RELATIVE POPULARITY OF MEDICINAL PLANTS DIVERSITY AMONG THE TRIBAL COMMUNITIES OF KOH-E-SUFAID, UPPER KURRAM AGENCY, FATA-PAKISTAN

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ISLAMABAD - PAKISTAN
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In

Plant Systematics & Biodiversity

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2016

DEDICATED TO MY LOVED ONES.....!!

DECLARATION

The material contained in this thesis is my original work and I have carried out the experimental work in the Plant Systematic and Biodiversity Lab, Quaid-i-Azam University, Islamabad. I have not formerly presented any such work for any other degree elsewhere.

Syed Khalil Haider

(Signature of the student)

I confirm that the above statement is correct. I have found that this is complete and satisfactory in all respect and that any/all revisions required by the final examining committee have been made.

Dr. Mushtaq Ahmad

(Signature of Supervisor)

CERTIFICATE

This is to certify that this dissertation submitted by **Mr. Syed Khalil Haider** is accepted in its present form, by the Department of Plant Sciences, Faculty of Biological Sciences, Quaid-i-Azam University, Islamabad, Pakistan as satisfying the thesis requirements for the degree of Master of Philosophy (M.Phil.) in Plant Systematics & Biodiversity.

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ABSTRACT

Abstract

Ethno-pharmacological relevance

Human dependence on plants dates back to prehistoric times. Besides other uses in everyday life, plants are used to treat various human ailments. This present investigation aimed at identifying the ethno-medicinal potential of the medicinal plants used against different diseases.

Materials and Methods

To explore the ethno-medicinal knowledge, informal interviews were carried out with a total of 142 informants (122) males and (20) females.

Results and Discussion

A total of 80 medicinal plants species belonging to 47 families were used by the tribal communities to cure 12 ailment categories. Family Asteraaceae was found to be the leading family with 11 medicinal plant species. Leaves were the predominant used part (34%), followed by flowers (20%), fruits (19%), seeds (10%), roots and shoots (6% each), bulb (2%), whole plant, wood, bark (1% each). Herbs were found to be the highest growth form (60%), followed by trees (23%) and shrubs (17%). *Seriphidium kurramense* was identified with highest Relative Frequency Citation (RFC). Family Nitrariaceae ranked with highest Family Importance Value (FIV). Informant Consensus Factor (ICF) is highest for Respiratory disorders (0.88). *Perovskia atriplicifolia* and *Urtica dioica* were the medicinal plant species with highest Used Value (0.33 each).

Conclusion

This present investigation revealed that tribal communities of the study area are heavily dependent on the medicinal plant resources to treat various ailments. Owing to the lack of the accessibility of basic health facilities and the efficacy of the medicinal plants they exhibit an essential role in everyday life of the local communities. This current investigation can prove to be productive if ethno-medicinal studies are sustained in the future. It can possibly lead to the isolation of important therapeutic agents.

INTRODUCTION

1.1 Ethnobotany

Humans have been interacting with plants from pre-historic times. The well-being of human society is the ultimate driving force behind this centuries old interaction (Lulekal *et al.*, 2013; Campbell, 2002). The relationship between plants and human cultures is not limited to the use of plants for food, clothing and shelter but also includes their use for religious ceremonies, ornamentation and healthcare (Schultes, 1992). And this valuable knowledge can be lost if there is no exchange of traditional knowledge among different cultures around the world (Winter and McClatchey, 2008).

1.2. Medicinal Plants

Plants and human beings have fundamental association since prehistoric times and they have evolved along parallel lines for their existence, and dependence upon each other (Shil *et al.*, 2014). This close interrelationship had prospered over generations of experience and practice. In folk healing systems wild resources of medicinal plants have been used by man since old ages. Indigenous people have adapted different modes of application and uses to exploit this natural resource (Ahmad *et al.*, 2014).

Alongside their ritual, nutritional, and magical value, plants have important role to play in the healthcare system of human beings. Owing to the high cost and different hazardous factors associated with the allopathic drugs, the traditional knowledge of folk medicines have been gaining popularity all over the world due to their effectiveness and low side effects (Tabuti *et al.*, 2003; Hoareau and Silva, 1999; Halberstein, 2005).

1.3. Global significance of the medicinal plants

According to the studies conducted by WHO, traditional herbal medicines work for the daily health needs of about 60% of the world's population, specifically for millions of people in the remote areas of developing countries (Calixto, 2005; WHO, 2010). Approximately 50,000 flowering plants are used as medicinal plants out of the total 422,000 flowering plants that has so far been reported from this world (Schippman, 2002). Two thirds of the world's population has been dependent on medicinal plants for centuries to cure numerous human pathologies (Bibi *et al.*, 2014).

Tribal communities living in far-flung areas depend on the natural resources which includes rich diversity of plants and animals to meet their everyday and health care needs.

Traditional herbal medicines have been used by them since ancient times in order to treat different diseases. Yet, valid scientific data on the usage of ethno medicinal plants is relatively obscure because of the lack of ethnobotanical studies which are still to be carried out in these remote areas (Xavier *et al.*, 2014). The Rio convention held in 1992 laid stress on the importance of the conservation of Earth's biodiversity as we are leading the species to extinction because of the habitat destruction. The principal goal of conserving biodiversity is to ensure sustainable survival of the living species, for provision of long-lasting resources in the form of ecosystem services (Boero, 2010).

1.4. Significance of medicinal plants in West

In western world "alternative medicine" has become very popular and various types of medicinal plants used in herbalism and some of these plants exhibit medicinal activities (Hassan, 2012). There are about 600 to 700 species of plants used for medicinal purposes out of 6,000 species of higher plants found throughout the world which are considered "miracle" source in curing owing compounds possessed by these medicinal plants (Juden, 2003). Ethno medicinal studies help in the discovery of new crude drugs from medicinal plants which are indigenously reported. Since beginning of ethnobotanical research, traditional medicinal knowledge of plants, has gifted us with a number of key modern drugs (Cox, 2000).

1.5. Significance of medicinal plants in Pakistan

Nature has gifted Pakistan with high mountains and massive glaciers with several of the world's highest peaks. Pakistan has been endowed with a rich medicinal flora due to its diverse range of altitude, rainfall and climatic conditions. The Himalaya, Karakorum and Hindu-Kush mountain range have about 25,000 plant species, which is 10% of world's plant species, out of which approximately 10,000 are of medicinal value. Studies conducted in early 1950 showed that up to 84% of the Pakistanis were dependent on traditional medicine for most of their medical needs. And it has been confirmed that there are 400-

600 medicinal plant species which are commonly used in herbal and traditional preparations (Shinwari and Maryam, 2004). About 70% of the medicinal plants and animals in the Himalaya range are wild, 70–80% of the population depends on indigenous medicines for health care needs (Bano *et al.*, 2014; Husain et al., 2007; Shinwari and Gilani 2003; Pie and Manandhar, 1987). The high alpine region of Northern Pakistan is botanically and ecologically poorly investigated (Khan *et al.*, 2011). It is imperative to document and preserve this valuable body of knowledge.

In Pakistan there are indigenous communities in different parts of the country which have centuries old knowledge about the traditional uses of the plants occurring in their respective areas. Studies regarding documentation reiterates that the traditional knowledge is mainly restricted to aged people (Shinwari, 2010). And this knowledge of therapeutic uses of plants is transferred from one generation to another. Ailments ranging from headache to wound are successfully treated by these medicinal plants.

1.6. Previous studies on relative popularity of medicinal plants in Upper Kurram Agency FATA Pakistan

There is no previous investigations or reports regarding relative popularity of medicinal plants in Upper Kurran Agency FATA Pakistan but the indigenous knowledge of the area has been documented where different medicinal plants have been reported to be used for treating different ailments among local people. These are some of the reports on the use of indigenous medicinal plants in traditional healthcare by indigenous communities of Kurram Agency, FATA, Pakistan.

A study was reported by (Gilani *et al.*, 2003) which was based on a market survey of the traded medicinal plants in Kurram Agency. Annual trade *Artemisia maritima, Morchella esculenta and Teucrium stocksianum* were found to be 2, 40,200 kg. Lalbadshah *et al.*, (2010) carried out an ethnobotanical study in the lower mountain in Malana, Parachinar Kurram Agency. He recorded 41 wild plant species which were found to be used in human therapy. Most commonly used species were *Artemisia absynthium, Berberis lycium and Mentha longifolia.* Hussain *et al.*, (2012) documented phytochemical studies

on 21 plant species belonging to 19 families. His study was aimed at identifying medicinal plants, indigenous knowledge and herbal recipes used in Kurram Agency.

Hussain *et al.*, (2013) studied 26 medicinal plants of Parahinar Kurram Valley. *Asparagus officinale* was found to be effective against constipation and *Berberis lycium* was used in urine and chest problems. Ajaib *et al.*, (2014) reported 46 herbs of ethnobotanical importance in 11 villages of Agra Valley, Parachinar Upper Kurram Agency. Ajaib *et al.*, (2014) studied shrubs and trees in Agra Valley, Parachinar. 18 shrubs and 27 trees of ethnobotanical importance were documented.

1.7. Scope and justification of the project

At present, health facilities for rural people in our country is deprived of basic medical treatment. Regarding health systems improving performance, Pakistan has been ranked 124 out of 191 countries (WHO, 2000). The reason behind insufficient health facilities (number of hospitals, doctors, paramedic staff, medicines etc.) is the lack of successive government's attention towards health fund allocation. Secondly there is also a lack of policy-making for health care. Hospitals are not well equipped and doctors are helpless due to lack of resources. As a result, people opt to get treatment from local healers practicing medicine especially in the rural areas.

Pakistan is blessed with various potential medicinal and aromatic plant resources, because of its diverse eco-geography. These medicinal plants are the basic source of pharmaceutical drugs (Verpoorte, 1998; Gilani and Ata-ur-Rahman, 2005). Additionally, this folk medicinal documentation will be useful for pharmaceutical industries in drug development. But the knowledge of these vital plant resources are limited to our elder people. There is a need to record this indigenous data in order to conserve this wealth of medicinal plants. This study is aimed at conserving and documenting this valuable knowledge.

1.8. Aims and Objectives

The purpose of this study is:

(1) To document the indigenous knowledge of medicinal plants among the tribal communities of Koh-e-Sufaid, Upper Kurram Agency, FATA Pakistan.

(2) To document knowledge concerning herbal medicine which is at risk of being lost.

(3) To explore information on the uses of plants, the modes of preparation, and the ways of administration.

(4) To assess the medicinal plants using quantitative ethnobotanical indices Frequency Citation (FC), Relative Frequency Citation (RFC), Used Value (UV), Family Importance Value (FIV) and Informant Consensus Factor (ICF), in order to find relative popularity of the medicinal plants used by the local people.

MATERIAL & METHODS

2.1. Study Area

Kurram is one of the seven tribal agencies. It is located in the northwest of Pakistan with the Afghan border (Figure 1). It is mostly mountainous. The Sufaid Koh Mountain Range is the prominent mountain which starts from Tarimangal and stretches eastwards. It is a combination of two Urdu words "Sufaid" which means "white" and "Koh" means, "mountain". It is covered with snow throughout the year. Sikaram Sar is the highest peak of Koh-e-Sufaid Range. Its elevation is 4,760 meters (GOP, 2000).

Administratively Kurram Agency is divided into three sections Upper Kurram, Lower Kurram and Central Kurram. Parachinar is the administrative center of Kurran Agency. It got its name because of a tribe "Para" which used to sit under a Chinar (Maple) tree to resolve their differences. Maple (*Platanus orientalis* L.) trees which are found abundantly in this valley.

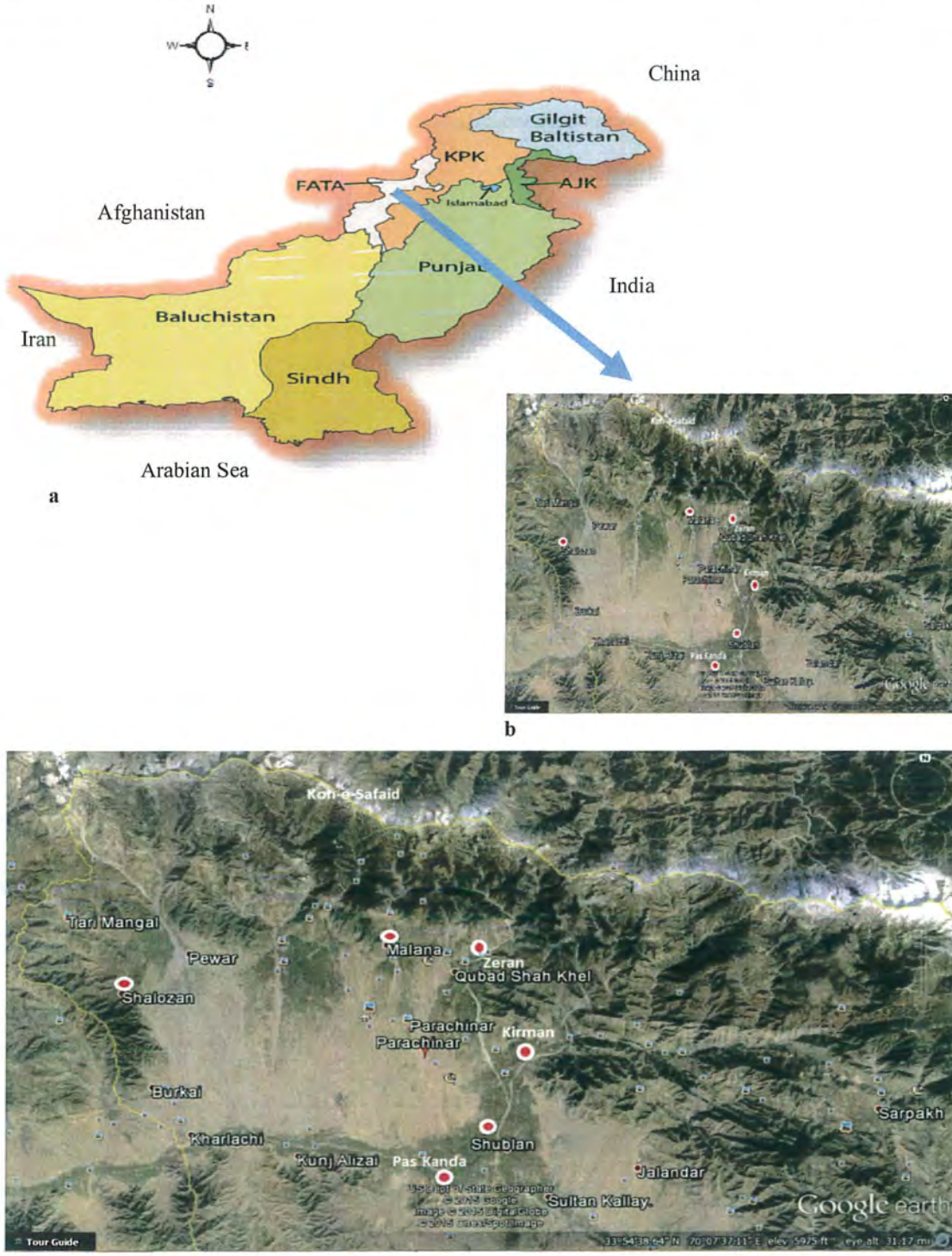
Parachinar is located under the foothills of "Sufaid Koh" with an elevation of 6,000 feet. It coordinates between 33.20 to 34.03 North latitudes and 69.50 to 70.45 East longitudes). It is bordered in the West and North by Afghan province of Paktia and Ningarhar respectively, in the East by Orakzai and Khyber Agencies, in the South East by Hangu District and in the South by Waziristan (GOP, 2000) (Figure 1 a-c).

2.1.1. Climate

Summer is quite pleasant and winter is extremely harsh with frequent snowfall in December till February.

2.1.2. Rainfall

Precipitation is normally in the form of rain, snow, sleet and hail mostly in winters. In summer rain mostly occur in precipitation. Annual rainfall in Parachinar is 1239.96 mm. The wettest month is known to be the month of August 200mm. and driest month is known to be the month of November receiving only 30.94mm of rainfall (Ajaib *et al.*, 2014).



(Figure 1) (a) Map of Pakistan showing FATA (b) Map showing Upper Kurram Agency (Study Area) (c) Location map of the study area

2.1.3. Temperature

The lowest temperature at Kurram was recorded –13.4°C on 29th January 2005 and the highest temperature 39.9 °C on 27th June 2005. Parachinar is one of the coldest places in Pakistan (Hussain *et al.*, 2012).

2.1.4. Phytogeography

There are drastic variations of altitude and temperature. As a result the climatic conditions of the Upper Kurram Agency support many types of vegetation. *Pinus roxburghii, Pinus wallichiana, Cedrus deodara, Quercus baloont* and *Quercus dentata* are the type of trees found on the high mountains. The low lands of the area where the temperature is comparatively high broad leave plants i.e. oriental plane, willow and poplar.

2.1.5. Demography

According to 1998 census population of Parachinar was 448,310 (Bureau of Statistics FATA Cell Peshawar 2013, Population Census Organization Islamabad). But recent estimates show that 6, 18000 (estimated on 1st January 2012-13) people are living in an area which spreads around 3,380 square kilometers. The annual growth rate is 2.5%. About 6% people reside in urban and 94% live in rural areas (GOP, 2000).

2.1.6. Occupation

Majority of the population is illiterate and earn their living through farming. Agriculture is quite developed here. Agricultural land is mostly irrigated so agriculture is the main source of income for people of the area. They sell their agricultural products especially tomato and fruits to Khyber Pukhtunkhwa and Punjab. However huge number of locals earn their remittances by working abroad especially in Middle Eastern countries. Some people also run their private businesses.

2.1.7. Agriculture

The common cash crop of Upper Kurram Agency are wheat (*Triticum aestivum*), rice (*Oryza sativa*), tomato (*Solanum lycopersicum*), corn (*Zea mays)* potato (*Solanum*

tuberosum) and black gram (*Vigna mungo*). Kurram Agency is also famous for its fruits. These are walnuts (*Juglan regia)*, apples (*Malus domestica)*, apricots (*Prunus armanica)* and peaches (*Prunus domestica)*. These fruits are one of the sources of income for the local communities.

2.1.8. Wildlife

Domestic animals are cow, horse, donkey, mule, goat, sheep, and hen. Wildlife of the area consists of monkeys, hares, wolves, jackals, and porcupines. Birds include quail, partridge, fowl, sparrow, pigeons, and crow.

2.1.9. Forest

Forests are an essential part of ecosystems. According to FATA Development Statistics (2011-12) indicates that only 8% of the total land area of Kurram is cultivated, whereas more than 91% of the land is unavailable for this purpose. Both manmade and natural forest cover makes 22% of the total forest area of FATA (GOP, 2011-1012). Although local communities show great interest in the improvement of forest but due to unavailability of natural gas in Kurram Agency, local communities fulfill their needs of fuel for routine use by cutting the natural forest of Koh -e- Sufaid and adjoining mountains. Wood is taken to local urban centers. As a result this natural forest is declining with increasing pace.

2.1.10. Water Resources

River Kurram which flows through the agency is the main source of water for the people (Plate 1 d). It enters from Paktia and Khost provinces of Afghanistan flow through the Kurram and enters North Waziristan, join Indus River near Isa Khel, Punjab Pakistan. Some other hill torrents are Shilozan Toye, Kharmatu, which originate from different parts of Koh-e-Sufaid and join Kurram River at different locations. Apart from River Kurram there are small water reservoirs in this area, which the local people called as "Dams". These are Malana Dam, Zeran Dam, Maidani Small Dam and Kot Ragha Dam.

2.1.11. Traditions and Culture

FATA is very rich in terms of cultural heritage and cultural diversity. Hospitality, tribal arts and crafts, ethnic diversity and natural beauty are qualities associated with tribal communities. The conservation of natural resources is considered as a collective responsibility. Tribals use to solve their local problems through "Jirgas". They support each other on special occasions like death, marriage and other ceremonies like harvesting and threshing of crops. Hujra is a (meeting place), which is built in almost every village where the locals sit and discuss their day to day issues. Males wear traditional Pakhtoon dress which is shalwar, kamees, and chadder. The women-folk usually use printed cloth. An overwhelming majority of women observe strict purdah from outsiders. On festivals like Eid and marriage they wear new clothes. Change are observed with respect to weather. Tribal women are very fond of wearing ornaments and jewelry of all type made of gold and silver. A lot of money is spent on the local ceremonies, mainly on marriage, death, birth and other ceremonies. Generally the houses are made of clay and they are clustered in villages (Plate 1 c). People mostly live in joint family system.

2.1.12. Health

Majority of the inhabitants of FATA do not have access to basic health facilities. As per (FATA development statistics 2013) there are 4 hospitals in Kurram Agency having 302 beds. Besides these there are 22 Basic Health Units (BHUs) and 49 dispensaries (GOP, 2013).

2.1.13. Education and literacy rate

According to (Bureau to Statistics, FATA Education Atlas 2011-12) total literacy rate of Kurram Agency is 28.48%. It is 36.27% for males and 21.03% for females. There are 7 colleges, 4 for boys and 3 for girls. Primary, middle and high schools for boys and girls are 357, 53 and 48 respectively. It is hoped that these figures will improve with the passage of time in considering the keenness of people of this area regarding seeking knowledge (GOP, 2011-12).

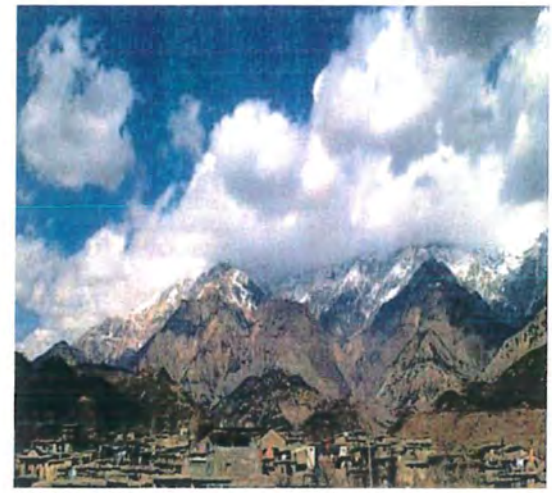
2.1.14. Ethnography of the study area

There is a tremendous ethnographic diversity in Kurram Agency. Major ethnic groups/tribes residing in Kurram Agency are Syed, Turi, Bangash, Zazi, Kharoti, Mengal, Massozai, Ghalzai, Parachamkani, Muqbal, Hazara, Khushi, as well as Sikh, Christian and Hindu Communities. Most of the people belong to Turi tribe followed by Bangash.

2.1.15. Language

Pashto is mostly spoken by these communities but Urdu is also understood and spoken by many. Medium of instruction in the Agency is English, Urdu and Pashto.

a. A natural forest



b. View of study area and Koh e Sufaid

c. A landscape

d. A typical mud house in the study area

e. Water resource

f. View of Darye e Kurram

Plate 1 (a-f) Pictorials of the study area

2.2. Data Collection

2.2.1. Sampling Informants

The ethno-medicinal field study was carried out in 6 different localities of the study area during April 2015 to September 2015 (Plate 2 a-l). These localities of Upper Kurram Agency are Shiloza, Malana, Kirman, Zeran, Shublan and Pas Kanda. A total of 142 informants including 18 herbalists, 122 males and 20 females. Most of females interviewed were housewives. While the males were predominantly farmers and some run their private businesses. People were interviewed using semi-structured questionnaire (Annexure-I) (Bruni *et al*; 1997). Information regarding the local name, habit, medicinal use, mode of utilization, recipes and plant part used were documented. Questions were asked in Pashto and the answers given by the informants were in Pashto as people of the area were most familiar to their local language.

2.2.2. Collection of medicinal plants

During the ethno-medicinal field survey, interviews were conducted with the local inhabitants (Plate 2 a-l)). Observations were made while visiting the study area medicinal plants reported by local communities were collected and identified in the field with the help of their vernacular names (Martin, 1995). Social bio-data of the informants such as name, age, educational background, gender and occupation were also recorded. After collection plants were tagged, wrapped in blotting paper and placed in polythene bags. Plants were brought to the Plant Sciences Department, Quaid-i-Azam University, Islamabad Pakistan, where they were pressed, dried and mounted on herbarium sheets.

2.2.3. Plant identification and herbaria

In the ethno-medicinal study a total of 80 plants were found to cure different diseases. The medicinal plants documented by the local people were collected and identified by the local people during the field survey (Plate 2 a-d). Plants were also photographed by Sony and Panasonic digital camera. Literature search was also carried out using the internet consulting databases Google, Google Scholar, Elsevier and Science Direct and also from books regarding ethnobotany. Verification of scientific names, family and author citation was done from accepted scientific research papers and databases the

Flora of Pakistan (www.eflora.com), and The Plant List (www.theplantlist.org). The voucher specimen were submitted to the Herbarium of Pakistan in Plant Sciences Department of Quaid-i-Azam University, Islamabad (Plate 3 a-f). The keywords used for searching desired literature from databases include Kurram Agency, FATA, Parachinar indigenous knowledge, ethnobotany, and medicinal plants quantitative ethnobotanical calculations.

Plate 2 (a-l) Ethno-medicinal plants and data collection

a Collection of plants in the rocks

b. Examining a medicinal plant

c. A local herbalist collecting *Ephedra gerardiana*.

d. Collection of plants in the field

e. Data collection from the locals

f. A herder giving information

g

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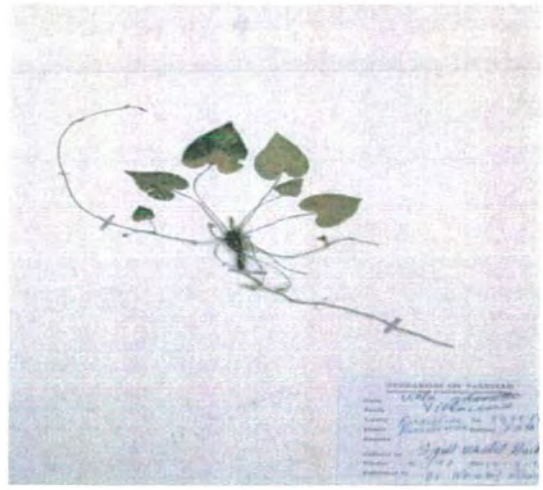
(a,b) Data collection from an aged informant (c,d) Market survey (e) Drying of plants (f) Collected seeds of *Quercus dentata*

Plate 3 (a-f) Herbarium specimen and identification



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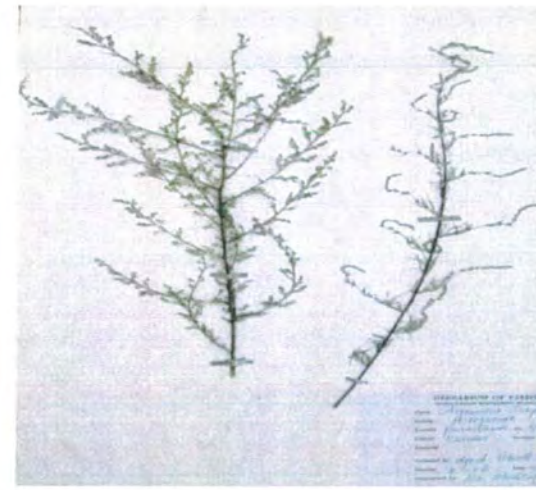

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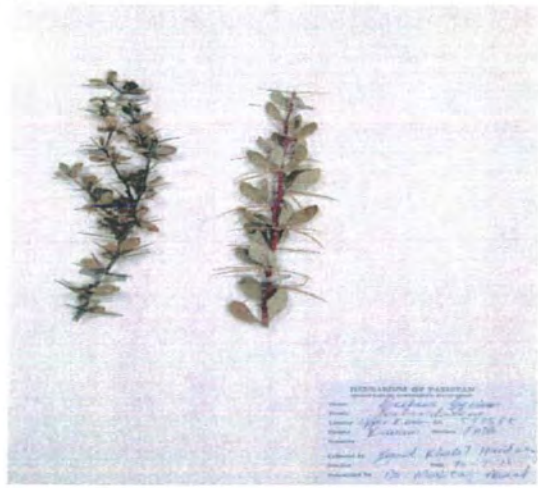

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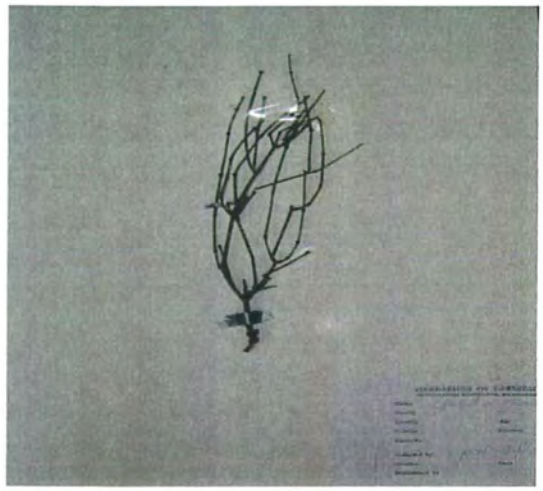


e

f

Plate 5 (a-f) Properly dried and mounted herbarium specimen and their identification

2.3. Data analysis

The descriptive data documented during field work were explained to find frequently-cited use species, mode of utilization, plant parts, preparation method and recipes. Ethno-medicinal data was quantitatively defined with the help of different statistical measures i.e. Frequency Citation (FC), Relative Frequency Citation (RFC), Used Value (UV), Family Importance Value (FIV), and Informant Consensus Factor (ICF).

2.3.1. Use Value (UV)

Use value described by (Phillips and Gentry 1993, Philips *et al.*, 1994) was calculated to evaluate the comparative significance of ethno medicinal use of specific plant species by local communities. Use value UV_i for species i was

$$UV_i = \sum U_i / N_i$$

Where "U_i" is the number of use report(s) cited by each informer for a specific plant species i, "N_i" is the total number of informer interviewed for a specific plant species.

2.3.2. Family Importance Value (FIV)

FIV was calculated to determine the harmony between the informants on the use of medicinal plants for the treatment of disorders. Family importance value was calculated using formula (Molares and Ladio, 2009):

$$FIV = FC \text{ (family) Average}/N \times 100$$

While, FC is the number of informants mentioning the family while N is the total of informants.

2.3.3. The Frequency Citation (FC) and Relative frequency citation (RFC)

The frequency (FC) is used for determining the most used plants and therefore the most preferred plants and the Relative frequency of citation (RFC) of reported species are determined by using following formula:

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

This index shows the local importance of each species and it is given by the frequency of citation (FC), the number of informants mentioning the use of the species

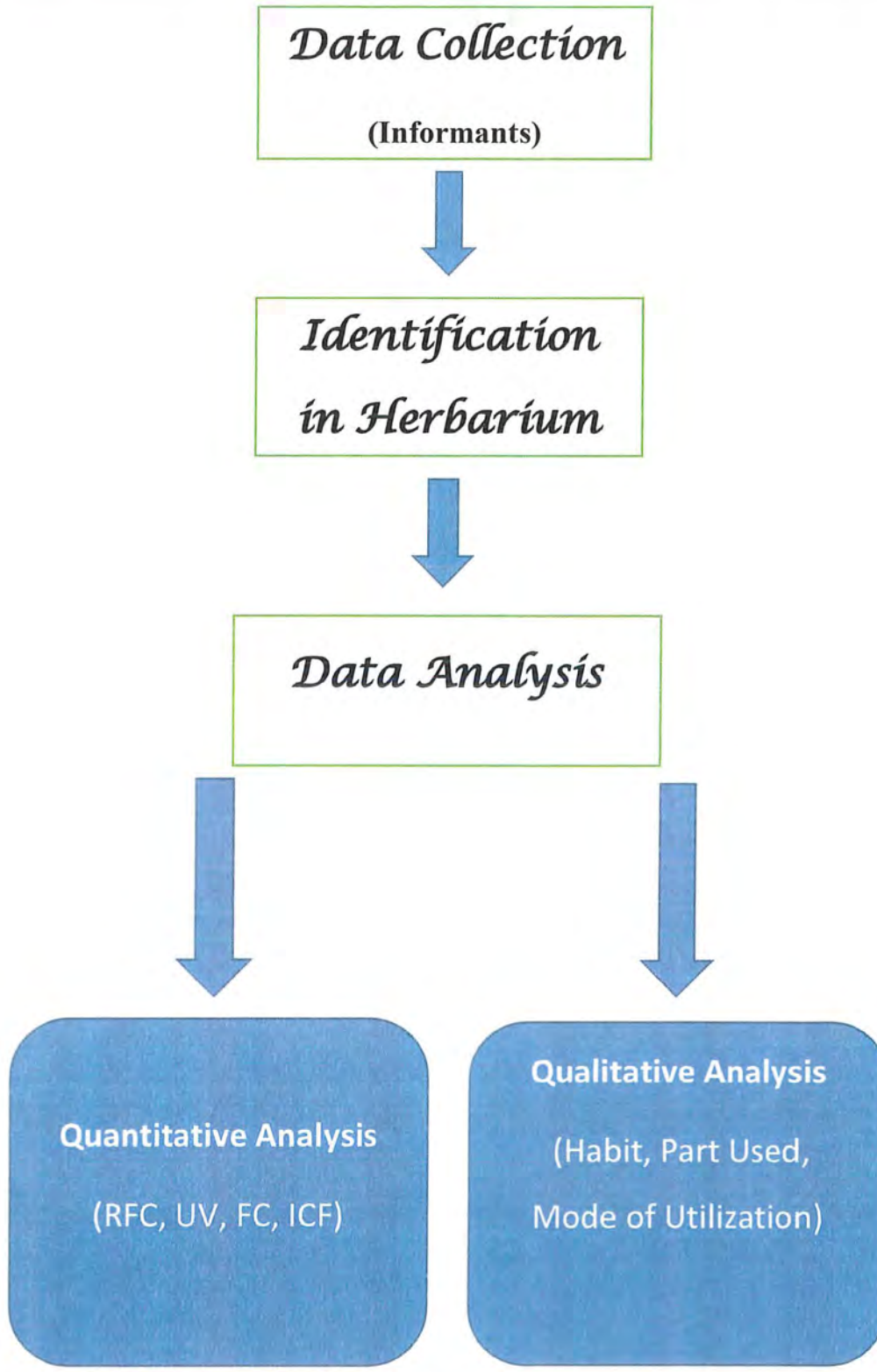
divided by the total number of informants participating in the survey (N), without considering the use categories (Ugulu *et al.*, 2009; Vitalini *et al.*, 2013).

2.3.4. Informant Consensus Factor (ICF)

(ICF) Informant Consensus Factor (Heinrich *et al.*, 1998) is used to assess the agreement among the informants in order to calculate the variability regarding usage of the medicinal plants by the local communities. It is calculated using the following formula:

$$ICF = (N_{ur} - N_t) / (N_{ur} - 1)$$

Where "N_{ur}" shows the number of use reports for a particular use category while "N_t" refers to the number of taxa used for a particular use category by all informants. The ICF results in range of 0-1, where low values (near to 0) show that plants are chosen randomly or if there is no exchange of information about their use among informants. And high values (near to 1) are acquired when there is a clear selection criterion among the community and/or if information is thoroughly exchanged between informants.



(Figure 2) Flow chart of Ethno-medicinal data collection

RESULTS & DISCUSSION

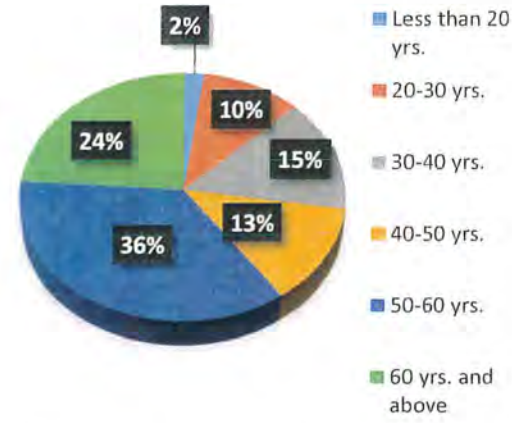
3.1. Demographic information of the informants

In the present investigation a total of 142 informants were interviewed during April 2015 to September 2015, out of which 122 were males and 20 females. The percentage of females is less due to the fact that females in tribal cultures maintain a state of seclusion from outsider men. Among all the informants 18 were traditional health practitioners. Majority of the informants were between 50-60 years of age (Table 1). The interviewers (56%) were mostly found to be illiterate while very few were educated (Figure 3 d).

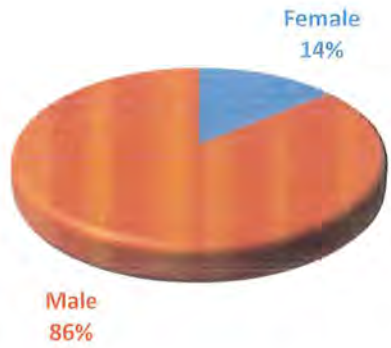
Table. 1. Demographic information of the informants

S. No.	Variables	Categories	No. of persons	Percentage %
1	Informant category	Traditional health practitioner	18	12.67
		Indigenous people	124	87.32
2	Gender	Female	20	14.08
		Male	122	85.91
3	Age	Less than 20 Yrs.	3	2.11
		20-30 Yrs.	15	10.56
		30-40 Yrs.	21	14.78
		40-50 Yrs.	18	12.67
		50-60 Yrs.	51	35.91
		60 Yrs. and above	34	23.94
4	Educational background	Illiterate	80	56.33
		5 Yrs.	30	21.12
		8 Yrs.	22	15.49
		10 Yrs.	4	2.81
		12 Yrs.	4	2.81
		Graduate	2	1.40
5	Experience of health practitioner	Less than 2 Yrs.	1	5.55
		2-5 Yrs.	4	22.22
		5-10 Yrs.	4	22.22
		10-20 Yrs.	3	16.66
		More than 20 Yrs.	6	33.33

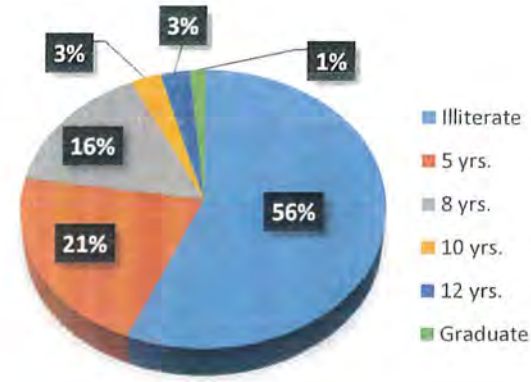
a. Percentage of informant category



b. Percentage of age of the informants



c. Gender distribution of the informants



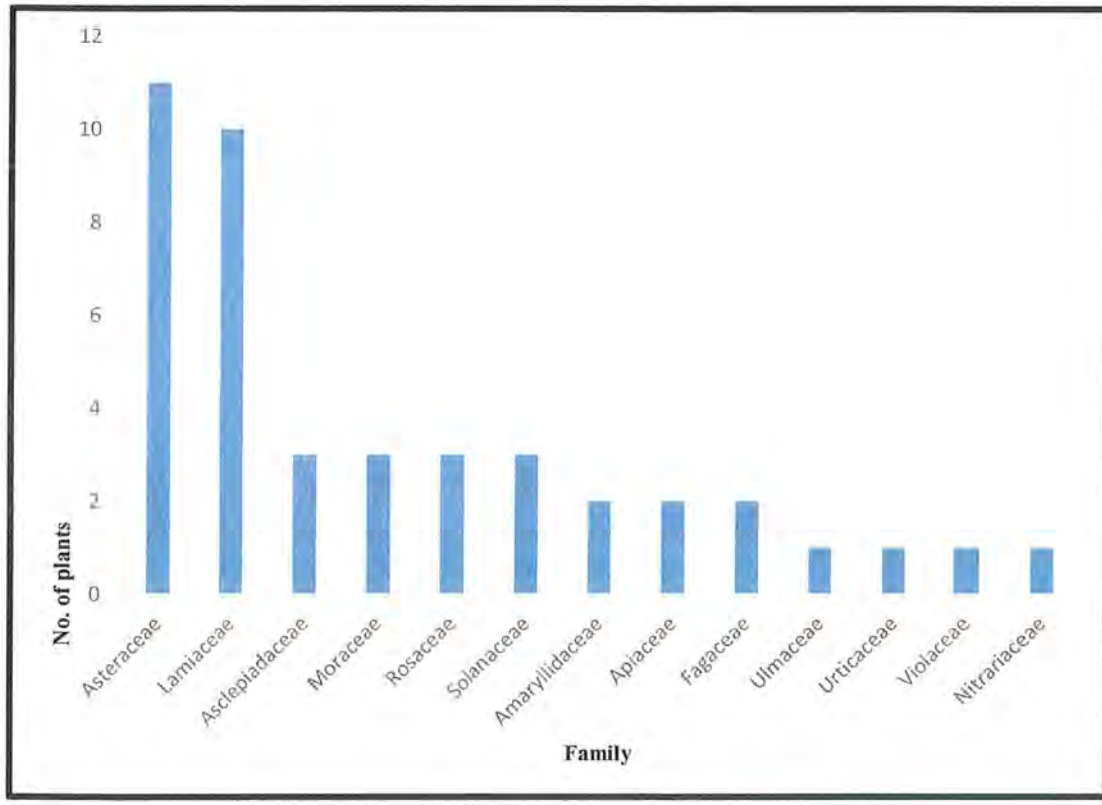
d. Educational background of the informants

(Figure 3 a-d) Percentage distribution of informants

3.2. Taxonomic diversity of medicinal plants

During the present investigation 80 medicinal plant species belonging to 74 genera were documented which were used by the indigenous tribal communities of Upper Kurram Agency, FATA- Pakistan, for treating various human diseases. These valuable medicinal plant species were distributed among 47 families (Table 2). As per the number of medicinal plant species, the family Asteraceae had the highest representation (11 spp.), followed by Lamiaceae with (10 spp.). Asclepiadaceae, Moraceaea, Rosaceae and Solanaceae with 3

species each; while Amaryllidaceae, Apiaceae, Fagaceae, Malvaceae, Plantaginaceae and Polygonaceae represented by 2 species each (Figure 4). The family Asteraceae has been found predominant plant family in the ethno-medicinal surveys carried out by (Bano *et al.*, 2014; Mahmood *et al.*, 2012; Shah *et al.*, 2014; Vitalini *et al.*, 2013; Bibi *et al.*, 2014). As far as herbal remedies are concerned, family Asteraceae has the highest range of plants. Out of the known 250,000 species of flowering plants, almost one out of ten are the members of the Asteraceae. An enormously diverse plant family found in almost every habitat on the planet earth except Antarctica (Moshi *et al.*, 2012).



(Figure 4) Graph showing some of the highest and lowest families

Table. 2. List of medicinal plants used by the local communities of the Koh-e-Sufaid, Upper Kurram Agency, FATA Pakistan

S. No.	Plant Names Family Voucher	Local Name	Life Form	Part Used	Mode of Utilization	Applications	FC*	RFC*	UR*	UV*
1	*Alianthus altissima* (Mill.) Swingle Simaroubaceae SKH-164	Draka	Tree	Leaves	Decoction	Strengthen Hair Blood Purification	20	0.14	2	0.1
2	*Allium cepa* L. Amaryllidaceae SKH-167	Pyaz	Herb	Bulb	Roasted Bulb Juice Fried	Antiseptic Hair fall Heart Problems	54	0.38	3	0.05
3	*Allium sativum* L. Amaryllidaceae SKH-175	Woga	Herb	Bulb	Juice Fried	Hair fall Sperm Count Eye Disease Rheumatism Ear Infections	59	0.41	5	0.08
4	*Anisomeles indica* (L.) Kuntze Lamiaceae SKH-173	Unknown	Herb	Leaves Flowers	Powder Raw	Teeth Cleaning Anthelmintic	15	0.10	2	0.13
5	*Artemisia absinthium* L. Asteraceae SKH-240	Mastyara	Herb	Leaves Flowers	Decoction	Blood Purifier Anthelmintic Antipyretic	50	0.35	3	0.06
6	*Artemisia scoparia* Waldst. & Kit. Asteraceae SKH-163	Shna Tarkha	Herb	Shoots	Decoction Smoke	Blood Purifier Anthelmintic	41	0.28	2	0.04
7	*Asparagus adscendens* Roxb. Asparagaceae SKH-201	Lakhtay	Herb	Shoots	Vegetable Paste	Rheumatism Skin Disorder	35	0.24	2	0.05
8	*Aster alaticus* Willd. Asteraceae SKH-170	Unknown	Herb	Flowers	Decoction	Gastric Problems Anthelmintic Antipyretic Blood Purification	30	0.21	4	0.13
9	*Astragalus spinosus* (Forssk.) Muschl. Papilionaceae SKH-162	Bizokhwny	Shrub	Flowers	Paste	Wound Healing	12	0.08	1	0.08
10	*Berberis lycium* Royle Berberidaceae	Shirazghi	Shrub	Fruits Roots	Powder Paste	Wound Healing Internal Wounds	62	0.43	3	0.04

	SKH-176					Jaundice				
11	*Calotropis procera* (Ait.) Ait. Asclepiadaceae SKH-188	Spelmay	Shrub	Shoots	Latex	Gastric Disorders Anthelmintic	37	0.26	2	0.05
12	*Cannabis sativa* L. Cannabaceae SKH-219	Bhang	Herb	Leaves	Juice	Sedative Coolant	19	0.13	2	0.10
13	*Caralluma tuberculata* N. E.Br. Asclepiadaceae SKH-191	Pawunki	Succulent	Leaves	Vegetable	Antidiabetic Obesity Rheumatism	52	0.36	3	0.05
14	*Celtis caucasica* Willd. Ulmaceae SKH-184	Tagha	Tree	Fruits	Raw	Tonic Laxative	35	0.24	2	0.05
15	*Centaurea iberica* Trevir. & Spreng Asteraceae SKH-182	Spen Azghi	Herb	Roots	Decoction	Kidney Stones Rheumatism	43	0.30	2	0.04
16	*Cichorium intybus* L. Asteraceae SKH-203	Shingul	Herb	Flowers	Powder	Obesity Rheumatism Diabetes	48	0.33	3	0.06
17	*Daphne mucronata* Royle Thymelaceae SKH-222	Laghooni	Shrub	Fruits Roots	Paste Powder	Skin Disorders Wound Healing	46	0.32	2	0.04
18	*Datura stramonium* L. Solanaceae SKH-189	Datora	Shrub	Leaves Seeds	Leaves Paste	Insect bites Antiseptic Skin Disorders	48	0.33	3	0.06
19	*Diospyros lotus* L. Ebenaceae SKH-161	Amlok	Tree	Fruits	Decoction Raw	Cough Flu Laxative	49	0.34	3	0.06
20	*Elaeagnus angustifolia* L. Eleagnaceae SKH-213	Sinzala	Tree	Fruits	Decoction	Cough Flu Expectorant	29	0.20	3	0.10
21	*Ephedra gerardiana* L. Ephedraceae SKH-168	Mawa	Shrub	Shoots	Decoction Powder	Cough Flu Antipyretic Females infertility Menstrual Problems	55	0.38	5	0.09

22	*Eryngium coeruleum* M.Bieb. Apiaceae SKH-200	Shna Azghi	Herb	Shoots Roots	Decoction	Kidney Disorders	15	0.10	1	0.06
23	*Euphorbia helioscopia* L. Euphorbiaceae SKH-179	Peshkhuti	Herb	Shoots Leaves	Latex Decoction	Skin Disorders Anthelmintic Colic Pain	33	0.23	3	0.09
24	*Ficus palmata* Forssk. Moraceae SKH-220	Inzar	Tree	Fruits	Raw	Cough Expectorant Laxative Heart Problems	39	0.27	4	0.10
25	*Foeniculum vulgare* Mill. Apiaceae SKH-190	Kogilani	Herb	Seeds	Raw Paste	Gastric Disorders Eye Sight Cough Flu	60	0.42	4	0.06
26	*Fumaria indica* (Hausskn.) Fumariaceae SKH-206	Shatara	Herb	Whole plant	Decoction	Blood Purification Hair fall Muscular Pain Skin Disorders	23	0.16	4	0.17
27	*Glycyrrhiza glabra* L. Leguminosae SKH-180	Khogawuni	Herb	Roots	Decoction	Cough Flu Rheumatism Muscle Pain	45	0.31	4	0.08
28	*Hibiscus trionum* L. Malvaceae SKH-231	Ghazan	Herb	Leaves Flowers	Vegetable	Gastric Disorders	20	0.14	1	0.05
29	*Impatiens balfourii* Hook.f. Balsaminaceae SKH-186	Balsan	Herb	Flowers	Paste	Joint Pains Skin Burns	18	0.12	2	0.11
30	*Juglans regia* L. Juglandaceae SKH-214	Waghz	Tree	Fruit Roots	Raw	Tonic Obesity Heart Problems Tooth problems Diabetes	48	0.33	5	0.10
31	*Malva parviflora* L. Malvaceae SKH-165	Tikalay	Herb	Leaves Flowers	Vegetable	Gastric Disorders Rheumatism	38	0.26	2	0.05
32	*Marrubium vulgare* L. Lamiaceae	Darshool	Herb	Leaves	Decoction	Blood Purification Anthelmintic	44	0.31	3	0.06

	SKH-198					Antipyretic				
33	*Matricaria chamomilla* L. Asteraceae SKH-187	Lukhrach	Herb	Flowers	Candied Juice	Laxative Heart Problems Blood Purifier Eye Diseases	55	0.38	4	0.07
34	*Melia azedarach* L. Meliaceae SKH-224	Bakyana	Tree	Leaves	Decoction	Hair fall Kidney Stones Urinary Problems Anthelmintic	26	0.18	4	0.15
35	*Mentha arvensis* L. Lamiaceae SKH-166	Podena	Herb	Leaves	Raw Juice	Gastric Disorders Tooth Ache	45	0.31	2	0.04
36	*Mentha longifolia* (L.) Huds Lamiaceae SKH-207	Wilani	Herb	Leaves	Raw Poultice	Flu Cough Gastric Disorders Anthelmintic	44	0.31	4	0.09
37	*Mentha royleana* Wall. ex Benth. Lamiaceae SKH-174	Nari Wilani	Herb	Leaves	Raw Poultice	Flu Cough Gastric Disorders	44	0.31	3	0.06
38	*Monotheca buxifolia* (Falc.) A. DC. Sapotaceae SKH-216	Gurgure	Tree	Fruits	Raw	Tonic Laxative	47	0.33	2	0.04
39	*Morus alba* L. Moraceae SKH-192	Spin Toot	Tree	Fruits	Raw	Tonic Laxative Cough	45	0.31	3	0.06
40	*Morus nigra* L. Moraceae SKH-212	Tor Toot	Tree	Fruits	Raw	Flu Cough Blood Production	41	0.28	3	0.07
41	*Myrtus communis L.* Myrtaceae SKH-181	Manray	Shrub	Leaves Fruits	Powder Raw	Tonic, Healing Rheumatism Males infertility	53	0.37	4	0.07
42	*Nannorrhops ritchiana* (Griff.) Aitch. Arecaceae SKH-232	Mazari	Shrub	Fruits	Raw	Tonic	28	0.19	1	0.03

43	*Olea ferruginea* Royle Oleaceae SKH-171	Khawan	Tree	Leaves Fruits	Poultice Oral	Skin Disorders Heart Problems	37	0.26	2	0.05
44	*Oxalis corniculata* L. Oxalidaceae SKH-210	Bibimalga	Herb	Leaves Flowers	Juice	Gastric Disorders Eye Diseases Antidiabetic	24	0.16	3	0.12
45	*Papaver somniferum* L. Papaveraceae SKH-172	Doda	Herb	Fruits Seeds	Decoction Raw	Flu Cough Sedative Depression Releasing	52	0.36	4	0.07
46	*Peganum harmala* L. Nitrariaceae SKH-183	Spinali	Herb	Seeds Shoots	Smoke Raw	Antiseptic Anthelmintic	59	0.41	2	0.03
47	*Periploca aphylla* Decne. Asclepiadaceae SKH-177	Barara	Shrub	Shoots	Latex Powder	Gastric Disorders Wound Healing Sedative	36	0.25	3	0.08
48	*Perovskia atriplicifolia* Benth. Lamiaceae SKH-229	Sarsonbe	Sub-shrub	Flowers	Decoction	Stomach Disorders Blood Purification	6	0.04	2	0.33
49	*Persicaria barbata (*L.) Hara Polygonaceae SKH-178	Marchki	Herb	Seeds	Raw	Gastric Disorders	4	0.02	1	0.25
50	*Pinus roxburghii* Sarg. Pinaceae SKH-199	Nakhtar	Tree	Wood	Resin	Cough Skin Disorders Sex Vigor Wound Healing	52	0.36	4	0.07
51	*Plantago lanceolata* L. Plantaginaceae SKH-239	Ghwazhbi	Herb	Leaves Seeds	Raw Poultice	Gastric Disorders Rheumatism	43	0.30	2	0.04
52	*Plantago major* L. Plantaginaceae SKH-185	Bartang	Herb	Leaves Seeds	Decoction	Colic Pain Tonic Flue Cough	45	0.31	4	0.08
53	*Platanus orientalis* L. Platanaceae SKH-197	Chinar	Tree	Bark	Ash	Wound Healing	9	0.06	1	0.11

54	*Polygonum plebeium* R. Br. Polygonaceae SKH-202	Banduki	Herb	Leaves Flowers	Vegetable	Stomach Disorders Energizer Coolant	22	0.15	3	0.13
55	*Portulaca oleracea* L. Portulacaceae SKH-221	Warkhuri	Herb	Leaves	Vegetable	Laxative Coolant Energizer	38	0.26	3	0.07
56	*Potentilla johnstonii* Soj k Rosaceae SKH-209	Zorbooti	Herb	Leaves	Raw	Sex Vigor Gastric Problems	46	0.32	2	0.04
57	*Punica granatum* L. Lythraceae SKH-215	Anar	Tree	Seeds	Candied	Heart Problems Cough	33	0.23	2	0.06
58	*Quercus dentata* Thunb. Fagaceae SKH-194	Shnasiary	Tree	Leaves Fruits	Raw Poultice	Urinary Disorders Skin Disorders	51	0.35	2	0.03
59	*Quercus alinifolia* Poech Fagaceae SKH-233	Sperasiary	Tree	Leaves Fruits	Raw Poultice	Urinary Disorders Skin Disorders	51	0.35	2	0.03
60	*Ranunculus laetus* Wall. ex Hook.f. & Thoms. Ranunculaceae SKH-193	Zairgul	Herb	Leaves Flowers	Paste Fried	Rheumatism Skin Disorder	23	0.16	2	0.08
61	*Robinia pseudoacacia* L. Fabaceae SKH-204	Chambeli	Tree	Seeds	Raw	Kidney Disorders	4	0.02	1	0.25
62	*Rosa x damascena* Mill. Rosaceae SKH-208	Gunlab	Shrub	Flowers	Candied	Laxative Tonic Gastric Disorders	47	0.33	3	0.06
63	*Rubus fruticosus* L. Rosaceae SKH-205	Spengeer	Shrub	Fruits	Raw Juice	Tonic Wound Healing Blood Production	39	0.27	3	0.07
64	*Sambucus nigra* L. Sambucaceae SKH-211	Khara Jara	Shrub	Fruits	Paste Juice	Flue Skin Disorders	10	0.07	2	0.2
65	*Scutellaria prostrata* Jacq. Ex Benth. Lamiaceae	Am Booti	Herb	Flowers	Paste Raw	Heart Problems Skin Disorders Gastric problems	20	0.14	3	0.15

	SKH-195									
66	*Seriphidium kurramense* (Qazilb.) Y. R. Ling Asteraceae SKH-217	Khara Tarkha	Herb	Leaves Flowers Seeds	Decoction Smoke	Blood Purifier Anthelmintic Antipyretic Antiseptic Jaundice	67	0.47	5	0.07
67	*Silybum marianum* (L.) Gaertn. Asteraceae SKH-223	Dum	Herb	Roots	Decoction	Kidney Stones Urinary problems Rheumatism	31	0.21	3	0.09
68	*Sisymbrium irio* L. Brassicaceae SKH-218	Khob e Kalan	Herb	Leaves	Raw	Gastric Disorders	35	0.24	1	0.02
69	*Solanum surattense* Burm.f. Solanaceae SKH-196	Kaware	Herb	Fruits	Vegetable	Diabetes Obesity	49	0.34	2	0.04
70	*Stachys parviflora* Benth. in DC. Lamiaceae SKH-230	Sehra Wilani	Herb	Leaves Flowers	Decoction Powder	Obesity Rheumatism Heart Problem Blood Purification	43	0.30	4	0.09
71	*Tanacetum artemisioides* Sch.Bip. ex Hook.f. Asteraceae SKH-238	Zawel	Herb	Flowers	Powder	Flu Cough Obesity	58	0.40	3	0.05
72	*Teucrium stocksianum* Boiss. Lamiaceae SKH-234	Khar Booti	Herb	Leaves	Decoction	Blood Purification Antipyretic Anthelmintic Jaundice Kidney Disorders	62	0.43	5	0.08
73	*Thymus linearis* Benth. In Wall. Lamiaceae SKH-226	Mawray	Herb	Flowers Leaves	Decoction	Cough Gastric Disorder Expectorant	53	0.37	3	0.05
74	*Traxacum officinale* F.H. Wigg. Asteraceae SKH-235	Zer Gul	Herb	Flowers	Poultice Paste	Rheumatism Insect Bites	16	0.11	2	0.12
75	*Urtica dioica* L. Urticaceae SKH-225	Sezaonki	Herb	Leaves	Paste	Skin Disorders	3	0.02	1	0.33

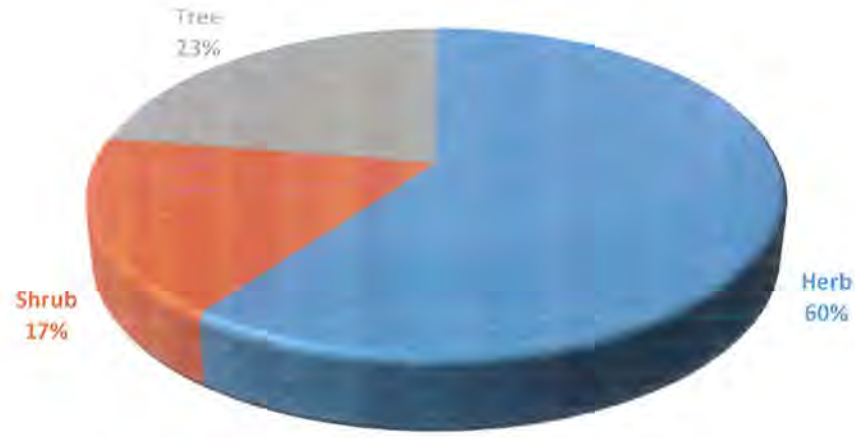
76	*Verbascum thapsus* L. Scrophulariaceae SKH-237	Spera Ponri	Herb	Leaves	Poultice Paste	Skin Disorders Wound Healing	48	0.33	2	0.04
77	*Viola odorata* L. Violaceae SKH-228	Banafsha	Herb	Leaves Flowers	Decoction	Flu Cough Antipyretic	56	0.39	3	0.05
78	*Withania coagulans* (Stocks) Dunal in DC. Solanaceae SKH-227	Khapyanga	Shrub	Seeds	Raw	Obesity Gastric Disorders Sperm Production Diabetes	64	0.45	4	0.06
79	*Xanthium strumarium* L. Asteraceae SKH-236	Khara Tora	Herb	Leaves	Raw	Insect bites Skin disorders	23	0.16	2	0.08
80	*Ziziphus nummularia* (Burm. f.) Wight & Arn. Rhamnaceae SKH-241	Markhanray	Tree	Leaves Fruits	Raw Decoction	Flue Cough Tonic	50	0.35	3	0.06

FC* = (Frequency Citation), RFC* = (Relative Frequency Citation), UR* = (Used Reports), UV* = (Used Value)

3.3. Qualitative analysis of the medicinal plants of the Koh-e-Sufaid Upper Kurram Agency, Pakistan

3.3.1. Life form

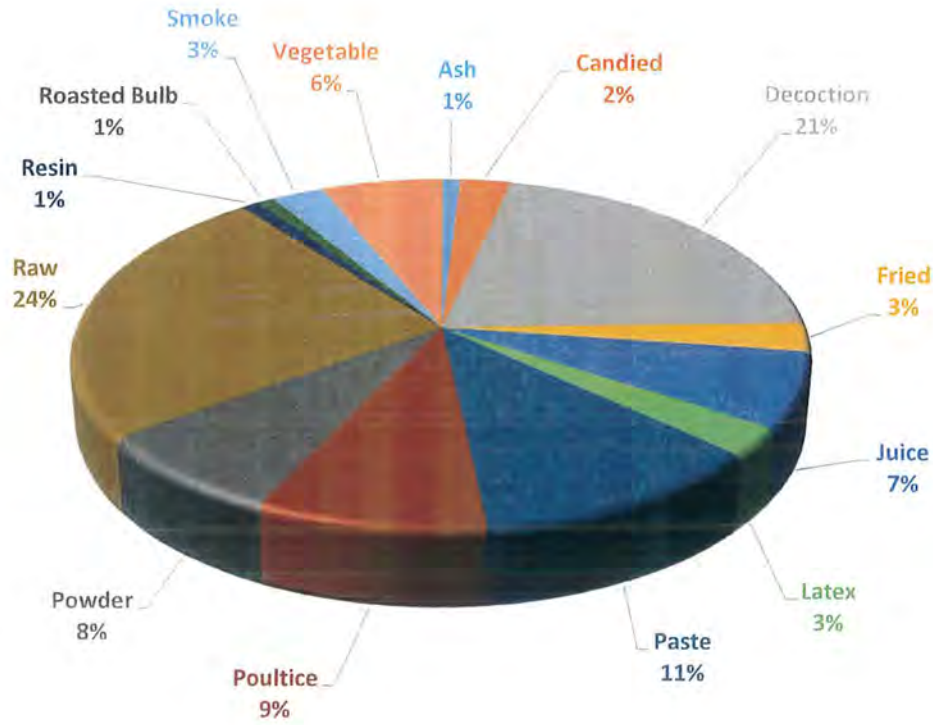
During the current study the dominant life form of the medicinal plants was found to be Herbs (60%), Shrubs (17%), and Trees (23%). Herbs are the dominant life form has been found in the previous studies conducted (Mahmood *et al.*, 2012; Abbasi *et al.*, 2013; Bibi *et al.*, 2014). The reason behind the dominance of herbs is that they can be dispersed to larger distances and they are easy to grown and stored. There are a number of reasons behind the high percentage of herbs in this investigation (Ayyanar and Ignacimuthu., 2005). Herbs are easily grown in various habitats. They can be easily collected, stored and can be utilized easily in herbal preparation (Giday, 2003).



(Figure 5) Chart showing Life form of the medicinal plant species of the study area

3.3.2. Mode of Utilization

The local communities of the study area uses all the different parts of the ethno-medicinal plants, in different modes of preparation. It is concluded from the data that raw form (24%) (unprocessed), was the dominant form of preparation (Figure 6). Followed by decoction (21%), paste (11%).



(Figure 6) Percentage of the mode of utilization of herbal medicine

The results are found to be similar to the studies conducted by (Bussmann *et al.*, 2011; Pakhtoonzada *et al.*, 2015). Kala, (2009) carried out a study in Chhattisgarh, India. He found 22 wild medicinal plant species out of which 13 were found to be used in raw form. Ash, Roasted bulb and Resin was found to be with lowest percentage (1% each). This might be due to the fact that it is easy to use medicinal plants in unprocessed form.

3.3.3. Folk herbal recipes used by Tribal Communities of Koh-e-Sufaid, Upper Kurram Agency, FATA-Pakistan

Plant Name	*Alianthus altissimia* (Mill.) Swingle
Family	Simaroubaceae
Local Name	(Daraka)
Recipe	Decoction of 100 mg of leaves is cooled and applied on the scalp to strengthen hair. One cup of that decoction before the breakfast help to purifies blood.

Plant Name	*Allium cepa* L.
Family	Amaryllidaceae
Local Name	(Pyaz)
Recipe	A bulb is cut and rubbed on skin as antiseptic. 100 ml of onion and garlic juice are combined and mixed with 100ml fragrant hair oil, is applied on scalp for treating hair fall and dandruff. Bulbs are fried and consumed to prevent cardiac problems.

Plant Name	*Allium sativum* L.
Family	Amaryllidaceae
Local Name	(Woga)
Recipe	Whole bulb is roasted applied topically on wounds for speedy healing. Onion juice, garlic juice are combined and mixed with fragrant hair oil is applied on scalp for treating hair fall and dandruff. Fried and consumed increases sexual vigor in males. 2-3 drops of onion juice is mixed with a small amount of honey and applied in eyes to cure eye diseases. 3-4 drops of oil in which garlic bulb is fried is used to treat ear infection.

Plant Name	*Anisomeles indica* (L.) Kuntze
Family	Lamiaceae
Local Name	(Unknown)
Recipe	Powder of leaves and flowers is used to clean teeth. Leaves are orally consumed to for killing internal worms.

Plant Name	*Artemisia absinthium* L.
Family	Asteraceae
Local Name	(Mastyara)
Recipe	50 ml of decoction in morning is effective against fever and internal worms. It also works as blood purifier.

Plant Name	*Artemisia scoparia* Waldst. & Kitam.
Family	Asteraceae
Local Name	(Shna Tarkha)

Recipe	100 ml of decoction is prepared from shoots. 2-3 teaspoon purifies blood and kills internal worms.

Plant Name	*Asparagus adscendens* Roxb.
Family	Asparagaceae
Local Name	(Lakhtay)
Recipe	Young shoots are cooked and eaten to cure internal pains while paste is applied on skin to treat skin infections.

Plant Name	*Aster alaticus* Willd.
Family	Asteraceae
Local Name	Unknown
Recipe	Decoction prepared from leaves and flowers is used to treat colic pain, internal worms, common cold and blood purification.

Plant Name	*Astragalus spinosus* (Forssk.) Muschl.
Family	Papilionaceae
Local Name	(Bizokhwny)
Recipe	Paste of flowers is helpful in wound healing.

Plant Name	*Berberis lycium* Royle
Family	Berberidaceae
Local Name	(Shirazghi)
Recipe	Paste of fruits is applied on wounds. A teaspoon of root powder is administered to cure internal wounds and jaundice.

Plant Name	*Calatropis procera* (Ait.) Ait.
Family	Asclepiadaceae
Local Name	(Spelmay)
Recipe	5-6 drops of milky latex is mixed in a glass of milk to treat colic pain and internal worms.

Plant Name	*Cannabis sativa* L.
Family	Cannabaceae
Local Name	(Bhang)
Recipe	Juice of leaves is mixed with buttermilk and drunk as coolant. It's also sedative.

Plant Name	*Caralluma tuberculata* N. E.Br.
Family	Asclepiadaceae
Local Name	(Pawunki)
Recipe	Cooked in meat is considered as Antidiabetic, Anti-obesity, Anti-rheumatic.

Plant Name	*Celtis caucasica* Willd.
Family	Ulmaceae
Local Name	(Tagha)
Recipe	Fruits are laxative and eaten as tonic and it helps to cure constipation.

Plant Name	*Centaurea iberica* Trevir. & Spreng
Family	Asteraceae
Local Name	(Spen Azghi)
Recipe	Decoction of roots is administered for removing kidney stones and curing internal pains.

Plant Name	*Cichorium intybus* L.
Family	Asteraceae
Local Name	(Shin Gul)
Recipe	A teaspoon of powder made from flowers is given to reduce wait, internal pains and diabetes.

Plant Name	*Daphne mucronata* Royle
Family	Thymelaceae
Local Name	(Laghooni)
Recipe	Fruit paste is considered an effective remedy to treat skin disorders, while roots are powdered and mixed with turmeric powder is applied on wounds to expedite healing of wounds.

Plant Name	*Datura stramonium* L.
Family	Solanaceae
Local Name	(Datora)
Recipe	Leaves are topically applied on insect bites. Seeds paste is antiseptic and helpful in curing skin disorders.

Plant Name	*Diospyros lotus* L.
Family	Ebenaceae
Local Name	(Amlok)
Recipe	2-3 fruits are boiled in water after mixing 10-15 seeds of fennel is recommended in flue and cough. Fruits are given to break constipation.

Plant Name	*Eleagnus angustifolia* L.
Family	Eleagnaceae
Local Name	(Sinzala)
Recipe	Decoction is prepared by mixing 4-5 fruits, a teaspoon of sugar and a dried poppy fruit. This decoction is used against flue and cough. This decoction is an effective expectorant.

Plant Name	*Ephedra gerardiana* L.

Family	Ephedraceae
Local Name	(Mawa)
Recipe	Decoction prepared from mixing dried shoots and sugar is boiled in water is considered effective against cough, flue, fever. While root powdered is administered in female infertility and menstrual irregularities.

Plant Name	*Eryngium coeruleum* M-Bieb.
Family	Apiaceae
Local Name	(Shna Azghi)
Recipe	Roots are boiled in water and that decoction is given in kidney disorders.

Plant Name	*Euphorbia helioscopia* L.
Family	Euphorbiaceae
Local Name	Peshkhuti
Recipe	Milky latex is applied on warts and leaves decoction is helpful in eradicating internal worms and colic pain.

Plant Name	*Ficus palmata* Forssk.
Family	Moraceae
Local Name	Inzar
Recipe	Consuming fruits in raw form are effective against cough, phlegm and constipation. Eating 3-4 dried fruits are used in heart problems.

Plant Name	*Foeniculum vulgare* Mill.
Family	Apiaceae
Local Name	Kogilani
Recipe	Chewing of seeds is recommended for colic pain, sore throat and flue. Seeds grinded in rose water are effective in improving eye sight.

Plant Name	*Fumaria indica* (Hausskn.)
Family	Fumariaceae
Local Name	Shatara
Recipe	Decoction of whole plant is blood purifier, removes pimples from skin. Washing hair with cooled decoction strengthen hair. It's also effective against muscular pains.

Plant Name	*Glycerhiza glabra* L.
Family	Leguminosae
Local Name	Khogawuni
Recipe	Decoction of roots is used for cough, flue and internal pains and muscular pains.

Plant Name	*Hibiscus trionum* L.

Family	Malvaceae
Local Name	Ghazan
Recipe	Flowers and leaves cooked in sugar are administered in cholera.

Plant Name	*Impatiens balfourii* Hook.f.
Family	Balsaminaceae
Local Name	Balsan
Recipe	Paste of flowers are applied on joints to relieve pain and it is effective against skin burns.

Plant Name	*Juglans regia* L.
Family	Juglandaceae
Local Name	Waghz
Recipe	Eating 3-4 fruits are considered energizer, it also reduces weight, antidiabetic and good for heart patients. Bark of stem and root is used to clean teeth.

Plant Name	*Malva parviflora* L.
Family	Malvaceae
Local Name	Tikalay
Recipe	Leaves and flowers are cooked and used to cure stomach disorders and internal pain.

Plant Name	*Marrubium vulgare* L.
Family	Lamiaceae
Local Name	Darshool
Recipe	Decoction of leaves is administered to remove internal worms. It's also a blood purifier and used against common fever.

Plant Name	*Matricaria chamomilla* L.
Family	Asteraceae
Local Name	Lukhrach
Recipe	Flowers preserved in sugar are laxative, blood purifier and cures heart problems. 2-3 drops of flower juice is used in eye diseases.

Plant Name	*Melia azedarach* L.
Family	Meliaceae
Local Name	Bakyana
Recipe	Decoction prepared from leaves is effective against kidney stones, urinary problems internal worms and hair fall.

Plant Name	*Mentha arvensis* L.
Family	Lamiaceae
Local Name	Podena

Recipe	Leaves are chewed to remove gastric disorders. 3-4 drops leaves juice is applied on cotton is effective against toothache.
Plant Name	*Mentha longifolia* (L.) Huds
Family	Lamiaceae
Local Name	Wilani
Recipe	One teaspoon of dried leaves grinded along fennel are good to relieve gastric pain and internal parasites. A cloth pad is filled with leaves and wrapped around children's chest to cure flue and cough.
Plant Name	*Mentha royleana*Wall. ex Benth.
Family	Lamiaceae
Local Name	Nari Wilani
Recipe	A cloth pad is filled with leaves and wrapped around children's chest to cure flue and cough. 4-5 leaves and chewed to cure colic pain.
Plant Name	*Monotheca buxifolia* (Falc.) A. DC.
Family	Sapotaceae
Local Name	Gurgure
Recipe	Fruits are eaten and considered as energy booster and laxative.
Plant Name	*Morus alba* L.
Family	Moraceae
Local Name	Spin Toot
Recipe	Fruits are consumed and rendered as tonic and laxative. They are good against cough.
Plant Name	*Morus nigra* L
Family	Moraceae
Local Name	Tor Toot
Recipe	Fruits are consumed to cures sore throat, flue and purifies blood.
Plant Name	*Myrtus communis* L.
Family	Myrtaceae
Local Name	Manray
Recipe	Leaves are dried and powdered, that powder is sprinkled on burnt skin to heal quickly. Fruits are considered as tonic. It cures internal pains and infertility in males.
Plant Name	*Nannorrphs ritchiana* (Griff.) Aitch.
Family	Arecaceae
Local Name	Mazari
Recipe	Fruits are considered revitalizing.
Plant Name	*Olea ferruginea* Royle

Family	Oleaceae
Local Name	Khawan
Recipe	Leaves are applied on skin rashes. Fruits are consumed by heart patients.

Plant Name	*Oxalis corniculata* L.
Family	Oxalidaceae
Local Name	Bibimalga
Recipe	A teaspoon of juice is administered in gastric problems and diabetes. 2 drops of juice is mixed with a drop of pomegranate juice to cure eye infections.

Plant Name	*Papaver somniferum* L.
Family	Papaveraceae
Local Name	Doda
Recipe	Fruits and dried latex is boiled in water and given to patients suffering from Flue, Cough. It's also sedative, depression releasing.

Plant Name	*Peganum harmala* L.
Family	Nitrariaceae
Local Name	Spinali
Recipe	Smoke is considered antiseptic. Seeds are helpful in removing internal worms.

Plant Name	*Periploca aphylla* Decne.
Family	Asclepiadaceae
Local Name	Barara
Recipe	Consuming milky latex cures gastric disorders. Powder of shoots is considered as wound healer and used in "Snuff" as sedative.

Plant Name	*Perovskia atriplicifolia* Benth
Family	Lamiaceae
Local Name	Sarsonbe
Recipe	Flowers and leaves are boiled. This decoction is used to cure gastric pain and blood purification.

Plant Name	*Persicarira barbata* (L.) Hara
Family	Polygonaceae
Local Name	Marchki
Recipe	Seeds are effective against colic pain.

Plant Name	*Pinus roxburghii* Sarg.
Family	Pinaceae
Local Name	Nakhtar

Recipe	4-5 drops of resin is added to milk and recommended to cure skin rashes and cough. Resin is also applied on wounds to help in healing process. It improves sex vigor in males.
Plant Name	*Plantago lanceolata* L.
Family	Plantaginaceae
Local Name	Ghwazhbi
Recipe	Leaves are cooked in oil and applied on body parts having pain. Seeds are boiled in water after mixing sugar with it is administered in colic pain.
Plant Name	*Plantago major* L.
Family	Plantaginaceae
Local Name	Bartang
Recipe	Seeds are boiled in water after mixing sugar with it is administered in flue, cough and colic pain. It's a good energizer.
Plant Name	*Platanus orientalis* L.
Family	Platanaceae
Local Name	Chinar
Recipe	Ash of bark is helpful in wound healing especially in domestic animals.
Plant Name	*Polygonum plebeium* R. Br.
Family	Polygonaceae
Local Name	Banduki
Recipe	When cooked it effective to cure stomach disorders, energizer and coolant.
Plant Name	*Portulaca oleracea* L.
Family	Portulacaceae
Local Name	Warkhuri
Recipe	Leaves cooked as potherb are laxative, coolant and revitalizing.
Plant Name	*Potentilla johnstonii* Soj k
Family	Rosaceae
Local Name	Zorbooti
Recipe	Its leaves are consumed as salad to improve sex vigor and to cure gastric pain.
Plant Name	*Punica granatum* L.
Family	Lythraceae
Local Name	Anar
Recipe	A tablespoon of seeds preserved in sugar is effective against cough and cardiac issues.

Plant Name	*Quercus alinifolia* Poech
Family	Fagaceae
Local Name	Shnasiary
Recipe	Ripened seeds are roasted and consumed to cure urinary disorders while leaves are rubbed on skin to cure skin infections.

Plant Name	*Quercus dentata* Thunb.
Family	Fagaceae
Local Name	Sperasiary
Recipe	Ripened seeds are roasted and consumed to cure urinary disorders while leaves are rubbed on skin to cure skin infections.

Plant Name	*Ranunculus laetus* Wall. ex Hook.f. & Thoms.
Family	Ranunculaceae
Local Name	Zairgul
Recipe	Flowers are crushed and applied on skin infections. Flowers are fried in oil and applied on pain showing bod parts.

Plant Name	*Robinia pseudoacacia* L.
Family	Fabaceae
Local Name	Chambeli
Recipe	Seeds are roasted and consumed to treat kidney disorders.

Plant Name	*Rosa damascena* L.
Family	Rosaceae
Local Name	Gunlab
Recipe	Flowers preserved in sugar are laxative, revitalizing and cures gastric disorders.

Plant Name	*Rubus fruticosus* L.
Family	Rosaceae
Local Name	Spengeer
Recipe	Fruits are helpful in blood production and revitalization. Fruit juice is applied on wounds.

Plant Name	*Sambucus nigra* L.
Family	Sambucaceae
Local Name	Khara Jara
Recipe	Fruit paste which considered anti fungicidal is applied on skin. 2 teaspoons of fruits juice is effective against flue.

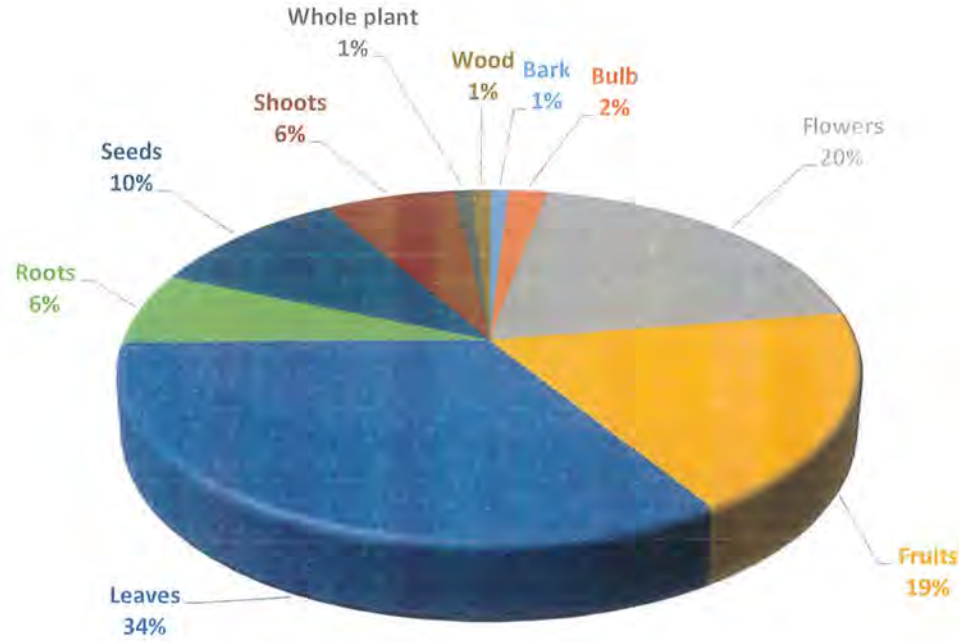
Plant Name	*Scutellaria prostrata* Jacq. Ex Benth.
Family	Lamiaceae
Local Name	Am Booti

Recipe	Flowers are consumed in raw form to cure heart problems, skin disorders and gastric problems.
Plant Name	*Seriphidium kurramense* (Qazilb.) Y. R. Ling
Family	Asteraceae
Local Name	Khara Tarkha
Recipe	50 ml of decoction in morning is effective against fever, internal worms and jaundice. It also works as blood purifier. Smoke is antiseptic.
Plant Name	*Silibum marianum* (L.) Gaertn.
Family	Asteraceae
Local Name	Dum
Recipe	Root decoction is effective against kidney stones, urinary problems and internal pain.
Plant Name	*Solanum surattense* Burm.f.
Family	Solanaceae
Local Name	Kaware
Recipe	Fruits are cooked and give to patients suffering from diabetes and obesity.
Plant Name	*Stachys parviflora* Benth. in DC.
Family	Lamiaceae
Local Name	Sehra Wilani
Recipe	A teaspoon full of dried powder made from dried flowers and leaves is recommended for reducing weight, internal pain and heart problems. Decoction of flowers and leaves works as blood purifier.
Plant Name	*Tanacetum artemisioides* Sch.Bip. ex Hook.f.
Family	Asteraceae
Local Name	Zawel
Recipe	Dried flowers are grinded along nutmeg is mixed with oil and applied on chest to cure flue and cough. 1 teaspoon of dried flowers powder is used consumed with water to help weight loss.
Plant Name	*Teucrium stocksianum* Boiss.
Family	Lamiaceae
Local Name	Khar Booti
Recipe	Decoction made from leaves is effective for blood purification, common fever, anthelmintic, jaundice, kidney disorders.
Plant Name	*Thymus linearis* Benth. In Wall.
Family	Lamiaceae
Local Name	Mawray

Recipe	Decoction made from dried leaves and flowers are used to treat flue and cough. It's also a good for colic pain.
Plant Name	*Traxacum officinale* F.H. Wigg.
Family	Asteraceae
Local Name	Zer Gul
Recipe	Leaves are topically applied on insect bites. Flowers and leaves are cooked in oil and applied on body parts to relieve internal pain.
Plant Name	*Urtica dioica* L.
Family	Urticaceae
Local Name	Sezaonki
Recipe	Paste of leaves is applied on skin to cure skin infections.
Plant Name	*Verbascum thapsus* L.
Family	Scrophulariaceae
Local Name	Spera Ponri
Recipe	Leaves are topically applied to treat skin disorders. Leaves paste is helpful in wound healing.
Plant Name	*Viola odorata* L.
Family	Violaceae
Local Name	Banafsha
Recipe	Flowers and leaves are boiled in water, sugar and fennel seeds are added to it. It helps to treat common fever, cough and flue.
Plant Name	*Withania coagulans* (Stocks) Dunal in DC.
Family	Solanaceae
Local Name	Khapyanga
Recipe	Oral consumption of 2-3 seeds with milk increases sperm production in males. 5-6 seeds consumed with water cures heart burn, diabetes and expedite weight loss.
Plant Name	*Xanthium strumarium* L.
Family	Asteraceae
Local Name	Khara Tora
Recipe	Leaves are topically applied on insect bites and skin disorders.
Plant Name	*Ziziphus nummularia* (Burm. f.) Wight & Arn.
Family	Rhamnaceae
Local Name	Markhanray
Recipe	Raw fruits are revitalizing. Fruits are boiled in water, a poppy fruit is also added to it then this decoction is advised to treat flue and cough.

3.3.4. Part Used

The various parts of the plants have different metabolites. These biochemical vitamins, minerals, antioxidants differ in their quantity due to their variation in the plant parts. In the present study Leaves (34%) were found to be the most commonly plant part used. Followed by Flowers (20%), Fruits (19%), Seeds (10%) and Roots (6%) (Figure 7). Same results were found in the previous studies (Abbasi *et al.*, 2013; Mahmood *et al.*, 2012; Saqib *et al.*, 2014; Ahmad *et al.*, 2014, Bussmann *et al.*, 2011). Leaves, fruits, seeds and roots are the most preferred because they contain high amount of the biologically active compounds as compared to other parts of the plants (Srithi *et al.*, 2009). Plucking of leaves do not have any detrimental effects on the survival of the plants, as in the case of roots. This is safer for the sustainability of plants as compared to other parts of the plants (Giday, 2010).



(Figure 7) Percentage of the part used

3.4. Quantitative analysis of the medicinal plants of the Koh-e-Sufaid, Upper Kurram Agency, Pakistan

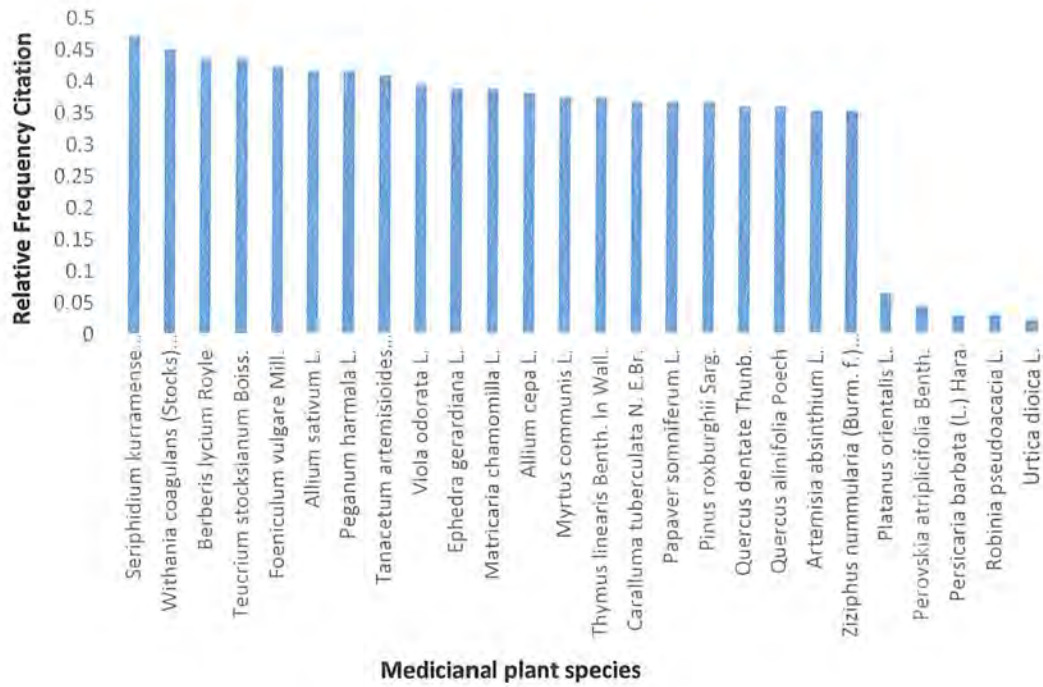
The modern ethnobotanical studies have been improved to greater extant by the use of the statistical quantitative and qualitative approaches or methods. The application of these statistical in the explanation of the ethnobotanical data has improved its productivity many folds. The quantitative approaches describe the variables quantitatively besides the qualitative data. In the present study, quantitative analysis has been applied on ethnobotanical data by calculating Relative frequency of citation (RFC), Family importance value (FIV), Used Value (UV) and ICF (Informant Consensus Factor).

3.4.1. Relative popularity of medicinal plants of the Koh-e-Sufaid, Upper Kurram Agency, Pakistan

The RFC is used to determine the most used plant species of an area with reference to informants that have been interviewed for that particular plant species. The RFC also gives us information of the frequently found species of an area. This is a quantitative statistical method which depends upon the total number of informants and the Frequency Citation (FC) for a specific plant species. In the contemporary study RFC ranges between 0.472 and 0.02. Ranked on the basis of Relative Frequency Citation (RFC), the most frequently used medicinal plants species used to cure different ailments in the study area includes, *Seriphidium kurramense, Withania coagulans, Berberis lycium, Teucrium stocksianum, Foeniculum vulgare, Allium sativum, Peganum harmala, Tanacetum artemisioides, Viola odorata, Ephedra gerardiana, Matricaria chamomilla, Allium cepa, Myrtus communis, Thymus linearis, Caralluma tuberculate, Papaver somniferum, Pinus roxburghii, Quercus dentata, Quercus alinifolia, Artemisia absinthium* and *Ziziphus nummularia.*

The highest value of RFC was 0.472 which was found for the *Seriphidium kurramense* (Figure 8) it confirms that this medicinal plant species is frequently found and people are quite familiar with its medicinal uses i.e. Blood Purifier, Anthelmintic, Antipyretic, Antiseptic, Jaundice. Besides its use by the local communities of Upper Kurram Agency, this endemic medicinal plant is transported to other parts of the country

for santonin extraction. Other synonyms used for *Seriphidium kurramense are Artemisia kurramense* and *Artemisia maritima* (Miraldi *et al.*, 1998, Qazilbash, 1951). Another most cited species is *Withania coagulans* with RFC 0.451. This is commonly used against obesity, gastric disorders and diabetes. It helps in sperm production. *Withania coagulans* is commonly found in the study area. Other most cited species are *Berberis lycium* and *Teucrium stocksianum* with RFC value of 0.437 each. Both of the medicinal plants can be easily found by the local inhabitants. It is followed by *Foeniculum vulgare* with RFC 0.423, which is found in the study area and it can also be bought from the local markets. This is a quick remedy for Gastric Disorders, Eye Sight, Cough and Flue. Other most cited plant are *Allium sativum* and *Peganum harmala* with RFC value of 0.415. *Allium sativum* is frequently grown by the local inhabitants and *Peganum harmala* is also easily available. Bulb of garlic is used for treatement of disorders such as, hair fall, sperm count, eye disease, rheumatism, ear infections. This plant is used as first aid for different human ailments mentioned above. The dried seeds and shoots of *Peganum harmala* are smoked as antiseptic and seeds are used in raw form to kill internal worms.



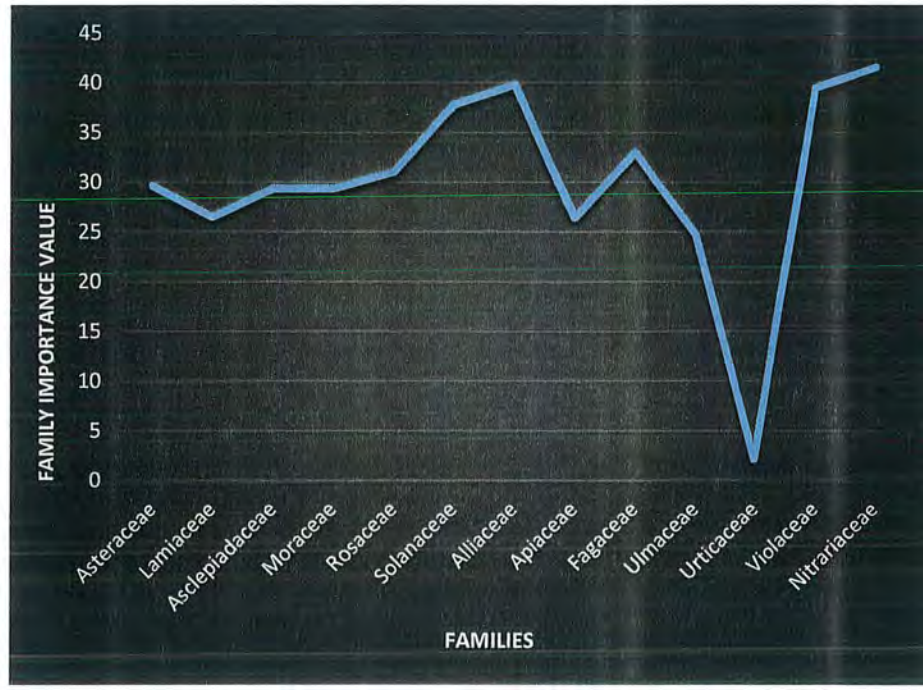
(Figure 8) RFC of the medicinal plants

The other commonly used medicinal plants species are *Tanacetum artemisioide* (0.408), *Viola odorata* (0.394), *Ephedra gerardiana, Matricaria chamomilla* (0.387), *Allium cepa* (0.38), *Myrtus communis* and *Thymus linearis* (0.373), *Caralluma tuberculate, Papaver somniferum* and *Pinus roxburghii* (0.366), *Quercus dentata* and *Quercus alinifolia* (0.359), *Artemisia absinthium* and *Ziziphus nummularia* (0.352).

Other plants found with least RFC value were *Urtica dioica* (0.021), *Robinia pseudoacacia, Persicaria barbata* (0.028), *Perovskia atriplicifolia* (0.042) and *Platanus orientalis* (0.063). This is a completely new body of literature on the relative popularity of medicinal plants in the Upper Kurram Agency, FATA Pakistan. Those plants with high popularity value can be further investigated for their potential pharmacological effects in the future.

3.4.2. Family importance value (FIV) of the Koh-e-Sufaid, Upper Kurram Agency, Pakistan

In the contemporary investigation a total of the 47 families have been documented out of which 13 families were reported to have high family importance value. A comparison was drawn among the dominant families of the medicinal plants. It showed Nitrariaceae as the most dominant family with the FIV (41.54), followed by Amaryllidaceae (39.78), Violaceae (39.43), Solanaceae (37.78), Fagaceae (33), Rosaceae (30.98), Asteraceae (29.57), Asclepiadaceae and Moraceae (29.33 each, Apiaceae (26.4), Ulmaceae (24.64), and Urticaceae was found with least FIV (2.11).



(Figure 9) Line graph showing Family Importance Value

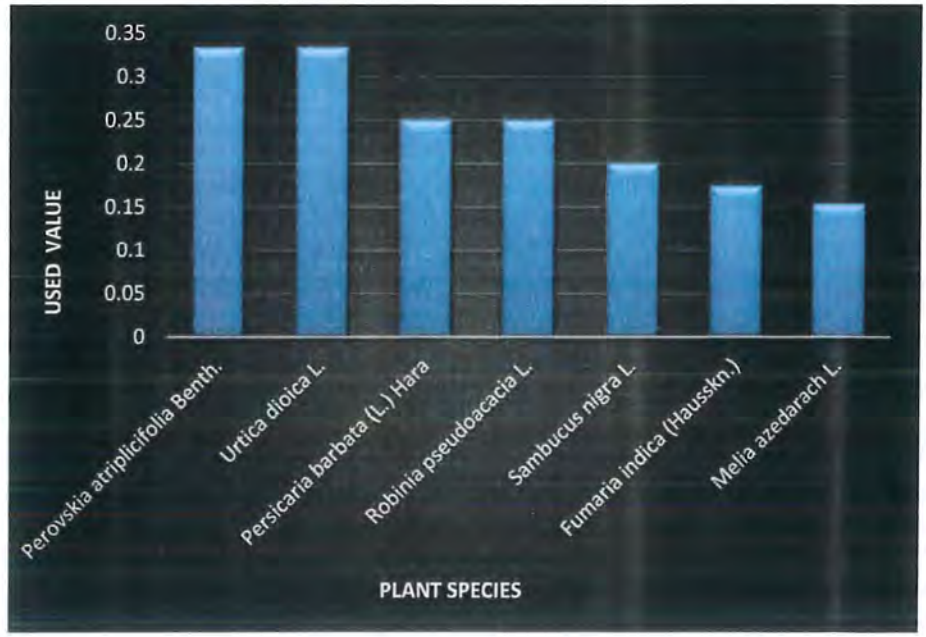
In the present study family Nitrariaceae is represented by only one species i.e. *Peganum harmala* (Figure 9). Syrian rue (*Peganum harmala*) is highly valued in Traditional Chinese and Iranian Medicine due to its effective carminative, antibiotic, analgesic and antimicrobial properties owing to the presence of Beta-carboline alkaloids (Niroumand *et al.*, 2015; Moloudizargari *et al.*, 2013).

The highest Family importance value shows plant species belonging to a particular family with high FIV value is used against specific ailment. Likewise, lowest family importance value reiterates that species belongs to a particular family is not much familiar to a plant family.

In a study carried out by (Rashid *et al.*, 2015), Papilionaceae was found to be the plant family with highest FIV (23.12). The results are different from the present study because of the floral and climatic variations in the ethno-medicinal data of different areas (Bibi *et al.*, 2014).

3.4.3. Used Value (UV)

Perovskia atriplicifolia and *Urtica dioica* was the plant with highest UV (0.33 each), it shows its widespread popularity with the local herbal healers and strong healing capacity. Followed by *Persicaria barbata* and *Robinia pseudoacacia* (0.25 each).



(Figure 10) Line graph showing Used Value

It was followed by *Sambucus nigra* (0.2), *Fumaria indica* (0.17), *Melia azedarach* (0.15) (Figure 10). Plants with high UV shows common distribution and efficiency to treat ailments. Such plants demand focus for future research initiatives. The results are not in agreement with the previous studies because of the floral diversity and variations in data of different areas.

Plate 4 (Pictorial of the medicinal plants of the study area)

***Solanum surattense* Burm.f.**

***Juglans regia* L.**

***Olea ferruginea* Royle**

***Artemisia absinthium* L.**

***Ephedra gerardiana* L.**

***Urtica dioica* L.**

***Thymus linearis* Benth. in Wall.**

***Impatiens balfourii* Hook.f.**

***Matricaria chamomilla* L.**

***Calotropis procera* (Ait.) Ait.**

***Ziziphus nummularia* (Burm. f.)**

***Berberis lycium* Royle**

***Teucrium stocksianum* Boiss.**

***Datura stramonium* L.**

***Papaver somniferum* L.**

***Robinia pseudoacacia* L.**

***Nannorrhops ritchiana* (Griff.) Aitch.**

***Elaeagnus angustifolia* L.**

***Scutellaria prostrata* Jacq. Ex Benth.**

***Perovskia atriplicifolia* Benth.**

***Asparagus adscendens* Roxb.**

***Aster alaticus* Willd.**

***Persicaria barbata* (L.) Hara**

***Periploca aphylla* Decne.**

***Viola odorata* L.**

***Potentilla johnstonii* Soj k**

***Sambucus nigra* L.**

***Daphne mucronata* Royle**

***Seriphidium kurramense* (Qazilb.) Y. R.**

***Ficus palmata* Forssk.**

***Rubus fruticosus* L.**

***Foeniculum vulgare* Mill.**

***Myrtus communis* L.**

***Cichorium intybus* L.**

***Quercus alinifolia* Poech**

***Quercus dentata* Thunb.**

Plate 5 (a-f) Plant parts used medicinally

a. ***Ziziphus nummularia*** **(Burm. f.) Wight & Arn.**

b. ***Quercus alinifolia*** **Poech**

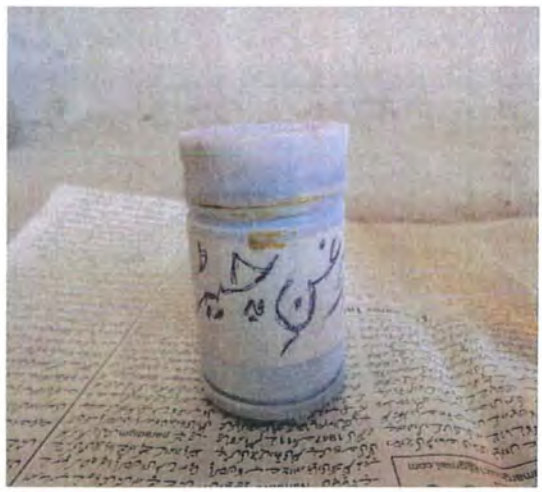
c. ***Withania coagulans*** **(Stocks) Dunal in DC.**

d.***Viola odorata*** **L.**

e. ***Elaeagnus angustifolia*** **L.**

f. ***Tanacetum artemisioides*** **Sch.Bip. ex Hook.f.**

Plate 6 (a-f) Herbal products and threat to plant diversity



a. Resin of *Pinus roxburghii*

b. Dried leaves of *Mentha longifolia*

c. Seeds of *Withania coagulens*

d. Plant parts used against Hair fall

e. Timber market in Parachinar

f. Deforestation in the Malana, K. Agency

3.4.4. Disease categories, ICF and used reports of the study area

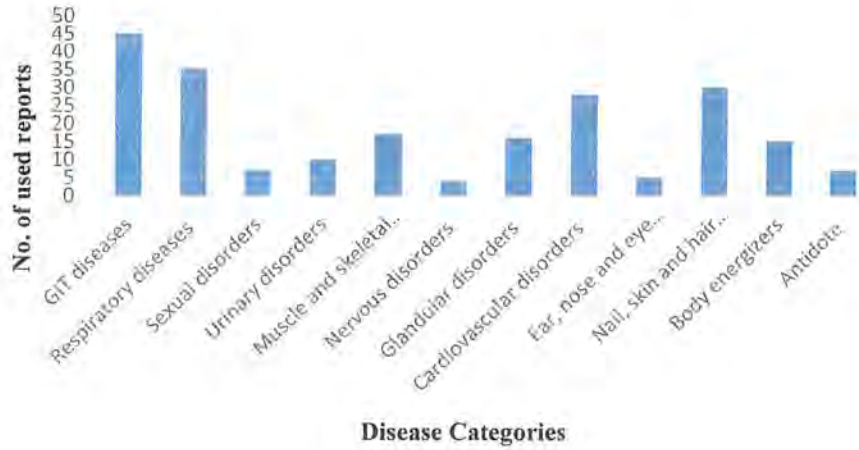
There are various medicinal plants used by the local communities for treatment of different health disorders. The disorders are grouped into 12 categories of ailments. These categories are Gastrointestinal diseases, Respiratory diseases, Sexual disorders, Urinary disorders, Muscle and skeletal disorders, Nervous disorders, Glandular disorders, Cardiovascular disorders, Ear, Nose and Eye disorders, Nail, skin and hair disorders, Body energizers, and Antidote (Table 3).

Table. 3. ICF value of medicinal plants used for treatment of various diseases

Category of diseases	Number of use reports	Percentage of use reports	No. of taxa used	Percentage of taxa	ICF*
GIT diseases	45	20.54	38	22.22	0.18
Respiratory diseases	35	15.98	19	11.11	0.88
Sexual disorders	7	3.19	6	3.50	0.2
Urinary disorders	10	4.56	8	4.67	0.28
Muscle and skeletal disorders	17	7.76	16	9.35	0.06
Nervous disorders	4	1.82	3	1.75	0.5
Glandular disorders	16	7.30	11	6.43	0.5
Cardiovascular disorders	28	12.78	21	12.28	0.35
Ear, nose and eye disorders	5	2.28	4	2.33	0.33
Nail, skin and hair disorders	30	13.69	26	15.20	0.16
Body energizers	15	6.84	13	7.60	0.16
Antidote	7	3.19	6	3.50	0.2

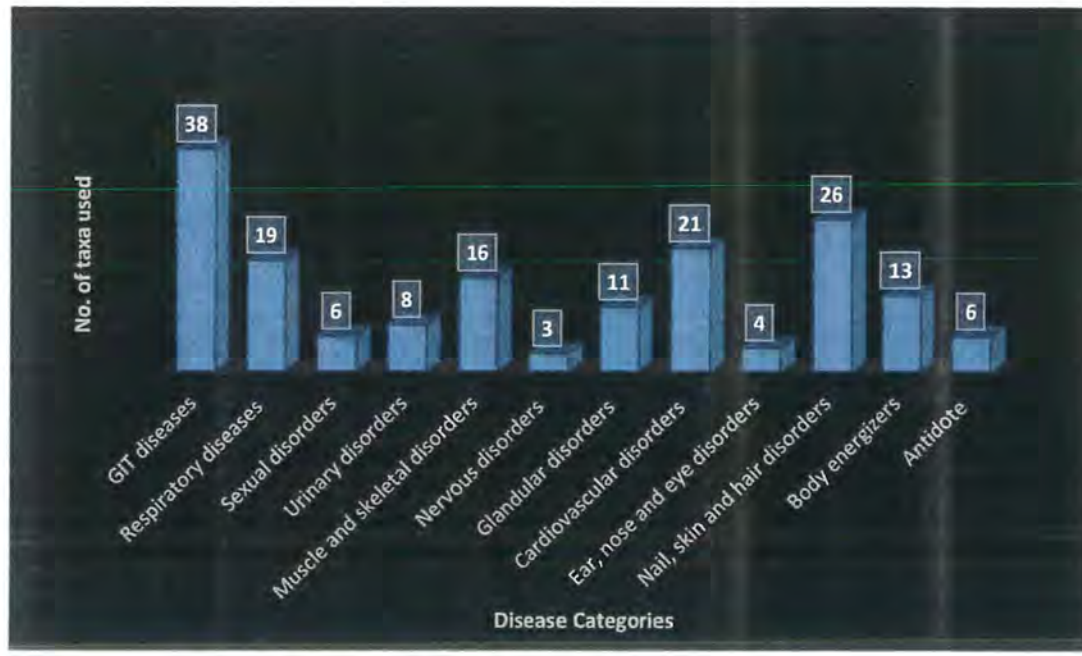
ICF* = Informant Consensus Factor

Gastrointestinal disorders were found to be highest with 45 used reports (Figure 11). The results found in this present study are found to be thoroughly coinciding with (Kayani *et al.*, 2015; Yaseen *et al.*, 2015, Hammond *et al.*, 1998; Kala, 2009; Rokaya *et al.*, 2010), who found GIT as the dominant diseases category treated with medicinal plants in the Alpine and Sub-alpine communities of Pakistan. In the current study GIT was found to be with highest percentage of (20%) among all the disease categories. Followed by Respiratory diseases (35) used reports, Nail, skin and hair disorders (30), Cardiovascular disorders (28).



(Figure 11) Graph representing used reports for each disease category

Previous ethno-medicinal studies conducted in the mountainous regions also support the fact that there are diverse medicinal plant species used to treat gastrointestinal disorders. The reason behind these observed results might be due to lack of sanitation, poor hygiene and low quality of food (Adzu *et al.*, 2003). The majority of the people of the area defecate in open air so this ultimately results in the water resources of the area. Gastrointestinal diseases comes under water borne diseases. Due to the lack of availability of clean drinking water might be the core reason behind the dominance of that category. Nervous disorders was found to be a diseases category with least used reports i.e. (4).



(Figure 12) Bar graph showing the no. of taxa used for each disease category

Highest ICF value was found for Respiratory disorders (0.88) as per disease categories are concerned, this might be due to the reason that Upper Kurram Agency is one of the coldest place in Pakistan. Mercury usually drops below freezing point, resulting in cough, cold, flue and other respiratory diseases. The local people of the area consider these medicinal plants as a quick and easily accessed source to treat respiratory disorders (Bano *et al.*, 2014). The ICF for respiratory disorders was found second (0.46) by (Kayani *et al.*, 2015) in a study conducted in the mountainous region of Pakistan, followed by Nervous and Glandular disorders with ICF value of (0.5 each). Muscle and skeletal disorders is a category of aliments with lowest ICF value (0.06).

3.5. Conclusion

This present investigation showed that tribal communities of the Upper Kurram Agency still relied in the valuable medicinal plant resources to treat various ailments, ranging from cold to chronic pain. Due to lack of the availability of basic health facilities and the effectiveness of the medicinal plants they largely depend upon the medicinal flora of the study area.

The present study manifested many factors threatening to the wide range of medicinal plants, these are; lack of awareness among the people regarding the effectiveness of the medicinal plants, overharvesting, fuel wood, and wild fires. There is a dire need to aware the local people about the vitality of medicinal flora in order to conserve and sustain this wealth of nature.

3.6. Recommendations

Taking into consideration the present ethno-medicinal study and its future implication, some of the important recommendations are as follow:

- Conservation and sustainable use of the medicinally important plants can be achieved if the local people are given awareness regarding importance of these medicinal plants.
- The use of the medicinal plants should be encouraged in order to conduct ethno-medicinal studies in future.
- Alternative ways of earning should be provided to the tribals, to prevent deforestation.
- People should be encouraged to grow medicinal plants.
- The current investigation can prove to be fruitful if further research is carried out in the study area. This could lead to the isolation of important therapeutic agents.

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Appendix - I

Questionnaire

Date.....

Informant's Details

Name..... Gender .....

Age ..... Occupation .....

Education..... Residence.....

What is the local name of the plant used for medicinal purposes?

Which part of the plant is used?

a) Leaves b) Stem c) Roots d) Flowers e) Seeds f) Fruit

What is the mode of utilization?

a) Decoction b) Infusion c) Oil d) Powder e) Extract

What is the habit of the plant?

a) Tree (wild/cultivated) b) Herb (wild/cultivated) c) Shrub (wild/cultivated)
b) Climber (wild/cultivated)

Which disease is cured by using that plant?

What is the recipe and how the drug is prepared?

What is the mode of administration?

Remarks

Plant identified as ..... (Botanical Name and Family)

Signature

Appendix-II

List of Abbreviations

1	FATA	Federally Administered Tribal Areas
5	FIV	Family Importance Value
6	ICF	Informants Consensus Factor
3	RFC	Relative Frequency Citation
2	TPL	The Plant List
4	UV	Used Value
7	WHO	World Health Organization

Turnitin Originality Report

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