



Ethno-pharmacological Evaluation of Plants Resources of District Malakand, Pakistan

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Research

Abstract

Background. The present study was conducted to assess the ethno-pharmacological practices of medicinal plants by the local tribes of District Malakand, Pakistan. The people of the area are mostly poor and rely on local medicinal plants for their basic primary health care needs. During the survey it was perceived that the area is under extreme threat of overgrazing, deforestation and agricultural land expansion and needs urgent and proper ecological management to protect the important medicinal flora for future generations.

Methods. The current Ethno-pharmacological study consists of frequent field visits and interviews with 200 local informers of the study area having different socio-economic and educational backgrounds. The information was collected from the indigenous people through interviews and semi-structured questionnaires. The data collected were analyzed with the help of quantitative indices such as Informant consensus factor (Fic) and Fidelity Level (FL%). The plants collected were identified with the help of flora of Pakistan and online plant databases.

Results. A total of 130 medicinal plants belonging to 112 genera and 55 families were documented during this survey. The results showed that the plants collected during the survey were predominantly herbs (51%) followed by trees (27%), shrubs (19%) and climbers only (03%). The plants collected were mostly from Ruderal habitat (40%), followed by arable (36%), woodland (18%) and wetland (06%). On the basis of habit the plants collected were mostly Perennials (58%), followed by Annuals (39%) and Biennials only (03%). The majority of the plants used in the preparation of crude drugs were whole plant (33%), followed by leaves (25%), fruits (08%), roots (06%), shoots, flowers, barks, seeds (05%), gum and latex (03%) and bulb (02%) respectively.

The highest Fic. values were recorded for cardiovascular and hypertensive diseases (1.0) followed by sore throat and narcotic diseases (0.80). The most important and extensively used species were *Allium sativum* L., *Caralluma tuberculata* N.E. Brown and *Mentha spicata* L. each with 100% FL value. This study showed that the area is gorgeous and rich in medicinal flora. The botanical name, local name, family name, flowering season, part used, and ethno-pharmacological uses of local medicinal plants were documented.

Conclusion. During this survey it was observed that the research area District Malakand, Pakistan is rich in medicinal flora and most of the indigenous people are poor and depend on medicinal plants for their basic primary health care needs. The survey showed that medicinal plants were mostly used by the local people to cure of gastrointestinal, skin, mouth, genital, urinary, cold, cough and joint diseases. The study will provide a baseline for further ethno-botanical, ethno-medicinal, phytochemical and antimicrobial studies.

Keywords: Medicinal plants, Ethno-pharmacological uses, Gastrointestinal diseases, Malakand, Pakistan.

Background

The use of plants as a source of medicines is as old as human civilization. Medicinal plants play an imperative role in the primary health care system of local people as these plants are the chief source of medication for the indigenous people. These plants possess natural chemical compounds which are used to cure various ailments. These natural chemical compounds have therapeutic properties (Ahmad *et al.* 2009, Hussain *et al.* 2018, Zaman *et al.* 2013). Out of 422,000 flowering plants reported from all over the world, approximately 50,000 plants are used for medicinal purposes. About 60% of the world population and about 80% of the population dwelling in developing countries rely on indigenous customary treatments (Hamilton 2004). More than 4.5 billion people in the developing world depend on local medicinal plants for their primary health care needs. Due to high cost of synthetic drugs and its side effects the majority of the rural people in villages used medicinal plants for the treatment of their ailments (Bhat *et al.* 2013). Medicinal plants contain a large diversity of bioactive compounds (Akkol *et al.* 2021, Hayat *et al.* 2021) that might help in the treatment of a wide variety of diseases in humans and animals (Ahmad *et al.* 2020) and the development of herbal drugs (Murad *et al.* 2012). The related traditional knowledge has been transferred mostly orally from generation to generations (Zelege 2016), and is still important for mental, physical and social benefits (Jan *et al.* 2011). According to the World Health Organization, about 4 billion people in emerging countries trust and consistently use the benefits of herbal remedies (Khan *et al.* 2021).

About 84% of people in Pakistan were dependent on traditional medicinal plants in early 1950's but now this practice is restricted to rural areas only (Ibrar *et al.* 2007). Medicinal plants are receiving a great importance and popularity in the modern world today. These traditional herbal medicines are considered to be safer and have less side effects as compared to synthetic drugs. The herbal medicines are also rich in vitamins and minerals apart from their medicinal constituents (Hussain *et al.* 2005). The significance of plants as a diet and folk medicines against many illnesses like asthma, malaria, jaundice, epilepsy, etc. has been well-known through several ethno-pharmacological studies all over the world (Aberoumand 2013, Mir 2014). The use of such plants not only fulfill the nutrients intake level but has also certain fitness welfares counter to long-lasting illnesses such as stroke, cardiac ailment and certain categories of cancer (Patil *et al.* 2012).

These medicinal plants possess many therapeutic properties which are used against various diseases and have the latent to safeguard body from inflammatory, cardiovascular, cancer, and diabetic ailments (Abbet *et al.* 2014, Hussain *et al.* 2009). Plants are linked with cure or defense of health situations such as malnourishment, cardiac ailment, tumor and diabetes (Neudeck *et al.* 2012). These plants also have pharmacological significance and are used as appetizer, purgative, carminative, astringent, diuretic, and blood purifier. These also possess stout latent to defend human body from cancers, high cholesterol level, and Heart diseases (Alvarez, 2004, Kruger *et al.* 1998).

At present the use and importance of medicinal plants is increasing every day. Useful chemical ingredients which are medicinally important are screened and extracted from these plants and are then used in crude and synthetic drugs. Ethno-pharmacological and therapeutic research work has been highly appreciated and valued now-a-days in the present health care system all over the world (Black 1996).

Materials and Methods

Study area

The present ethnobotanical study was carried out in District Malakand, Pakistan Figure 1. (Murad *et al.* 2012). It is located at 34° 35' North latitude and 71° 57' East longitude. Malakand is a very fertile valley with mostly sandy-loamy soil surrounded by hills. The climate of district Malakand is pleasant in summer while a bit cooler in winters. The total area of district Malakand is 952 sq. km (368 sq. miles). The main tribes and races which live here are Yousafzai, Baizai, Ranizai, Utmankhel, Piran-Syeds and Gujars. Pashto is the only speaking language of the peoples of this area. The local people are mostly farmers and poor and depend on agricultural products to fulfill their basic needs (Office of the Deputy commissioner Malakand 2015).

The research work was done during different seasons of the year 2019. The area was visited on weekly basis in order to collect the ethno-pharmacological data. The data was collected from the local people, Pansaries and Hakeems through interviews and a semi-structured questionnaire. The medicinal flora in the area was studied with respect to their habit, habitat, growth form, frequency, part used, flowering season, plant status, methods of collection, methods of crude drug preparation, mode of administration and ethno-pharmacological uses.

The plant specimens collected during the study were properly pressed, dried, preserved and fixed on herbarium sheets. The collected plants were then identified with the help of Flora of Pakistan (Ali & Qaiser 1991-2015).

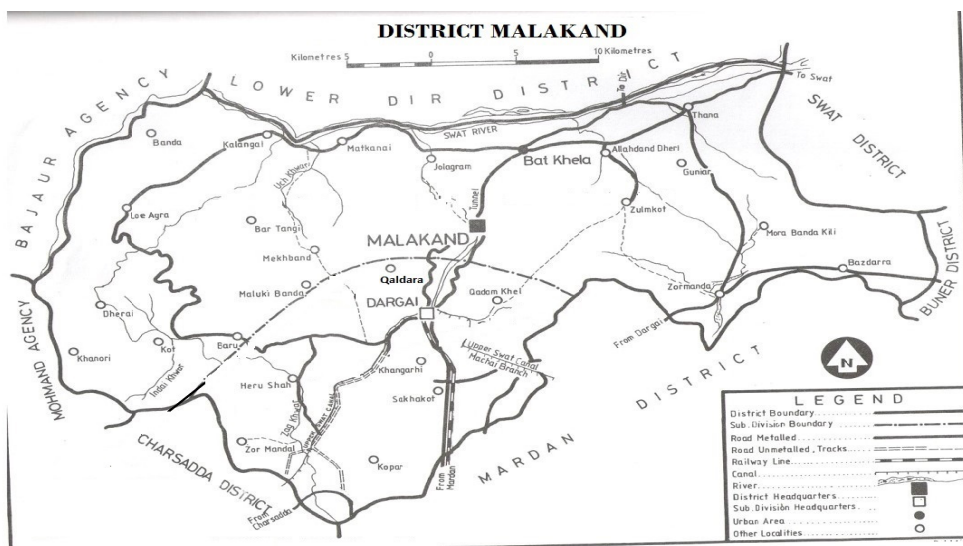


Figure 1. Map of the study area District Malakand, Pakistan

Informant Consensus Factor (Fic)

Informant consensus factor (Fic) was calculated after the reported traditional medications and corresponding diseases were grouped in to 22 categories. Fic values were obtained by calculating number of use citations in each disease category (Nur), minus the number of times a species were used (Nt), divided by the number of used citations in each category minus one. Fic value was calculated by means of the following formula:

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

Fic values lie between 0 and 1. Those plants having high Fic values are considered to be more active pharmacologically than those having low Fic values (Heinrich *et al.* 1998).

Fidelity Level (FL)

Fidelity level is used for knowing the key informant's most preferred species used for curing certain disease. Those medicinal plants which were frequently used by the local rural communities of the area for the treatment of diseases have high FL values than those that are used less frequently. Fidelity level showed the percentage of informants claiming the use of a certain plant species for the same major purpose. For calculating FL values all the diseases were grouped into 22 categories. FL is calculated by using this formula:

$$FL = \frac{I_p}{I_u} \times 100$$

Where I_p is the number of respondents who reported the use of medicinal plants for a specific disease and I_u is the total number of respondents who mentioned the same plant for any other disease. Those medicinal plants which were used in some recurring for the same disease are considered to be more active biologically (Jadid *et al.* 2020, Srithi *et al.* 2009).

Results

Informant's demographics:

In the current study a total of 200 participants including local people (65%) and Traditional health practitioner (35%) were interviewed in the fields, homes, shops and other social gathering places. Among 200 participants 120 (60 %) participants were men and 80 (40%) were women, respectively. The participants between age groups 60–80 years held more knowledge about medicinal plants and its uses, followed by the age group 40–60 years and 20–40 years old respectively. Majority of the participants interviewed were illiterate (58%), followed by Primary level (26%), Matric level (10%) and Graduate level only (06%) respectively.

Ethno-pharmacological Data Analysis:

The present ethno-botanical survey of 130 medicinal plants revealed that medicinal plants collected were mostly herbs (51%), followed by trees (27%), shrubs (19%) and climbers (03 %) respectively (Fig. 2a). On the basis of habitat plants collected were mostly from the Ruderal habitat (40%) followed by Arable (36%), Woodland (18%) and Wetland (06 %) respectively. (Fig. 2b). The medicinal plants collected were mostly Perennial plants (58%) followed by Annuals (39%) and Biennials (03%). (Fig. 3a). This means that perennial plants are mostly available throughout the year for local people to prepare herbal remedies. Majority of the plants collected during the survey were common (64%) and less were Scattered (36%) on the basis of their frequency (Fig.3b). This shows that majority of the plants were easily collected from the study site. The part used in the preparation of crude drugs were mostly whole plant (33%), followed by leaves (25%), fruits (08%), roots (06%), shoots, flowers, bark and seeds (05%) each, gum and latex (03%) each, and bulb only (02%) (Fig. 4a). Most of the medicinal plants collected during this study were in spring season (59%), followed by summer season (32%), autumn season (05%) and winter season (04%) respectively (Fig. 4b). Most of the natural phytochemical ingredients were found to be present in naturally growing wild plants as compared to cultivated plants. The method used for the preparation of crude drugs by the local people of Malakand were mostly decoction (47%), followed by infusion (31%), concoction (10%), maceration of seeds (06%) and powder formation (06%) respectively (Fig. 5a). The mode of administration of crude drugs prepared by the local people from herbal remedies were mostly through Oral route (75%) followed by dermal application (25%) (Fig. 5b). The maximum Informant consensus factor (Fic) value were documented for cardiac and hypertensive ailments (Fic= 1.0), followed by Ophthalmic or eye diseases (Fic= 0.83), sore throat and narcotic diseases (Fic= 0.80) respectively as shown in (Table 2). The most significant and widely castoff species were *Allium sativum* L., *Caralluma tuberculata* N. E. Brown and *Mentha spicata* L. each with 100% Fidelity level (FL) value as shown in (Table 3).

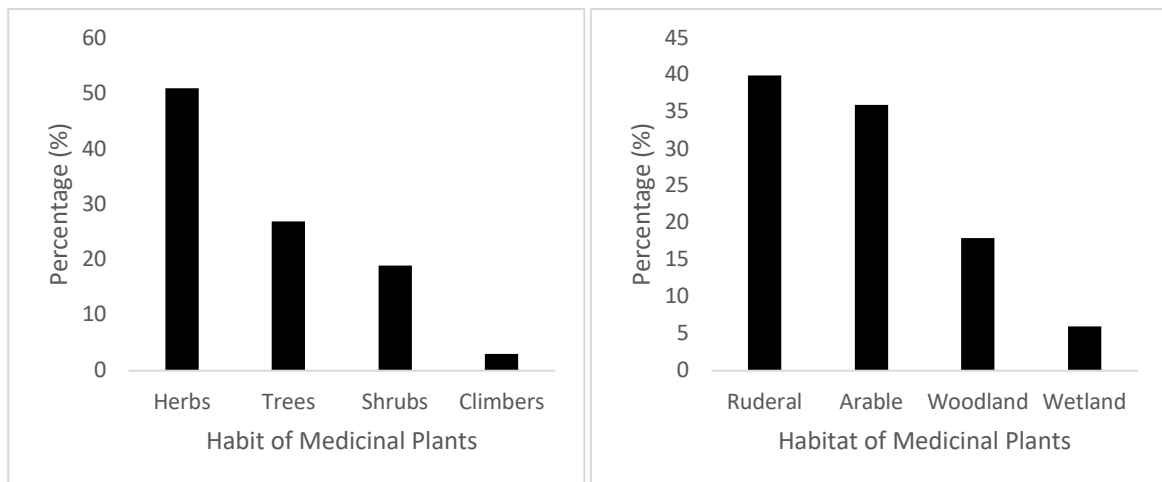


Figure 2. (a) Habit of Medicinal Plants (b) Habitat of Medicinal Plants

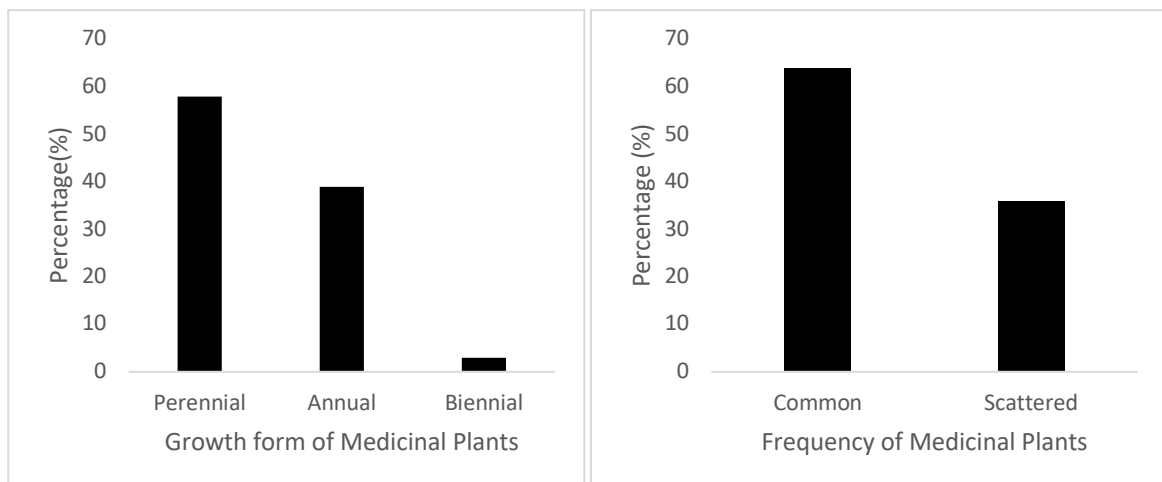


Figure 3. (a) Growth form Medicinal Plants (b) Frequency of Medicinal Plants

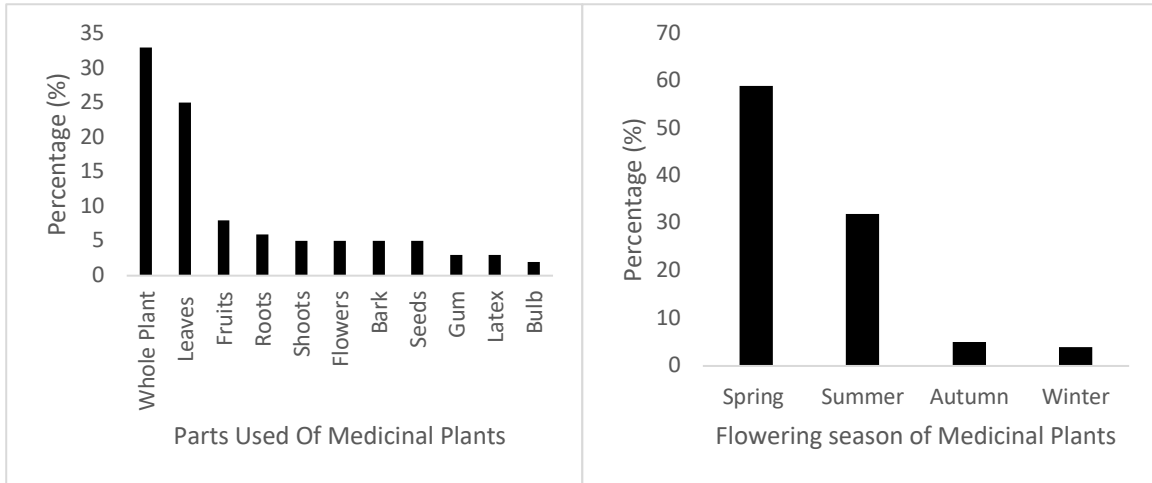


Figure 4. (a) Part used Medicinal Plants (b) Frequency of Medicinal Plants

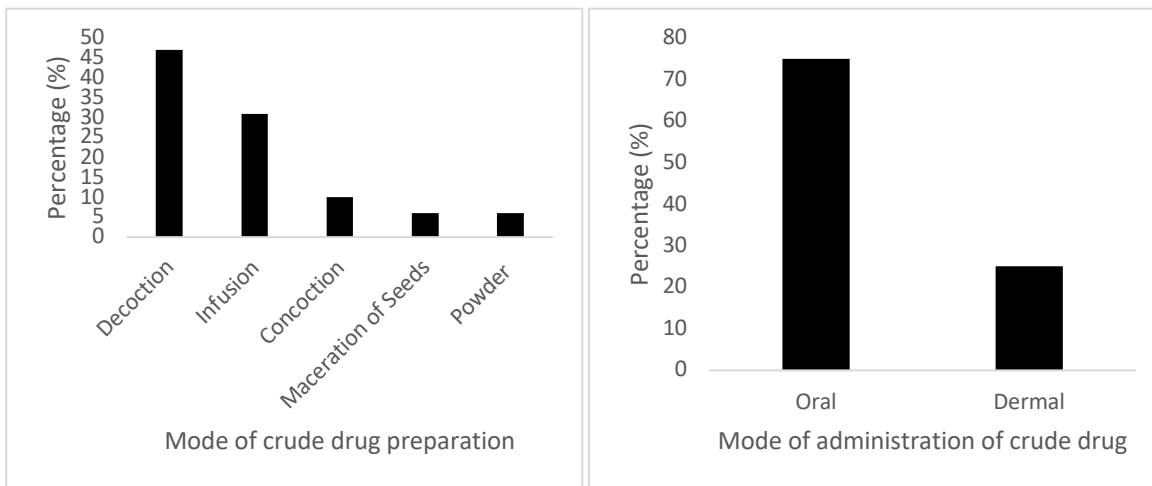


Figure 5. (a) Mode of crude drug preparation (b) Mode of administration of crude drugs

Table 1. Medicinal Plants and their Ethno-Pharmacological uses

Family name	Botanical name	Local name	Habit	Part Used	Ethno-Pharmacological Uses
Acanthaceae	<i>Justicia adhatoda</i> L.	Baikar	Shrub	Leaves and flowers	Poultice is applied to swellings.
Adiantaceae	<i>Adiantum incisum</i> Forssk.	Pato sanra	Herb	Whole plant	Decoction is used against cough and fever.
Amaranthaceae	<i>Achyranthus aspera</i> L.	Naray Ghishky	Herb	Whole plant	Decoction is used to treat toothache and asthma.
Anacardiaceae	<i>Mangifera indica</i> L.	Aam	Tree	Fruit	Fruit is used as laxative and Tonic.
Apiaceae	<i>Coriandrum sativum</i> L.	Dhanya	Herb	Leaves and seeds	Leaves and seeds are used as Carminative.
Apiaceae	<i>Carum carvi</i> L.	Dhanya botay	Herb	Leaves and seeds	Leaves and seeds are used as a flavoring agent.
Apocyanaceae	<i>Rhazya stricta</i> Decne.	Ghandichar	Herb	Whole plant	Leaves are applied as poultice to joint infections.
Apocyanaceae	<i>Nerium oleander</i> L.	Ghanderi	Shrub	Leaves and flowers	Juice extracted is used to treat toothache and swellings.
Araceae	<i>Colocassia esculenta</i> (L.)	Kachalo	Herb	Leaves and rhizome	Corm is used as laxative and stomachic.
Asclepiadaceae	<i>Calotropis procera</i> W.T. Aiton	Spalmay	Shrub	Whole plant	Infusion is used to cure skin diseases.
Asclepiadaceae	<i>Caralluma tuberculata</i> N.E. Br	Pamankai	Herb	Succulent stem	Succulent stem is used to cure to diabetes and hypertension.
Asclepiadaceae	<i>Periploca aphylla</i> Decne.	Barrara	Shrub	Stem and fruits	Decoction is applied to skin diseases and swellings.
Asteraceae	<i>Xanthium strumarium</i> L.	Ghat ghishkay	Herb	Leaves	Infusion from leaves is used as Sedative and diaphoretic.
Asteraceae	<i>Helianthus annuus</i> L.	Nwarparast	Herb	Seeds	Oil from seeds is used as laxative and for heart diseases.
Asteraceae	<i>Tagetes erectus</i> L.	Dambar gulai	Herb	Leaves and flowers	Infusion is used to regulate menses.
Asteraceae	<i>Taraxicum officinale</i> L.	Ziar gulai	Herb	Whole plant	Juice is used as diuretic.
Asteraceae	<i>Silybum marianum</i> (L.) Gaertn.	Ghata ghana	Herb	Leaves and seeds	Leaves and seeds are used as diuretic.
Asteraceae	<i>Parthenium hysterophorus</i> L.	Sheen botay	Herb	Whole plant	Infusion is used is Anti-diabetic.
Asteraceae	<i>Lactuca serriola</i> L.	Shoda pai	Herb	Whole plant	Juice extracted is used to treat Rheumatism and kidney problems.
Asteraceae	<i>Saussurea heteromalla</i> (D. Don) Raizada & Saxena	Haji banry	Herb	Seeds	Seeds are used as anti-pyretic and carminative.
Asteraceae	<i>Centaurea iberica</i> Sennen & Elias	Speena ghana	Herb	Whole plant	Infusion from whole plant is used to remove kidney stones.
Asteraceae	<i>Centaurea Americana</i> Spreng.	Ghana	Herb	Whole plant	Infusion from whole plant is used to remove kidney stones.
Asteraceae	<i>Carthamus oxycantha</i> L.	Kareeza	Herb	Seeds	Seeds are used to treat male infertility and jaundice.
Berberidaceae	<i>Berberis lyceum</i> Royle.	Ziar largay	Shrub	Root, bark, rhizome	Powder of root, bark and rhizome is used as anti-inflammatory and carminative.
Brassicaceae	<i>Brassica campestris</i> L.	Sharsham	Herb	Seeds and leaves	Oil extracted from seeds are used as emollient and for massage.
Brassicaceae	<i>Brassica nigra</i> (L.) W.D.J.Koch	Toor sharsham	Herb	Leaves and seeds	Oil extracted from seeds are used as emollient and for massage.
Brassicaceae	<i>Nasturtium officinale</i> W.T. Aiton	Tarmeera	Herb	Young shoots	Infusion is used as stomachic and purgative.

Brassicaceae	<i>Capsella bursa-pastoris</i> (L.) Medik.	Bambaisa	Herb	Leaves and seeds	Leaves and seeds are used as stimulant and diuretic.
Buxaceae	<i>Buxus wallichiana</i> Baill.	Shamshad	Shrub	Whole plant	Juice is used as Purgative and diaphoretic.
Cactaceae	<i>Opuntia dillenii</i> L.	Zuqam	Shrub	Whole plant	Infusion is used as expectorant and demulcent.
Canabaceae	<i>Canabis sativa</i> L.	Bhang	Shrub	Leaves and flowers	Leaves and flowers are used as narcotic and anti-anxiety.
Caryophyllaceae	<i>Silene conoidea</i> L.	Mangotay	Herb	Whole plant	Infusion from the plant is used as Ophthalmic.
Caryophyllaceae	<i>Silene vulgaris</i> (Moench) Garcke	Mangotay	Herb	Whole plant	Infusion from the plant is used as Ophthalmic.
Celasteraceae	<i>Gymnospora royleana</i> M.A. Lawson	Soor azghay	Shrub	Leaves	Decoction from the plant is used against toothache.
Chenopodiaceae	<i>Chenopodium album</i> L.	Sarmay	Herb	Whole plant	Juice extracted from the whole plant is used as anti-inflammatory.
Chenopodiaceae	<i>Chenopodium murale</i> L.	Sarmay	Herb	Whole plant	Juice extracted from the whole plant is used to treat urinary problems.
Chenopodiaceae	<i>Spinacea oleracea</i> L.	Palak	Herb	Leaves and seeds	Leaves are used as laxative and seeds are used to treat jaundice.
Convolvulaceae	<i>Convolvulus arvensis</i> L.	Pirwati	Climber	Whole plant	Juice extracted are used as diuretic.
Cupressaceae	<i>Thuja orientalis</i> L.	Sarwa	Small tree	Leaves and seeds	Leaves and seeds are used to cure skin infections.
Cuscutaceae	<i>Cuscuta reflexa</i> Roxb.	Maraz botay	Climber	Whole plant	Infusion is applied to skin against Scabies and eczema.
Euphorbiaceae	<i>Euphorbia helioscopia</i> L.	Mandanro	Herb	Leaves	Milky juice is used to cure skin diseases.
Euphorbiaceae	<i>Mallotus philippinensis</i> (Lam.) Müll. Arg.	Kambela	Small tree	Leaves and bark	The decoction from the leaves and bark is used to cure wounds.
Euphorbiaceae	<i>Ricinus communis</i> L.	Randa	Shrub	Seeds	Seeds are used to treat constipation and as purgative.
Euphorbiaceae	<i>Euphorbia royleana</i> Boiss.	Zahro botay	Shrub	Latex	Latex is extracted and is used as Analgesic and anti-inflammatory.
Fabaceae	<i>Acacia modesta</i> Wall.	Palusa	Tree	Gums	Gum is mixed with flour and Desi Ghee and are used as sexual tonic and for backache.
Fabaceae	<i>Acacia nilotica</i> (L.) Willd. ex Delile	Kikar	Tree	Gums and leaves	Gum is mixed with flour and Desi Ghee and are used as sexual tonic and for backache.
Fabaceae	<i>Albizia lebbek</i> (L.) Benth	Srekh	Tree	Bark, seeds and pods	Powder made from bark, seeds and pods is used to treat skin diseases.
Fabaceae	<i>Butea monosperma</i> (Lam.) Taub.	Palai	Tree	Leaves and flowers	Decoction from leaves are used against Diarrhea. Infusion from flowers are used to treat dysentery.
Fabaceae	<i>Cassia fistula</i> L.	Landice	Tree	Leaves and fruits	Fruits are used anti-spasmodic and laxative.
Fabaceae	<i>Cassia occidentalis</i> L.	Beenak botay	Herb	Leaves and seeds	Leaves and seeds are used to cure menstrual problems.
Fabaceae	<i>Dalbergia sisso</i> Roxb. ex DC	Shawa	Tree	Leaves and bark	Leaves and bark decoction are used to cure skin diseases.
Fabaceae	<i>Lathyrus aphaca</i> L.	Pirwatay	Prostrate herb	Whole plant	Juice is used as narcotic and sedative.

Fabaceae	<i>Medicago denticulata</i> L.	Pishtaray	Herb	Leaves and shoots	Infusion is used to treat bronchitis.
Fabaceae	<i>Melilotus parviflora</i> L.	Leewanay	Herb	Whole plant	Infusion is used to treat genital diseases.
Fabaceae	<i>Prosopis glandulosa</i> Torr	Wilayati kikar	Tree	Leaves, flowers and gums.	Concoction of gum with flour and ghee is used as sexual tonic.
Fabaceae	<i>Trifolium repens</i> L.	Shawatal	Herb	Whole plant	Juice extracted are used to treat cough and fever.
Fumariaceae	<i>Fumaria indica</i> Pugsley.	Papra	Herb	Whole plant	Infusion from the plant is used as blood purifier and sedative.
Juglandaceae	<i>Juglans regia</i> L.	Ghwaz	Tree	Bark, leaves and fruits	Bark and leaves are used as anthelmintic and fruits are used as tonic.
Lamiaceae	<i>Otostegia limbata</i> (Benth.) Boiss.	Spin azghay	Shrub	Whole plant	Decoction is used to treat mouth diseases and wound healing.
Lamiaceae	<i>Mentha spicata</i> L.	Podina	Herb	Whole plant	Leaves and young shoots are used as flavoring agent and anti-spasmodic.
Lamiaceae	<i>Mentha longifolia</i> (L.) Huds.	Valenay	Herb	Whole plant	Leaves and young shoots are used as flavoring agent and anti-spasmodic.
Lamiaceae	<i>Salvia moorcroftiana</i> L.	Khar dug	Herb	Whole plant	Juice extracted is used for wound healing and boils.
Lamiaceae	<i>Ocimum basilicum</i> L.	Kashmalai	Herb	Whole plant	Decoction from the whole plant is used as anti-spasmodic and seeds as carminative.
Lamiaceae	<i>Ajuga bracteosa</i> Wall.ex Benth	Gothi	Herb	Whole plant	Infusion is used as anti-fever and for sore throat.
Lamiaceae	<i>Micromeria biflora</i> Benth.	Shamakai	Herb	Whole plant	Juice extracted is used as toothache and for wounds healing.
Lamiaceae	<i>Colebrookia oppositifolia</i> Sm.	Bazeday	Shrub	Leaves and roots	Decoction from leaves and roots is used to treat wounds healing and skin diseases.
Liliaceae	<i>Allium cepa</i> L.	Piaz	Herb	Leaves and bulbs	Leaves and bulbs are used as stimulant, expectorant and anti-septic.
Liliaceae	<i>Allium sativum</i> L.	Oouga	Herb	Leaves and bulbs	Leaves and bulbs are used as stimulant, expectorant and anti-septic.
Liliaceae	<i>Asphodelus tenuifolius</i> L.	Piazakai	Herb	Seeds	Seeds are used as anti-inflammatory and as diuretic.
Liliaceae	<i>Asparagus plumosus</i> Cav.	Tendonai	Herb	Young shoots	Young shoots are used to cure Dysentery and diarrhea.
Malvaceae	<i>Malvastrum tricuspidatum</i> A. Gray	Skha botay	Herb	Whole plant	Juice is applied to cure wound healing.
Malvaceae	<i>Abutilon indicum</i> (L.) Sweet.	Ziar gulai	Shrub	Leaves and flowers	Leaves and flowers infusion is used to cure asthma and urinary tract problems.
Malvaceae	<i>Abelmoschus esculentus</i> (L.) Moench	Bhindai	Herb	Fruit	Fruit is used as diuretic and demulcent.

Meliaceae	<i>Melia azedarach</i> L.	Shanday	Tree	Leaves and fruits	Infusion from leaves and fruits are used as Anti-septic and to treat skin diseases.
Moraceae	<i>Ficus carica</i> L.	Inzar	Tree	Fruits	Fruits are used to cure dysentery and urinary bladder problems.
Moraceae	<i>Ficus glomerata</i> L.	Oormal	Tree	Leaves, bark and fruits	Infusion from leaves and bark is used treat mouth infections, nose bleeding and leucorrhea.
Moraceae	<i>Ficus religiosa</i> L.	Peepal	Tree	Leaves, bark and fruits	Infusion from leaves and bark is used to treat infertility. Fruits are used for sexual weakness.
Moraceae	<i>Ficus benghalensis</i> L.	Barh	Tree	Leaves, roots and fruits	Leaves and roots decoction is used against vaginal complaints. Fruits are used to cure diabetes.
Moraceae	<i>Morus alba</i> L.	Toot	Tree	Fruits	Fruits are used as Purgative and for nose bleeding.
Moraceae	<i>Broussonetia papyrifera</i> (L.) Vent.	Gul toot	Tree	Fruits	Fruits are Diuretic and laxative.
Moraceae	<i>Psidium guyava</i> L.	Amrood	Tree	Fruits	Fruits are stomachic and digestive.
Moraceae	<i>Eucalyptus globulus</i> Labill.	Lachi	Tree	Leaves, bark and oil	Infusion from the leaves and bark is anti-septic and are used to cure skin diseases and burns.
Nyctaginaceae	<i>Mirabilis jalapa</i> L.	Gul-i-Nazak	Herb	Whole plant	Poultice of leaves is applied to swellings and wounds.
Oleaceae	<i>Olea ferruginea</i> Wall.ex Aitch	Khoona	Tree	Leaves and fruits	Fruits and oil is used to treat rheumatism and toothache.
Oleaceae	<i>Jasminum officinale</i> L.	Rambel chambel	Climber	Leaves and flowers	Infusion from leaves are used to treat impotency and menstrual problems.
Oxalidaceae	<i>Oxalis corniculata</i> L.	Threwakay	Herb	Whole plant	Plant juice is used as stomachic and anti-fever.
Pinaceae	<i>Pinus roxburghii</i> Sarg.	Nakhtar	Tree	Resin and seeds	Resins are used to treat gonorrhoea and snake bite.
Plantaginaceae	<i>Plantago lanceolata</i> L.	Jabai	Herb	Leaves and seeds	Leaves and seeds are used to cure Dysentery.
Plantanaceae	<i>Platanus orientalis</i> L.	Chinar	Tree	Bark	Decoction from bark is used to cure Diarrhea and dysentery.
Poaceae	<i>Cyanodon dactylon</i> (L.) Pers	Kabal	Herb	Whole plant	The decoction made is used to treat Jaundice and urinary tract diseases.
Poaceae	<i>Avena sativa</i> L.	Jamdar	Herb	Straw	Straw extraction is used as anti-spasmodic.
Poaceae	<i>Dichanthium annulatum</i> (Forssk) Stapf	Wakha	Herb	Whole plant	Decoction made is used to treat dysentery and diarrhea.
Poaceae	<i>Hordeum vulgare</i> L.	Warbashi	Herb	Seeds	The seeds used are stomachic, digestive and expectorant.
Poaceae	<i>Lolium multiflorum</i> Lam.	Mastak	Herb	Whole plant	The extraction made is used as aphrodisiac and anodyne.
Poaceae	<i>Polypogon monspeliensis</i> L.	Gaya	Herb	Whole plant	The decoction made is used to cure heart palpitations.
Polygonaceae	<i>Polygonum barbatum</i> L.	Polpulak	Herb	Whole plant	The infusion made is used as astringent and cooling agent.
Polygonaceae	<i>Rumex dentatus</i> L.	Shalkhay	Herb	Whole plant	Juice is diuretic, stomachic and purgative.
Portulacaceae	<i>Portulaca oleracea</i> L.	Warkhary	Herb	Leaves and shoots	Leaves and shoots infusion is used to cure Burns, cough and skin diseases.

Pteridaceae	<i>Dryopteris jaxtaposta</i> L.	Kwanjay	Herb	Fronds	Fronds decoction is digestive.
Punicaceae	<i>Punica granatum</i> L.	Anangone	Shrub	Bark and fruits	Decoction from bark and Juice from fruits are used to cure arthritis, bleeding and dysentery.
Ranunculaceae	<i>Ranunculus arvensis</i> L.	Ziar gulai	Herb	Whole plant	Infusion is used to cure asthma and fever.
Ranunculaceae	<i>Ranunculus muricatus</i> L.	Ziar gulai	Herb	Whole plant	Infusion is used to cure asthma and fever.
Rhamnaceae	<i>Sageretia thea</i> (Osbeck) M.C. Johnst	Mamanra	Shrub	Leaves and fruits	Leaves and fruits are used as emollient and to cure jaundice.
Rhamnaceae	<i>Ziziphus nummularia</i> (Burm.f.)Wight & Arn.	Karkanda	Small tree	Fruits	Fruits are anti-spasmodic, anti-microbial and diuretic.
Rhamnaceae	<i>Ziziphus jujuba</i> Mill.	Beera	Tree	Fruits	Fruits are used as diuretic, emollient, expectorant and tonic.
Rosaceae	<i>Rosa moschata</i> Benth.	Gulab	Shrub	Flower	Flowers juice are used as Ophthalmic and to cure skin burning.
Rosaceae	<i>Prunus domestica</i> (L.)Thunb.	Alucha	Tree	Fruits	Fruits are laxative, stomachic and digestive.
Rosaceae	<i>Prunus armeniaca</i> (L.) Blanco.	Khubani	Tree	Fruits and seeds	Fruits and seeds are laxative, emollient and expectorant.
Rosaceae	<i>Prunus persica</i> (L.) Batsch	Shaltalo	Tree	Fruits	Fruits are laxative and diuretic.
Rosaceae	<i>Cotoneaster microphyllus</i> Wall.	Kharawa	Shrub	Fruits	Fruits are astringent and to cure cough and fever.
Rosaceae	<i>Eriobotrya japonica</i> (Thunb.) Lindl	Lokat	Tree	Fruits	Fruits are diuretic and expectorant.
Rutaceae	<i>Citrus medica</i> (L.) Osbeck	Neembo	Shrub	Fruits and leaves	Fruits and leaves astringent.
Rutaceae	<i>Citrus aurantium</i> L.	Naranj	Tree	Fruits and leaves	Fruits and leaves are Bitter, anti-fertile and anti-spasmodic.
Rutaceae	<i>Citru sinensis</i> (L.) Osbeck	Malta	Tree	Fruits and leaves	Fruits are used as appetizer and blood purifier.
Salicaceae	<i>Populus ciliate</i> Wall. ex Royle	Spairdar	Tree	Bark and leaves	Bark and leaves are used as blood purifier and to treat menstrual cramps.
Salicaceae	<i>Salix babylonica</i> L.	Wala	Tree	Bark and leaves	Plant parts are used as astringent and anti-rheumatic and to cure skin diseases.
Sapindaceae	<i>Dodonaea viscosa</i> Jacq.	Ghwaraskay	Shrub	Leaves	Leaves poultice is used to cure wounds and joint pains.
Sapindaceae	<i>Litchi chinensis</i> Sonn.	Leechi	Tree	Bark and fruits	Bark and fruits are used to treat sore throats and intestinal problems.
Sapotaceae	<i>Monothecha buxifolia</i> (Falc.) A. DC.	Gurgura	Tree	Fruits	Fruits are used as Tonic, laxative and digestive.
Scrophulariaceae	<i>Verbascum thapsus</i> L.	Khar ghwag	Herb	Leaves and flowers	Infusion from leaves and flowers are used to cure asthma, boils and as anti-inflammatory.
Simaroubaceae	<i>Ailanthus altissima</i> (Mill.) Swingle	Backyana	Tree	Leaves and bark	Leaves and bark is used as astringent, anti-spasmodic and vermifuge.
Solanaceae	<i>Solanum nigrum</i> L.	Kachmacho	Herb	Leaves and fruits	Leaves and fruits are used as diuretic and to cure diarrhea.
Solanaceae	<i>Solanum surratense</i> Burm.f .	Maraghonai	Herb	Fruits	Fruits are used to cure asthma and cough.
Solanaceae	<i>Capsicum annum</i> L.	Marchakay	Herb	Fruits	Fruits and seeds are used as appetizer and irritant.

Solanaceae	<i>Datura innoxia</i> L.	Batora	Shrub	Leaves, flowers and seeds	Plant parts are used as anodyne and narcotic.
Solanaceae	<i>Withania somnifera</i> L.	Kotilal	Shrub	Whole plant	The juice is used as aphrodisiac, narcotic and as sexual tonic.
Thymelaceae	<i>Thymelea passerine</i> (L.) Coss. & Germ	Shamakai	Herb	Whole plant	Decoction made is used as diuretic and toothache.
Tillicaceae	<i>Grewia optiva</i> (Buch-Ham). Ex Roxb.)	Pastawoonay	Shrub	Bark, leaves and fruits	Extraction is used as aphrodisiac and anti-fever.
Verbenaceae	<i>Vitex negundo</i> L.	Vemandai	Shrub	Leaves, roots and seeds	Infusion is used as astringent and vermifuge.
Vitaceae	<i>Vitis vinifera</i> L.	Kwar	Climber	Fruits	Fruits are used as diuretic and laxative.

Table 2. FIC values of traditional medicinal plants for treating human ailments in District Malakand.

Disease categories	Nur	Nt	Fic
Gastrointestinal	77	50	0.64
Skin diseases	60	20	0.67
Diuretic	44	17	0.62
Cold, cough, influenza	49	21	0.58
Expectorant	35	19	0.47
Rheumatism	51	27	0.48
Genital diseases	37	18	0.52
Astringent	34	20	0.42
Tonic	55	31	0.44
Asthma	30	19	0.38
Toothache	25	14	0.45
Antiseptic	20	09	0.57
Analgesic	33	18	0.46
Anti-diabetic	17	10	0.43
Aromatic	21	13	0.40
Mouth diseases	14	08	0.46
Sore throat	16	04	0.80
Blood purification	09	05	0.50
Narcotic	06	02	0.80
Ophthalmic	07	02	0.83
Hypertensive	05	01	1.0
Cardiovascular	03	01	1.0

Table 3. Fidelity level value of important medicinal plants used against a given disease.

Medicinal plant	Diseases	lp	lu	FL Value%
<i>Mentha longifolia</i>	Gastrointestinal	26	30	86.66
<i>Periploca aphylla</i>	Skin diseases	17	20	85.00
<i>Rumex dentatus</i>	Diuretic	15	19	78.94
<i>Morus alba</i>	Cold, cough	19	24	79.16
<i>Calotropis procera</i>	Expectorant	10	13	76.92
<i>Justicia adhatoda</i>	Rheumatism	15	19	78.94
<i>Meliolotus parviflora</i>	Genital diseases	09	10	90.00
<i>Citrus medica</i>	Astringent	22	25	88.00
<i>Acacia modesta</i>	Tonic	17	21	80.95
<i>Solanum surratense</i>	Asthma	13	15	86.66
<i>Olea ferruginea</i>	Toothache	09	10	90.00
<i>Melia azedarach</i>	Anti-septic	10	15	66.66
<i>Ricinus communis</i>	Analgesic	20	22	90.90
<i>Caralluma tuberculata</i>	Diabetic	11	11	100.00
<i>Mentha spicata</i>	Aromatic	20	20	100.00
<i>Ajuga bracteosa</i>	Oral diseases	07	09	77.77
<i>Otostegia limbata</i>	Sore throat	15	17	88.23
<i>Fumaria indica</i>	Blood purification	10	12	83.33
<i>Datura innoxia</i>	Narcotic	05	10	50.00
<i>Silene conoidea</i>	Ophthalmic	09	10	90.00
<i>Allium sativum</i>	Hypertensive	20	20	100.00
<i>Helianthus annuus</i>	Cardiovascular	15	20	80.00

Discussion

About 80% of the global population are thought to be directly or indirectly dependent on traditional herbal or plant-based medicines to fulfill their primary health care needs (Ahmad, 2005). In developing and underdeveloped countries like Pakistan it is believed that 84% individuals still depend on folk herbal medicines to cure their ailments (Hocking 1958). In the current ethno-pharmacological study 130 medicinal plants were investigated for their ethno-

pharmacological practices in the research area. It was perceived during the investigation that a single plant species were used by the indigenous people for the cure of more than one ailments. Similar Ethno-pharmacological studies have been conducted by other scientists like (Barkatullah *et al.* 2009, Hussain *et al.* 2005, Ibrar *et al.* 2007, Jan *et al.* 2008, Murad *et al.* 2011, Qasim *et al.* 2010, Qureshi *et al.* 2008) whose results are analogous and parallel to the present study.

The study show that the area have abundant important medicinal plants and the native people and herbalists of the area are consuming these important plants to treat different types of ailments. Information regarding the use of these plants for the listed diseases were also described by other researchers in the study area such as (Barkatullah *et al.* 2009, Zabihullah *et al.* 2006). During the survey it was keenly observed that medicinal plants in the area are on the decline with each passing day due to over exploitation by the local people, overgrazing, degradation of habitat and ignorance of the local people about the importance and use of these medicinal plants. As a result of this negligence and misuses the beneficial medicinal plants of the region has been lessened to a great extent. These results are parallel and similar to the results of other workers such as (Shinwari & Khan 2000).

These plants were mostly used to cure ailments such as respiratory, throat, mouth, joints, Gastro-intestinal, skin and genital complaints. Such uses of medicinal plants for the cure of such illnesses are similar and in line to the results of other researchers such as (Ahmad & Hussain 2008, Qureshi *et al.* 2009, Tariq *et al.* 2004).

The presence of these important medicinal plants has also been reported from other parts of Pakistan with almost similar ethno-pharmacological uses. These medicinal plants will provide a baseline for future studies and will help in the discoveries of novel drugs.

Conclusion and Recommendations:

The assessment of the present Ethno-pharmacological survey showed that, the research area has plenty of medicinal flora which is used by the indigenous people extensively to cure a wide range of human ailments. The major chunk of the inhabitants of the research area farmers and poor mostly rely on native medicinal plants to fulfill their primary health care needs. It is also obvious from the conducted interviews that the indigenous knowledge about medicinal plants and their usage is only limited to elder and old aged persons and local herbalists as the new generation is not interested in old traditional medicines due to availability of modern synthetic drugs. Therefore, it is recommended that there is a dire need to take positive and immediate steps for the careful conservation of medicinal plant resources of the area before this valuable asset of medicinal flora become extinct or lost forever in future. The indigenous knowledge about medicinal plants and their ethno-pharmacological uses should be documented properly and must be transmitted to the younger generation. This study will provide a baseline for further Ethno-botanical, Ethno-medicinal, Anti-microbial and phytochemical investigations in the area.

Declarations

Ethics statement: Prior to the survey, we obtained oral informed consent from each participant.

Consent for publication: Not applicable.

Availability of data and materials: Requests for data can be directed to the first author.

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Competing interests: The authors declare that they have no competing interests."

Author contributions: Muhammad Ibrahim conducted the research work and data analysis and wrote the first draft of the manuscript. All authors read, revised, reviewed and approved the final draft of the manuscript.

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