Research Article

Indigenous ethnomedicinal knowledge of inhabitants of Neelan valley, district Abbottabad, KPK, Pakistan

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Abstract

The indigenous knowledge of utilizing medicinal plants for the treatment of various ailments in very ancient and emerges under the influence of culture in each society. The culture of Pakistan is very rich in utilizing medicinal plants to cure various diseases. The current study was conducted to collect the indigenous knowledge from the local community regarding the utilization of native plant species for the cure of different diseases. The study was carried out in the Neelan Valley, Abbottabad, Khyber Pakhtunkhwa, Pakistan. The method used in the current study for documentation of the indigenous knowledge and traditional uses of important medicinal plants was based on questionnaires and personal interviews during field visits. A total of 350 informants, including 216 males and 134 females were interviewed for their traditional knowledge of medicinal plants used for various diseases and their knowledge regarding different folklores. As a result of interviews, 42 important medicinal plant species belonging to 32 families including 12 trees, 13 shrubs and 17 herbs were documented. The ethnomedicinal record was produced by listing the local and botanical name, plant family, habit, parts used and ethnomedicinal uses/folklores. The most frequent plant parts used for the aforementioned purpose were leaves, flowers, seeds and whole plants. Most of plants were used against digestive/gastrointestinal and respiratory disorders, jaundice, diabetes, rheumatism etc., as well as for antipyretic and anthelmintic purposes. It was observed that indigenous knowledge of herbal folklores is commonly used in the area to control various diseases, but is mostly confined to elderly people, while younger population is less aware of this knowledge due to altering socio-cultural trends in the area of study.

Keywords: Indigenous knowledge, Medicinal plants, Ethnomedicinal uses, Abbottabad, Pakistan.

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Introduction

Indigenous knowledge (IK) is the manifestation of human observations and experiences gained through ages which prevails in each region, community and is

orally recognized in different forms like myths, symbols, ritual and spiritual beliefs. It emerges under the influence of culture in each society and sustains human health and natural resources in balanced condition [1 - 2]. As traditional knowledge is developed by the experience of local people under their own cultural context, it is helpful for best utilization of resources including the medicinal plants. Indigenous knowledge provides base for agriculture, food, health, social issues and environmental conservation. The knowledge possessed by the inhabitants of any locality is the collection and collaboration of the past ideas shared among the local and thus different regions of the world have developed their own folk wisdom or utilization of plant resources, conservation and their management [3 - 4].

The branch of science dealing the traditional practices of the medicinal plants is called as ethnobotany, the term initially coined by US botanist John Harshberger in 1896, although the traditional use of the medicinal plants is very ancient [5 - 6]. The medicinal plants discovery and utilization by the native people for curing various diseases is as old as the utilization of the plants for food purpose. This is evident by the ancient history, which revealed that the ancient people utilized these medicinal plants for curing various diseases and ailments [7, 5]. Any plant having active chemical substances or phytochemicals, that give definite physiological response during the treatment of disease in the human being or animals is called medicinal plants [8]. Medicinal plants possess diverse types of biochemicals with essential safe and effective ingredients. .Around 80% of the world population is dependent upon this traditional system of healthcare. This traditional knowledge of using medicinal plants by local people to cure various human and animals' diseases is being depleted with the passage of old people [2, 9 - 10].

Pakistan has a high floral diversity and about six thousand vascular floral species are reported, flourished under different climatic, ecological and topographical regions [8]. The plant resources not only provide basic materials but also inherit their cultural, traditional local values and history as indigenous knowledge. These plants are the sources for the economic prosperity of the inhabitants of that area [11]. Utilization of ethnomedicinal plants still exists in Pakistan and is best observed in rural and remote areas [9]. Many ethnobotanical studies have been conducted to accumulate and document the indigenous uses of medicinal plants for humans [10, 12 - 18] as well as their ethnoveterinary uses [19 - 21] in Pakistan.

Traditional knowledge uses and practices of medicinal plants has been transmitted orally and inherited from generation to generation but due to failure of documentation and modern cultural impacts are undoubtedly declining in modern generation in different communities [22]. Unfortunately, traditional knowledge is confined to aged people and is getting depleted in young generation due to changing socio-cultural trends [17, 23 - 24]. The ethnomedicinal values of various medicinal plants were investigated in Sakhra Valley, district Swat, KP, Pakistan during 2021-22, where 153 medicinal plants species from 63 families and 100 genera were documented. The majority of the plants having medicinal values were from family Lamiaceae, followed by Asteraceae, Rosaceae, Brassicaceae, and Polygonaceae. In most of the cases, whole plant (60 species) was used in various formulations followed by leaves (30 species) and fruits (28 species). Gastrointestinal problems were reported to be treated by 81 plant species, followed by excretory (36 species), and respiratory problems (28 species) [2]. Another study was performed in the villages of Dawarian and Ratti Gali, District Neelam, Azad

Jammu and Kashmir (AJK) Pakistan to enlist the traditional ethnobotanical uses of wild flora of that area. The study showed the presence of 103 wild medicinal plants species from 46 families of plants. The results showed that the family Asteraceae is ranked 1st with 12 plants species enlisted. The maximum plant parts used were the leaves (18%), followed by seeds (17%) and roots (13%) [4]. Another study was conducted in the District Haripur, KP, Pakistan, where around 80 plant species (33 herbs, 24 trees, 21 shrubs and 2 climbers) belonging to 50 families were reported to treat the human and livestock diseases. The maximum plants were from family Lamiaceae with 7 species (8.7%), followed by the family Fabaceae with 6 species (7.5%), while the family Moraceae was represented by 5 species (6.2%). Although the local people reported the use of various parts of plants, but the most popular used method was decoction/tea (22 species), which was followed by the powder/grained plants (20 species) and preparation of paste/poultice etc. (14 species) [24].

The aim of the current study was to explore the native medicinal plant species and to document their ethnomedicinal knowledge attained by the inhabitants of the Neelan Valley, Abbottabad, Khyber Pakhtunkhwa, Pakistan. To keep a record of traditional knowledge and practices of medicinal plants by the inhabitants of the area and share it with the community to avoid the elimination of this traditional knowledge.

Material and Methods

Description of the study area

Neelan valley or Nenlan valley, confined as a hilly area in District Abbottabad, Khyber Pakhtunkhwa (KP), Pakistan is located on the back side of Margalla Hills, Islamabad, in the feet of Nathiagalli-Murree hills and Galliyat area (Figure. 1). The valley is located at 34°09′N latitude and 73°13′E longitude and at an altitude of 1250 meters. The important villages of the area include Hajia Gali, Chamnaka, Chandomera, Karach, Somwala, Rayala, Korni, Chapri, Bodla, Satora, Langrial, Dubran and Jabbri. As per standard classification of forest types of Pakistan, the vegetation of the study area falls in two major forest categories i-e coniferous subtropical pine forests and scrub dry subtropical broad-leaved forests [25].

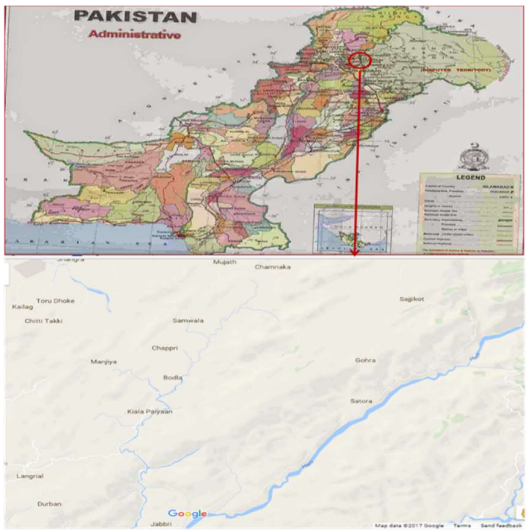

Figure. 1: Map of the study area Neelan Valley, Abbottabad, Pakistan representing the important villages scattered on hills and plains.

Survey of traditional knowledge

Questionnaire method and interviews were conducted for documentation of floral indigenous knowledge based on previous studies [26 - 27]. The interviews were conducted in local community, through knowledgeable and reliable people (men and women), plants collectors, hakims, herdsmen, experienced elders as well as young persons. The local names of plants, habits, flowering seasons, traditional uses and others relevant information's were documented during the interviews. The ethnomedicinal information was collected by pre-planned questionnaires. The medicinal plants having traditional

practices and indigenous knowledge among the natives have been selected as reference species.

Plant collection and preservation

Field trips were frequently conducted in different localities/villages of the investigated area in four seasons using the methodology of [28] to gather information about the ethnomedicinal uses of the plants by the local people. The main target sites in the valley were Hajia Gali, Chamnaka, Chandomera, Riala, Samwala, Bodla, Faqir Muhammad, Langrial, Jabbri and Dubran. The collected plant specimens were properly pressed, dried, mounted and identified through the available literature [29]. The mounted specimens were deposited in the Herbarium, Department of Environmental Sciences, University of Haripur, KP, Pakistan for future references.

Derivation of informant consensus factor (ICF)

Informant consensus factor (ICF) was calculated to access the treatment of disease based on medicinal plants. A disease system with more than three respondents was considered during ICF analysis. The ICF was calculated by the following formula [30].

ICF = N-T/N-1

Where N is the number of respondents mentioning disease and T is the total number of plant species mentioned for disease.

Photography

Photographs of the medicinal plants traditionally used by the local inhabitants were taken with the help of digital camera Nikon Coolpix P520. Pictures of the medicinal plants were taken with flowers, inflorescences, leaves and branches for proper identification.

Results

Demographic features of area and informants

The current study was conducted to highlight the traditional knowledge of ethnomedicinal plants of Neelan Valley, District Abbottabad, KP, Pakistan. Neelan valley is famous for beautiful scenic views and lush green vegetation, due to which, valley is called Neelan in local language (Hindko) meaning lush green vegetation. The important villages like Hajia Gali, Chamnaka, Chandomera, Karach, Somwala, Rayala, Korni, Chapri, Bodla, Langrial, Dubran and Jabbri are scattered and are owned by different ethnic groups (Figure. 1). The main languages of the area are Hindko and Pahari Hindko, while some population, especially the young generation speak the national language Urdu. Two major forest categories i-e coniferous subtropical pine forests and scrub dry subtropical broad-leaved forests are represented by the area as reported by [25]. The five major reserved forests (Satora reserved forest, Rahi reserved forest, Sarla reserved forest, Kohala-lassan reserved forest and Margalla reserved forest) along with other small guzaras, reserves, and mehdoodas are located in the investigated area. The important high mountains of the Valley are Dubran, Siribang, Langrial and Danna Nooral. Less than half the population is dependent on agricultural activities. The usage of plant resources plays a vital role in fulfilling the basic needs of the natives. Although there is no local herbal market for these plants in these villages, Havelian, Abbottabad and Haripur cities are the market sources to buy and sell these plants.

A total of 350 informants of different age groups were interviewed from different villages, of which 216 (61.7%) were male and 134 (38.3%) were female (Table 1).

Among males, 110 were below 40, while 106 were between 40-80 years. In females, 52 were below 40, while 82 were between 40–80 years. The youth were interviewed to check their traditional knowledge of utilizing these plants as herbal folklores. Although it was observed that the youth are not much aware of this traditional ethnomedicinal knowledge. The major reason was their less interest in gaining this knowledge and more tendency to use pharmacy medicines.

Table 1: Age and gender distribution of ethnic informants.

Informants	Age groups	Number of Informants	(%) Age
Male	Below 20	58	16.6
	20-40	52	14.8
	40-60	56	16
	60-80	50	14.3
Female	Below 20	30	8.6
	20-40	22	6.3
	40-60	44	12.6
	60-80	38	10.8

Taxonomic classification of reported medicinal plants

The current study reported 42 important medicinal plant species of 36 genera from 32 families used by the inhabitants of the area as herbal remedies to cure various diseases (Table 2). The plants having authentic medicinal values and importance were included in the study. The dominant plant families of the investigated area were Moraceae (3 species), Lamiaceae (3 species), Euphorbiaceae (2 species), Apocynaceae (2 species), Asteraceae (2 species), Amaranthaceae (2 species) and Mimosaceae (2 species), while remaining 25 families were represented by single species (Table 2). The most demanding plant species used by local inhabitants to cure various ailments were *Acacia modesta, Adhatoda vasica, Bauhinia variegata, Berberis lyceum, Calatropis procera, Datura stromonium, Dodonea viscosa, Ficus palmata, Melia azedarach, Mentha arvensis, Morus nigra, Nerium oleander, Oxalis corniculata, Fumaria indica, Punica granatum, Riccinus communis, Solanum nigram, Taraxacum officinale, Viola odorata,* and *Zanthoxylum armatum*. Of the medicinal plants used by the local inhabitants, the maximum plants used were herbs (40.4%), followed by the shrubs (31%), while trees were represented by low percentages (28.6%) (Figure. 2).

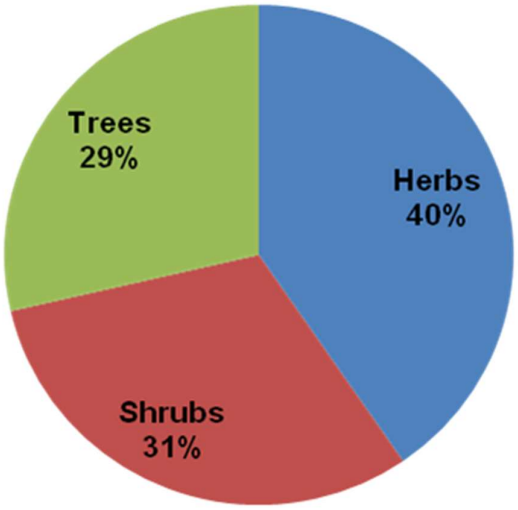

Figure. 2: Life form of medicinal plants used by the inhabitants of Neelan Valley, Abbottabad, Pakistan.

Ethnomedicinal information of each plant along with plant parts used and their pharmacological importance is listed in Table 2. Some of the important medicinal plants of the area were photographed and are shown (Figure. 3).

Plant parts used and mode of application

Of the investigated medicinal plants, various plant parts were traditionally used to treat various diseases.

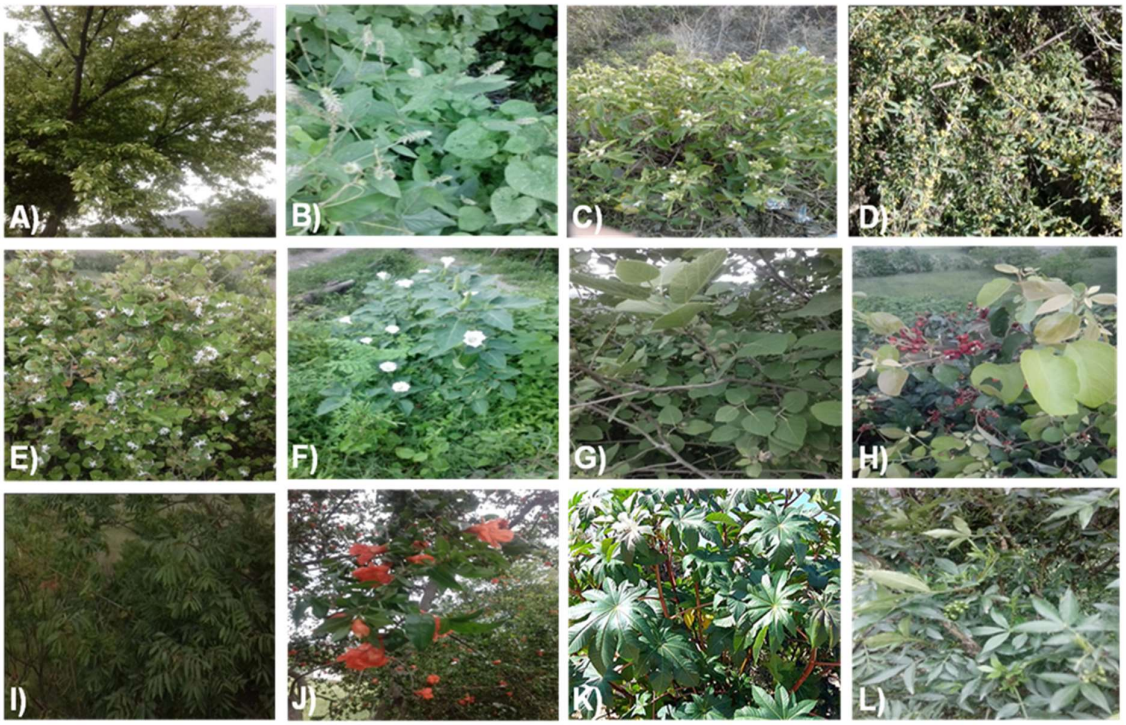

Figure. 3: Medicinal plants collected from Neelan Valley, Abbottabad, Pakistan used to treat various diseases by inhabitants of the area. A) *Acacia modesta*, B) *Achyranthus aspera*, C) *Adhatoda vasica*, D) *Berberis lycium*, E) *Carissa opaca*, F) *Datura stromonium*, G) *Ficus palmata*, H) *Mallotus phillipphensis*, I) *Pistacia integerrima*, J) *Punica granatum*, K) *Riccinus communis*, L) *Zanthoxylum armatum.*

The most frequently used plant parts were leaves (28%), flowers (10.7%), seeds (10.7%), fruits (9.3%), whole plant (8%), while pods and wood (1.3%) were rarely used (Figure. 4). In few cases the plants exudates like gums (*Acacia modesta*) and latex (*Ficus bengalensis*) were also used as an ailment to treat various diseases (Table 2). In most cases, the plants decoction is used, while plant extracts, juices, powder, paste, tea, fresh parts or cooked food is also utilized to treat different diseases.

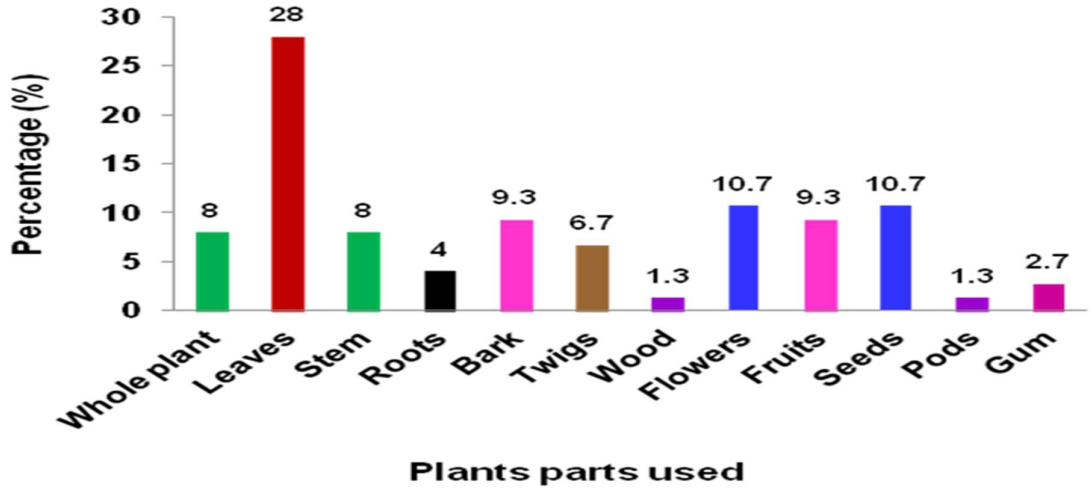

Figure 4: Parts of medicinal plants used by native people. Leaves were most frequently used to treat various ailments, followed by flowers and seeds.

Traditional uses of the medicinal plants by local inhabitants

Of the 42 plants used by the local occupants to cure various diseases, many plants were used to cure more than one disease (Table 2) such as *Adhatoda vasica* is used to control diabetes, jaundice, skin diseases, toothache, cough, bronchitis, asthma, tuberculosis, for blood purification, as expectorant and as an anthelmintic agent.

Table 2: List of results of medicinal plants used traditionally by inhabitants of Neelan Valley, Abbottabad, KPK, Pakistan to cure various ailments.

S/No	Botanical Name	Local name	Family	Habit	Part used	Ethnomedicinal uses/folklore
1	*Acacia modesta Wall.*	Phulai	Mimosaceae	Tree	Bark, twigs, gum	Mouth boils, gum bleeding and diseases. Tooth decay. Gum is used for post-delivery for backache. Decoction of bark is used as gargle for mouth thrashes. Fresh twigs are used as toothbrush (*masvak*).
2	*Acacia nilotica* L. *Delile*	Kikar	Mimosaceae	Tree	Flowers, bark, gum	Jaundice, hepatitis, astringent, nose bleeding. Gum is used for cough and bronchitis.
3	*Achyranthes aspera* L.	Lehnda Path Kanda	Amaranthaceae	Herb	Whole plant	The plant is dried and powdered, mixed with honey or sugar and used for chronic cough, asthma, throat infection and expectorant.
4	*Amaranthus viridis* L.	Chulvari, chulai	Amaranthaceae	Herb	Whole plant	For abdominal pains, constipation, gastritis, mouth boils, diarrhea and dysentery. Leaves are cooked as vegetables.
5	*Adhatoda vasica* Nees	Bhaikur	Acanthaceae	Shrub	Leaves, flowers	For blood purification, diabetes, tuberculosis, jaundice, skin diseases, toothache, mostly for all types of coughs, Bronchitis and asthma. Gulqand of flower is used as expectorant. Anthelmintic and antiseptic.
6	*Aloe barbadensis* Mill	Kanwar ghandal	Liliaceae	Herb	Leaves, Gell	For constipation and intestinal worms, Used as appetizer, for blood purification, rheumatism, face pimples and skin diseases. Anthelmentic, purgative, spleen and liver troubles and piles.
7	*Bauhinia variegata* L.	Kalyari	Caeselpinaceae	Tree	Flowers, pods, roots	For stomach diseases, dyspepsia, dried powdered flowers are used as worm killer and for piles and dysentery. Young flowers are cooked as vegetable.
8	*Berberis lyceum* Royle	Sumbal	Barberidacea	Shrub	Bark, roots, fruits	For constipation, rheumatism, tonic, antiseptic, internal injuries, diabetes, cough, chest problems, throat, gargle strengthen the gums and piles. Fine powder bark of root and stem is used with water or milk to heal internal wounds and pain.
9	*Calatropis procera*	Ak	Asclepiadaceae	Shrub	Whole plant	Purgative, anthelmintic poultice for swelling, fresh root is used to relieve toothache, used as toothbrush, warmed leaves are used as poultice.
10	*Carissa opacca* Stapf ex Hanies	Grinda	Apocynaceae	Shrub	Fruit, leaves, roots	Decoction of roots and leaves is used for jaundice, hepatitis and diabetes. Fruits are eaten for medicinal purposes.

S/No	Botanical Name	Local name	Family	Habit	Part used	Ethnomedicinal uses/folklore
11	*Coriandrum sativum*	Dhania	Apiaceae	Herb	Leaves, stem, seeds	For blood pressure, condiment, used in making chatni, appetizer.
12	*Cichorium intybus* L.	Kasni	Asteraceae	Herb	Seeds, stem, flowers	Tonic used in fevers, diuretic, for liver diseases, jaundice.
13	*Cynodon dactylon* L.	Khabal	Poaceae	Herb	Whole plant	For nose bleeding, piles, scabies, skin diseases, fever, decoction as lotion for swellings and sores.
14	*Datura stromonium* L.	Datura	Solanaceae	Sub Shrub	Seeds, flowers, leaves	Earache, scalp, sleeping, not used directly (poisonous).
15	*Diospyrous lotus* L.	Amlok	Ebenaceae	Tree	Fruits	Carminative, to warmth body. For chest phlegm. Fruits are tasty and eaten.
16	*Dodonea viscosa* L., Jacq.	Sanatha	Sapindaceae	Shrub	Leaves, bark, stems	Bark is used for hepatitis, jaundice, diabetes, febrifuge, used in skin swelling and burns, leaves are used for bandage with cloth, twigs are wrapped with broken bones. Leaf powder is used in burns.
17	*Ficus bengalensis* L.	Buhr	Moraceae	Tree	Arial roots, latex	For hepatitis and jaundice, rheumatism, arial roots are used as toothbrush for toothache.
18	*Ficus palmata Forsk*	Phagwari	Moraceae	Tree	Fruits	For constipation, antiseptic, ripened fruits are eaten mostly early in the morning, stomach regularity.
19	*Grewive optiva* J.R. Drumm. ex Burret	Dhaman	Tiliaceae	Tree	Bark, Fruits	For constipation, laxative, ripened fruits are eaten by children.
20	*Mallotus phillipphensis* (Lam.) Muell. Arg	Kamila	Euphorbiaceae	Shrub/ tree	Fruits, seeds	For colic pain, anthelmintic, purgative, poultice for skin diseases, scabies. Powdered seeds are used with water to kill abdominal worms.
21	*Melia azedarach* L.	Daraik	Meliaceae	Tree	Leaves, fruits	For diabetes, anthelmintic, rheumatism, decoction of leaf is used externally for skin diseases and mouth wash.
22	*Mentha arvensis* L.	Podin A	Lamiaceae	Herb	Leaves, twigs, stems	For stomachic, appetizer, carminative, diarrhea and dysentery. Leaves tea is prepared to treat vomiting, fevers, digestive disorders, and obesity.
23	*Mentha longofolia* L.	Chitta podina	Lamiaceae	Herb	Leaves, twigs	Used as carminative, dried powder leaves are used for fevers, dysentery, vomiting and nausea.
24	*Mirabilis jalapa*	Alta	Nyctaginaceae	Herb	Leaves	Leaves are fastened on wounds for healing
25	*Morus nigra* L.	Toot	Moraceae	Tree	Fruit	For throat infections, cough, cold and flu, hoarseness of voice. Both fresh and dried fruits are eaten.
26	*Nerium oleander* L.	Kunair	Apocyanaceae	Shrub	Leaves, flowers	For scabies and external skin diseases etc. The plant is poisonous.
27	*Ocimum basilicum* L.	Niazbo	Lamiaceae	Herb	Leaves, flowers, stems, seeds	Used for fever, cough, cold and flu. Leaf juice applied externally for skin ailments, leaves are used for making chatni, carminative.
28	*Olea ferruginea* Royle	Kaho	Oleaceae	Tree	Leaves, fruit, twigs	Used for diabetes, rheumatism, asthma, boiles and pimples. Young leaves are chewed for mouth-sores and twigs are used to brush teeth to relieve toothache. Ripened fruits are eaten for diabetes.

S/No	Botanical Name	Local name	Family	Habit	Part used	Ethnomedicinal uses/folklore
29	*Oxalis corniculate*	Khatmilla	Oxalidaceae	Herb	Leaves	Used for stomach troubles, jaundice, skin inflammation and intoxication
30	*Fumaria indica (Hausskn.)*	Papra	Fumariceae	Herb	Whole plant	Bitter, cooling, intoxication, leprosy, diuretic, specially used for skin and blood diseases, in diabetes, worm killer and in fevers.
31	*Pinus roxburghii* Sargent	Chir	Pinaceae	Tree	Woods, resins	For skin burns, wounds, boils, and rheumatism. Resin is applied externally.
32	*Pistacia integerrima*	Kangar	Anacardiaceae	Tree	Gall, bark	For jaundice, dysentery. Decoction of bark is used for jaundice.
33	*Punica granatum* L.	Daruna	Punicaceae	Shrub/ tree	Fruit, bark, seeds	For jaundice and liver diseases, gum bleeding, anthelmintic, dried fruit skin is used against diabetes, astringent, appetizer. Powdered seeds are mixed in chatni.
34	*Riccinus communis* L	Arand	Euphorbiaceae	Shrub	Leaves, seeds	Used as laxative, rheumatism, for constipation, leaves are placed as poultice on healing wounds, sores, boiles and swellings in skin diseases.
35	*Rubus fuiticosus* L.	Garacha	Rosaceae	Shrub	Fruit, leaves	For diarrhea, cough, fever, carminative and diuretic. Fruits are edible.
36	*Solanum nigram* L	Kachmach	Solanaceae	Herb	Whole plant	For lever disease, jaundice, intestinal worms and swellings. Tonic, diuretic and for piles. Leaves are used as poultice for wounds.
37	*Taraxacum officinale*	Hund, Dudal	Asteraceae	Herb	Leaves	Used for kidney and liver disorders, diabetes, diuretic, analgesic. Leaves are boiled and used as vegetable.
38	*Rumex dentatis* L.	Ola	Polygonaceae	Herb	Leaves	For rheumatism and urinary disorders, blood flow, leaves are also cooked as vegetables.
39	*Viola odorata* L.	Banafsha	Violaceae	Herb	Leaves, flowers	For cough, cold, flu, fever and good sleep, violet tea or decoction is preferably used in fevers.
40	*Vitex negundo* L.	Marvan	Verbenaceae	Shrub	Leaves, twigs	Used for gum and skin diseases, fever, skin allergy, twigs are used as toothbrush for toothache.
41	*Zanthoxylum armatum* DC	Timbar	Rutacceae	Shrub, Tree	Seeds, stem	For jaundice, constipation, diabetes and obesity. For improving digestion, carminative, used in chatni. Toothbrush is used for toothache.
42	*Ziziphus numularia* Burm	Beri	Rhamnaceae	Shrub	Leaves, fruits	For wounds bleeding, cooling effect. Leaves boiled water is used for washing skin, fruits tasty and are eaten, appetizer.

Berberis lyceum is used against constipation, rheumatism, internal injuries, diabetes, cough, chest problems, throat infections, piles and as antiseptic. *Fumaria indica* is used against intoxication, leprosy, diabetes, skin and blood diseases, as antipyretic, anthelmintic and cooling purpose. *Melia azedarach* is used against diabetes, rheumatism, skin diseases, as anthelmintic and for mouth washes and *Riccinus communis* is used as laxative, for healing wounds, against rheumatism, constipation, sores, boiles and swellings in skin diseases. The inhabitants of the area used maximum plants against digestive/gastro-intestinal disorders (32),

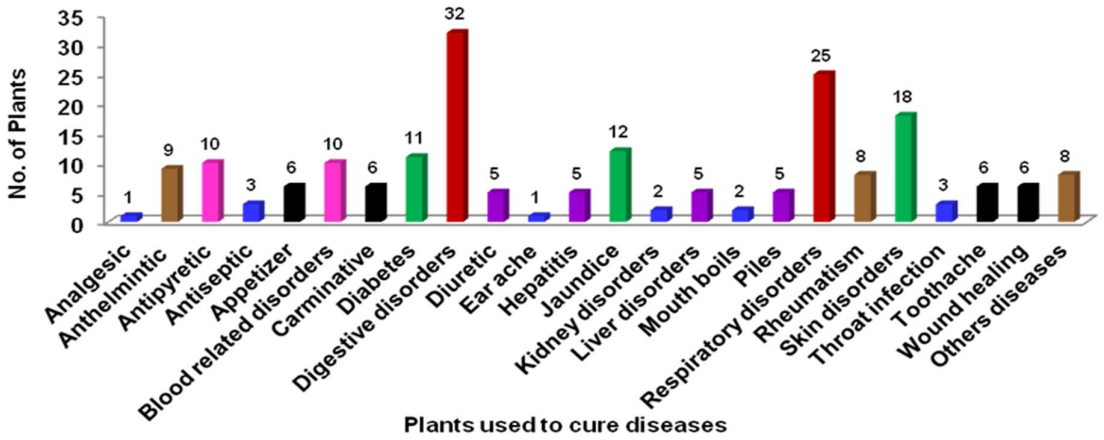

Figure. 5: Various plants indigenously used by the local inhabitants to control various diseases. Digestive disorders include diseases such as constipation, diarrhea, dysentery, vomiting, nausea, stomach issues as well as plants used for laxative and purgative purposes. Respiratory disorders are comprised of chest issues, asthma, bronchitis, cough, cold, flu, tuberculosis and as phlegm expectorant. Skin disorders include all skin related diseases such as rashes, bioles, swelling, burns, allergies, pimples etc.

respiratory disorders (25), skin disorders (18), jaundice (12), diabetes (11), as antipyretic to control fevers (10), anthelmintic (9), rheumatism (8) etc. Only *Adhatoda vasica* was reported to treat tuberculosis and *Fumaria indica* was reported to control leprosy (Figure. 5).

Informant consensus factor (ICF for diseases

Informant consensus factor (ICF) for disease system checks the efficiency of the native drug plant species utilized by inhabitants of the area for a disease. Only that ICF was considered where more than 3 respondents gave the information about particular plant with relevant disease. High ICF value close to 1 showed that informants are more confident in selection of plant against a particular disease and values close to 0 indicate that informants are less satisfied with the use of plant for a particular disease. In the current studies, the ICF values ranged from 0.42 to 0.90, with an average of 65 (Table 3).

Table 3: Informant consensus factor (ICF) for various diseases calculated from Neelan valley, Abbottabad, Pakistan.

S/No	Diseases	ICF values	No.	Diseases	ICF values
1	Digestive disorders	0.93	12	Antipyretic	0.68
2	Respiratory disorders	0.9	13	Wound healing	0.65
3	Skin disorders	0.87	14	Kidney disorders	0.56
4	Mouth cavity disorders	0.82	15	Diuretic	0.52
5	Diabetes	0.77	16	Liver disorders/Hepatitis	0.52
6	Rheumatism	0.75	17	Toothache	0.5
7	Carminative	0.74	18	Piles	0.49
8	Jaundice	0.73	19	Throat infection	0.46
9	Anthelmintic	0.72	20	Earache	0.45
10	Appetizer	0.7	21	Analgesic	0.43
11	Blood related disorders	0.69	22	Antiseptic	0.42

In most of the plants, a high consensus was developed by the informants, while in few cases, low ICF revealed their less satisfaction for the use of plants against particular diseases. The ailments were categorized into 22 classes based on their ethnopharmacological uses and it was observed that maximum ICF values were for digestive or gastro-intestinal disorders (0.93), followed by respiratory (90), skin disorders (0.87) and mouth cavity related disorders (0.82). The lowest ICF values were detected for the plants having analgesic (0.43) and antiseptic (0.42) properties revealing that inhabitants of the area have less knowledge of various microbes and the use of plants with antiseptic properties. The ICF values for jaundice, diabetes and rheumatism were also high indicating that the inhabitants of the studied area more frequently use their indigenous knowledge to control these diseases.

Age wise indigenous knowledge of inhabitants of the area

We also studied the traditional knowledge gained by the inhabitants (male and female) of local area depending on various age groups (Figure. 6).

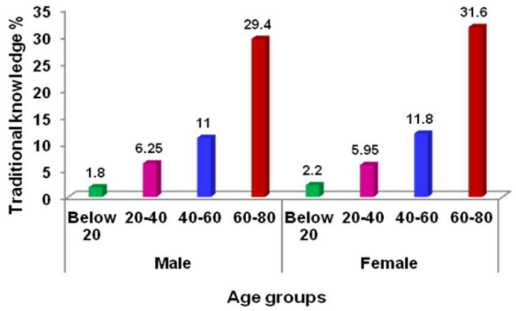

Figure. 6: Age group wise traditional knowledge exhibited by the inhabitants of local area. Indigenous knowledge is more confined to elders of the community, while younger's are less aware of this knowledge.

The first age group comprised of young (<20) persons was interviewed to determine their traditional knowledge for utilizing these plants to cure various diseases. The second age group was between 20-40 years, third group was between 40-60 years, while fourth group was comprised of elders (60-80 years). Based on collected information's, we concluded that the young informants having age group <20 years have got least information (1.8% in males and 2.2% in females) regarding the use of medicinal plants as an ailment against various diseases. This information increased with the age groups and the elder persons of the community have attained the maximum information about traditional uses of these plants to cure various ailments. It was observed that elder females preserve more traditional knowledge (31.6%) of using medicinal plants in comparison to elder males (29.4%). This revealed that maximum knowledge is attained by elders of the community, mostly females and there is an urgent need to transfer this knowledge to the youth of the population to preserve this for future generations.

Discussion

Herbal medicine system is still prevailing in the world since time immemorial for health care [31]. In Indo-Pak sub-continent, data of herbal medicines was compiled in the Rigveda between 4500-1600 B.C. and Ayurveda between 2500-600 B.C. This system holds its roots back in Greek medicine era, which was later adopted by the Arabs, then the knowledge spread to the Indian subcontinent and Europe [32]. In Pakistan, around 700 plants are reported to be utilized as medicinal plants for curing various diseases mostly in rural and remote areas [33]. Different researchers have documented this traditional knowledge in various parts of KP, Azad Jammu and Kashmir and Punjab, Pakistan [34, 6, 17, 23, 35, 10, 18].

Of the 350 informants of present survey,

216 (61.7%) were males and 134 (38.3%) were females. The prevalence of male informants was due to the traditional factors, as females were reluctant to fill questionnaires, record interviews and share their information. The elder females have no such limitations and shared their knowledge regarding indigenous use of medicinal plants to cure various ailments, which was the most significant (31.6%). In the previous studies, such male prevalence was also observed in other regions of Pakistan [17, 35]. The less awareness of youth for keeping the indigenous knowledge of medicinal plants was obvious in present and previous studies [17].

Total of 42 important plants were reported with high therapeutic importance used by the local people to cure various diseases. The most frequently used traditional plants by local inhabitants to cure various ailments were *Acacia modesta, Adhatoda vasica, Bauhinia variegata, Berberis lyceum, Calatropis procera, Datura stromonium, Dodonea viscosa, Ficus palmata, Melia azedarach, Mentha arvensis, Morus nigra, Nerium oleander, Oxalis corniculata, Fumaria indica, Punica granatum, Riccinus communis, Solanum nigram, Taraxacum officinale, Viola odorata,* and *Zanthoxylum armatum*. Some of the plants of present study were previously reported with various pharmacological uses from vicinity of the area [14, 34, 6, 18]. Several studies have been conducted from nearby areas and plants with medicinal values and used traditionally by inhabitants of the areas were documented. Traditional uses of medicinal herbs from Kotli Sattian, District Rawalpindi were reported recently [34]. Ethnomedicinal uses of plants species has been recorded from Patriata and New Murree, Pakistan [14]. In Siran Valley, Mansehra, 80 medicinal plants were documented [22]. About 108 medicinal plants used by the natives of the Kaghan Valley, KP were reported [36]. Ethnomedicinal uses of 61 medicinal plant species have been listed from Khanpur Valley, Haripur, Pakistan [23]. All these previous investigations of medicinal plants were from the nearest valleys/area and showed some common plants with common uses, which revealed the expansion of traditional knowledge in the old ages.

During the study, it was documented that most of the plants were herbs, followed by shrubs and trees. The medicinal herbs are more common than other life forms in Pakistan, confirmed in several previous studies. Several major plant parts used by local people were the fresh leaves, flowers, fruits, seeds and whole plants. The most frequent use of these parts especially leaves as herbal remedy is due to the availability of more phytochemicals, crude drugs and other mixtures to cure various diseases. The utilization of these plant parts is more convenient in comparison to other plant parts and recently conducted studies also confirmed that these plant parts are more frequently used by the rural [6, 17, 10, 2]. It was noted in a current study that decoction was the most common mode of application of folk recipes, followed by juice, powder and paste etc, while tea and cooked plants are also used as a remedy to control various diseases. Several other studies have shown parallel results in different areas [23, 10]. It was reported in the current survey that most of the plants were used to cure digestive/gastro-intestinal disorders, followed by respiratory and skin disorders. The currents results are in congruent to previous studies such as in South Waziristan, KP, Pakistan, and in Khanpur Valley, District Haripur, KP, Pakistan, the maximum plants were used to cure digestive, respiratory and skin disorders [17, 23]. In Azad Jammu and Kashmir, maximum plants were used to cure respiratory disorders, followed by gastro-intestinal disorders [10]. [37] studied the ethnobotanical uses of medicinal plants to

cure various respiratory disorders among the inhabitants of Gallies–Abbottabad, Pakistan, nearest area to the present study. The ICF values were also higher for digestive, respiratory and skin disorders in current study, which revealed that prevalence of these disorders attributed to the unhygienic food, living style and contaminated water in the investigated area. The ethnopharmacological data have shown that digestive problems are indicated as first category disorders not only in Pakistan, but in other countries as well [27, 38 - 40] which is strengthen by high ICF values.

During collection of data, it was revealed that most of the knowledge regarding the use of medicinal plants was with the elderly people, especially females as they are mostly using these practices at home to cure themselves and their family members from various diseases and disorders. The females are more interested to gain this traditional knowledge as reported previously by local women in southern Himalayan regions of Pakistan [41]. In contrast, the young people (<20), both male and female are not much aware of this knowledge. This is a dilemma in many parts of Pakistan, where this knowledge is limited to elders of the community. This concluded that both the medicinal plants and their indigenous knowledge are declining due to severe stress and less interest of youth to gain this important knowledge. Traditional knowledge is only restricted to the elder people and was not conveyed to the younger's due to communication gaps, their least interests and changing socio-cultural trends. Similarly land use problems, deforestation, over exploitation and subsequent fires are depleting these herbal resources rapidly [17, 35]. Different projects should be launched at each level for floral diversity conservation and local community development. Non-government organizations along with government bodies should take steps to share this information with the youth by arranging awareness seminars, knowledge sharing meetings, workshops and trainings to gain this knowledge and preserve these important plants for future.

Conclusion

The relationship of plants with people is immemorial from time. Plants not only fulfill our basic needs but also provide opportunities to treat a wide spectrum of ailments. The inhabitants of the Neelan Valley, Abbottabad, Pakistan rely on their native medicinal plants for curing various diseases. The elder people of the area possessed sufficient knowledge about medicinal plants and their uses, inherited them through their forefathers. Unfortunately, it was observed that young generation is not familiar with valuable indigenous knowledge due to modern socio-cultural impacts. Besides, at one hand plant resources are being depleted due to excessive grazing, over-exploitation, and deforestation, and at the other hand floral indigenous knowledge is rapidly declining due to failure of its documentation. It becomes necessary to carry out more studies at each level to conserve plant diversity and document related traditional folk knowledge and practices.

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