*Pak. J. Biotechnol. Vol. 21(1), 25-33, **2024*** http://doi.org/10.34016/pjbt.2024.21.01.870

Research Article

OPEN ACCESS

Available on http://www.pjbt.org
Pakistan Journal of Biotechnology
(PJBT)
(P-ISSN: 1812-1837 and E-ISSN: 2312-7791)

THE UTILIZATION OF MEDICINAL PLANTS FOR HEALTHCARE PURPOSES BY THE RESIDENTS OF TURMIK VALLEY, GILGIT-BALTISTAN PAKISTAN

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Article Received 28-10-2023, Article Revised 10-11-2023, Article Accepted 03-01-2024.

Abstract

People in Turmik valley, which is located in one of the more isolated areas of Gilgit-Baltistan, continue to rely on natural treatments to fulfill their main healthcare requirements. However, the folk wisdom that has been passed down through generations is gradually disappearing as a result of the development of contemporary allopathic medicines. For this reason, it is essential to document the indigenous wisdom for the benefit of children and grandchildren. The purpose of this study is to investigate the use of medicinal plants in the investigation area for the treatment of a variety of illnesses. The research findings revealed the presence of 27 plant species belonging to 17 distinct families in the studied area. Among these, the Asteraceae family was found to be the most prevalent, comprising seven different species. Leaves and flowers emerged as the most frequently utilized plant parts, constituting 40% of the overall usage, and were typically prepared as decoctions (accounting for 24% of preparations). In terms of species dominance, Thymus emerged as the most prominent, followed by *Cicer microphyllum* Royle, while *Sassurea graminifolia* was identified as the least dominant species. However, it is important to note that the medicinal plants in the region face a range of threats, including overgrazing, uprooting, unsustainable harvesting practices, and the adverse effects of climate change. These challenges underscore the pressing need for conservation efforts, which should involve both government agencies and local communities, in order to safeguard these crucial medicinal species. The study recommends implementing awareness sessions and training programs, ideally through academic institutions, to raise awareness about the importance of conserving these medicinal plants and to equip individuals with the knowledge and skills needed for sustainable practices. Notably, *Thymus,* Benth, *Hippophae rhamnoides* ssp., and *Convolvulus arvensis* L. were identified as the most commonly used medicinal plants in the region, emphasizing their significance in traditional healing practices.

Keywords: Local Plants, Ethno botany, Traditional uses, Karakorum range, Tormik Valley

INTRODUCTION:

Gilgit Baltistan (GB) is characterized by its unique climate, geographical location, altitude, and rugged mountains. It is often referred to as the Northern Areas of Pakistan (Baig, 2022). This region is home to the Karakoram, Himalayas, and Hindukush mountain ranges, collectively hosting around 25,000 species of flora, (Parveen *et al.*, 2022) accounting for roughly 10% of the world's plant diversity. Approximately 10,000 of these species are not used for medicinal purposes (Hussain *et al.*, 2019).

The local inhabitants of GB have a rich history of using plants for various purposes, including medicine, fuel, construction, fodder, and food. This diverse plant life is a result of the region's distinct climate and topography (Ali *et al.*, 2015). The local residents possess a reliable native knowledge system for managing and utilizing natural resources and their environment (Adnan and Othman, 2012). These plants also hold economic significance for the local communities.GB is home to people from different tribes, including Syed, Mughul, Sheen, Yaskun, Balti, Brishiski, Khowar, Tajik, and more (Wali Khan *et al.*, 2015). Some areas in GB, like Skardu, are isolated due to the high mountains, making the local population heavily reliant on traditional biodiversity for sustenance and other essential needs (Sharma and Pegu, 2011), especially for the elderly population. Initially, plants were primarily used for food, medicine, and shelter, but over time, their importance expanded to various other uses (Abbas *et al.*, 2016). Wild plants have always been of great interest and have been

explored for their potential benefits to humanity. Traditional knowledge of plant usage has been passed down through generations, forming the basis of medicinal practices (Siram *et al.*, 2023).

Traditional medicine is now recognized globally as a valuable healthcare resource, with the World Health Organization (WHO) acknowledging its significance(Bhagwat, Dudley and Harrop, 2011). Over 10% of known plant species are used for medicinal purposes, and traditional knowledge has led to the development of various drugs (rul and stha, 2015), including substances like Tubocurarine, Narcotics, and Morphine (Hoffman and Gallaher, 2007).

Many people in Pakistan rely on medicinal plants to treat a wide range of illnesses, from minor ailments to life-threatening diseases (Kasrina and Zukmadini, 2021). Some wild plants are commonly used, such as Ephedra, Artemisia, and Hippophae, while others like Garlic, Ginseng, and Cumin have been cultivated for medicinal purposes (Khan *et al.*, 2014). In the Tormik region of Baltistan, a study recorded 63 plant species, with a prevalence of the Asteraceae and Fabaceae families. The study also identified commonly used medicinal plants like *Thymus Linearis* Benth and *Hippophae Rhmnoides* ssp. *Turkestanic*a L (Da Costa Ferreira *et al.*, 2021). Additionally, the study discovered six species of vegetables and two species of edible wild fruits previously unreported in the area. Local residents also rely on several grass species (Mahmood *et al.*, 2011), such as *Bromus pectinatus* Thunb and *Poa pratensis* L., to feed domestic animals (Mahmood *et al.*, 2011). The objectives of this study were to document local medicinal plants used in phytotherapeutic practices for human healthcare, (Maryo and Wendawek, 2014) conduct phytochemical studies on these plants, and identify the threats and challenges facing medicinal plants in the region, along with potential solutions and recommendations (Abbas *et al.*, 2023).

Study Area: The study focuses on Tormik Valley, located in the Rondo district of Northern Pakistan (Hussain, 2019). This valley spans an area of 2,750 square kilometers, with approximately 1,010 square kilometers (36%) consisting of natural pastures, ranging in elevation from 2,000 to 6,000 meters above sea level (Ali et al., 2015). Despite its narrow size, the area includes 27 permanent villages and 16 temporary summer settlements

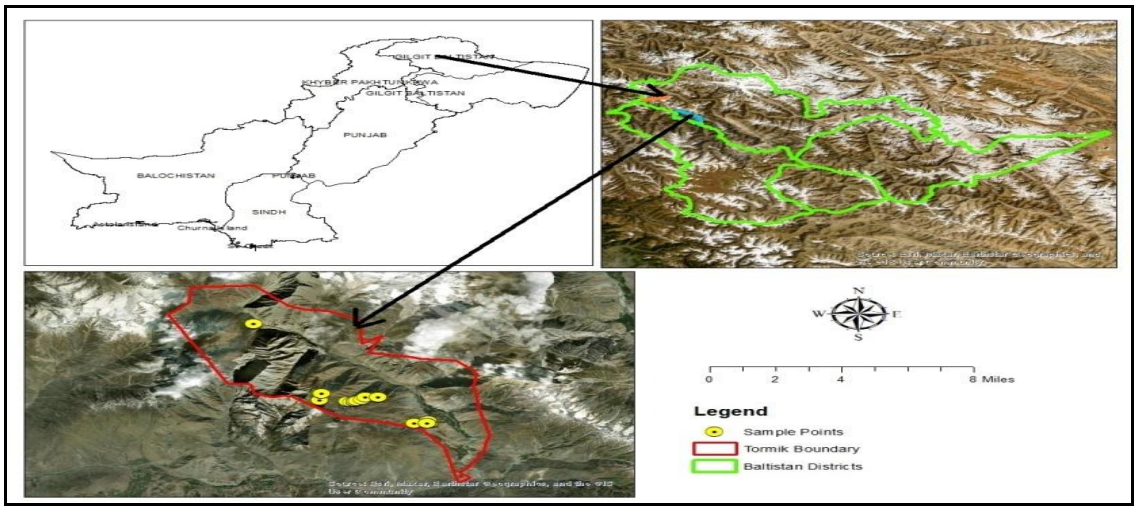

Figure: 1 study area map.

Data collection and analysis: The study was carried out in sub-division Roundu Tormik, District Skardu from 10 July to16 October and collected information about the medicinal plants. The field work consisted of two parts

1. Phyto-sociological data
2. Ethno-botanical data by using interviews and questioners.

Phyto-sociological data analysis*:* Phyto-sociological data was gathered through the utilization of the quadrat method (Blundo et al., 2021). This method was employed to investigate the plant community within the study area and to discern the presence of rare, endangered, and abundant species. In this study, a total of 22 quadrats, each measuring 5 x 6 meters, were randomly placed within the natural vegetation containing herbs and shrubs(Schippman, Leaman and Cunningham, 2002). These quadrats were situated at a distance of 70 meters from each other.

Within each quadrat, the species that held medicinal significance were identified, and their individual counts were recorded. Subsequently, these plants were collected based on information provided by knowledgeable informants (Blundo *et al.*, 2021). To evaluate the plant data collected from the study area, several metrics were computed using the following formulas:

Frequency (F2): F2= (Number of quadrats in which a species occur/Total number of quadrats)

Relative frequency (F3): F3= (Frequency of a species/ Total frequencies of all species) *100

Density (D2): D2= (Number of individual of a species/ Total sampled area)

Relative density (D3): D3= (Total number of individual of a species/ Total number of individual of all species)

Abundance of Species (AB): AB= (Total no of individuals of a species in all quadrates/Total number of quadrates in which the species occurred)

Relative Importance Value (RVI): RVI= Relative density+ Relative frequency

The plant communities were identified after calculating the RVI of each species and then based on this value species are considered as dominant which have larger importance

Table. 1 shows species frequency, relative frequency, density, relative density, abundance of species and relative important values

Species	F	R.F	D	R.D	AB	RVI
Fragaria Nubicda	0.091	2.381	0.0073	1.96	0.364	4.337
Astragalus frigidus	0.182	4.7619	0.0073	3.91	0.727	8.674
Cicer microphyllum Royle.	0.227	5.9524	0.0073	7.82	1.455	13.78
Artemisia brevifolia	0.091	2.381	0.0073	0.73	0.136	3.114
Allium	0.182	4.7619	0.0073	2.93	0.545	7.696
Arnebia euthrima	0.136	3.5714	0.0073	1.96	0.364	5.527
Cousinia thomsonii	0.091	2.381	0.0073	0.73	0.136	3.114
Thymus	0.364	9.5238	0.0073	18.6	3.455	28.11
Bergenia ciliata (Haw.) Sternb.	0.091	2.381	0.0073	6.36	1.182	8.738
Aconitum Heterophyllum	0.182	4.7619	0.0073	3.91	0.727	8.674
Swertia alata	0.136	3.5714	0.0073	2.44	0.455	6.016
Tanacetum falconeri	0.227	5.9524	0.0073	5.62	1.045	11.58
Onosma hispida Wall.	0.136	3.5714	0.0073	3.18	0.591	6.75
pleurospermum candollei	0.091	2.381	0.0045	1.22	0.227	3.603
Sassurea Graminifolia	0.045	1.1905	0.0027	0.73	0.136	1.924
Delphinium	0.182	4.7619	0.0182	4.89	0.909	9.652
Pimpinella diversifolia DC.	0.091	2.381	0.0127	3.42	0.636	5.804
Mentha royleana Wall.	0.136	3.5714	0.0118	3.18	0.591	6.75
Caltha Palustris Alba	0.136	3.5714	0.0055	1.47	0.273	5.038
Urtica dioica	0.091	2.381	0.0027	0.73	0.136	3.114
Descurainia Sophia	0.091	2.381	0.0055	1.47	0.273	3.848
Solanum nigrum L.	0.091	2.381	0.0027	0.73	0.136	3.114
Hippophae rhamnoides	0.045	1.1905	0.0009	0.24	0.045	1.435
Equisetum arvense	0.091	2.381	0.0036	0.98	0.182	3.359
Convolvulus arvensis	0.045	1.1905	0.0009	0.24	0.045	1.435
Epilobium	0.091	2.381	0.0036	0.98	0.182	3.359
Chenopodium album	0.091	2.381	0.0027	0.73	0.136	3.114

F= Frequency. RF= Relative Frequency, D= Density, RD= Relative Density, AB= Abundance of Species, RVI= Relative Importance Value

Ethno-botanical data by using Group Discussion and questioners: Traditional knowledge about the medicinal uses of plants in the study area was gathered through interactions with various local individuals, such as local healers, students, sheepherders, farmers, and other community members (Shahzad, Abubakr and Fischer, 2021). This information was collected using structured questionnaires and group discussions. During our field visits, the informants shared insights about the local names of plant species(Abbas et al., 2023), the specific plant parts employed, the methods of preparation, and the ailments for which these plants were utilized (Anwar, Khan and Atta-ur-Rahman, 2019). To analyze the gathered data, statistical methods within the SPSS software were employed.

MATERIALS AND METHODS

The following apparatus were used during field research for sample collection. A Camera, Cutter, blotting papers, measuring tap Plants presser, Field booklet and GPS etc.

The following steps were taken to collect the information of the plants.

Sampling: Several villages in Tormik valley were surveyed in August 2021 to evaluate the traditional use of medicinal plants, collected plant specimens, and recorded the ethno botanical data through questionnaires, Quadrates methods and interviews.

Quadrate method size (5 × 6 m) (Cox, 1990) was used for shrubs and herb species. A total of 22 stands were taken at every 70 meter interval. GPS was used to record the elevation. The reading of GPS was noted in the notebook. The circumference of shrubs was taken by the help of measuring tape.

Data Collections: Data was collected from 100 participants of Tormik Valley. The number of male and female of 40 and below 40 was 50 each. The questions Asked in Group discussion with aged peoples and also collected information

Laboratory work: The laboratory study included pressing, drying, mounting, identification, labeling and preservation of the plants.

Pressing and drying: The collected plants from the field were pressed correctly before wilting in between the sheets of blotting paper. The blotting papers were exchanged after every 2 days to eliminate all the residual moisture contents of the plants samples(Nasir, Ali and Stewart, 1972). The plants were then pressed through wooden presser to remove all the folds.

Mounting and identification: The floral specimens after dried were mounted on the herbarium sheets (11 ½ x 16 ½) with the help of glue (Khan *et al.*, 2015). The mounted plants were then identified with the help of flora of Pakistan i.e. existing literature the, botanical name, family name, local name and other suitable information's of the plant samples were printed on each standard herbarium sheet.

Preservation: The mounted floral specimens were submitted to UOBS herbarium, Department of Biological Science after putting the voucher numbers.

RESULT AND DISCUSSION

This study was conducted to document and explore the traditional uses of medicinal plants in the Tormik Valley, Skardu Baltistan. In the field study, researchers identified and collected 27 different species of medicinal plants from various areas within Tormik Valley (Wali Khan *et al.*, 2015) Among these, three species were identified as shrubs, while the remaining 24 were categorized as herbs (Hussain *et al.*, 2019).. Herbs accounted for 89.65517% of the total flora, whereas shrubs made up 10.34483% (Hussain, 2019), (Jehan *et al.*, 2022).Throughout the study, a total of 27 plant species were collected from the research area (Zeitschriftenartikel, 2014). The phyto-sociological characteristics of these species are presented in Table 1. The table indicates that Thymus had the highest relative frequency (9.6), followed by *Cicer microphyllum* Royle (5.952380952), while *Sassurea graminifolia* exhibited the lowest relative frequency (1.19047619). Thymus also displayed the highest relative density (18.58190709), followed by Cicer microphyllum Royle (7.82396088), whereas Convolvulus arvensis had the lowest relative density (0.244498778). In terms of relative importance value (RVI), Thymus had the highest value (28.10572), followed by *Cicer microphyllum* Royle (13.77634). Conversely, *Sassurea graminifolia* had the lowest RVI value among the studied species.The purpose of this research was to document and investigate the traditional uses of medicinal plants in Tormik Valley, Skardu Baltistan. During the field study, researchers (Amjad *et al.*, 2020) identified and gathered 27 distinct plant species with medicinal properties from various regions within Tormik Valley(Rehman, Tahir and Ali, 2023). Among these, three species were classified as shrubs, while the remaining 24 were categorized as herbs (Zeitschriftenartikel, 2014). Herbs accounted for the majority, constituting 89.65517% of the total flora ('No Title', 2013), while shrubs made up the remaining 10.34483%. (Jehan *et al.*, 2022)The study yielded a total of 27 plant species collected from the study area. The table in the report presents the phyto-sociological characteristics of these species. Notably, Thymus exhibited the highest relative frequency (9.6), followed by *Cicer microphyllum* Royle (5.952380952), whereas *Sassurea graminifolia* had the lowest relative frequency (1.19047619). Thymus also recorded the highest relative density (18.58190709), with *Cicer microphyllum* Royle coming in second (7.82396088), and *Convolvulus arvensis* having the lowest relative density (0.244498778). In terms of relative importance value (RVI), Thymus emerged as the most significant species with an RVI of 28.10572, followed by *Cicer microphyllum* Royle with an RVI of 13.77634. On the other hand, *Sassurea graminifolia* displayed the lowest RVI among the studied species. (1.923973).

Number of plants in each famil: It was also noted that all of these plants belonged to the following families. Composite was the largest family having 4 species followed by Asteraceae, Fabaceae and Alliaceae. Asteraceae containing 4 species Fabaceae containing 2 species Alliaceae containing 2 species and other remainings were belonging to Lamiaceae, Saxifragaceae, Ranunculaceae, Gentianceae, Boraginaceae, Ranunculaceae, Apiaceae, Lamiaceae, ssicaceae, Solanaceae, Eleagnaceae, Convolvulaceae, Onagraceae and Amaranthaceae each containing 01 species. Detail showed in Table. 2. & Figure.1

Table 2 family wise Distribution of medicinal plants in study area

Family	No of Species	%
Fabaceae	2	11.76471
Asteraceae	4	23.52941
Alliaceae	1	5.882353
Lamiaceae	2	11.76471
Saxifragaceae	1	5.882353
Ranunculaceae	1	5.882353
Gentianceae	1	5.882353
Boraginaceae	1	5.882353
Ranunculaceae	1	5.882353
Apiaceae	1	5.882353
Lamiaceae	1	5.882353

Urticaceae	1	5.882353
Brassicaceae	1	5.882353
Solanaceae	1	5.882353
Eleagnaceae	1	5.882353
Equisetaceae	1	5.882353
Convolvulaceae	1	5.882353

Ethno-medical studies: People of this valley have strong traditional and cultural values. Still they are much dependent on their natural resources. The results stated that more than 27 plant species were commonly used to treat different diseases. These 27 plant species were belonging to 17 families while on the basis of habit categories 24 species were herbs, 03 species were shrubs.

According to the use of plant parts for the treatment, most common used parts were the leaves and flower (40%),); seed and root or Rhizome were 23%; while the stem and bulb and whole plant contribute 37% (Fig 3). According to floristic diversity on the basis of habit category maximum identified flora of study area are herbs (90%) followed by the shrubs 10 % this same result noticed by (Hussain, 2019).The people of the area commonly use medicinal plants to get rid of diseases quickly (Jehan *et al.*, 2022). Most common used part of plants is leaves and flower. According to collected information people are habitual to use direct method. Most commonly used method is fresh juice about 31 %, while second most common method of use decoction is about 24% and powder form about 11%, infusion about 17% and past form is 17% (fig 4). Some plants species have more than one type of mode of use common among the inhabitants of the area.

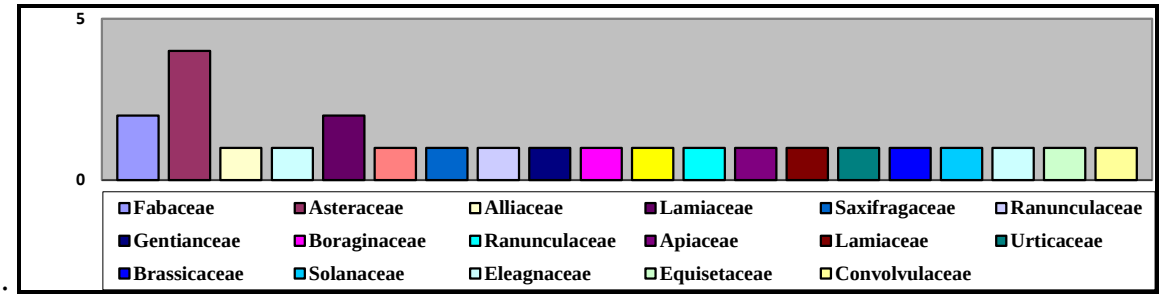

Figure: 2 families and number of species

Classification of part(s) used in traditional way: Flowers and Leaves (40%) were the commonly used plants by the local residents of the study area followed by Rhizome and Root (23%), whole plant (37%), Whole means sometime more than one parts of the plant is used combine i.e. leaves and flowers, fruit and root, stem and leaves, leaves and root, fruit and leaves each contributed

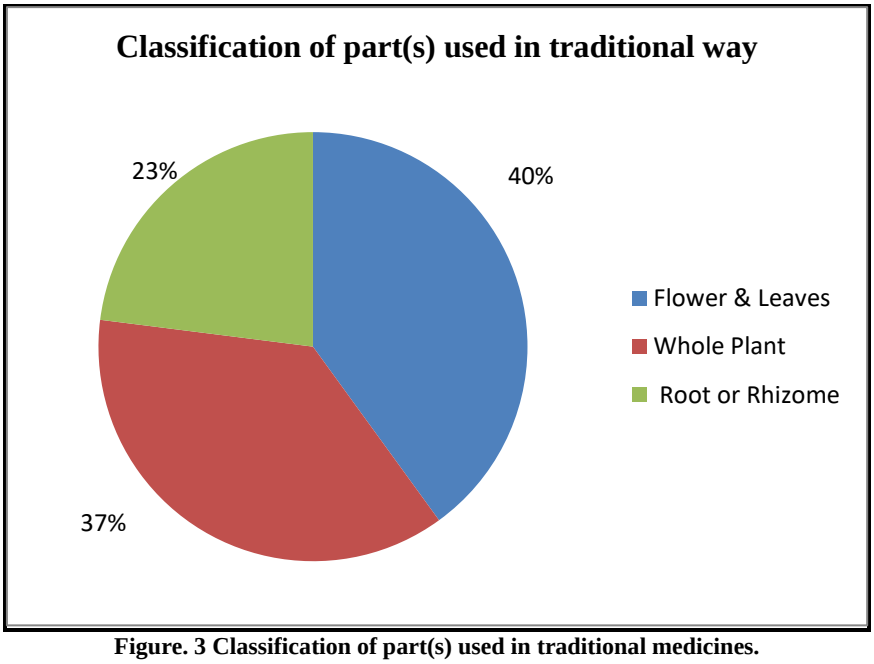

Figure. 3 Classification of part(s) used in traditional medicines.

Life form of the medicinal plants: Due to the availability of herbaceous life and wide distribution herbs are dominant. It was found that the inhabitants of the study area commonly used herb (90%) followed by shrub (10%) life form. Herbs are the dominant life form in the study area. Herbs are the most usually used and wide spread plants all over the world

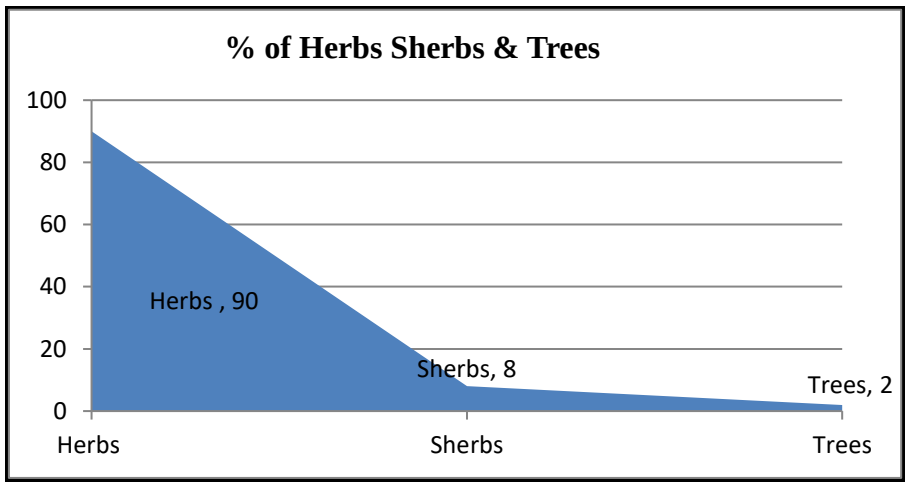

Figure. 4. percentage of herbs, shrubs and trees

Methods of uses of Medicinal plants: The people of the study area use five methods for the uses of the medicine. Among this juice (31%) is the most commonly used method in drug formulation due to its easy way of preparation, followed by powder Decoction (24%), paste (17%), infusion (17%) and (11%) respectively)

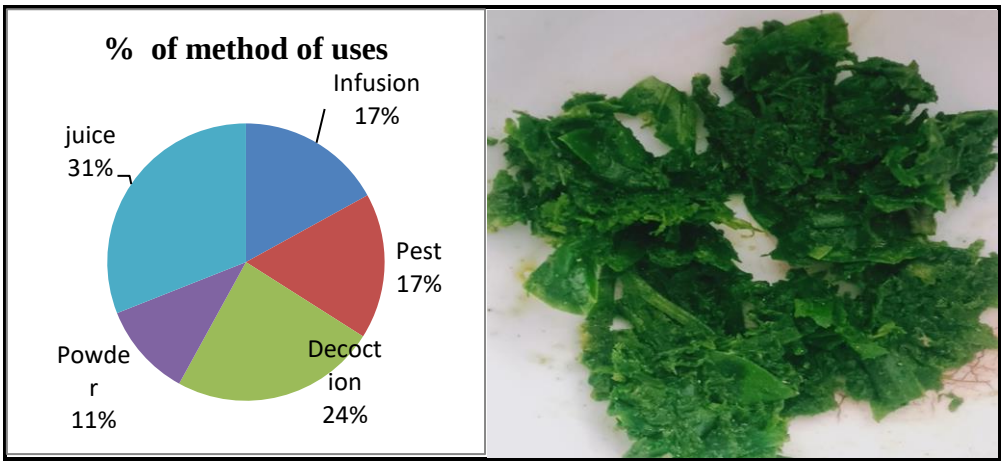

Fig 5. Percentage of usage methods

Discussion

The local community in the study area relies on various plant species from the Asteraceae, Fabaceae, and Alliaceae families for traditional herbal medicine to treat a range of illnesses. However, the study (Hassan *et al.*, 2022) revealed that there is limited knowledge among the local population regarding which parts of these plants are used for medicinal purposes. Interestingly, the most commonly used plant part is the leaves, with 26% of respondents indicating their use, which aligns with a previous study (Wali Khan *et al.*, 2015) (Amjad *et al.*, 2020) reporting leaves as the primary plant part used (38%). This preference for leaves may be due to their easy accessibility, as leaves are readily available on both herbs and shrubs. The methods of preparing these medicinal plants vary across different regions (Awan, Jamal and Khan Azhar, 2013), influenced by local knowledge and available resources. In this study, the predominant method of preparation was decoction (39%), followed by powder (19%), paste (13%), and infusion (10%). This contrasts with a similar study by (Hussain *et al.*, 2022), which found that powder (25%), juice (31%), paste (20%), direct application (19%), and fumigation (5%) were more common. Grinding was the most widely used preparation method (39%), followed by boiling and chewing, each at 11%. The study also revealed that many valuable medicinal plants, such as *Aconitum heterophyllum* Wall ex. Royle, *Allium carolinianum* DC., *Dactylorhiza hatagirea* (D.Don), and *Berberis lyceum* Royle, are at risk due to the collection of their underground parts, such as bulbs and roots. Overcollection by pharmaceutical organizations and the growing population have contributed to the

increased use of these plants, endangering their existence. Additionally, natural and human-induced factors like climate change, overgrazing (Ahmad *et al.*, 2021), and unsustainable harvesting practices pose threats to the medicinal plants in the study area (Rambey *et al.*, 2020).

Certain plant species in the region are found at high elevations and are primarily collected by shepherds and hunters, such as *Pleurospermum candolleii* Benth ex. CB. Clarke, *Delphinium brunonianum*, and *Biebersteinia odora* Stephan ex. *Fisch*. These plants are dried and stored for off-season use, and community members often share them when needed, (Abbas *et al.*, 2023) reflecting the cooperative and generous nature of the local community. The utilization of medicinal plants in treating various illnesses in this study is similar to research conducted in Nubra Valley, India, involving plant species like *Acantholimon lycopodoides* Boiss, *Peganum harmala* Linn, *Allium* Regel, and Dactylorhiza hatagirea (D. Don). This similarity can be attributed to the geographical proximity and shared climatic conditions between the two regions (Tahir *et al.*, 2023).

The data for this study were collected through interviews with local residents, particularly from older individuals and women, who provided extensive information about the plants, including their local names and medicinal uses. It was found that several plant species in the region were used to treat a range of health issues, including high fever, hypertension, blood purification, stomach problems, intestinal worms, and kidney ailments

Table no.3 cumulative table of plants ethnobotanical uses.

Botanical	Local Name	Parts of plant	Method of use	Purpose of use
Fragaria Nubicula	grusss	Arial parts	Direct use	Vomiting
Astragalus frigidus	Shashel	Leaves	Grind and put paste	Wound healing
Cicer microphyllum Royle.	stranjung strowa	Whole plant	Fresh plants are collected and cooked in water as a vegetable. It is suggested the plant is ea ten raw once a day	Kidney stones, urinary ,Problems
Artemisia brevifolia	Burxa	Areal pars	Boiled in water then it use	0Abdominal worm, obesity
Allium	blaq xong	Blub	Decoction	joint pain
Arnebia euthrima	thang marxi	Whole plant	A fresh or dried whole plant boiled and then use twice daily	Joints pain, blood purification
Cousinia thomsonii	Cherchu	Flower	The flower is boiled and applied paste topically on infected areas as needed	Dermatitis
Thymus	Tumbruk	Flower	Flowers are boiled in water and the decoction is taken twice daily	Abdominal pain, Vomiting
Bergenia ciliata (Haw.) Sternb	Shapor	Rhizome	A decoction of rhizome is taken twice a day while a paste is applied topically on eyelids	Stomach ulcer, eye ache
Aconitum Heterophyllum	Buma	Root	Two parts of root Grind and form powder	Stomach ulcer,
Swertia alata	Tikta	Whole body	Dip in water for specific time then used twice in day	Sugar, , Headache
Tanacetum falconeri	Tylo	Whole plant	A decoction of the whole plant is recommended once a day	Body ache, fever
Onosma hispida Wall.	Kangmer	Whole plant	The whole plant is cooked in water as a vegetable and taken twice a day as needed	Jaundice, constipation
Pleurospermum candollei	Sahndun	Leaves and flower	Boiled in water	Blood pressure
Delphinium	makhoting	Whole plant	The whole plant is dried and ground with water and the paste is then applied on the head as hair tonic	Hair tonic
Pimpinella diversifolia	Kohniod	Whole plant	Wash and eat when feel BP low	Blood Pressure
Mentha royleana Wall.	Pholing	Leaves	A decoction of leaves is made and taken three times a day	Abdominal pain & gastric problems
Caltha Palustris Alba	Shone	Leaves	The leaves are first boiled and chopped; then the paste is applied on infected skin two times in a day	Dermatitis
Urtica dioica	Khashing	Whole plant	The whole plant is boiled in water and the decoction is taken orally thrice daily,	Joint pain, blood tonic,

			whereas boiled and chopped leaves are applied on pimples and pustules	Pimples
Descurainia Sophia	Khasir	Whole plant	A decoction of the whole plant is made and recommended thrice daily	Asthma, constipation
Solanum nigrum L.	drumba skhlo	Fruit	The fruits are toasted and applied to aching teeth three times in a day	Toothache
Hippophae rhamnoides	Karxoq	Fruit and leaves	A fresh fruit paste is taken twice daily while a decoction of leaves is taken twice a day/a leaf paste is rubbed on infected parts	Gastrointestinal disorders, dermatitis
Equisetum arvense	Thang Shaing straw	Whole plant	A decoction of the whole plants is taken twice daily	Urinary tract disorders
Convolvulus arvensis	Khinh khing mo	Whole plant	Fresh plants are boiled in water as a vegetable and eaten with wheat bread twice a day	Constipation
Epilobium	hlchama straw	Leaves	Direct	Hot Fever, head ache
Chenopodium album	Khniyo	Whole plant	By boiled	Blood deficiency

CONCLUSION

The study conducted in the Karakorum Mountains of Northern Pakistan revealed significant Traditional Knowledge among the local population regarding the use of plants. Leaves and flowers were the most commonly utilized plant parts (40%), primarily prepared as decoctions (24%). Phytosociological data indicated Thymus as the dominant species (RVI: 28.10572), followed by *Cicer microphyllum* Royle was (13.77634), with *Sassurea graminifolia* being the least dominant (RVI: 1.923973). Local plants play a crucial role in the region and should be carefully considered and reevaluated by ethno pharmacologists and the public health sector. This information is also valuable for initiatives aimed at promoting sustainable development in an economically challenged area, helping to formulate effective strategies for boosting the local economy. This study underscores the importance of comprehensive interdisciplinary research to preserve local knowledge systems and document traditional medicinal plant usage, along with maintaining plant diversity in the Karakorum Range's Tormik Valley provide base line for future study.

ACKNOWLEDGEMENT

The authors are tanksful to the local communities for their sustainable guidance and assistance.

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