

Ethno-Medicinal Survey of Indigenous  
Medicinal Plants used by the Local  
Population of Goleen Valley, Chitral,  
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CC-BY 4.0Keywords Ethnomedicinal study;  
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## Abstract

The study was conducted with the aim to document the indigenous practices of therapeutic plants of Goleen Valley, Chitral, Pakistan. Ethnomedicinal data was obtained from inhabitants of the area through face to face interviews and semi-structured questionnaires. To analyze data quantitatively, Familiarity index, Family Importance Value, Consensus-index, Informant consensus factor indices were applied. A total of 36 medicinal plants were documented. The recurring habit forms were herbs (53%), shrubs (25%), trees (19%) and climbers (3%). The most frequently utilizing plant part was the leaves (36%). The mode of preparation was dominated by decoction (26.19%). The Familiarity index value has been dominated by Zea mays (0.54), followed by Peganum harmala (0.46). Family Malvaceae has the maximum FIV value (60.31). The value of "CI" was highest for Zea mays (++++). The ICF value was high for Muscu-skeletal disorders (0.818), next to it was digestive diseases (0.78) and Fever-malaria-typhoid (0.76). The present study shows that the practice of therapeutic plants for the cure of various diseases is still prevalent in the study area. The high degree of consensus among the local population reveals that the information/knowledge about the uses of therapeutic plants is still living in the study area. Therefore, awareness about the conservation of medicinal flora should be raised among the local communities.

## Introduction

When earliest man witnessed animals ingesting some plants the ethnobotany originated. The meticulous meaning of the term "ethnobotany" is the knowledge of botany about early age human generation [1]. For basic health-care almost 80% of the population of human depends upon therapeutic plants [2]. Plant based remedies are as well picking up attractiveness of the western people, since they have negligible or no negative effects if directed appropriately [3]. Other than therapeutic utilize, plants are progressively utilized as a part of beauty care products and nutraceuticals [4].

Natural remedies were found to be profoundly viable to treat an extensive variety of illnesses [4], as well as digestive ailments [4-7]. Individuals living in the mountainous regions of Pakistan utilize plants for numerous reasons, for example, drugs, protect, timber wood, kindling, sustenance and feed such as remedies, housing, timber wood, fire wood, food and fodder etc [8]. Through-out the world Digestive diseases and their related symptoms are the reason for varied remedial practices. Nearly 8-10% of the populace is influenced in developed world. The primary reasons suggested are alterations in way of life, poverty, changes in dietary patterns and water pollution, among others; likewise to be considered is the augmented activity of disease causing agents [9]. Agreeing with Mc. Michael [10], these agents might increment in numbers due to worldwide atmosphere alterations.

The utilization of therapeutic plants overwhelms the scenario of folk medicines for disorders of digestive system. Strikingly, a characteristic of these plants have to be their specific odor or potentially flavor: these are typically bitter, fragrant also astringent. These organoleptic qualities for the normally originate from certain secondary metabolites in the plant tissues, for example, terpenoids and their derivate [9], and tannins or other chemical components [5].

Commencing the ethnic perspective the organoleptic qualities of these species, particularly odor and flavor, expose important facts about their remedial characteristics, and also the manner they act inside the body and the most ideal method to get ready and direct them. In the meantime, these qualities can be precious memory aids with regards to the cultural transference of this ethno-medicinal data [9].

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For the preceding around 34-years, verbally pass on information because of its economic importance has been expanding and allowed the array of such an essential data in regards to therapeutic plants effectively explored in less-developed regions, for example, Pakistan [8, 11-18]. People of Chitral still partially rely upon therapeutic plants for majority of their illnesses, thus loss of these plant assets will, to a specific degree, hamper the current healthcare system in the area. Actions for the protection of plant assets particularly therapeutic plants of Chitral valley are critically required [19]. The folk culture and the natural ecosystem of these areas were generally saved. Since verbally conveyed conventional information is controlled by older generation, a large portion of it can vanish severely because their passing [20, 21]. Still, no single ethno therapeutic review has been directed in Goleen Valley, Chitral, Pakistan.

The present work is the first effort to un explore the therapeutic plants of Goleen Valley, Chitral of Khyber Pakhtunkhwa, where these illnesses are found most common. The present review aimed for recording the conventional practices of therapeutic plants of Goleen Valley, and to assess the viability of plant species in light of the literature review.

### Material and Techniques

#### Introduction to the study area

The study area is located 35°- 47' to 36°- 07' N and 71°-58' to 72°- 18' E (Figure 1). The study area is about 33Km away from Chitral on its east. The area is bordered by Istan Gol, Reshun Gol and Mori Gol on north side, while Laspur is on the eastern side. The Madaklasht is on its south and the Koghuzi Gol is to its western border. The area

has height of 10,000ft from sea level. During winter the temperature drops to -13°C. The vegetation of Goleen valley is in the form of dry temperate coniferous forest with *Cedrus deodara* and *Juniperous macropoda* as major species and the locality factors and the attendant site conditions of Conifer Forests in the valley generally tend to be of medium to low quality. As a result, the crop quality is also medium to low. Precipitation in the valley is received mostly in the form of snow. As a result, the Coniferous Forests are of the Dry Temperate Type and thus are of xerophytic character due to non-receipt of monsoon rains. Canopy cover in xerophytic forests tends to be open. Winds are common in the area and are a major source of desiccation and loss of moisture. This adds to dryness of the area and hence the increase in xeric conditions and the accompanying openness of canopy. Due to cold temperatures in the upper parts, the growing season is short (AKRSP, 2014).

#### Plants collection and identification

Different online data bases have been employed (ISI Web of Science, MEDLINE, Science Direct, Scopus, and Google Scholar) with specific pursuit terms, for example, ‘ therapeutic plants’, ‘ medicinal plants’, ‘ethnomedicinal study’, ‘ethnobotanical study’ and ‘Chitral, Pakistan’ before beginning the field work. The term ‘Chitral, Pakistan’ was employed to constrain the topographical extent of the search. The exactness of species names given in this work depend upon that from the original bases. But, we confirmed presently recognized name(s) in online classification sources (<http://www.theplantlist.org>) and (<http://www.tropicos.org/project/Pakistan>). Available vernacular names are too given. Habitat and origin (wild/developed) of the each plant species was documented [4, 22].

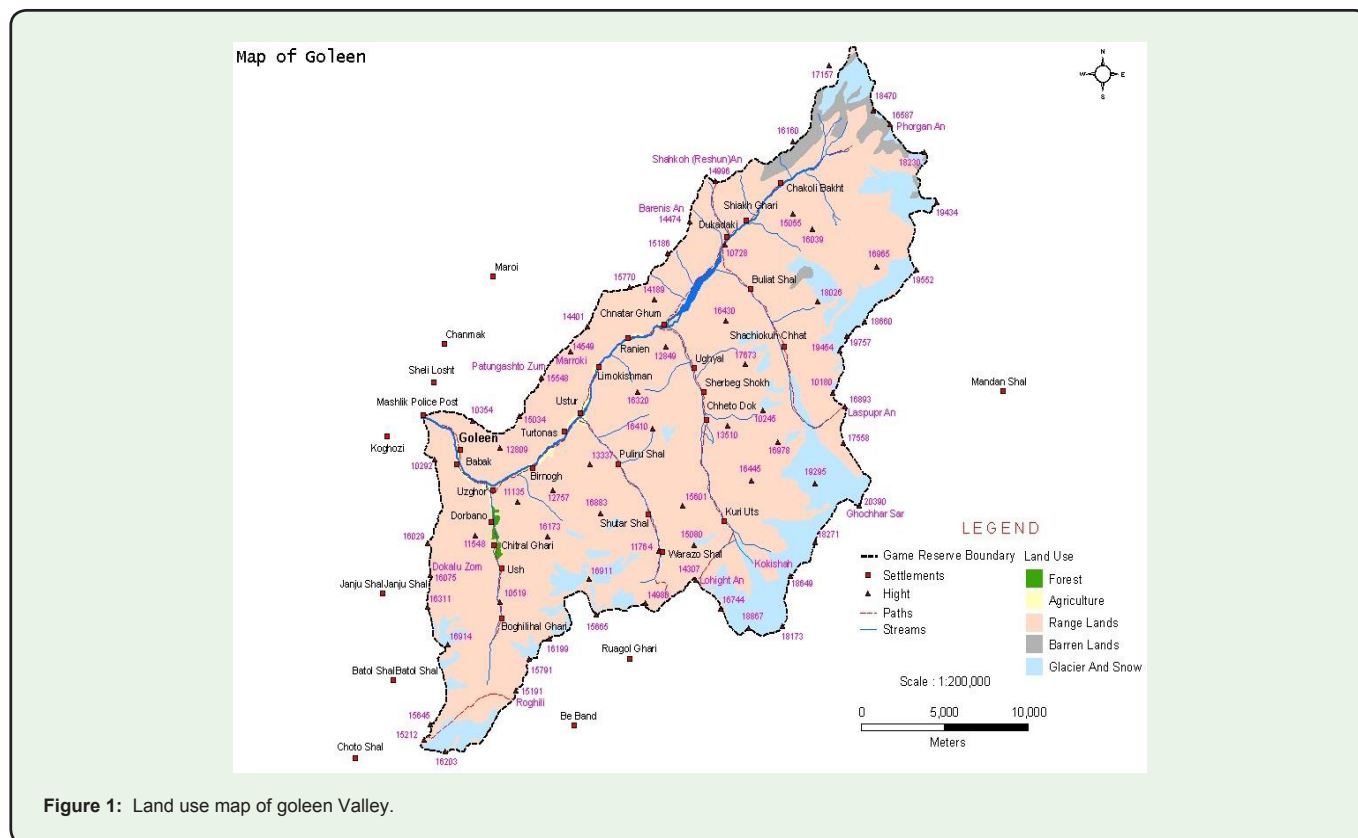


Figure 1: Land use map of goleen Valley.

To get phytochemical or pharmacological evidences about respective therapeutic plants species we investigated the above stated databases. Pharmacological reviews give direct description for folk practices, while phytochemical reviews give aberrant data. Plants contain numerous kinds of secondary metabolites that have diverse medicinal properties. Because of the enormous number of studies were counseled.

### Collection of ethnomedicinal data

The ethnomedicinal studies have been completed from 2015-16 to record the data about therapeutic plants utilized by native occupants. Data was gotten by means of semi-structured interviews [23] keeping in mind the end goal to get data of therapeutic species utilized by natives. Sixty three informants comprising of 5 herbalists, 46 male (73%) and 17 (27%) female were interrogated. They have been questioned about information they have about the plants they utilized against various diseases, the folk names, plants parts utilized and the preparation mode. All the informants' expert herbalists were chosen arbitrarily and no appointments were scheduled before the visits.

Keeping in mind the end goal to affirm the pharmacological authentication of the use reports, the data accumulated have been cross checked using various data-bases, for example, MEDLINE, Science Direct, Google Scholar, Scopus and PubMed for the purpose that, the medicinal plants in practice for therapeutic uses in the study-area were recorded previously in the literature or not.

### Quantitative analysis of data

The ethnomedicinal data gathered was expounded with a specific end goal to determine the most referred species; the most referred therapeutic uses, the most utilized plants parts and the most common mode of preparation. The species were assembled into 11 classes of diseases in view of emic data gathered from informants (Table 2). The aim was to document all the data as it was given by the informants to us. A quantitative investigation was additionally completed with a specific end goal to assess the significance of those species in the culture of the elderly individuals of the area. This sort of investigation, the first of its kind in this area, has been made using the accompanying indices.

**Familiarity Index (FI):** To find out the popularity of therapeutic plant among the folk communities a relative indicator Familiarity Index (FI) has been used (24, 25), that has been attained by using:

$$FI = FC/N$$

FC = Particular species' frequency stated as remedy

N = Sum of informants take part in survey

**Family Importance Value (FIV):** To know the importance and familiarity of a family for its medicinal values family importance value (FIV) has been applied [26]; this was found out through the following formula.

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

FC = Informants number citing the family

N = Sum of respondents take part in this survey

**Informant Consensus Factor (ICF):** In edict to find-out the agreement between practice of plants for different disease groups and informants of the study area Informant Consensus Factor (ICF) has been applied, it was intended with the help of the succeeding formula [27-29].

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

Nur = Total number of reports of the use category in inquiry and

Nt = Total number of species used in this category.

**Consensus Index (CI):** To find out the %age of informants inhibited in the area with folk medicinal knowledge of medicinal plant species practiced to treat diseases was computed by Consensus Index (CI%) which showing reference by % of respondents [30].

$$CI = \frac{n}{N} \times 100$$

Where

n = Number of respondents citing therapeutic species

N = Total number of informants

## Results and Discussion

### Socio-demographic evidence

Statistical analysis of respondents is stated below. The informants' age ranges from 20-80 years. The most noteworthy cite frequency of remedial species of plants were documented from individuals with age range 45-65 years, while little data was acquired from more younger/older respondents. In the 1<sup>st</sup> group (younger respondents), this may be because of progressed and dynamic lack of engagement in the ethics of "folk culture" and "rural advancement". In the 2<sup>nd</sup> case (older respondents), as indicated by our observations in the field, that less confirmation acquired could be justified by certain unwillingness/objective difficulties in contributing in interviews. Besides, most astounding reference reports were gotten from the rural groups when contrasted with urban groups. These results discrete from the normally putative conflict [31], that medicinal plants data in less developed/rural regions is abating. It might be because of the ethnic separation from the folk rehearses and more reliance on modern healthcare system.

A total of 63 informants have been interviewed and classified into various statistical classes. An aggregate of 46 male (73%) and 17 (27%) female were interviewed for ethnomedicinal information. The prevalence of men (46) informants was because of gender issue that women cannot talk with a stranger male (the questioner). Since it has been practical in other geographical areas that ladies are typically soundly knowledgeable informants about curative plants and we admit the element that this can have slightly influenced the outcomes of our work. The vast majority of the informants were ranchers or shepherds, still active or retired and an almost small number of workers, shopkeepers, Government servants, housewives and a couple main respondents as folk herbalists have been interviewed. A large portion of the respondents were not finished secondary school.

### Diversity of medicinal plants

In study area 36 species are documented, that are in practice to treat various diseases (Table 1). These therapeutic plant species are

**Table 1:** Listing plant names, family names, local names, part used, preparation modes, local medicinal uses and taking routes.

S/No.	Plants names/Voucher No.	Informants number	Family Name	FI	CI%	Part Used	Administration Mode	Local Uses
1	<i>Adiantum venustum</i> D. Don (GV-01)	13	Pteridiaceae	0.2	++	Leaves	Powder/Decoction	Cardiac problem baldness and anti-asthmatic.
2	<i>Alcea rosea</i> L. (GV-02)	17	Malvaceae	0.26	+++	Petals	Raw/Decoction	Emollient, laxative and bleeding gum
3	<i>Artemisia indica</i> Willd. (GV-03)	10	Astaraceae	0.15	++	Leaves	Extract	Gastric problem.
4	<i>Artemisia maritima</i> L. (GV-04)	14	Astaraceae	0.23	++	Leaves	Decoction	Antiseptic and anti-inflammatory and anti-malarial
5	<i>Beta vulgaris</i> L. (GV-05)	6	Chenopodiaceae	0.09	+	Roots	Decoction	constipation
6	<i>Carthamus tinctorius</i> L. (GV-06)	11	Astaraceae	0.17	++	Petals	Powder	wheals and cough
7	<i>Cannabis sativa</i> L. (GV-07)	19	Cannabaceae	0.3	+++	Leaves	Powder	Abdominal pain.
8	<i>Capparis spinosa</i> L. (GV-08)	18	Capparidaceae	0.28	+++	Flower/ Fruits	Raw/Powder	Typhoid fever and face cosmetics
9	<i>Cichorium intybus</i> L. (GV-09)	9	Astaraceae	0.14	++	Roots	Decoction	Promote digestion
10	<i>Crataegus songarica</i> K. Koch (GV-10)	16	Rosaceae	0.25	++	Fruits	Raw	Cardio tonic
11	<i>Cydonia vulgaris</i> Pavol. (GV-11)	4	Rosaceae	0.06	+	Fruits	Syrup	Cough and pneumonia
12	<i>Ephedra gerardiana</i> Wall. ex Stapf (GV-12)	15	Ephedraceae	0.23	++	Braches	Extract	Aching backs
13	<i>Elaeagnus angustifolia</i> L. (GV-13)	7	Eleagnaceae	0.11	++	Fruits	Syrup	Sour throat and high fever
14	<i>Ficus carica</i> L. (GV-14)	21	Moraceae	0.33	+++	Fruits	Extract	Stomach pain and cough
15	<i>Foeniculum vulgare</i> Mill. (GV-15)	24	Umbellifereceae	0.38	+++	Leaves/ Seeds	Raw/Decoction	Toothache and abdominal pain
16	<i>Hyoscyamus niger</i> L. (GV-16)	27	Solanaceae	0.42	+++	Leaves	Decoction	Asthma
17	<i>Juglans regia</i> L. (GV-17)	16	Juglandaceae	0.25	++	Seeds	Raw	Wound healing
18	<i>Malva neglecta</i> Wallr.(GV-18)	23	Malvaceae	0.36	+++	Roots	Decoction	Purgative
19	<i>Matricaria chamomilla</i> L. (GV-19)	12	Astaraceae	0.19	++	Flower	Decoction	Abdominal pain and fever
20	<i>Mentha longifolia</i> L. (GV-20)	26	Lamiaceae	0.41	+++	Leaves	Tea	Stomach pain
21	<i>Mentha spicata</i> L. (GV-21)	28	Lamiaceae	0.44	+++	Leaves	Powder/Raw	Carminative
22	<i>Mentha arvensis</i> L. (GV-22)	23	Lamiaceae	0.36	+++	Leaves	Powder/Raw	Gastric problems
23	<i>Morus alba</i> L. (GV-23)	16	Moraceae	0.25	++	Fruits	Syrup	Rheumatism
24	<i>Peganum harmala</i> L. (GV-24)	29	Rutaceae	0.46	+++	Seeds	Powder	Anti-helminthic
25	<i>Punica granatum</i> L. (GV-25)	27	Punicaceae	0.42	+++	Fruits	Powder	Diarrhea and dysentery
26	<i>Plantago lanceolata</i> L. (GV-26)	21	Plantaginaceae	0.33	+++	Leaves/ Seeds	Raw	Insect bites and constipation
27	<i>Rosa webbiana</i> Wall. ex Royle (GV-27)	13	Rosaceae	0.21	++	Flower	Extract	Eye diseases
28	<i>Rubus fruticosus</i> G.N.Jones (GV-28)	18	Rosaceae	0.28	+++	Fruits	Raw	To increase the amount of blood
29	<i>Rumex longifolius</i> DC. (GV-29)	9	Poligoneae	0.14	++	Leaves	Paste	Laxative
30	<i>Sisymbrium irio</i> L. (GV-30)	7	Brassicaceae	0.11	++	Seeds	Paste	Facial pimples
31	<i>Sophora affinis</i> Torr. & A.Gray (GV-31)	5	Fabaceae	0.07	+	Leaves	Powder	Wounds
32	<i>Solanum nigrum</i> L. (GV-32)	17	Solanaceae	0.26	+++	Fruits	Juice	Remove pimples
33	<i>Urtica dioica</i> L. (GV-33)	7	Urticaceae	0.11	++	Whole Plant	Decoction	Astringent and anti-helminthic
34	<i>Viola rupestris</i> F.W.Schmidt (GV-34)	13	Violaceae	0.21	++	Leaves	Powder	Fever, headache and constipation
35	<i>Verbascum thapsus</i> L.(GV-35)	5	Scrophulariceae	0.07	+	Leaves	Paste	Wound healing
36	<i>Zea mays</i> L. (GV-36)	34	Poaceae	0.54	++++	Flower	Decoction	To promote urination

CI values CI (0-10) = +, (11-25) = ++, (26-50) = +++ and above 50 = ++++

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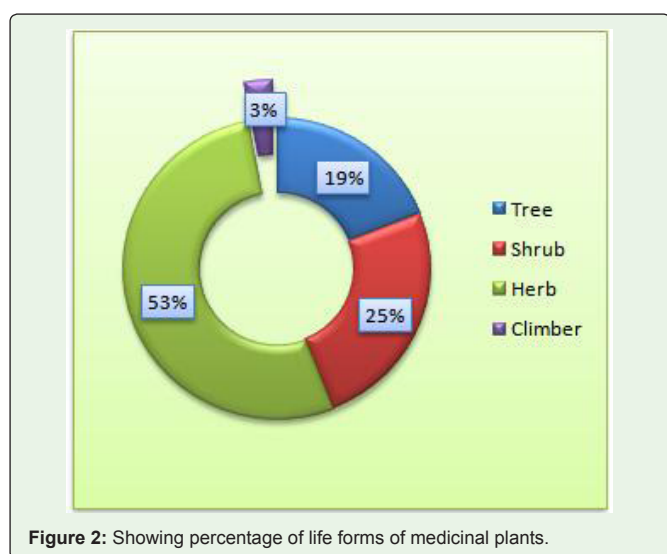


**Table 2:** Listing ICF values for major 11 ailments categories.

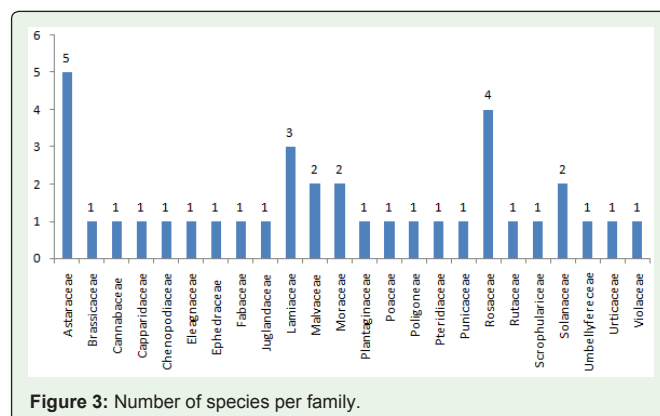
S/No.	Diseases Categories	Nt	Nur	ICF
1	Antiseptic	2	5	0.25
2	Digestive Diseases	17	49	0.78
3	Fever, Malaria, Typhoid	7	27	0.76
4	Heart and Blood diseases	2	13	0.68
5	Mouth-teeth diseases	2	8	0.75
6	Musculo-skeletal disorders	5	23	0.81
7	other diseases	2	5	0.75
8	Respiratory Diseases	7	31	0.8
9	Skin diseases	2	9	0.7
10	Urinary Diseases	2	15	0.68
11	Wound Healing	2	12	0.62

belonging to 24 families. The documented therapeutic plants have been categorized into 11 major disease classes (Table 2). Digestive diseases are the ailment cured through the maximum number of medicinal plant species (17), tailed by fever-malaria-typhoid and respiratory diseases (7 spp. each). In Table 1 for each medicinal plant the botanic name, name of family, voucher number, part utilized, folk names (in Chitrali dialect), the ethnomedicinal data, crude preparation method, remedial uses, FI, FIV, CI and ICF have been provided.

Medicinal plants used for treatment of various diseases present diversity in habit (Figure 2). Herbs are representing the growth form with high percentage (53%), followed by shrubs (25%) and trees (19%). Herb is the most leading form of growth, which recognized the element that mostly herbs are used for medicinal purposes and the other reason for the dominance of herbs is their better adaptation and acclimatization to the topographic and climatic conditions in the study area, as compared to shrubs and trees, this is in ratification with the work [32-34]. It is reported by informants mostly herbs are used because of their potency and fast regeneration in study area as compared to other life forms. The high percentage of herbs is also reported in some other studies [35, 36].



**Figure 2:** Showing percentage of life forms of medicinal plants.

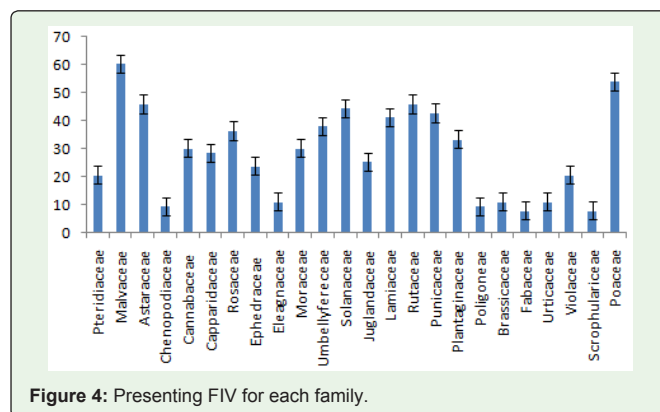


**Figure 3:** Number of species per family.

Among the families the most noteworthy families in terms of number of species reported are Asteraceae (5 spp.), Rosaceae (4 spp.) and Lamiaceae (3 spp.) (Figure 3). The medicinal plants species used by local people in high percentage of are belonging to Asteraceae families, it is similar to the work of (Tareen et al. 2016; Bibi et al., 2014). To determine the pharmacological significance of therapeutic plant families FIV has been intended regardless of the number of species represented by the family (Figure 4). Family Malvaceae with peak FIV value (60.31) trailed by Poaceae (53.96), Rutaceae (46.03) and Solanaceae (44.44). Medicinal plant species of family Asteraceae, Rosaceae and Lamiaceae are medicinally significant cited in many pharmacological works, such as [26, 37-40].

**Phyto-partsused, preparation method & administration mode**

In order to prepare various folk medicines different parts of plants have been used, such as bark, flower, fruit, leaves, root, seed, and stem (Figure 5). The most frequently utilizing plant parts are the leaves (36%) tailed by fruits (23%), flowers (15%) and seeds (13%). Leaves utilized more frequently has been also reported by Dogan and Ugulu (2013), Shah and Rahim (2017), Tareen et al. (2016) and Saikia et al. (2006) [37,41-43], likewise fruit and seeds have been reported by Rokaya et al. (2010) and Tareen et al. (2016) [37,44]. Similarly, from scientific point of view, leaves are the primary photosynthetic part in the plants and well-known for synthesis of numerous active ingredients and pharmacologically more active than some other part Shah and Rahim (2017), Ahmad et al, 2014; Rokaya et al, 2014) [42,15,4]. Furthermore, the utilization of leaves is less deleterious



**Figure 4:** Presenting FIV for each family.

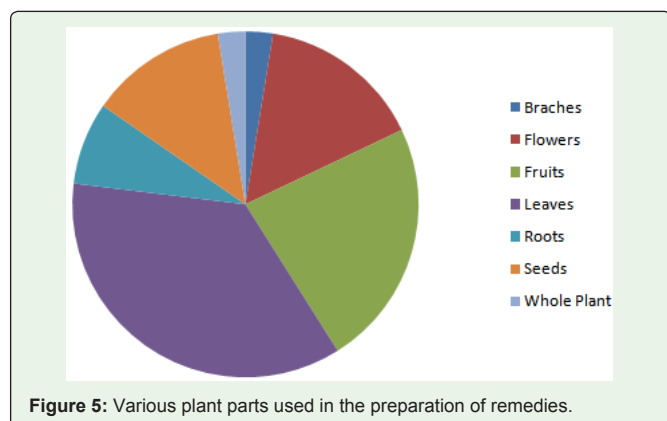


Figure 5: Various plant parts used in the preparation of remedies.

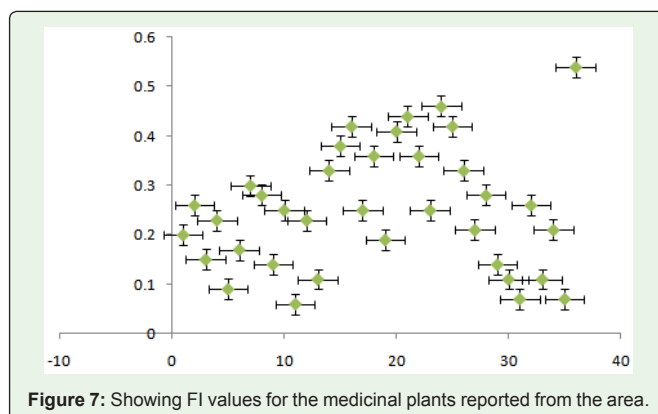


Figure 7: Showing FI values for the medicinal plants reported from the area.

to the survival of a plant species as compared to the use of other parts (e.g. roots, stem, bark), or the use of entire plants [32, 45-46]. Moreover, leaves are collected more easily than other parts of plants [31].

Different plant parts were used either direct/unprocessed or in the form of decoction, juice, powdered or any other form along with dietary items. The decoction (26.19%) was the most common method of preparation of herbal remedy followed by powder (23.80%) and raw (21.42%) (Figure 6).

### Familiarity Index value of medicinal plants

Medicinal plant species used to cure different ailments documented through interviews are listed in the Table 1. Along with the application of questionnaires, analytical tools have also been applied, in order to analyze the ethnomedicinal data quantitatively and for cross verification. Like, the familiarity index was used to determine the general practicality of the cited medicinal plant [47, 24-25].

Medicinal plant species that are more frequently in practiced in the study area are cited most frequently. It is important to highpoint that certain plants are too utilized for food purpose. Familiarity Index (FI) value has been led by *Zea mays* (0.54) 34 citations and 1 use categories, followed by *Paganum hermala* (0.46) with 29 citations and 1 use categories, *Mentha sipcata* (0.44) 28 citations and 2 uses. Least values of FI are shown by *Cydonia vulgaris* (0.06) with 4 citations and 2 use reports (Table 1 & Figure 7).

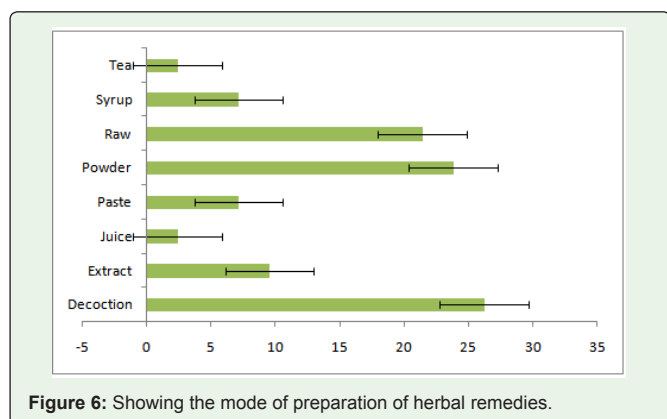


Figure 6: Showing the mode of preparation of herbal remedies.

### CI values of botanical taxa

Informants percentage interviewed for folk knowledge about medicinal plants in practice to cure various ailments and Consensus Index (CI) are given in Table 2, that uncovers that the value of "CI" is maximum for *Zea mays* (++++) on the other hand it is minimal for *Cydonia vulgaris* (+). This review indicate similarity of the consequences of different indices indicating at comparative results, for example, FIV values demonstrate significance of family Poaceae and FI values demonstrate high proportion of recurrence of *Zea mays* referred by the native informants, similarly, CI values also shows agreement on the significance of *Zea mays* as a vital, well-known therapeutic plant utilized in traditional remedies in the study area.

### Medicinal importance of plants

Data documented about therapeutic plants in practiced for cure various ailments in the study area were gathered into 11 classes of medicinal importance (Table 2 and Figure 8). In the study we recorded different diseases from the study area through interviews from informants which are living in the area. Those were grouped into 11 different ailments/illnesses (Table 2). The group of diseases that has been most frequently reported is Muscu-skeletal disorders. Informant's consensus and main classes on the usage of medicinal plants were elucidated through the ICF (a computed index). The range of ICF has been from 0-1 (Table 2). The ailment groups with maximum ICF value is Muscu-skeletal disorders (0.81), followed by Digestive Diseases (0.78), Fever-Malaria-Typhoid (0.76).

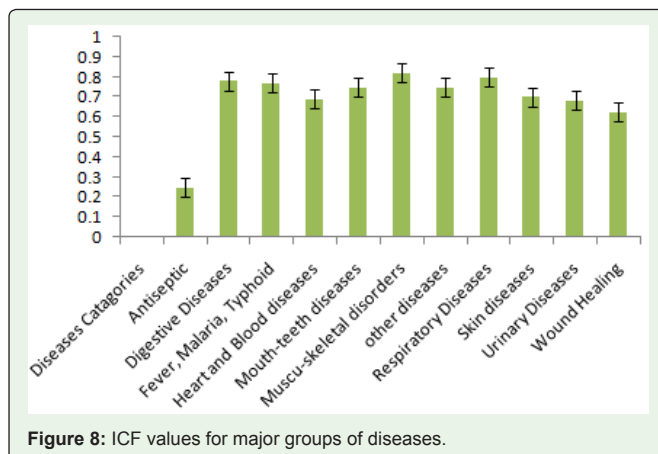


Figure 8: ICF values for major groups of diseases.

## Conclusion

This work has been done to document the medicinal plant species in practice to cure different diseases. During this work a total of 36 therapeutic plant species have been documented for the cure of various ailments. From literature review and up to the best of our knowledge this is the first work done in the study area. The medicinal plants with highest FI value were *Zea mays*, *Paganum hermala* and *Mentha spicata*. The families with highest FIV value are Asteraceae, Poaceae, Rosaceae and Lamiaceae. In life form herbs were dominant followed by shrubs and trees, the most abundantly used part for medicinal purpose were the leaves, decoction was the most common method used to prepare the crude drug. In this study 11 major groups of different diseases have been made, that are cured by therapeutic plants. Using folk medicinal knowledge this work is a significant contribution to the ethnobotanical knowledge of Goleen Valley, Chitral, Pakistan in the perspective of ailment administration. Therefore a project should be design that explores the flora in terms of medicinal plants and carry out their phytochemical screening and to develop awareness among the local communities in terms of conservation.

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