* L. for genetic variation and ex-situ conservation. Pak. J. Bot. 42, 2489–2495.
Jabeen, Q., Aslam, N., 2011. The pharmacological activities of prunes: the dried plums. J. Med. Plants Res. 5, 1508–1511.
Kabiruddin, M., Makhzan-ul-Mufradat, 1955. Nadeem University Printers, Lahore, pp. 75–76.
Kaingu, C.K., Oduma, J.A., Kanui, T.I., 2011. Practices of traditional birth attendants in Machakos District Kenya. J. Ethnopharmacol. 137, 495–502.
Kala, C.P., 2005. Ethnomedicinal botany of the Apatani in the Eastern Himalayan region of India. J. Ethnobiol. Ethnomed. 1, http://dx.doi.org/10.1186/1746-4269-1-11.
Kanter, M., 2008. Effects of *Nigella sativa* and its major constituent, thymoquinone on sciatic nerves in experimental diabetic neuropathy. Neurochem. Res. 33, 87–96.

Karampoor, P., Azarnia, M., Mirabolghasemi, G., Alizadeh, F., 2014. The effect of hydroalcoholic extract of fennel (*Foeniculum vulgare*) seed on serum levels of sexual hormones in female Wistar rats with Polycystic Ovarian Syndrome (PCOS). Arak Med. Univ. J. 17 (5), 70–78.
Khan, B.A., Wang, J., Warner, P., Wang, H., 2015b. Antibacterial properties of hemp hurd powder against *E. coli*. J. Appl. Polym. Sci. 132, http://dx.doi.org/10.1002/app.41588.
Khan, N., Ahmed, M., Ahmed, A., Shaukat, S.S., Wahab, M., Ajaib, M., Siddiqui, M.F., Nasir, M., 2011. Important medicinal plants of Chitral Gol National Park (CGNP) Pakistan. Pak. J. Bot. 43, 797–809.
Khan, R.U., Mehmood, S., Muhammad, A., Mussarat, S., Khan, S.U., 2015a. Medicinal plants from Flora of Bannu used traditionally by North West Pakistan's women to cure gynecological disorders. Am. Eur. J. Agric. Environ. Sci. 15, 553–559.
Khare, C.P., 2007. Indian Medicinal Plants – An Illustrated Dictionary. 1st Indian Reprint Springer (India) Pvt. Ltd, New Delhi, India, pp. 28.
Khorshidi, N., Ostad, S.N., Mosaddegh, M., Soodi, M., 2010. Clinical effects of fennel essential oil on primary dysmenorrhea. Iran. J. Pharm. Res. 2, 89–93.
Lawal, I., Amao, A., Lawal, K., Alamu, T., Sowunmi, I.L., 2013. Phytotherapy approach for the treatment of gynaecological disorder among women in Ido Local Government Area of Ibadan, Oyo State, Nigeria. J. Adv. Sci. Res. 4, 41–44.
Lepcha, S.R., Das, A.P., 2011. Ethno-medico-botanical exploration along the international borders to Tibet Autonomous Region of China and the kingdom of Bhutan with special reference to the Pangolakha Wildlife Sanctuary, East Sikkim. In: Gosh, C., Das, A.P. (Eds.), Recent Studies in Biodiversity and Traditional Knowledge in India. , pp. 257–270.
Mahmood, A., Rashid, S., Malik, R.N., 2013. Determination of toxic heavy metals in indigenous medicinal plants used in Rawalpindi and Islamabad cities, Pakistan. J. Ethnopharmacol. 148, 158–164.
Mariäa, I.G., Francisco, A.T., Betty, H.P., Adel, A.K., 2002. Antioxidant capacities, phenolic compounds, carotenoids, and vitamin C contents of nectarine, peach, and plum cultivars from California. J. Agric. Food. Chem. 50, 4976–4982.
Maroyi, A., 2013. Traditional use of medicinal plants in south-central Zimbabwe: review and perspectives. J. Ethnobiol. Ethnomed. 9, http://dx.doi.org/10.1186/1746-4269-9-31.
Mehta, S., Soni, N., Satpathy, G., Gupta, R.K., 2014. Evaluation of nutritional, phytochemical, antioxidant and antibacterial activity of dried plum (*Prunus domestica*). J. Pharmacogn. Phytochem. 3, 166–171.
Miller, E.C., Swanson, A.B., Phillips, D.H., Fletcher, L., Liem, A., Miller, J.A., 1983. Structure-activity studies of the carcinogenicities in the mouse and rat of some naturally occurring and synthetic alkenyl benzene derivatives related to safrole and estragole. Cancer Res. 43, 1124–1134.
Mills, S., Bone, K., 2000. Principles and Practice of Phytotherapy. Modern Herbal Medicine. Churchill Livingstone.
Monika, Kour, N., Kaur, M., 2014. Antimicrobial analysis of leaves of *Cannabis sativa*. J. Sci. 4, 123–127.
Moshi, M.J., Otieno, D.F., Weisheit, A., 2012. Ethnomedicine of the Kagera Region, North Western Tanzania. Part 3: Plants used in traditional medicine in Kikuku village Muleba District. J. Ethnobiol. Ethnomed. 8, http://dx.doi.org/10.1186/1746-4269-8-14.
Murad, W., Azizullah, A., Adnan, M., Tariq, A., Khan, K.U., Waheed, S., Ahmad, A., 2013. Ethnobotanical assessment of plant resources of Banda Daud Shah, District Karak Pakistan. J. Ethnobiol. Ethnomed. 9, http://dx.doi.org/10.1186/1746-4269-9-77.
Musa, M.S., Abdelrasool, F.E., Elsheikh, E.A., Ahmed, L.A., Mahmoud, A.L.E., Yagi, S.M., 2011. Ethnobotanical study of medicinal plants in the Blue Nile State Southeastern Sudan. J. Med. Plants Res. 5, 4287–4297.
Muthu, C., Ayyanar, M., Raja, N., Ignacimuthu, S., 2006. Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu India. J. Ethnobiol. Ethnomed. 2, http://dx.doi.org/10.1186/1746-4269-2-43.
Nadkarni, A.K., 1982. Indian Materia Medica, 3rd ed. Popular Prakashan.
Nasir, E., Ali, S.I., 1971–1991. Flora of west Pakistan, Tech. Rep. 1-190. Pakistan Agriculture Research Council, Islamabad, Pakistan.
Nordeng, H., Havnen, G.C., 2005. Impact of socio demographic factors, knowledge and attitude on the use of herbal drugs in pregnancy. Acta Obstet. Gynecol. Scand. 84, 26–33.
Oyedemi, S.O., Okoh, A.I., Mabinya, L.V., Pirochenva, G., Afolayan, A.J., 2009. The proposed mechanism of bactericidal action of eugenol, α-terpineol and β-terpinene against *Listeria monocytogenes*, *Streptococcus pyogenes*, *Proteus vulgaris* and *Escherichia coli*. Afr. J. Biotechnol. 8, 1280–1286.
Padal, S.B., Vijayakumar, Y., Butchi, R.J., Chandrasekhar, P., 2013. Ethnomedicinal uses of Shrub species by Tribals of Borra Panchayat, Ananthagiri Mandalam, Visakhapatnam district, Andhra Pradesh, India. Int. J. Pharm. Sci. Invent. 2, 10–12.
Paini, A., Punt, A., Viton, F., Scholz, G., Delatour, T., Marin-Kuan, M., Schilter, B., van Bladeren, P.J., Rietjens, I.M., 2010. A physiologically based biodynamic (PBBD) model for estragole DNA binding in rat liver based on in vitro kinetic data and estragole DNA adduct formation in primary hepatocytes Toxicol. Appl. Pharmacol. 245, 57–66.
Phillips, O., Gentry, A.H., 1993. The useful plants of Tambopata Peru: I. Statistical hypotheses tests with a new quantitative technique. Econ. Bot. 47, 15–32.
Prakash, D., Upadhyay, G., Gupta, C., 2013. Total phenol and antioxidant activity of some fruits and their under-utilized parts. Int. Food Res. 20, 1717–1724.
Qaiser, J., Naveed, A., 2011. The pharmacological activities of prunes: the dried plums. J. Med. Plant Res. 5, 1511–4508.
Qureshi, R.A., Ghufran, M.A., Gilani, S.A., Yousaf, Z., Abbas, G., Batool, A., 2009. Indigenous medicinal plants used by local women in southern Himalayan regions of Pakistan. Pak. J. Bot. 41, 19–25.
Randrianarivelo, R., Sarter, S., Odoux, E., Brat, P., Lebrun, M., Romestand, B., Menut, C., Andrianoelisoa, H.S., Raherimandimby, M., Danthu, P., 2009. Composition and antimicrobial activity of essential oils of Cinnamosma fragrans. Food Chem. 114, 680–684.
Rather, M.A., Dar, B.A., Sofi, S.N., Bhat, B.A., Qurishi, M.A., 2012. *Foeniculum vulgare*: a comprehensive review of its traditional use, phytochemistry, pharmacology, and safety. Arab. J. Chem., http://dx.doi.org/10.1016/j.arabjc.2012.04.011.
Rekka, R., Murugesh, S., Prabakaran, R., Tiruchengode, N.D., 2013. Plants used by Malayali tribes in ethnogynaecological disorders in Yercaud Hills, Southern Eastern Ghats Salem District, Tamil Nadu. Sci. Res. Rep. 3, 190–192.
Ridvan, P., Ugur, C., Kaan, K., Denizhan, U.M., Zafer, T., 2015. An ethnobotanical study on medicinal plants in Espiye and its surrounding (Giresun-Turkey). J. Ethnopharmacol. 163, 1–11.
Sadeghi, Z., Mahmood, A., 2014. Ethno-gynecological knowledge of medicinal plants used by Baluch tribes, southeast of Baluchistan, Iran. J. Rev. Bras. Farmacogn. 24, 706–715.
Saleh, S., 2006. Protection by *Nigella sativa* (Black seed) against hyperhomocysteinemia in rats vascular disease. Preventia 3, 73–78.
Sharma, P., Malhotra, C., Taneja, D.K., Saha, R., 2008. Problems related to menstruation amongst adolescent girls. Indian J. Pediatr. 75, 125–129.
Sher, H., Aldosari, A., Ali, A., de Boer, H.J., 2015. Indigenous knowledge of folk medicines among tribal minorities in Khyber Pakhtunkhwa, northwestern Pakistan. J. Ethnopharmacol. 166, 157–167.
Sher, H., Bussmann, R.W., Hart, R., de Boer, H.J., 2016. Traditional use of medicinal plants among Kalasha, Ismaeli and Sunni groups in Chitral District, Khyber Pakhtunkhwa province Pakistan. J. Ethnopharmacol. 188, 57–69.
Srinivasan, D., Nathan, S., Suresh, T., Perumalsamy, P.L., 2001. Antimicrobial activity of certain Indian medicinal plants used in folkloric medicine. J. Ethnopharmacol. 74, 217–220.
Tareen, R.B., Bibi, T., Khan, M.A., Ahmad, M., Zafar, M., 2010. Indigenous knowledge of folk medicine by the women of Kalat and Khuzdar regions of Balochistan, Pakistan. Pakistan J. Bot. 42, 1465–1485.
Tolossa, K., Debela, E., Athanasiadou, S., Tolera, A., Ganga, G., Houdijk, J.G., 2013. Ethno-medicinal study of plants used for treatment of human and livestock ailments by traditional healers in South Omo Southern Ethiopia. J. Ethnobiol. Ethnomed. 9, http://dx.doi.org/10.1186/1746-4269-9-32.
Trotter, R., Logan, M., 1986. Informant consensus: new approach for identifying potentially effective medicinal plants. In: Etkin, N.L. (Ed.), Indigenous Medicine and Diet: Behavioral Approaches. Redgrave Publishers, New York, pp. 91–112.
Tugume, P., Kakudidi, E.K., Buyinza, M., Namaalwa, J., Kamatenesi, M., Mucunguzi, P., Kalema, J., 2016. Ethnobotanical survey of medicinal plant species used by communities around Mabira Central Forest Reserve Uganda. J. Ethnobiol. Ethnomed. 12, http://dx.doi.org/10.1186/s13002-015-0077-4.
Umadevi, M., Rajeswari, R., Rahale, C.S., Selvavenkadesh, S., Pushpa, R., Kumar, K.S., Bhowmik, D., 2012. Traditional and medicinal uses of *Withania somnifera*. Pharm. Innov. 1, 102–110.
van Andel, T., de Boer, H.J., Barnes, J., Vandebroek, I., 2014. Medicinal plants used for menstrual disorders in Latin America, the Caribbean, sub-Saharan Africa, South and Southeast Asia and their uterine properties, a review. J. Ethnopharmacol. 155, 992–1000.
Verma, A.K., Kumar, M., Bussmann, R.W., 2007. Medicinal plants in an urban environment: the medicinal flora of Banares Hindu University, Varanasi, Uttar Pradesh. J. Ethnobiol. Ethnomed. 3, http://dx.doi.org/10.1186/1746-4269-3-35.
Yamamoto, K., Okazaki, A., Sakamoto, Y., Funatsu, M., 2009. The relationship between premenstrual symptoms, menstrual pain, irregular menstrual cycles, and psychosocial stress among Japanese college students. J. Physiol. Anthropol. 28, 129–136.
Zonyane, S., Van Vuuren, S.F., Makunga, N.P., 2012. Pharmacological and phytochemical analysis of a medicinal plant mixture that is used as a traditional medicine in Western Cape. In: Proceedings of the 38th Annual Conference of the South African Association of Botanist, University of Pretoria, Pretoria, South Africa, January, p. 124.