Ethnomedicinal Potential of indigenous plants of the Northern Balochistan, Pakistan

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Abstract

Background: The Pakistani region of Balochistan lies within the borders of three countries (Pakistan, Iran, Afghanistan) and is a large, arid and mountainous province that makes up a large part of the country's land area. It is called a sacred land by the locals as it has different ecological conditions such as attractive landscapes, magnificent forests and a variety of unique flora and fauna. This study, the medicinal use of plants in the Northern region of Balochistan province in Pakistan was documented.

Methods: During the field research conducted in 2021-2023, an open-ended survey was prepared to record and document the ethnomedicinal use of high-value medicinal plants in the study area. The ethnomedicinal data was collected by administering the prepared questionnaire to local people, pansars, judges, local midwives and old wise men (both men and women).

Results: A total of 93 ethomedicinally important plant species from 40 families are reported from the northern Balochistan. Out of the 93 species, 1 species (1.07 %) was a gymnosperm, 11 species (11.82 %) belonging to 6 families were monocotyledons and the remaining 81 species (87.09 %) belonging to 33 families were of dicotyledons. Papilionaceae was the leading family in terms of species diversity, represented by 14 medicinal plant species (15.05 %) belonging to 9 genera (9.67 %), followed by Asteraceae with 9 species (9.67 %) belonging to 9 genera (9.67 %), Apiaceae with 7 species (7.52 %) belonging to 7 genera (7.52 %), Brassicaceae with 5 species (5.37 %) belonging to 5 genera (5.37 %) and Lamiaceae with 5 species (5.37 %) belonging to 4 genera (4.30 %). The remaining 36 families had less than 5 species each (5.37 %). According to habit, most medicinal plants were herbs with 55 species (59 %), followed by shrubby plants with 33 species (36 %) and trees were represented by 5 species (5 %). The most common and important plant part used in the preparation of recipe was the whole plant, 37 species (39.78 %), followed by leaves, 14 species (15.05 %) and seeds, 10 species (10.75 %). Oral ingestion was the main route of administration with 74 (79%) species, followed by topical application with 9 species (10 %), while 10 species (11 %) were used both topically and orally. The ethnomedicinal study revealed a total of ninety-three species most important for therapeutic use. The bulb of *Allium griffithianum* is used orally for mouth ulcers, while the whole plant of *Achyranthes aspera* is used for coughs and rheumatism. Therefore, some species are also used for multiple purposes (*Berberis baluchistanica*, *Onosma hispida*, *Citrullus colocynthis, Ephedra intermedia, Acacia nilotica*, *Astragalus khalifatensis*, *Berchemia pakistanica*, *Ziziphus mauritiana* and *Withania coagulans*), while only a few plants in this area have a single therapeutic use (*Achillea wilhelmsii*, *Iphiona grantioides*, *Matricaria aurea*, *Microcephala lamellate*, *Heliotropium*

baluchistanicum, *Cardaria chalepense*, *Sisymbrium irio*, *Tetracme stocksii*, *Acanthophyllum grandiflorum*, *Convolvulus spinosus*, *Cuscuta pulchella*, *Euphorbia granulata*, *Ricinus communis*, *Iris stocksii*, *Alhagi maurorum*, *Caragana brachyantha*, *Parkinsonia aculeata*, *Papaver pavoninum*, *Sorghum halepense*, and *Ranunculus falcatusi*).

Conclusions: Since the species have medicinal value, the results of our study provide important scientific as well as practical insights. In this context, we believe that the species used by local people in traditional treatment will be important for the protection of social health.

Keywords: Ethnomedicinal plants; Herbal recipes; Northern Balochistan; Pakistan

Background

Ethnobotany is an interdisciplinary science concerned with how indigenous or local people use plants or their parts for different purposes (McClatchey *et al.* 2009). Local or indigenous peoples and cultures use a variety of plants for different purposes. Many people still rely on plants as a source of food, medicine, fuel, building materials, dyes, and money because they can be used in so many different ways (Ajaib *et al.* 2016). The use of medicinal plants and their products to cure various diseases is widespread around the world, but most prevalent in developing countries, where 80% of the population is dependent on plants or their products (Calixto 2005).

Ethnobotanical studies not only document the mutual interactions between humans and plants that have existed for centuries, but also form the basis for using the results of these interactions for the development of people living in rural areas, for the protection of biodiversity, for the identification of utilized, exported and endangered species and for legal regulations (Ertuğ 2004, Tekkoyun 2023). The aim of ethnobotanical and ethnomedical studies is to improve the use of plant resources and to preserve and pass on traditional knowledge to future generations (Kufer *et al.* 2005; Barkatullah *et al.* 2009). In addition, they can be a resource for the cultivation of plants that are superior in terms of disease resistance and for the identification of new plant species from which colorfast dyes with more durable colors can be obtained. Since ethnobotanical studies are conducted by different disciplines each discipline applies different techniques in their studies (Ertuğ 2004, Tekkoyun 2023). The Himalayan region, which includes parts of Afghanistan, Bangladesh, Bhutan, China, Nepal, Myanmar, India and Pakistan, is considered the peak of biodiversity in terms of medicinal plant species (Shinwari and Qaisar 2011, Hussain *et al.* 2012, Rashid *et al.* 2018, Sulaiman *et al.* 2020). At this point, due to its geographical location, unique climatic, soil and geomorphologic characteristics, Pakistan has a mat biodiversity with an important ecological structure and is very rich in medicinal and endemic plants spread over a large area (Ali, 2008, Bibi, 2015). Four phytogeographic regions were defined while analyzing the phanerogams of Pakistan: In the analysis of phanerogams of Pakistan, Pakistan has four phytogeographical regions followed by Irano-Turanian (45.6%), followed by Sino-Japanese (10.6%), Saharo-Sindhian (9.1%) and Indian (4.5%) (Ali and Qaiser 2011). It is home to an estimated 6,000 species of higher plants. About 600 to 700 species are reportedly used for medicinal purposes (Ali and Qaiser 2011). In Pakistan, about 75% of the local population depends on medicinal plants for all or most of their health needs, and the medicinal plant flora is extensively used for the production of medicines, food, cosmetics and dietary supplements (Petrakoua *et al.* 2020; Sulaiman *et al.* 2020).

Outstandingly, Northern Balochistan is a floristic province, part of Irano-Turanian floristic region, a biogeographical region characterized by its unique plant species and ecological features. It is located at the crossroads of southwestern Asia and includes parts of Iran, Afghanistan, and Pakistan (Takhtajan, 1986). This floristic province includes the eastern part of Iran, the southern regions of Afghanistan, and the western regions of Pakistan, including the province of Balochistan. The biodiversity of Northern Balochistan has been known as an important source of traditional medicines for millions of years. For the communities in this rural region, medicinal plants appear to be the optimal solution to many health problems (Jamal *et al.* 2012, Sulaiman *et al.* 2020). Numerous studies on ethnobotanical utilization of plant diversity in Northern Balochistan have been conducted in various periods (Sarangzai *et al.* 2013, Bibi *et al.* 2014, Bibi *et al.* 2015, Bibi *et al.* 2016, Sherani *et al.* 2020, Anjum *et al.* 2020, Ulhaq *et al.* 2021,Ur Rehman *et al.* 2023). However, there are still untouched areas waiting to be explored. In Balochistan, Killa Abdullah, Pishin, Quetta, Killa Saifullah, Sherani, Barkhan, Loralai, Musakhel, Zhob, Duki, Ziarat, parts of Harnai, parts of Nushki and a small part of Kalat are located in the Floristic Province of Northern Balochistan (Takhtajan 1986). Despite the difficult climatic conditions, the province of Northern Balochistan has a remarkable diversity of plant species, many of which have developed unique adaptations to survive in the arid environment. The flora includes a mixture of desert plants, shrubs, grasses, and succulents. The most interesting and characteristic plant regions in Balochistan are the “Juniper tracts” in Ziarat and the *Pinus gerardiana* forests in the Sulaiman Mountain Range in Zhob. The juniper forest of Ziarat is a world heritage site characterized by unique flora and endemic plants. The most important and abundant species

are *Juniperus polycarpos* var. *seravschanica*, rarely mixed with *Pistacia atlantica* var. *cabulica*, *Fraxinus xanthoxyloides, Cotoneaster afghanica, Berchemia pakistanica, Spirea brahuica, Cotoneaster rechingeri, Prunus rechingeri* and *Berberis calliobotrys*.

Materials and Methods

Study area

Balochistan, the largest province of Pakistan in terms of area, extends from 23°-31°North latitude and 61°-70° East longitude. Northern Balochistan floristic province, a part of Irano-Turanian floristic region, is a biogeographical region characterized by its unique plant species and ecological features. It lies at the crossroads of southwestern Asia and includes parts of Iran, Afghanistan, and Pakistan. This province is known for its diverse flora, which has adapted to the arid and semi-arid climate of the region, making it an area of ecological interest (Takhtajan, 1986). The total area of Northern Balochistan is 347,190 km² which accounts for 48 % of Pakistan's land mass. The average annual rainfall is 225 mm (Figure 1).

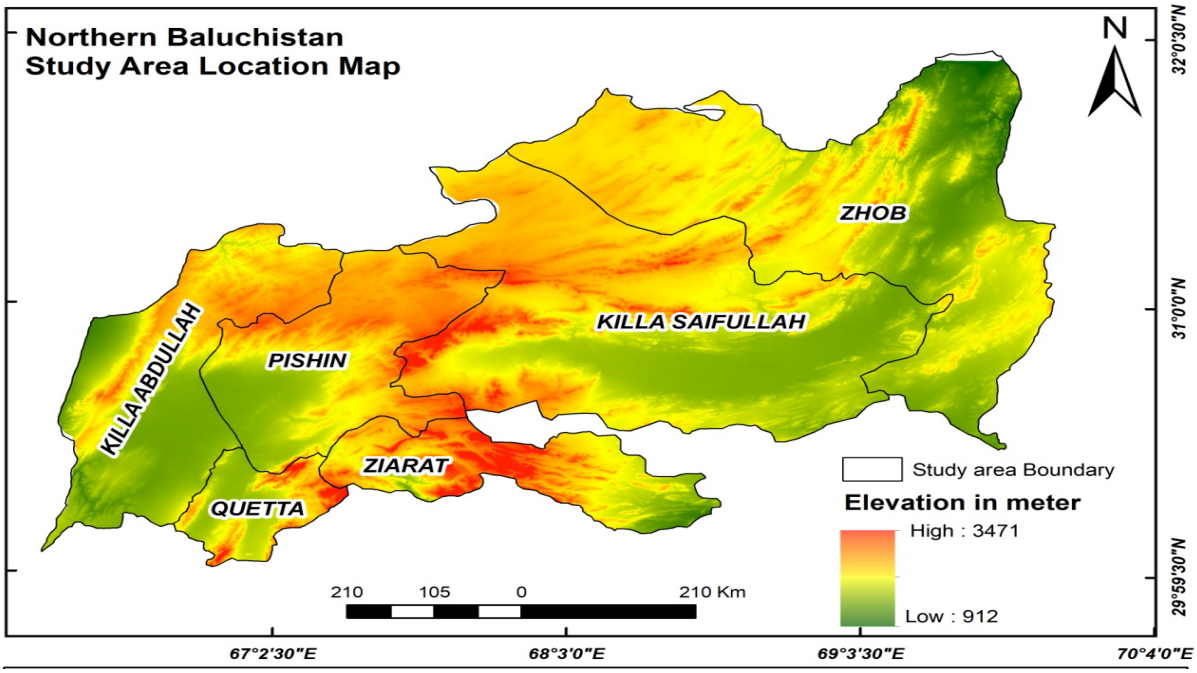

Figure 1. Map of the study area with Northern Balochistan

Background of the people (tribe, language, life style, occupation)

Balochistan, which stretches across parts of Iran, Pakistan, and Afghanistan, is home to a diverse ethnic population with different cultures, dialects, and lifestyles. Here a brief overview of the main groups. The Baloch are the largest ethnic group in Balochistan. They are categorized into tribes, which include the Rind, Lashari, Jamot, and Marri. The Baloch mainly speak Balochi, an Iranian language from the Indo-European language family. Traditionally, many Baloch lived nomadically or semi-nomadically, herding goats, sheep, and camels. However, urbanisation and modernity have led to a change in lifestyle, with more and more Baloch settling in cities and pursuing a variety of professions. Historically, the Baloch lived from cattle breeding, agriculture, and fishing. In current times, Baloch work in a variety of fields, including agriculture, commerce, government services, and the military.

Identification and Preservation of Plants

The Plants were identified with the help of catalogues and Flora of Iranica, Flora of Pakistan (Nasir and Ali 1970-1995, Ali and Qaiser 2000-2012), Checklist of vascular plants of Afghanistan (Breckle *et al.* 2013) Field Guide Afghanistan: Flora and Vegetation (Hedge and Freitag 2010). Voucher specimens were provided to the herbarium of Peshawar University (PUP) for reference. The habitats of plants were determined (Figure 2).

Ethnomedicinal Data Collection

An open-ended questionnaire was designed to record and document the ethnomedicinal use of high-value medicinal plants in the study area. Ethnomedicinal information was gathered from local residents, pansaries, hakims, local midwives, and elderly sages (both men and women) during the field studies conducted in 2021-2023. As the majority of respondents and

locals were illiterate, all questionnaires were completed on site. Among other ethnobotanical information and data, local names, season, part used, collection time, and technique, posological information such as recipe or preparation of the dose, route of administration, ethno-veterinary and ethno-medicinal use in humans were also documented. For each medicinal plant, about 10–15 respondents were interviewed to gather authentic data on the local names and traditional uses (Barkatullah et al., 2009; Ullah et al., 2024).

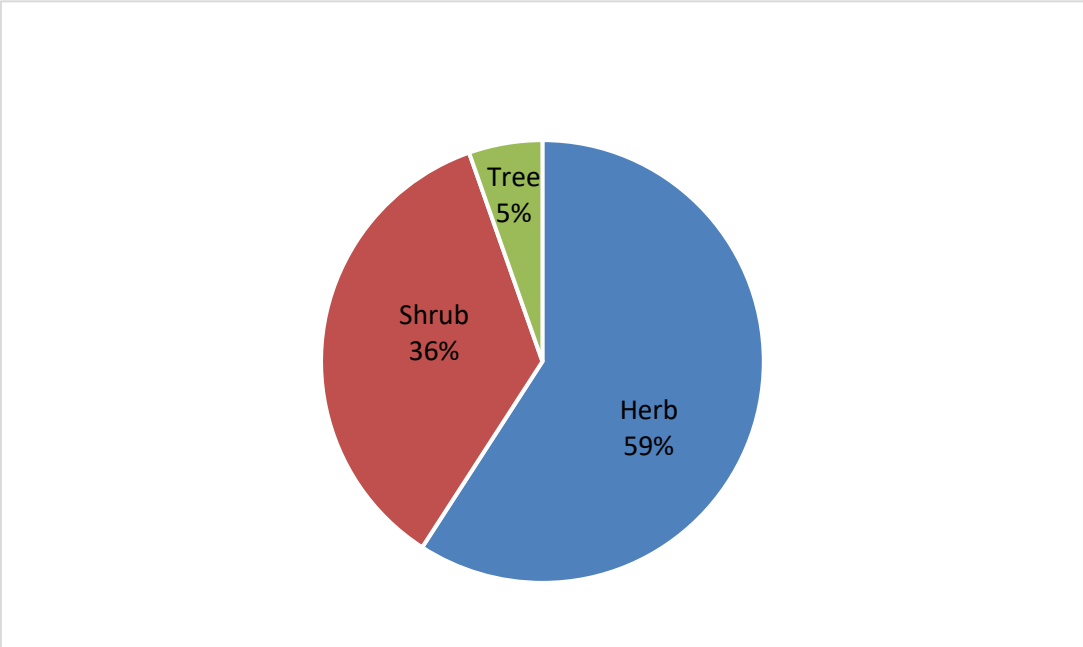

Figure 2. Percentage (%) of plant life forms

Results and Discussion

Northern Balochistan is rich in medicinal plants which are used by the locals to treat various diseases and ailments. All the documented taxa are presented along with information such as family names, botanical names, distribution in Northern Balochistan, vernacular names, parts used, routes of administration, life forms and ethnobotanical uses by the local people. Thus, it is important to collect, document and preserve this local knowledge for future generations.

A total of 40 local informants including farmers, hakeem, shopkeepers, housewives and laborers labors (16 men and 24 women) were interviewed to collect data on medicinal use in the research area (Table 1). Men and women willingly participated in the interviews and revealed a wealth of folk wisdom. The majority of respondents (42.5%) belonged to the middle-aged group between 36 and 45 years of age, followed by 46 to 55 -year-olds (27.5%). It is worth noting that the over 55s (7.5%) showed a lower propensity for herbal treatments. This could be due to the fact that their memory is declining, as Waheed *et al.* (2023) stated in their study. The situation is relatively better for young people between the ages of 25 and 35 (22.5%). This suggests that this could be due to their better socioeconomic status and easier access to information (Waheed *et al.* 2023). Interestingly, participants were categorized as illiterate (30%), graduate (22.5%), middle school (17.5%), postgraduate (12.5%), secondary school (10%), and primary school (7.5%) in terms of their inclination towards herbal treatment. This situation is related to the tasks illiterate people deal with in daily life and their belief in ancient knowledge (Sonibare and Abegunde 2012). Regarding the occupations of the participants, the tendency towards herbal treatment found among farmers (37.5%), shopkeepers (27.5%), housewives (17.5%), hakeems (10%), and laborers (7.5%), respectively. As Waheed *et al.* (2023) stated in their study, it is important to keep in mind that ethnobotanical knowledge can be influenced by many factors such as age, gender, ethnicity and occupation. While there was a significant difference in knowledge between genders and ethnicities, age also affected the extent of knowledge.

In the present study, a total of 93 ethomedicinally important plant species belonging to 40 families were reported from the Northern Balochistan (Table 2). These 93 species are used by the local people of Northern Balochistan for the treatment of 38 diseases. In the current study, we documented the therapeutic aspects of plants belonging to 40 families used by indigenous people to treat different types of ailments. Ethnobotanical studies have been conducted in many previous studies in neighboring regions of the country. Sarangzai *et al.* (2013) in their research and plant collections in Visirat region of

Balochistan found that 90 different taxon species belonging to 35 families were used by the local people for medicinal purposes for various ailments. Bibi *et al.* (2014) reported that a total of 102 plant species belonging to 47 families were used for medicinal purposes in Mastung region of Balochistan. Bibi *et al.* (2015) found that in Northern Balochistan, a total of 24 endemic medicinal plants belonging to 19 genera and 14 families were used by the indigenious people for the treatment of various diseases in 12 categories. Bibi *et al.* (2016) reported a total of 49 plant species belonging to 47 genera and distributed in 30 families in Kalat district Northern Balochistan. Sherani *et al.* (2020), in their review article emphasized on information regarding the status and conservation of biodiversity (coniferous forests, scrub forests, subtropical desert, riverine and mangrove forests) in Balochistan city.

Table 1. Demographic evaluation of the key respondents (*n*=40)

Variables	**Demographic categories**	**Total**	**Percentage (%)**
Gender	Men	16	40
	Women	24	60
Age groups	25-35	9	22.5
	36-45	17	42.5
	46-55	11	27.5
	56 and above	3	7.5
Educational attainment	Illiterate	12	30
	Primary	3	7.5
	Middle	7	17.5
	Secondary	4	10
	Graduate	9	22.5
	Postgraduate	5	12.5
Occupation	Farmers	15	37.5
	Hakeems	4	10
	Shopkeepers	11	27.5
	Housewives	7	17.5
	Labors	3	7.5

This study showed that most of the plant species belong to the families Fabaceae (16 species), Asteraceae (9 species), Apiaceae (7 species), Brassicaceae (5 species) and Lamiaceae (5 species) (Table 3). Similarly, in Kalat district of northern Balochistan, Bibi *et al.* (2016) found that the most abundant families were Asteraceae and Lamiaceae with their characteristic essential oils (4 species each), followed by Fabaceae, Brassicaceae and Apiaceae. Bibi *et al.* (2016) found that the 5 largest medicinal plant families in the region are Asteraceae (10 species), Lamiaceae (10 species), Brassicaceae (5 species) and Rosaceae (4 species), in Mustang province of Balochistan. Sarangzai *et al.* (2013) pointed out that the highest number of species belonging to families used for medicinal purposes are Lamiaceae (12 species), Compositae (9 species), Rosaceae (7 species), Solanaceae (6 species), Apiaceae (5 species) and Moraceae (4 species). In this study, the dominant life forms of plants found that (59.13%) were found to be herbs 36% shrubs, and 5% trees (Figure 2). While trees and shrubs develop on the coastal side where rainfall is high, it can be said that herbaceous plants are common due to the dryness of the interior parts. Moreover, the presence of large grazing areas in the region is also important to explain the abundance of plant and shrub vegetation. Bibi *et al.* (2015), identified 24 species consist of perennial plants (30%), They found that there are shrubs (29%), annual plants (25%) and undershrub plants (16%). While the most represented life form in the studies by Bibi *et al.* (2016) was 'tree' (44.9%), interestingly, herbaceous plants come second (42.86%), followed by shrubs (10%) and semi-shrubs. We can conclude that the content of vegetation influences factors such as the type of plants people traditionally use, the way they use them, etc.

The study of medicinal plants revealed that ninety-three species from forty families represent the most important therapeutic uses. The bulb of *Allium griffithianum* is used orally for mouth ulcers, while the whole plant of *Achyranthes aspera* is used for coughs and rheumatism, the flowers and leaves of *Aerva javanica* for curing inflammation, the leaves of *Amaranthus viridis* for burning feet and the flowers and leaves of *Ixiolirion tataricum* are used to treat stomach problems. Similarly many species such as the gum of *Pistacia khinjuk* to ease childbirth during pregnancy, the seeds of *Bunium persicum* for digestive problems, the gum of *Dorema aureum* (blood pressure), *Ferula costata* sedes (constipation), the fruits of *Foeniculum vulgare* fruits (vomiting), the leaves of *Pimpinella ranunculifolia* used orally for stomach problems, the seeds of *Stewartiella baluchistanica*

(as a carminative), *Trachyspermum ammi* fruits (abdominal pain), *Rhazya stricta* is taken both orally and topically for snake bites, *Calotropis procera* milk extract is used for scorpion bites, *Calotropis gigantea* flowers are used to heal bones bone healing, *Caralluma tuberculata* whole plant is used to treat rheumatism and diabetes, *Vincetoxicum stocksii* leaves (jaundice and leprosy). Therefore, some species are also used for their multiple uses (*Berberis baluchistanica*, *Onosma hispida*, *Citrullus colocynthis*, *Ephedra intermedia, Acacia nilotica*, *Astragalus khalifatensis*, *Berchemia pakistanica*, *Ziziphus mauritiana* and *Withania coagulans*). Only very few plants have a single therapeutic use in this area (*Achillea wilhelmsii*, *Iphiona grantioides*, *Matricaria aurea*, *Microcephala lamellate*, *Heliotropium baluchistanicum*, *Cardaria chalepense*, *Sisymbrium irio*, *Tetracme stocksii*, *Acanthophyllum grandiflorum*, *Convolvulus spinosus*, *Cuscuta pulchella*, *Euphorbia granulata*, *Ricinus communis*, *Iris stocksii*, *Alhagi maurorum*, *Caragana brachyantha*, *Parkinsonia aculeata*, *Papaver pavoninum*, *Sorghum halepense*, and *Ranunculus falcatusi*).

Interestingly, among the reported plant parts, the most frequently used part was the whole plant with 39.78% (viz. *Achyranthes aspera, Achillea wilhelmsii, Caralluma tuberculata, Eremurus stenophyllus, Euphorbia granulate, Salvia cabulica, Scorzonera ammophila*), followed by leaves (15.5%) (*Amaranthus viridis, Hertia intermedia, Pimpinella ranunculifolia, Vince toxicum stocksii*), seeds (10.7%) (*Alyssum desertorum, Medicago monantha, Stewartiella baluchistanica, Ziziphora tenuior), roots (3.2%) (Acanthophyllum grandiflorum, Iris stocksii, Glycyrrhiza glabra), fruits (3.2%) (viz. Foeniculum vulgare, Papaver pavoninum, Trachyspermum ammi*) followed by flower (3.2%) (*Calotropis gigantean, Astragalus stocksii, Rosa brunonii*), gum (2.1%) (*Allium griffithianum, Dorema aureum*), bark (2.1%) (*Acacia nilotica, Berberis calliobotrys*), leaves and fruits 3 species (3.22 %) (*Withania coagulans, Withania somnifera, Ziziphus mauritiana*), leaves and flowers 3 species (3.22 %) (*Aerva javanica, Ixiolirion tataricum, Viola cinerea*), and leaves and roots 2 species (2.15 %) (*Berberis baluchistanica, Rhazya stricta*) while other plant parts were used individually for the preparation of the recipes (Figure 3). Similarly, Waheed *et al.* (2023) found that whole plants (*n*=35) were commonly used to alleviate various ailments. Rahim *et al.* (2023) reported in their study that among the plant parts, leaves were the most commonly used at 30%, followed by the whole plant (18%). Zareef *et al.* (2023) found that indigenous people in the study region used different parts of the plant (together or separately) to treat various gynecological diseases. They reported that the most commonly used part in herbal preparations was the whole plant (14 spp., 23.3%), followed by the leaves (13 spp., 21.6%) and other parts. Also, the findings of our study agree with those of Bibi *et al.* (2014), and Bibi *et al.* (2015) who reported the use of whole plant and leaves as dominant parts use in Mustang district of Balochistan. Bibi *et al.* (2014) concluded that the frequent use of the whole plant in the region could be due to the fact that the region is mountainous with very little rainfall, and the plants are mostly herbaceous and wild shrubs. Therefore, people collect the whole plant and boil it, pulverize it or make an infusion from it. The reason why the indigenous people used the plant completely could be because they wanted to derive greater benefit from the plant. On the other hand, Bibi *et al.* (2014) reported that many ethnobotanical studies reported that the leaves were most commonly used in Asian countries such as China, India, Thailand, Bangladesh, Iran and Pakistan. Researchers (Srithi *et al.* 2009, Odonne *et al.* 2013, Bibi *et al.* 2015) have tried to explain this situation by the fact that leaves contain more bioactive compounds, that leaves are found in almost all plant species (from grasses to trees) and that they are a renewable resource.

The main route of administration is oral (79%; 74 species) (viz. *Adonis aestivalis, Amaranthus viridis, Artemisia scoparia, Cymbopogon jwarancusa, Ferula costata, Papaver pavoninum, Ricinus communis, Salsola imbricata, Tetracme stocksii*), topically and orally (11%) (*Hertia intermedia, Heliotropium baluchistanicum, Onosma hispida, Rhazya stricta, Rosa brunonii*), and topically (10%) (*Alhagi maurorum, Cardaria chalepense, Calotropis procera, Sophora mollis*) (Figure 4). Waheed *et al.* (2023) found that the plants they investigated (crude drugs) were used orally (54%) and topically (36%), while the use of eye drops was the lowest (3%). Bibi *et al.* (2015) reported that the plants they studied were generally used orally and topically. Zareef *et al.* (2023) also found that the plants they studied were generally used orally. We hypothesise that the reason why they are generally taken orally by local people for various diseases may be because people believe that they can cure them more effectively.

This study showed that of the 93 species, 1 species (1.07%), namely *Ephedra intermedia*, belongs to the gymnosperms, 11 species (11.82%) belonging to 6 families belong to the monocotyledons (Figure 5) and the remaining 81 species (87.09 %) belonging to 33 families belong to the dicotyledons (Figure 6). Irfan *et al.* (2023) reported that 58 taxa were angiosperms, of which 54 taxa were dicotyledons, 4 taxa were monocotyledons and 30 taxa were gymnosperms. Parveen *et al.* (2021), conducted a similar study and recorded a total of 85 species belonging to 42 families from Khyber Pakhtunkhawa (Pakistan). They reported that 35 of the 42 families were dicots, 5 families were monocots and 2 families were gymnosperms. Ali *et al.* (2023), found that angiosperms (92.5%), gymnosperms (3.3%) and pteridophyte species (2.5%) were found among the plants in the lower Swat region of Pakistan. These valuable studies conducted in various regions of Pakistan show that the regions are diverse and rich in every aspect, which is the main source of ethnobotanical information richness.

Table 2. List of medicinal plants traditionally used by among the local population in Northern Baluchistan, Pakistan

Family name	Botanical name	Habit	Distribution in Northen Balochistan	Vernacular name	Part used	Route of administration	Traditional uses
Alliaceae	*Allium griffithianum* Boiss	Herb	Quetta, Ziarat.	Zangali Piaz	Bulb	Oral	Mouth ulcer
Amaranthaceae	*Achyranthes aspera* L..	Herb	Pishin, Qaillah Abdullah	Obat kandri	Whole plant	Oral	Cough and rheumatism
	Aerva javanica (Burm.f.) Juss. ex J.A.	Herb	Pishin, Quetta	Sandrozhei	Flowers and leaves	Oral	Stuffing pillows, removes swelling and inflammation
	Amaranthus viridis L.	Herb	Ziarat, Pishin	Jao sag	Leaves	Oral	Burning of feet
Amaryllidaceae	*Ixiolirion tataricum* (Pall.) Herb	Herb	Quetta	Sosing	Flower and Leaves	Oral	Fever and gastric problems
Anacardiaceae	*Pistacia khinjuk* Stocks	Tree	Pishin	Shiny	Gum	Oral	Easy delivery during pregnancy
Apiaceae	*Bunium persicum* (Boiss.) Fedtsch	Herb	Ziarat, Quetta	Moninga	Seeds	Oral	Cold cough and digestion problem
	Dorema aureum Stocks	Herb	Killa Saifullah, Quetta	Ooshl	Gum	Oral	Abortifacient and for control blood pressure
	Ferula costata Kor. ex Nasir	Herb	Quetta	Hing	Seeds	Oral	Gastric problem and constipation
	Foeniculum vulgare Mill.	Herb	Qillah Abdullah, Pishin, Quetta	Khwazaolanay	Fruit	Oral	Stomachache colic pain, constipation and controlling vomiting
	Pimpinella ranunculifolia Boiss	Herb	Quetta	Whosboo	Leaves	Oral	Digestion and Stomachache
	Stewartiella baluchistanica E. Nasir	Herb	Quetta	Soii	Seed	Oral	Hear burn and carminative
	Trachyspermum ammi (L.) Sprague	Herb	Pishin, Ziarat	Sperkai	Fruit	Oral	Stomachic and abdominal pain
Apocynaceae	*Rhazya stricta* Decne.	Shrub	Zhob, Quetta, Pishin, Ziarat	Rangobul	Root and leaves	Oral and Topical	Vermifuge, eye diseases and snake bite
Asclepiadaceae	*Calotropis procera* (Li.) Aiton f	Shrub	Killa Saifullah, Zhob	Karag	Milk/ Sap	Topical	Scorpion sting and snake bite
	Calotropis gigantea (L..) Aiton f	Shrub	Killa Saifullah, Zhob	Karag	Flower	Topical	Healing of bone

	Caralluma tuberculata N.E. Brow	Herb	Quetta, Pishin	Marmut	Whole plant	Oral	Cure for rheumatism and diabetes mellitus
	Vincetoxicum stocksii Ali & Khatoon	Shrub	Zhob, Quetta	Shinshobi	Leaves	Oral	Leprosy, Jaundice and insects bite
Asphodelaceae	*Eremurus stenophyllus* Boiss & Baker	Herb	Quetta, Pishin	Shezgee	Whole plant	Oral	Retain placenta in goat
	Achillea wilhelmsii C.koch	Herb	Pishin, Quetta	Zawal	whole plant	Oral	Stomach pain
	Artemisia scoparia Waldst. & Kit	Shrub	Ziarat, Pishin, Killa Saifullah	Tarkha	whole plant	Oral	Trypanosomosis and antihelmintic
	Hertia intermedia (Boiss) O. Ktze.	Shrub	Pishin, Quetta	Gaungha	Leaves	Oral and Topical	Cure for boils, pimples, and headache and worm infestation
	Iphiona grantioides Boiss.	Shrub	Quetta, Pishin, Ziarat	Kolmur	Whole plant	Oral	Asthma
Asteraceae	*Matricaria aurea* (Loefl.) Schultz-Bip	Herb	Quetta, Pishin	Painphuli	Whole plant	Oral	Remedy for fever
	Microcephala lamellate Bunge	Herb	Pishin	Chargual	Whole plant	Oral	Remove swelling of uterus
	Seriphidium quettense (Podlech) Ling	Shrub	Quetta	Tharka	Leaves	Oral	Fever, Stomach cooling and diabetes
	Scorzonera ammophila Bunge.	Herb	Qailla Abdullah, Quetta, Pishin	Kororak	Whole plant	Oral	Intestinal pain and constipation
	Xylanthemum macropodum (Hemsal & lace)	Herb	Ziarat, Quetta	Pushkunphilli	Whole plant	Oral	Jaundice and Stomachic
Berberidaceae	*Berberis baluchistanica* Ahrendt	Shrub	Pishin, Quetta	Karoskai	Leaves and Roots	Oral	Jaundice, for intestinal ulcers and stomachache
	Berberis calliobotrys Aitch. ex Koehne	Shrub	Ziarat, Quetta	Ziar Largay	Bark	Oral	Coughing and nasal infection
Boraginaceae	*Heliotropium baluchistanicum* Kazmi	Herb	Quetta	Sag darro	Whole plant	Topical and oral	Eye disease
	Onosma hispida Boiss	Herb	Ziarat, Pishin, Qailla Abdullah	Arreling	Whole plant	Topical and oral	Expulsion of dead blood after delivery and fever
Brassicaceae	*Alyssum desertorum* Stapf	Herb	Ziarat, Pishin	Tukhum –e-shirgen	Seeds	Oral	Pain in feet and for diarrhea

	Cardaria chalepense (L..) Hand.-Mazz	Herb	Quetta, Pishin, Ziarat	Bashki	Leaves	Topical	Eczema
	Descurainia sophia L..	Herb	Qailla Abdullah, Quetta, Zhob	Khakshir	Seeds	Oral	Fever and colic pain in children
	Sisymbrium irio L.	Herb	Quetta	Jangli siray	Leaves	Oral	For cough
	Tetracme stocksii Boiss	Herb	Killa Saifullah	Ouskii	Whole plant	Oral	For colic pain
Caryophyllaceae	*Acanthophyllum grandiflorum* Boiss.	Shrub	Qailla Abdullah, Pishin	Khah aghazai	Root	Oral	Abdominal pain
Chenopodiaceae	*Salsola imbricata* Forssk	Herb	Pishin, Quetta	Zumai	Whole plant	Oral	Stomached and diabetes
Convovolaceae	*Convolvulus spinosus* Burm. f.	Shrub	Quetta, Pishin	Tatak	Whole plant	Oral	Strong purgative
Cucurbitaceae	*Citrullus colocynthis (*L..) Schrad	Trailing herb	Pishin, Killa Saifullah	Mashanga	Seeds and Fruit	Oral	Purgative, constipation and remove gastro complaints
Cuscutaceae	*Cuscuta pulchella* L..	Climber Herb	Pishin, Quetta	Zar dozan	Whole plant	Oral	For burning of feet
Cyperaceae	*Cyperus rotundus* L.	Herb	Quetta, Pishin, Ziarat	Tuzgh	Underground rhizome	Oral	Stomach and analgesic
Ephedraceae	*Ephedra intermedia* Schrenk & Meyer	Shrub	Ziarat, Quetta, Qailla Abdullah, Zhob	Homan	Ariel parts	Oral	Controlling asthma and flu, and for swelling of uterus
Euphorbiaceae	*Euphorbia granulata* Forssk	Herb	Zhob, Pishin, Quetta	Gwander	Whole plant	Oral	Blood purifier
	Ricinus communis L.	Shrub	Pishin, Quetta, Zhob ,Ziarat	Aranda	Leaves and seeds	Oral	Purgative
Fabaceae	*Acacia nilotica* L.	Tree	Quetta, Zhob	Kikar	Bark	Oral	Diarrhea, dysentery, diabetes and throat infection
	Alhagi maurorum Medic.	Shrub	Pishin, Quetta, Zhob	Dozan	whole plant or Roots	Topical	For bathing
	Astragalus affghanus Boiss	Herb	Pishin, Qailla Abdullah	Jib	whole plant	Oral	Leprosy and antiseptic
	Astragalus anisacanthus Boiss	Herb	Pishin, Quetta, Qailla Abdullah	Da soi paleez	Leaves	Oral	Mouth ulcer and foot wounds
	Astragalus khalifatensis Ali	Herb	Ziarat	jabo	Whole plant	Oral	Colic pain and leprosy
	Astragalus kahiricus DC	Herb	Pishin, Quetta	Da soui gozona	Leaves	Oral	To increase milk in goat
	Astragalus stocksii Bunge	Shrub	Quetta, Ziarat	Zehrgolli	Flower	Oral	Given to goat for constipation

	Caragana ambigua Stocks.	Shrub	Ziarat, Zhob, Pishin	Khra Makhai	Flower and Fruit	Oral	Intestinal pain and chest infection
	Caragana brachyantha Rech.f	Shrub	Pishin	Makhi	Whole plant	Oral	Delayed menses
	Colutea armata Hemsley & Lace	Shrub	Quetta, Ziarat	Pukunhi	Whole plant	Oral	Urine discharge and remove kidney stone
	Ebenus stellata Boiss.	Shrub	Pishin, Qailla Abdullah	Sambal	Whole plant	Oral	Mouth ulcer and cleaning the teeth
	Glycyrrhiza glabra L..	Herb	Pishin, Killa Saifullah, Qailla Abdullah	Khog largay	Roots	Oral	Cough , asthma and expectorant
	Medicago monantha (L..) Mill	Herb	Quetta, Pishin	Karal	Seed	Oral	For internal wound after delivery
	Parkinsonia aculeate L..	Herb	Quetta	Babor	Leaves	Oral	For arthritis
	Prosopis cineraria L.	Tree	Quetta, Pishin	Kanda	Flowers and seeds	Oral	Eaten by pregnant women to avert miscarriage
	Sophora mollis (Royle) Baker	Shrub	Ziarat, Quetta, Zhob, Killa Saifullah	Zegwara	Whole plant	Topical	To treat sore eyes and headache
Fumariaceae	*Fumaria indica* (Hausskn.) Pugsley	Herb	Pishin, Quetta	Shatara	Whole plant	Oral and Topical	Blood purifier, acnes and pimples
Iridaceae	*Iris stocksii* (Baker) Boiss.	Herb	Quetta, Pishin	Gharwasha	Roots	Oral	Stop diarrhea
Juglandaceae	*Juglans regia* L.	Tree	Quetta, Ziarat	Akhrot	Bark and Leaves	Oral	Cleaning teeth and Jaundice
	Lallemantia royleana Benth	Herb	Zhob, Killa saifullah, Pishin	Malangyan	Whole plant	Oral	Abdominal gas and constipation
	Nepeta glomerulosa Boiss.	Herb	Zhob, Quetta, Pishin	Chinjan butai	Whole plant	Oral and Topical	Pneumonia and skin diseases
Lamiaceae	*Salvia bucharica* M.Pop.	Shrub	Quetta, Ziarat	Sursuandah	Whole plant	Oral and Topical	Cough and abdominal pain
	Salvia cabulica Benth	Shrub	Ziarat, Quetta, Pishin	Metative	Whole plant	Oral	Stomachache and pain in feet soul

	Ziziphora tenuior L..	Herb	Ziarat, Quetta, Qailla Abdullah	Tukham malangan	Seeds	Oral	Dysentery and febrifuge
Malvaceae	*Malva neglecta* Waller.	Herb	Zhob, Ziarat	Khubasi	Whole plant	Oral	Cough and fever
Oleaceae	*Olea ferruginea* Royle.	Tree	Zhob, Killa Saifullah	Zaitoon	Stem, Fruit, and branches	Oral	Purgative and cure for gonorrhea
Papaveraceae	*Papaver pavoninum* Schrenk	Herb	Pishin, Quetta, Ziarat	Apume boti	Fruit	Oral	For vaginal prolapsed
Plantaginaceae	*Plantago ciliata* Desf.	Herb	Quetta, Pishin, Zhob	Janglee isabghol	Seeds	Oral	For dysentery and constipation
Poaceae	*Cymbopogon jwarancusa* (Jones) Schult	Shrub	Quetta, Ziarat, Killa Saifullah	Khawai	Whole plant	Oral	Cough Chronic rheumatism and dyspepsia
	Cynodon dactylon (L.) Pers.	Herb	Quetta, Pishin	Murgha	Whole plant	Oral and Topical	For blood stoppages and dysentery
	Sorghum halepense (L..) Pers	Herb	Pishin, Ziarat, Killa Saifullah	Deddam	Whole plant	Topical	For cattle mastitis
Ranuculaceae	*Adonis aestivalis* L..	Herb	Pishin, Quetta, Ziarat	Da Pashe Kos	Whole plant	Oral	Diuretic and cardiac stimulant
	Ranunculus falcatus L..	Herb	Quetta, Qailla Abdullah	Wah-washu	Whole plant	Topical	Skin disease
Rhamnaceae	*Berchemia pakistanica* Browicz	Shrub	Ziarat	Spera butae	Leaves	Oral	Body ache, headache and feve
	Ziziphus mauritiana Lam	Shrub	Zhob	Berre	Leaves and fruit	Oral	Increase in lactation in goat an laxative
Rosaceae	*Rosa brunonii* Lindl	Shrub	Ziarat	Zangle gulgulab	Flower	Oral and Topical	Gastric problems and rose water used for eye clearing
Solanaceae	*Datura stramonium* L..	Shrub	Pishin, Quetta, Ziarat	Bathora	Leaves	Oral	Leaf juice is used as vermicides in cow and goat
	Hyoscyamus niger L..	Herb	Ziarat	Bang lewana	Seeds	Topical	Stop bleeding after delivery
	Withania coagulans (Stocks) Dunal.	Shrub	Killa Saifullah, Ziarat, Quetta	Kamhazoree	Leaves and fruit	Oral	Colic pain, to treat toothache and carminative to caw and goat

	Withania somnifera (L.) Dunal	Shrub	Quetta, Pishin, Ziarat	Bodmar	leaves and fruit	Oral	Leaves are used to cure sore eyes and to stop diarrhea in caw
Tamaricaceae	*Tamarix aphylla* (L) Karst	Shrub	Quetta, Ziarat, Qailla Abdullah	Ghaz	Leaves	Topical	The smock of leaves is used for pain killer for open wounds
Urticaceae	*Forsskaolea tenacissima* L.	Herb	Quetta, Pishin, Ziarat	Saka gol	Whole plant	Oral	Cough and headache
Vitaceae	*Ampelopsis vitifolia* (Boiss). subsp. *hazarganjiensis*	Shrub	Hazarganji (Quetta)	Jangi angoor	Leaves	Oral	joints pain and chest infection
Violaceae	*Viola cinerea* Boiss.	Herb	Ziarat, Quetta, Pishin	Banafsha	leaves and Flower	Oral	Febrifuge (to treat fever) and pulmonary diseases
	Fagonia indica Burm.	Shrub	Quetta, Pishin, Killa Saifullah	Asgai	Leaves and branches	Oral	Cure for dysentery, fever and asthma
Zygophyllaceae	*Peganum harmala* L..	Herb	Quetta, Pishin, Zhob, Ziarat	Spalany	Seeds	Oral	For dyspepsia and easy delivery
	Tribulus terrestris L..	Herb	Quetta, Pishin	Tahkandi	Whole plant	Oral	Bladder inflammation and for kidney pain.

Table 3. Families of medicinal plants used to treat of various diseases in Northern Balochistan

Family	Genera	Species
Alliaceae	1	1
Amaranthaceae	3	3
Amaryllidaceae	1	1
Anacardiaceae	1	1
Apiaceae	7	7
Apocynaceae	1	1
Asclepiadaceae	3	4
Asphodelaceae	1	1
Asteraceae	9	9
Berberidaceae	1	2
Boraginaceae	2	2
Brassicaceae	5	5
Caryophyllaceae	1	1
Chenopodiaceae	1	1
Convovolaceae	1	1
Cucurbitaceae	1	1
Cuscutaceae	1	1
Cyperaceae	1	1
Ephedraceae	1	1
Euphorbiaceae	2	2
Fabaceae	11	16
Fumariaceae	1	1
Iridaceae	1	1
Juglandaceae	1	1
Lamiaceae	4	5
Malvaceae	1	1
Oleaceae	1	1
Papaveraceae	1	1
Plantaginaceae	1	1
Poaceae	3	3
Ranunculaceae	2	2
Rhamnaceae	2	2
Rosaceae	1	1
Solanaceae	3	4
Tamaricaceae	1	1
Urticaceae	1	1
Vitaceae	1	1
Violaceae	1	1
Zygophyllaceae	3	3
Total	84	93

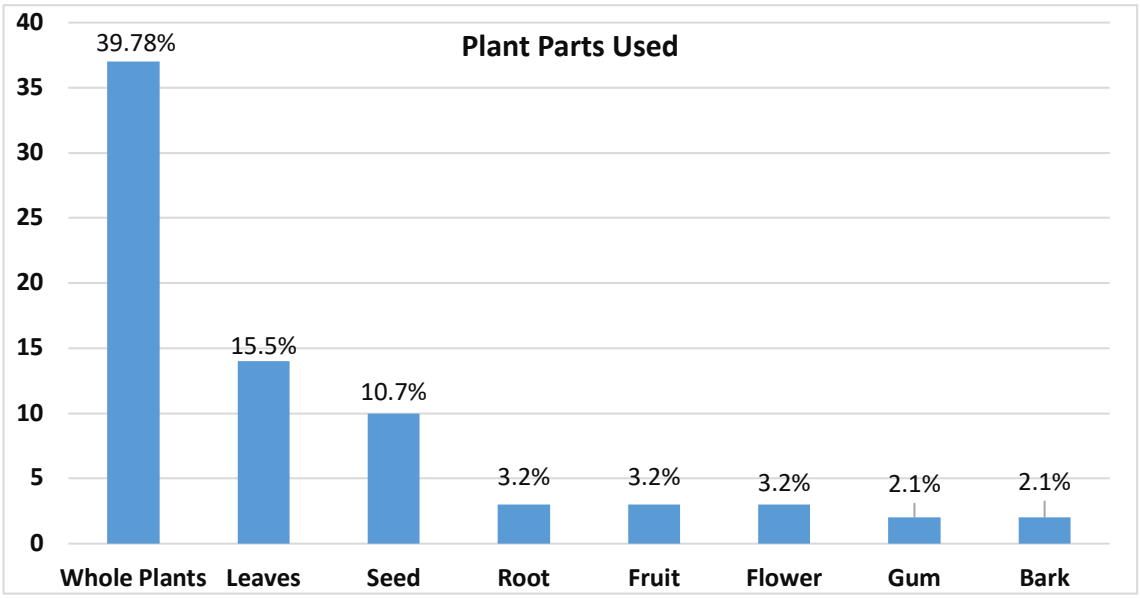

Figure 3. Plant parts used by indigenous people in the research area

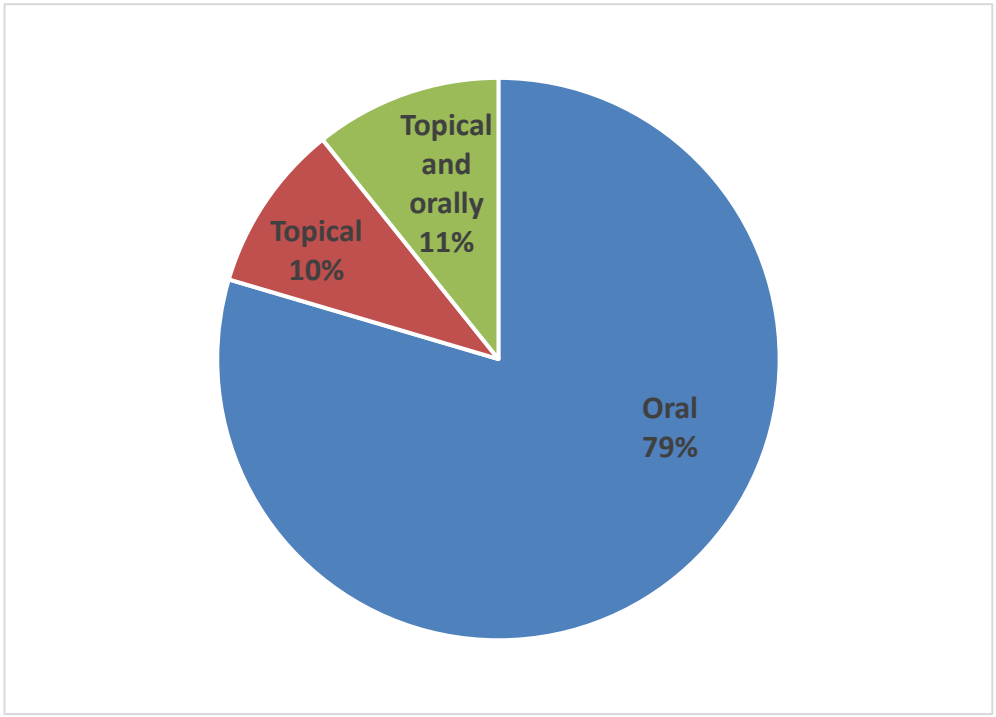

Figure 4. Percentage (%) of administration use of the plants

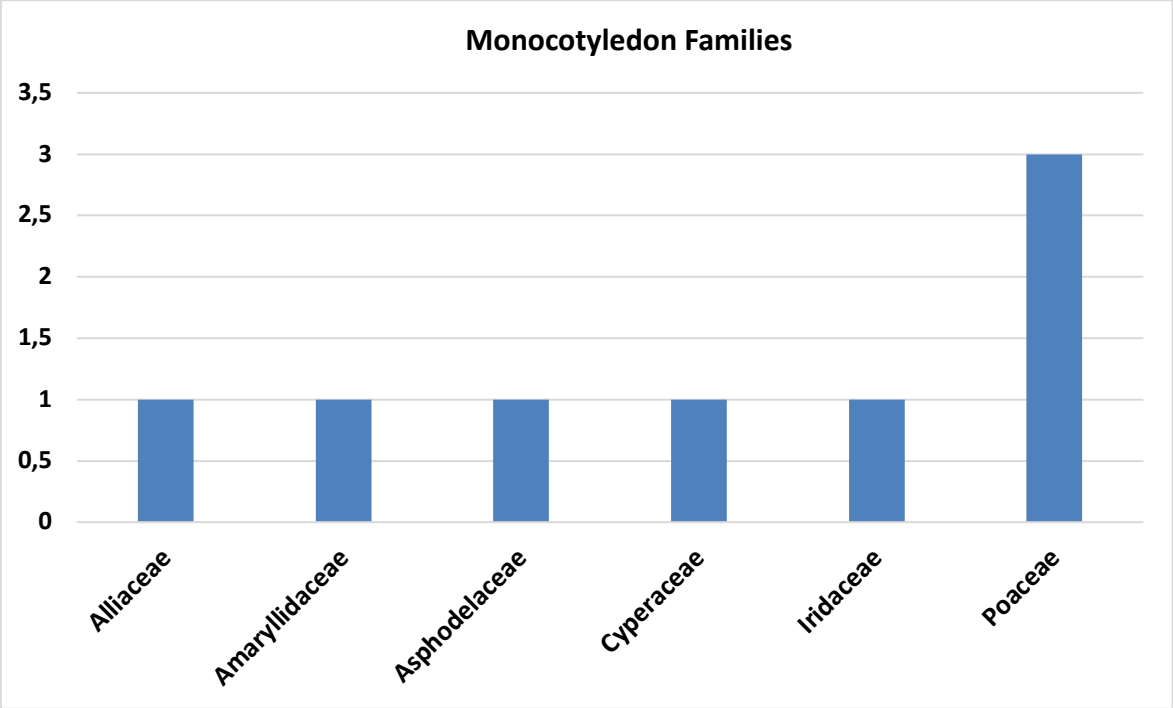

Figure 5. Contribution of monocotyledon plant families in the research area

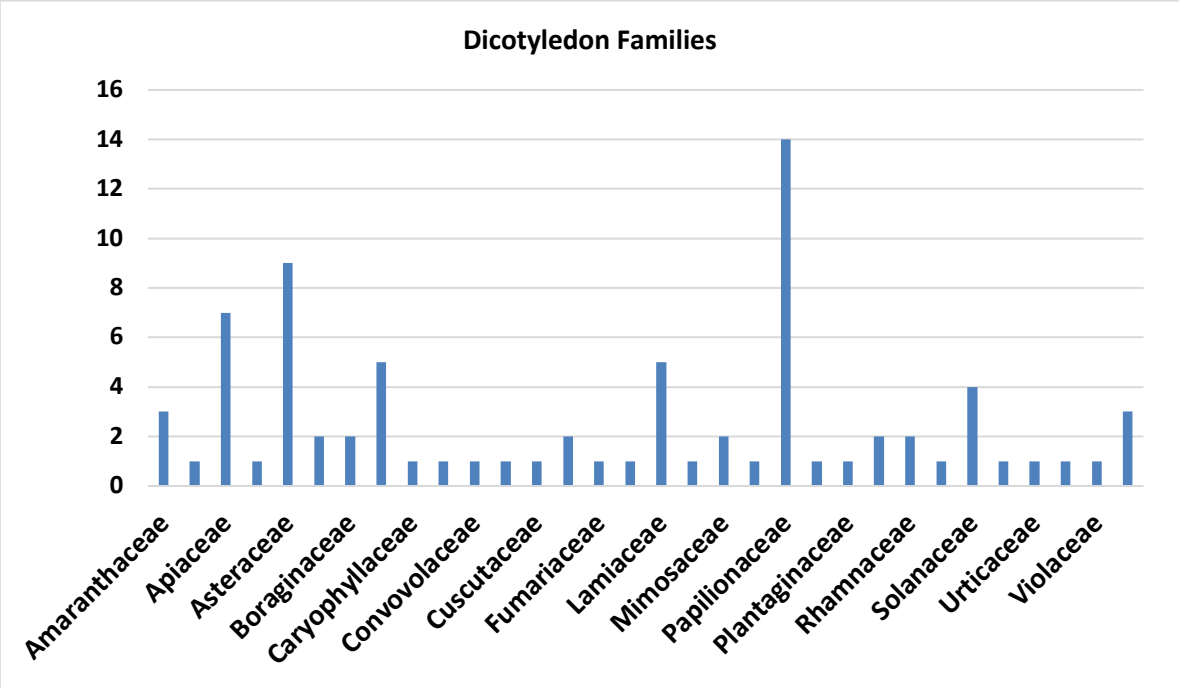

Figure 6. Contribution of dicotyledon plant families in the research area

Conclusion

According to the findings of this study, the Nouthern Balochistan is rich in indigenous medicinal flora. Our findings revealed significant information about various medicinal plants used by the locals of the study area for the treatment of various diseases. The traditional use of the plants reported in the present study has opened the door for phytochemical and pharmacological studies to evaluate the efficacy of these species. And we believe that the results of these studies will form the basis for important ethnopharmacological developments and discoveries. Above all, since these plants and species have medicinal value, the results of our study can be a source of important scientific and practical knowledge.

Declarations

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

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Author's contribution: Rafiq Ullah and Nadeem Ahmed collects the field data, Muhammad Nauman Khan, Alevcan Kaplan and Ghulam Jelani supervised this work, Muhammad Nauman Khan, Alevcan Kaplan, and Sana Wahab participated in data analysis and the final revision of the manuscript. All the authors approved the final manuscript after revision.

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