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# An ethnobotanical study of aromatic medicinal plants of Swat Valley, Pakistan

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**Abstract.** *Ali S, Munazir M, Sher H, Qureshi R, Akram M. 2023. An ethnobotanical study of aromatic medicinal plants of Swat Valley, Pakistan. Asian J Ethnobiol 6: 161-170.* Plants play a key role in local medicines and are a source of income, as in the case of Swat, Pakistan, which is rich in medicinal plants coupled with rich in the practice of traditional knowledge and diverse cultures. So, the present study aimed to record the cultural uses of aromatic medicinal plants commonly used as medicines by herbalists from remote areas in Swat Valley. The survey was carried out in 2021 and 2023 using a semi-structured questionnaire with a total of 106 people were interviewed. A total of 33 aromatic medicinal plant species belonging to 30 genera and 14 families were identified and recorded. Lamiaceae was the most commonly used plant family (33%), followed by Apiaceae (18%), Rutaceae (9%), Zingiberaceae (6%), and Myrtaceae (6%). Herbs were commonly used for herbal recipes with 23 species (69%), followed by shrubs (12%), trees (15%), and climbers (3%). Shoots and leaves (30%) were the most commonly used parts of the plants, followed by fruits (18%), seeds (15%), bulbs (6%), rhizomes, bark, and needles (3%). In terms of mode of application, powder was the most common mode (42%), followed by dried (30%), infusions (27%), decoctions (24%), crushing (6%), and heating (3%). The highest Relative Frequency of Citation (RFC) was *Skimmia laureola* with 0.84, while *Anisomeles indica* had the lowest RFC (0.13). In terms of Fidelity Level (FL), *Zingiber officinale* had the highest FL (83%), while *Sium latifolium* had the lowest FL (13%). The recorded aromatic medicinal plants are mostly used to treat stomach problems. It has also been observed that elderly people are more knowledgeable than younger ones. Therefore, the present study suggests that these plants should be screened for new compounds linked to their reported use in the development of new therapeutics.

**Keywords:** Aromatic plants, cultural use, ethnopharmacological profile, Swat Valley, therapeutic agents

## INTRODUCTION

Since the beginning of human history, plants and humans have had a close and devoted link, not only ecologically but also socio-culturally. For centuries, medicinal and aromatic plants have been used as ingredients for food, flavor, clothing and medicine. Generally, plants with high medicinal and aromatic values have history of use as a source of cheap and effective therapies for several diseases (Salganik and Heckathorn 2004; Qureshi et al. 2016). The custom and tradition of using medicinal plants to treat ailments have always been an essential part of many cultures and can be traced back 7,000 years (Goodman and Ghafoor 1992). For example, the Sumerian clay tablet, a 4000-year-old medical script, documents the most primitive known plant remedies for numerous diseases (Ali et al. 2018). Many of the medications used in today's healthcare systems are derived from plants and were, for the most part, inspired by their traditional uses (Farnsworth and Soejarto 1991; Newman and Cragg 2012).

The number of plant species globally is estimated between 350,000 and 400,000 species in which a great number of them are utilized to treat various diseases (Bussmann et al. 2007; Paton et al. 2008; Abbasi et al. 2010). According to the World Health Organization (WHO), herbal medicines constitute the major source of healthcare for 80% of the world's population in third-world nations (World Health Organization 2003). The trade in aromatic and medicinal plants has a global market worth US$60 billion (Hamilton 2006). Due to the growing trend and popularity of herbal medications, its value is anticipated to significantly increase by the year 2050 (Lange 1997; Al-Quran 2008; Khan et al. 2011).

In Pakistan, due to the vast cultural acceptance and economic potential of materials made from plants, major scientific and commercial trends have been seen during the past few decades (Sher et al. 2014; 2015) including medicine derived from plants. Due to a lack of access to contemporary pharmacopeia, the rural population relies more on a range of traditional herbal medicines (Khan et al. 2012). Nonetheless, there is a great spectrum and variation in the traditional knowledge on the ethnobotanical uses of medicinal plants across local communities in Pakistan. The difference in how traditional medicine is practiced can be attributed to a number of elements, such as community culture, history, attitudes, and philosophies (Šavikin et al. 2013). Over time, knowledge on how to make handmade traditional herbal remedies is typically passed down from one generation to another (Mahmood et al. 2011a,b).

Pakistan has remarkable natural resources, ethnic composition, and ancient civilizations, with a multiplicity of climates, environmental zones, and geographical areas that are gifted with a variety of medicinal plants (Yaseen et al. 2015). It has a great diversity of flowering plants described to occur in different parts of the country. About 6000 species of flowering plants have so far been recognized and familiarized in Pakistan (Ahmad et al. 2014a,b; Nasir and Ali 1971-1999). Among them, more than 10% (600-700 plant species) have medicinal purposes (Akhtar et al. 2013) of which 400-600 species are used in traditional health care (Shinwari and Qaiser 2011).

The great diversity of medicinal plants in Pakistan is due to its climatic conditions, ecological zones, and topography (Sher et al. 2010). There are about 350 traditional herbal preparations used to treat numerous infectious diseases throughout Pakistan (Ahmad and Husain 2008). One of the unique ecological zones in Pakistan is Swat Valley which is an arid region located in high mountainous area. Medicinal plants from the arid area are well known for their nutritional and therapeutic potential. Swat contains a massive diversity of phyto-ecological and agro-climatic combinations, supporting the presence of a huge variety of natural resources. Therefore, the present study is aimed to documents aromatic plants from Swat and their ethnomedicinal use. The current study will provide baseline information on the documented aromatic plants for further study in order to examine their pharmacology and photochemistry to encourage cultural diversity and sustainable use of these aromatic plant resources in the area.

## MATERIALS AND METHODS

### Study area

The present study was conducted in the district of Swat, Pakistan, which lies on the mountain ranges of the Hindu Kush Himalaya and Karakoram. Swat District is located around 190 km to the northeast of the provincial capital of Peshawar (Sher et al. 2017). It is known for its beautiful scenery, encompassing river, fertile lowlands, and extreme altitude gradients to some of the highest mountains in the world. Swat contains five ecological zones: alpine, subalpine, moist temperate, dry temperate, and subtropical (Sher et al. 2017). It is separated from Afghanistan by the Hindu Kush mountain range and harbors the highest peak of the range, Tirich Mir, at 7708 meters. The cool climate of the Swat District and its topography give rise to rich alpine and subalpine ecological zones that are especially important for sourcing medicinal and aromatic plants (Sher et al. 2017). Pakistan's Swat region is the highest in elevation with 980 meters above sea level are on average. The region experiences four distinct seasons: spring, summer, winter, and autumn. The district's upper reaches, including Kohistan, experience bitterly cold winters and are perpetually covered in snow. Temperatures can practically exceed 41°C in the summer on the lower plains, which are dry and hot. As a result, the district's lower areas rarely experience snowfall (Ali 2023). Two monsoon cycles are present in both the upper and lower portions of the region. While the second takes place in the summer, the first happens in the winter. While the upper Swat is covered in dense pine forests, the lower Swat contains vegetation, including dry bushes and deciduous trees (Ali 2023). During the Gandhara culture, which lasted until the tenth century, the area was a significant early Buddhist center; later, the Swat region largely converted to Islam (Niaz 2007). Nearly 90% of the locals are Pashtun, with the Yusufzai tribe being the most prevalent (Niaz 2007).

### Field interview methods

The study was conducted in remote areas of the district through semi-structured ethnomedicinal interviews with residents between 2021 and 2023. There were 106 people interviewed in total (90 men and 16 women). The interviewees were mostly elderly and ranged in age from 25 to 85. Due to the areas' diversity of ethnic groups, ethno-medicinal research has a certain degree of representativeness. The Yousuzai and Gujars were the two primary ethnic groups, and they had a considerable understanding of the study of ethnic medicine. Interviews took place in parks, markets, and fields. Furthermore, since all of these sites were public rather than private, no specific consents were required. After defining the study's goal, a thorough series of questions pertaining to plant therapeutic practices was put out, and at least twice as many people with extensive understanding of medicinal plants were questioned. The information was verified by neighborhood hakims (a practitioner of herbal medicine) or herbalists and cross-referenced with material that was already published. A questionnaire was used to document every meeting with local people and was kept on file for future use. Microsoft Office 2013 was used to import the information and data on aromatic medicinal plants for statistical analysis. The interview questions included native plant names (vernacular names), ailments for which the plants were used, the sections of the plants used, and preparation and administration procedures in an effort to empathetically describe the customary practices of therapeutic plants. The study went into the field with the interview subjects to gather samples of the plants they were told about. The entire collection of plants has not yet been added to any organization’s herbarium.

### Voucher specimen collection

We gathered voucher specimens in 2021-2023 to better represent and safeguard the aromatic medicinal plants obtained in the region. Under the guidance of locals and herbalists with extensive knowledge of these aromatic therapeutic plants, voucher specimens were gathered and prepared. A total of 33 aromatic plants used as medicine in the area were gathered. In the field, the plants were collected and ready for herbarium preservation. The Flora of Pakistan was used to identify the collected plants. With the related field data, a thorough checklist for the region was created. From Tropicos (https://www.tropicos.org/home), accepted plant names were obtained.

**Data analysis**

The data collected were analyzed statistically using various quantitative indices: Fidelity Level (FL) and Relative Frequency of Citation (RFC).

*Fidelity Level (FL)*

Fidelity Level (FL) index was calculated using the formula described by Friedman et al. (1986) to determine the most preferred species used in the treatment of a particular ailment as more than one plant species are used in the treatment in the same category:

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

Where: Np is the number of informants mentioned the usage of the plant for a specific diseases and N is the total number of informants mentioned the species for any diseases. High FL value shows high frequency of usage of the plant species for cure of a specific diseases category by the informants of the study area.

*Relative Frequency of Citation (RFC)*

RFC is of the most utilized plant taxon by the native people (Tardío and Pardo-de-Santayana 2008). It was determined using the formula:

$$RFC = FC/N$$

Where ($0 < RFC < 1$), FC is the number of informants citing a useful species and N is the total number of informants in the survey.

## RESULTS AND DISCUSSION

**Sociodemographic profile of local informants**

Humans have been utilizing plants for a very long time to meet a variety of everyday needs and to maintain life forms. It includes plants with medicinal uses as alternatives to synthetic medications developed by native people from place to place. Due to the presence of temperate climates in its upper portions, Swat District has a high diversity of plants. According to the demographic profile, only 15% of informants were women, and 85% of men were interviewed for the medicinal and aromatic plants of the area. Due to cultural and religious restrictions, fewer women than men were interviewed since women would not be willing to engage and share expertise with the male interviewers. Over 79% of older adults (those over 40) were more knowledgeable about folk medicinal treatments than people in their middle years (aged under 40). Since the young have a limited desire for such traditional practices due to the alteration of their way of life and culture, the elders are typically the ones who are given the crucial native information about aromatic plants. Farmers made up 50% of the informants, followed by Shaponkeys (shepherds) (16%), healers (14%), laborers (8%), shopkeepers (6%), and teachers (5%). Out of 106 people, 35% were illiterate 20% had completed their higher education 13% had completed their secondary education 13% had finished middle school 12% were still in elementary school, and 9% had completed their higher education. According to the ethnic breakdown, Yousufzai made up 41% of the population, Gujjars 23%, Kohistani 14%, Mula 11%, Mians 9%, and Parachas 6%, as indicated in Table 1. Pashto and Gujjaro were the languages most commonly used.

**Biological information and medicinal uses of plants**

The present study was carried out to document aromatic medicinal plants from a highly floristic and culture-rich district of Swat, Pakistan. A total of 33 aromatic medicinal plant species from 30 genera and 14 families were documented. Lamiaceae had the highest percentage of total species utilized by the locals with 33% (11 species), followed by Apiaceae (18%) or six species, Rutaceae (9%) or three species, Zingiberaceae (6%) and Myrtaceae (6%) contained two species each. In total, 72% of known aromatic medicinal species belong to these five families as shown in Figure 1. The remaining species are from nine other families, each of which has one species. Herbs (69%) predominated the group with 23 species, followed by shrubs (12%), trees (15%), and climbers (3%) as shown in Figure 2. Based on field observation, various species that were collected in the Swat District were found to be easily collected and to be used therapeutically. The trend of medicinal plants is passing through generations.

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

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Age** | 10–20 years<br>1 (1%) | 20–30 years<br>05 (5%) | 30–40 years<br>16 (15%) | 40–50 years<br>23 (21%) | 50–60 years<br>43 (41%) | Above 60 years<br>18 (17%) | Total<br>106 | %<br>100% |
| **Qualification** | Illiterate<br>38 (35%) | Primary<br>12 (11%) | Middle<br>13 (12%) | Secondary<br>13 (12%) | Higher secondary<br>20 (19%) | Higher education<br>10 (9%) | Total<br>106 | %<br>100% |
| **Profession** | Farmers<br>53 (50%) | Shepherds17<br>(16%) | Hakims<br>15 (14%) | Teachers<br>5 (5%) | Shopkeeper<br>7 (6%) | Laborers<br>9 (8%) | Total<br>106 | %<br>100% |
| **Ethnic** | Yousufzai<br>41 (39%) | Gujjar's<br>23 (22%) | Mians<br>10 (9%) | Parachas<br>6 (5%) | Mula<br>11 (10%) | Kohistani<br>15 (14%) | Total<br>106 | %<br>100% |

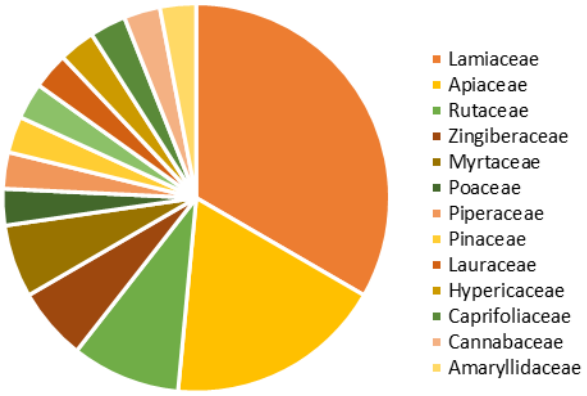


**Figure 1.** Family of aromatic plants used as medicines

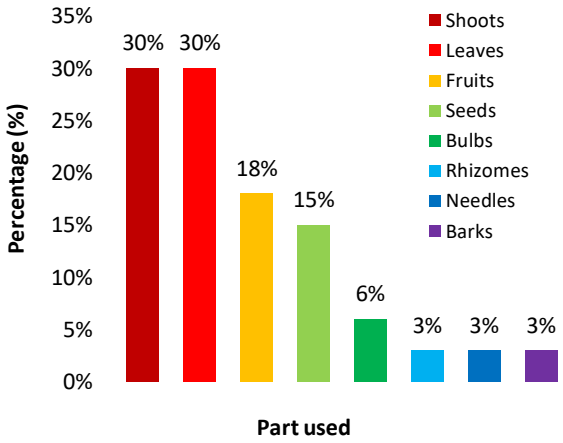


**Figure 3.** Parts of plants are used to cure different diseases

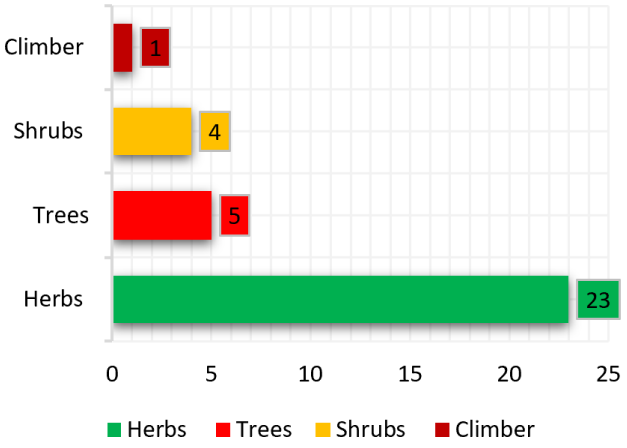


**Figure 2.** Life form of the usable plants

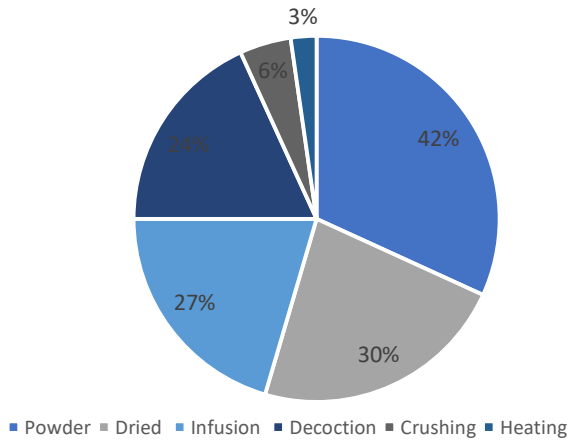


**Figure 4.** Method of preparation of herbal recipes

## Plant parts and mode of preparation

Native people of the district Swat claimed that certain or several components of the local plants were used in herbal remedies. It is also important to note that different plant parts may be used to cure different ailments or that a specific plant part may be needed to cure a certain condition. For this reason, it is crucial to list the plant component along with the diseases it treats. However, we gathered information from 106 reports of 33 species using a variety of nine plant parts as shown in Table 3. Shoots and leaves (30%) were the most commonly used parts of the plants, followed by the fruits (18%), seeds (15%), bulb (6%), rhizome, bark, and needle (3%), respectively as shown in Figure 3. Additionally, for three species, two or more parts are used in the treatment and curing of diseases, with different parts employed for different effects. For example, the seed of *Ocimum basilicum* is used for fever and headaches, while the leaves are used for constipation, and the flower is used for fragrances as shown in Table 3. Based on the above findings, we can safely draw the conclusion that different parts of the plant exhibit different functions. The results of the study revealed that powder was the most common mode of preparing aromatic medicinal plants, accounting for 42% of the recorded preparations, followed by dried (30%), infusions (27%), decoctions (24%), crushing (6%), and heating (3%) as shown in Figure 4. Therefore, there are several methods for the preparation of aromatic medicinal plants used in the area. However, different methods present different efficiencies, and the most appropriate preparation method should be chosen.

## Disorders treated

Based on this survey, the collected aromatic plants are broadly used in local traditional medicine to treat gastrointestinal disorders, fever, dysentery, impotency, cough, asthma, wounds, depression, antipathies, cancer, TB, and diabetes as shown in Table 3. Commonly, local people combine two or more aromatic medicinal plants to treat a particular ailment. In this survey, most of the identified aromatic medicinal plants can be employed as both medicine and flavor agents. The local population used these plants to maintain good health in the long term. Some aromatic medicinal plants can be made into healthcare products, such as herbal teas and medicinal juices, which contribute to

health through therapies or prevention. Furthermore, some people cultivate aromatic vegetables and plants with certain characteristics that are conducive to supplying the body with necessary nutrients and particular trace elements. In our survey, plants such as *Coriandrum sativum, Zingiber officinale, Elettaria cardamomum, Zanthoxylum armatum, Cymbopogon citratus, Allium sativum, Mentha spicata,* etc. were cultivated as vegetables, flavouring agents, and for medicinal purposes. The *M. spicata* was grown for flavor and stomach disorders; *C. sativum* as a vegetable and for cough and weakness; *Z. officinale* for spices, stomach, and cough; *E. cardamomum* for stomachic, vomiting, and asthma; and highly used as tea flavor; *C. citratus* for weight loss and tea flavor; *A. sativum* for antioxidants and to promote male impotency; and highly used as food flavor and *M. spicata* used for stomach, cough and toothache, while high used as flavor for chutney. According to the results of our study, the most common methods of application are oral and external. According to the present study, about 97% of aromatic plants can be used as oral medicines, whereas only one plant, *Cannabis sativa*, was reported to be employed only as an externally applied drug. Under some circumstances, oral and external treatments can better cure disease. These plants have anti-inflammatory and anti-bacterial functions. There were many aromatic plants identified during this survey that present unique characteristics and play specific roles in the medical community.

**Uses for other purposes**

Aromatic plants have been commonly used as flavors for foods, tea substitutes, spices, candies, honeybees, fragrances, juices, and chutneys. In the current study, among the 33 of aromatic plant species recorded, a total of 29 plants were used for other purposes, such as 12 plants used as flavor agents, six used as substitutes for tea, six used for spices, two used for candies, two visited by honeybees, two species burned to protect from evil eyes, and one species used as juice. However, the use of aromatic plants was high in the area, particularly in remote areas. They collected some species from the wild, and some were cultivated in the area for their own use, such as *Allium cepa, M. spicata,* and *C. sativum,* which were cultivated in the area for different uses, such as salads and making different recipes. The *Z. officinale* was grown for use as a flavor in recipes and spices. The *Z. armatum* and *Z. alatum* were collected from the wild for use as flavor for chutney; *C. citratus* was cultivated for use as a flavoring agent for tea; and some were also collected from the wild as tea substitutes, such as *Abies pindrow, Mentha arvensis, Origanum vulgare,* and *Clinopodium umbrosum. Sium latifolium* was collected from the wild as a flavoring agent for sag; *Mentha sylvestris* was collected from wild to cook with maize cobs as a flavoring agent; *O. basilicum* was grown as a flavoring agent and for better fragrances, *Syzygium aromaticum* and *Piper nigrum* were grown as sources of spice. The present study concluded that aromatic plants are highly used and have high demand in the area. Therefore, locals collected them from the wild or cultivated areas for different purposes.

**Marketing value of aromatic plants in the area**

The present study revealed that people in the area cultivated some aromatic species for marketing purposes. Among them were *M. spicata, C. sativum, Foeniculum vulgare, Z. officinale, A. sativum, P. nigrum, E. cardamomum, S. aromaticum,* and *C. citratus,* which were cultivated as sources of income. The highest price rate was found in *C. citratus,* followed by *S. aromaticum, F. vulgare, E. cardamomum,* as shown in Table 2. Local people used these plants as source of income, mainly herb healer involved in the marketing of these plants.

**Quantitative value of plant use**

Quantitative ethnobotany is particularly interested in quantifying the importance of plants to a community. In our survey, we used the Relative Frequency of Citation (RFC) with resulting value ranged from 0.13 to 0.84. The RFC demonstrated how people frequently reported various ailments on plants. RFC was used to gauge a species' popularity within its native habitat. *Skimmia laureola* had the greatest RFC value (0.84), followed by *Z. officinale* (0.82), *C. sativa* (0.80), *Mentha longifolia* (0.77), *M. spicata* (0.73), *E. cardamomum* (0.71), and *P. nigrum* (0.68). Table 3 showed that *Anisomeles indica* had the lowest RFC (0.13), followed by *S. latifolium* (0.14), *Isodon rugosus* (0.15), and *Calamintha debilis* (0.16) as shown in Table 3.

**Table 2.** Marketing value of aromatic medicinal plants used in Swat District, Pakistan

| Plant Species | Marketing Form | Part Sold | Bundle | Gram | Price (PKR) | Price (USD) |
|---|---|---|---|---|---|---|
| *Mentha spicata* | Fresh/dried | Shoot | 1 | 100g | 20/40 | 0.069/0.13 |
| *Coriandrum sativum* | Fresh/dried | Leaves/seed | 1 | 100g | 20/90 | 0.069/0.3 |
| *Foeniculum vulgare* | Dried | Seed | - | 100g | 200 | 0.69 |
| *Zingiber officinale* | Fresh/dried | Bulb | - | 100g | 80 | 0.27 |
| *Allium sativum* | Fresh | Bulb/leaves | - | 100g | 25/80 | 0.87 |
| *Piper nigrum* | Dried | Fruit | - | 100g | 150 | 0.52 |
| *Elettaria cardamomum* | Dried | Fruit | - | 100g | 160 | 0.55 |
| *Syzygium aromaticum* | Dried | Fruit | - | 100g | 400 | 1.38 |
| *Cymbopogon citratus* | Fresh/dried | Leaves | - | 100g | 500 | 1.73 |

**Table 3.** List of aromatic plant use as medicine in Swat Valley, Pakistan

| Plants/Voucher Number | Family | Habitat | Part used | Form of Use | Form/Method of Use | Other uses | RFC | FL |
|---|---|---|---|---|---|---|---|---|
| *Allium cepa* L. SMHR-001 | Amaryllidaceae | Herb | Bulb | Direct eating/infusion | Eating its bulb as antioxidant, used for fever and treat male impotency | Used in food as flavor | 0.66 | 60 |
| *Coriandrum sativum* L. SMHR-002 | Apiaceae | Herb | Leaves/seed | Dried/infusion | Dried seed in chicken soup or infusion highly effective in cough and weakness | Leaves used as flavor for foods | 0.56 | 50 |
| *Carum carvi* L. SMRH-003 | Apiaceae | Herb | Seeds | Fresh/dried | Power used for dyspepsia | Used in spices | 0.51 | 46 |
| *Foeniculum vulgare* Mill. SMHR-004 | Apiaceae | Herb | Seed | Dried/decoction | Seed with water or decoction of seed used for stomachic | Seed used as flavor in candies | 0.72 | 55 |
| *Mentha sylvestris* L. SMHR-005 | Apiaceae | Herb | Shoot | Dried/infusion | Powder taken with water is used for gastric problems | Cooked with maize cobs as flavoring agent | 0.21 | 45 |
| *Plectranthus rugosus* Wall. ex Benth. SMHR-006 | Apiaceae | Herb | Leaves | Dried/infusion | Powder taken with water or infusion is used for internal inflammations | Honeybee species | 0.38 | 40 |
| *Sium latifolium* SMHR-007 | Apiaceae | Herb | Shoot | Fresh | - | Shoot used as flavor in sag and seed used in spices | 0.14 | 13 |
| *Cannabis sativa* L. SMHR-008 | Cannabaceae | Herb | Leaves | Dried/heated | Keep heated leaves in fracture for relief of pain and its smokes inhale for asthma | Dry leaves burning to protect from evil eyes | 0.80 | 64 |
| *Valeriana jatamansi* Jones. SMHR-009 | Caprifoliaceae | Herb | Rhizome | Crushed/decoction | Used as antioxidant and carminative | - | 0.20 | 35 |
| *Hypericum perforatum* L. SMHR-010 | Hypericaceae | Herb | Shoot | Powder/fresh | Tea of the plant use for anxiety, stomachache and depression | - | 0.29 | 45 |
| *Anisomeles indica* (L.) Kuntze. SMHR-011 | Lamiaceae | Herb | Shoot | Powder | Powder taken with water is effective for allergies | - | 0.13 | 43 |
| *Calamintha debilis* (Bunge) Benth SMHR-012 | Lamiaceae | Herb | Shoot | Powder/infusion | Powder taken with water or infusion used for stomach disorders | - | 0.16 | 41 |
| *Clinopodium umbrosum* (M.Bieb.) Kuntze SMHR-013 | Lamiaceae | Herb | Shoot | Powder | Powder taken with water is used for wounds | Herbal tea | 0.21 | 40 |
| *Isodon rugosus* (Wall. ex Benth.) Codd SMHR-014 | Lamiaceae | Shrub | Leaves | Powder/decoction | Decoction or powder used for stomach disorder | Honeybee | 0.15 | 44 |
| *Mentha longifolia* (L.) L. SMHR-015 | Lamiaceae | Herb | Shoot | Powder/infusion | Powder taken with water or use of decoction used for belly pain, gas and stomachic | Flavoring agent | 0.77 | 73 |
| *Mentha spicata* L. SMHR-016 | Lamiaceae | Herb | Shoot | Powder/infusion | Powder taken with water or shoot directly eaten is used for stomachic and leaves keep in teeth to relieve pain | Flavor agent | 0.73 | 65 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Micromeria biflora* (Buch.-Ham. ex D.Don) Benth. SMHR-017 | Lamiaceae | Herb | Leaves | Powder | Powder with water used for healing and fever | Pot herb | 0.28 | 33 |
| *Ocimum basilicum* L. SMHR-018 | Lamiaceae | Herb | Leaves/seed | Seed powder | Seed powder with water used for fever and leaves used for constipation | Fragrance and flavor | 0.35 | 54 |
| *Origanum vulgare* L. SMHR-019 | Lamiaceae | Herb | Seed | Powder | Powder with water used for fever and stomachic | Seed used in tea | 0.25 | 20 |
| *Thymus linearis* Benth. SMHR-020 | Lamiaceae | Herb | Shoot | Powder | Powder with water used Fever | Herbal tea | 0.6 | 61 |
| *Thymus serphyllum L.* SMHR-021 | Lamiaceae | Shrub | Leaves | Decoction | Plants is anticancer properties | Herbal tea | 0.50 | 57 |
| *Cinnamomum verum* J.Presl SMHR-022 | Lauraceae | Tree | Bark | - | Stem used as tooth brash | Used in spices | 0.42 | 63 |
| *Syzygium aromaticum* (L.) Merr. & L.M.Perry SMHR-023 | Myrtaceae | Tree | Fruit | Dried/decoction | Powder with water or decoction and chewing is effective for stomachache, fever, and TB. | Used in curries and spices | 0.59 | 71 |
| *Myrtus communis* L. SMHR-024 | Myteraceae | Shrub | Leaves/Fruits | Decoction | Decoction or making tea from leaves effective in cough | Extract juice used as drink | 0.5 | 56 |
| *Mentha arvensis* L. SMHR-025 | Lamiaceae | Herb | Leaves | Infusion | Infusion and making tea from its leaves are effective in ulcer and other internal inflammation | Herbal tea | 0.22 | 26 |
| *Abies pindrow* (Royle ex D.Don) Royle SMHR-026 | Pinaceae | Tree | Needle | Decoction | Decoction or making tea from it effective in asthma | Tea substituent | 0.63 | 50 |
| *Piper nigrum* L. SMHR-027 | Piperaceae | Climber | Fruits | Powder | Powder in chicken soup used for cough and improvement of eye vision | Fruit used as spice and flavor in foods | 0.68 | 65 |
| *Cymbopogon citratus* (DC.) Stapf SMHR-028 | Poaceae | Herb | Shoot | Dried/infusion | Making tea from leaves used for weight lose | Flavoring agent/herbal tea | 0.53 | 64 |
| *Skimmia Laureola* Franch. SMHR-029 | Rutaceae | Shrub | Leaves | Dried/decoction | Powder with water used for stomachic and diabetes | Leaves smoke used against evil eyes | 0.84 | 77 |
| *Zanthoxylum alatum* Roxb. SMHR-030 | Rutaceae | Tree | Fruits | Powder | Powder taken with water effective for stomachic | Flavor for chutney | 0.41 | 30 |
| *Zanthoxylum armatum* DC. SMHR-031 | Rutaceae | Tree | Fruits | Powder | Powder taken with water for stomach and fever | Used as flavor for chutney | 0.64 | 57 |
| *Elettaria cardamomum* (L.) Maton SMHR-032 | Zingiberaceae | Herb | Fruit | Dried | Chewing dried fruits help in stomachic, vomiting and asthma | Tea flavor | 0.71 | 54 |
| *Zingiber officinale* Roscoe SMHR-033 | Zingiberaceae | Herb | Bulb | Crushed | Crushed bulb used for stomach and making tea from it used for cough | Used as flavor for foods and also used in spice | 0.82 | 83 |

In term of Fidelity Level (FL), no species had value of 100%. The *Z. officinale* had the highest FL value (83%), followed by *S. laureola* (77%), *M. longifolia* (71%), and *S. aromaticum* (71%), which are used to treat stomach, cough, diabetes, fever, and tuberculosis. The plants which are used to treat fever, stomachaches, and inflammation have lower FL such as *S. latifolium* (13%), followed by *O. vulgare* (20%), *M. sylvestris* (21%) and *M. arvensis* (26%) as shown in Table 3. However, as many 18 species have a strong tendency to be used for stomach and related illnesses, followed by fever (7 species), cough (4 species), asthma and pain (3 species), inflammations (2 species), weakness (1 species), cancer (1 species), antioxidants (1 species), impotency (1 species), depression (1 species), allergies (1 species), wounds (1 species), TB (1 species), eye (1 species), and diabetes (1 species).

**Discussion**

The topography in Swat District provides ideal physical condition for the growth and maintenance of several highly valuable medicinal and aromatic plants (Sher et al. 2014). Since around 5000 BC, aromatic plants, commonly referred to as herbs and spices, have been utilized in the Middle-east to enhance the flavor and scent of food as well as for preservation and therapeutic purposes (Piccaglia et al. 1993; Chang 2000; Li et al. 2006). According to the World Health Organization (WHO), approximately 80% of the world's population, particularly in developing countries, still relies on plant-produced medications for their healthcare (Collins 2006; Gurib-Fakim 2006). Their use is still widespread today. Aromatic plants, their extracts, and their essential oils have been studied among these natural supplements due to their advantages over antibiotics as growth boosters. They are generally accepted as safe (GRAS) and residue-free (Varel 2002; Windisch et al. 2009; Brenes and Roura 2010).

In the present study, a total of 33 aromatic plant species used as medicines and a source of income were documented in Swat District. Our study suggested that *C. sativum* is used for cough and weakness and also highly used as spices for food; *M. spicata* is used to cure stomachic and toothache; *Micromeria biflora* is used for healing fever; *S. aromaticum* is used for stomachache, fever, and TB; *A. cepa* is used as an antioxidant and for fever; *Z. officinale* is used for stomachache and cough; and *E. cardamomum* is used for stomachic, vomiting, and asthma. Hence, our result showed some differences from the study by Akhtar et al. (2013) and Ali et al. (2018). The *C. sativa* was mentioned by Iqbal and Hamayun (2004), Hussain et al. (2006), Ali et al. (2011), and Bibi et al. (2014), as a narcotic, anodyne, and tonic, while our study reported it as painkiller and use against evil eyes. Bibi et al. (2014) mentioned *A. cepa* for pimples and skin infections from Baluchistan, while our study reported it is used as an antioxidant agent and used for snake bites. *Plectranthus rugosus* was mentioned by Hussain et al. (2006) as an antiseptic that cures toothaches, while our study mentioned it for internal inflammation. Iqbal and Hamayun (2004) reported *C. sativum* for piles, secretion of gastric juices, and a fruit decoction is given in colic, seeds create appetite, while our study suggested it is effective in cough and weakness. Iqbal and Hamayun (2004) reported *A. cepa* as a diuretic, aphrodisiac, expectorant, antiseptic, and for tobacco poisoning, while our study suggested it as an antioxidant, for fever, and to treat snake bites. The *M. spicata* is used as a stimulant, carminative, and stomach and toothache*; M. sylvestris* is used for stomach; *Valeriana jatamansi* is used as an antioxidant and carminative, so the findings of this study support this (Iqbal and Hamayun 2004). Gulzar et al. (2019) reported similar uses for *C. sativa, M. longifolia, Z. armatum,* and *M. biflora* from the Malakand district. Ahmad et al. (2011) mentioned similar reports for *F. vulgare*, *M. longifolia,* and *Z. armatum* from the Tehsil Kabal Swat, while both studies found different uses of *O. basilicum.* Khan et al. (2015a,b) mentioned similar uses for *Z. armatum* and different uses for *P. rugosus.* Shah et al. (2016) mentioned *A. cepa* and *C. sativum,* while our study disagreed with them in cases of use, while similar studies mentioned *F. vulgare*. Nabi et al. (2013) mentioned *A. cepa* as a source of food but did not mention any medicinal uses, while for *M. longifolia* and *C. sativa,* similar uses were mentioned, while different uses were mentioned for *Coriaundrum sativum, S. aromaticum,* and *F. vulgare.* Ali et al. (2023) reported similar uses for *A. cepa, M. longifolia, O. basilicum,* and *F. vulgare*, while different for *Cuminum cyminum,* and *P. rugosus.* Akhtar et al. (2013) mentioned *Hypericum perforatum* as a diuretic, stimulant, and analgesic, as well as *O. vulgare* used as diuretic, against toothache and earache, while our study revealed that *H. perforatum* is used for anxiety, stomach, and depression, and *O. vulgare* is used for fever and stomachic. Our study revealed that *Clinopodium debile* and *I. rugosus* is used for stomach disorders, while Ahmad et al. (2015) mentioned *C. debile* as forage and for healing wounds and *I. rugosus* is an antipyretic and an antidiarrheal. The present study is in line with Ali et al. (2018) in the case of *Thymus linearis.* The present study reported that *A. indica* is effective for allergies, but there was no report of this study from Swat.

Some aromatic medicinal plants have high demand in local markets. So, in the present study, we also documented the marketing value of selected plants. It was observed throughout the survey that residents of the study region not only cultivated or harvested aromatic herbs for medical uses but also used them as a source of income. Therefore, a total of nine plants were sold in local markets. Our findings are consistent with similar reports of medicinal plant used as a source of income in Swat (Hussain et al. 1995; Sher et al. 2004; Begum et al. 2005). While it was noted that only local healers are involved in the collection of medicinal plants, Sher et al. (2015) stated that superior economic outcomes can be reached from the harvesting of wild medicinal plants as opposed to the traditional cash crop. A number of therapeutic herbs from local marketplaces are also supplemented by them. Local people in remote locations of the study region significantly benefited economically from using forest products. Different communities in Pakistan's northern mountains that rely on wild resources have discovered similar benefits (Sher 2002; Hamayun et al. 2003; Islam et al. 2006; Shinwari et al. 2006; Ahmad et al. 2014a). Crops can aid in the economic development of a region in particular and the nation as a whole (Sher et al.

2014). According to the current study, the city of Mingora is the center for the commerce and gathering of numerous valuable medicinal and aromatic plants. According to (Rashid et al. 2011), the bulk of marketable medicinal plants is gathered in Pakistan's northern regions, particularly the Swat District. In order to supplement their meager income and meet their fundamental necessities in rural life, people are forced to pick medicinal plants and sell them at extremely low prices to middlemen, especially in mountainous areas (Nwafor et al. 2021). The most common medicinal recipe preparation was in powder form, as observed in this study. A similar result was also obtained by (Akhtar et al. 2013). While our results are different from those of Fallah et al. (2006), because they reported that most people used medicinal plants in processed form, some used as paste form, and a few uses used in powder form, shoot was the dominant part used in herbal remedies. In this regard, our observations disagree with those of Cakilcioglu and Turkoglu (2010), Akhtar et al. (2013), Ahmad et al. (2014b), and Bano et al. (2014) because the said leaf a dominant part of herbal recipes, because they focused on whole medicinal plants; while the present study is based focused on aromatic plants.

The present study was the first documentation from the Swat District reporting aromatic medicinal plants from the area. Some plants in the current study had similar uses to those found in the literature while others had different uses. Therefore, there is a need to scientifically validate the ethnomedicinal uses of the documented plants.

In conclusion, this study is the first ever to document information on aromatic plants used in traditional medicinal practice in Swat District, suggesting that the region is home to a large number of aromatic plants. There were 33 aromatic plant species that belonged to 14 families used by the locals for medicinal purposes. The quantitative analysis determined the importance of the medicinal plants in the target area. Therefore, Swat is a place where local medicinal plants have a variety of applications, and a multifaceted medical healthcare delivery system has been established here. However, there is still a paucity of physiotherapeutic support for several of the local traditional remedies. To investigate the potential of aromatic plants, it is therefore required to analyze the chemical components and pharmacological properties of some medicines.

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