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Research Article

Ethnomedicinal and Cultural uses of *Ziziphus* Species in Flora of Malakand Division KP, Pakistan

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Abstract

Background and Objective: Ethnomedicinal knowledge offers the folk medicines of mankind that are cheap than standard treatment and are easily available. The aim of this study was to investigate the 6 *Ziziphus* species used commonly as ethno medicine for treatment of various ailments in the study area. **Materials and Methods:** Field surveys were organized for collection and compilation of medicinal plants species of *Ziziphus*. Overall 140 local residents were interviewed randomly through questionnaire. The data obtained were quantitatively analyzed using the used value (UVi), relative frequency citations (RFCs), fidelity level index (FL %), consensus index (CI %) and informant consensus factor (FIC). **Results:** CI indicates consensus on the importance of *Ziziphus jujuba* Mill (CI = 84.321%) as important well known medicinal plant used in cultural folk medicines and treated a number of disorders in the Malakand Division. The medicinal plant species with highest fidelity level was of *Ziziphus jujuba* Mill cited 100% for promotion of lactation, Head ache and sore throat etc. Informant consensus factor (FIC) ranged from 0.851 to 1 for various diseases. Maximum FIC value for disease category is due to representation by only 1 medicinal plant taxa/species (Nt = 1). **Conclusion:** The People of study area are deeply dependent on *Ziziphus* medicinal plant species for the treatment of a variety of ailments. Due to urbanization, the ethno-medicinal knowledge can be lost in future, so it is a dire need to collect and systematically record this precious and practical indigenous information and pay due attention to protect and conserve medicinal *Ziziphus* plants species.

Key words: Malakand Division, *Ziziphus* species, traditional knowledge, ethnomedicinal practices, medicinal plants

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Traditional medicine is vital source in developing countries where conventional medicines for human health upkeep are unreachable or unaffordable to poor rural residents^{1,2}. Nearly 80% of populations in the world today depend on folk traditional medicine for curing both human and animal ailments^{2,3}. The world health organization (WHO) has highlighted the importance of the traditional folk medicines, since a large majority of rural people in the developing countries still rely on these medicines as the first protection in health care³.

The Jujube is the collective name for any of a genus of evergreen and deciduous shrubs and trees of the buckthorn/ Rhamnaceae family, categorized as the genus *Ziziphus* of the family Rhamnaceae and order Rhamnales. This family contains about 50 genera and nearly more than 600 species⁴. The most important species of the genus *Ziziphus* is *Z. jujuba* Mill (Chinese jujube) and *Z. mauritiana* Lam. (called ber) are the most important in terms of distribution and economic value. The genus *Ziziphus* consists of six species in Pakistan, they are *Z. jujuba* Mil. *Z. mauritiana*, *Z. oxyphylla*, *Z. numularia*, *Z. spina-cristi* and *Z. rogersii*. The members of this genus have small, regular flowers that produce drupaceous fruits. They are mostly found in tropical and subtropical regions all over the world. Like widespread in Asia, the Mediterranean region, Africa, Australia and tropical America⁵. Some kinds of jujube such as Chinese jujube are native to China^{6,7} and its history of cultivation goes back over 4000 years⁷. It has been widely planted in reforested areas within the Yellow River valley, chosen as a species compatible with the present ecology and economy⁸.

Medicinal plants are being used for the treatment of several maladies by the local resident since earliest times. It is assessed that 53 million people are living in the rural areas of Pakistan^{3,9}. Due to the high price of modern medicines, the poor peoples are unable to pay the cost and they are attracted towards the traditional medicines^{2,3,10}. In Pakistan very little attention has been given on documentation of *Ziziphus* plant species used as folk medicines and there is an enormous need to record this knowledge^{2,3,11}. At present the valuable traditional knowledge is vanishing rapidly. Moreover the rising cost of allopathic remedies and the problem of environmental pollution, this is the time to develop cost-effective and environment friendly medicines for human and animal ailments. In the current study area this is the first attempt to illuminate the ethno medicinal uses of *Ziziphus* species.

The main objective of the present research was the documentation of ethnomedicinal knowledge regarding various species of *Ziziphus* used by the local inhabitants of the area for treatment of various diseases and ailments.

MATERIALS AND METHODS

Study area: Malakand division is a hilly area situated within the Northern Pakistan covering an area of approximately 29,872 Km² and having a variety of climatic conditions (Fig. 1). Touching the foothills of the Hindu Kush, Himalayas and Karakoram ranges, the climate of Malakand Division changes from humid subtropical at the foothills to the typical arid climate characteristic of the plains of South Asia¹⁰. District Swat stretches from 35.2227° North to 72.4258° East longitude and the climatic conditions varies from dry to moist temperate. The climate is affected by numerous factors comprising latitude, altitude, the Indian Ocean Summer, Monsoon and the Western cyclonic streams, coming from the Mediterranean Sea, in the winter. Dir lower is located in the Dry temperate zone (34.9161° N, 71.8097° E, 4411 ft a.s.l), Dir upper is a moist temperate region (35.3356° N, 72.0468° E, 3174 ft a.s.l) while, District Buner having areas of both dry and moist temperate regions (34.3943° N, 72.6151° E, 4049 ft above sea level). The area is surrounded by the high mountains, (Fig. 1). The community in the Malakand Division has multiple urgent needs resulting from economic poverty, geographical isolation and very poor provision of health, education and communication services in rural area. The research work cannot address all these issues but hopes to make a significant impact on a number of key signs for the health of the area's. The Valley is full of natural resources and sceneries but many factors like no transportation, health care centers, markets, schools etc as well as environmental factors are their due to which it didn't gain any importance yet. For data collection several visits were made on the basis of seasonal variation to different areas of Malakand Division¹⁰.

Medicinal plants collection, questionnaire and data collection: Two hundred and forty local informants were interviewed. The study was conducted from January, 2017 till September, 2018. The study was based on direct communication with the local informants of the area. On the basis of this information, the medicinal value of study area plants was recorded. After that methodology was adopted by following the study of these researchers^{2,12-14}.

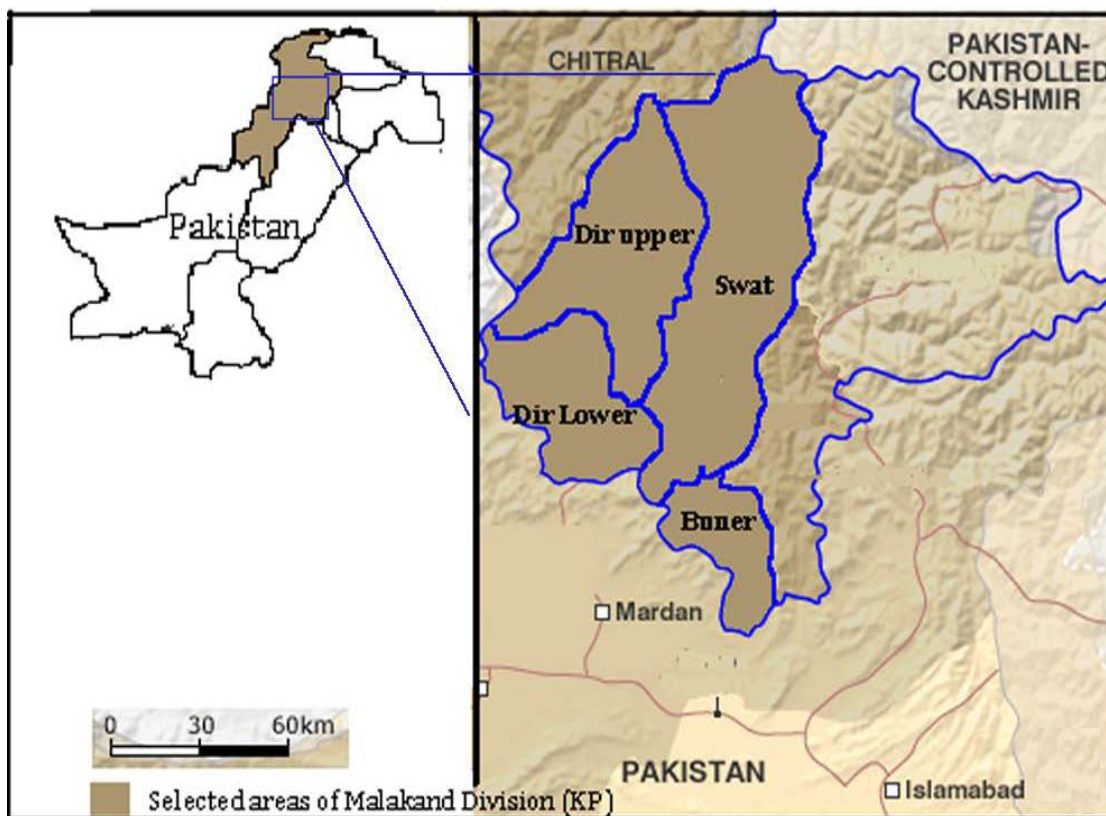


Fig. 1: Map of Malakand division by Noor *et al.*¹⁰

Statistical analysis

Used value index (UVi): Used value index evaluates the relative importance of each medicinal plant species based on their relative use among informants¹⁵ and it was calculated by using the formula:

$$UVi = \frac{\sum U_i}{N_i}$$

where, U_i is each informant cited number of use reports for a given medicinal plant species where, N_i is the total number of informants interviewed for a given medicinal plant species.

Relative frequency of citations (RFCs): To evaluate the traditional value and medicinal importance of each plant species in an area, the formula for RFC was used¹⁶:

$$RFCs = \frac{FCs}{N}$$

where, FCs is number of local informants who reported traditional medicinal use of the species and N is the total number of informants of the study. (In this study, $n = 240$).

Consensus index (CI%): Percentage of local informants having traditional knowledge of plant species medicinal use against diseases (In this study) was calculated by Consensus index (CI%) which indicating citation by % of informants:

$$CI (\%) = \frac{n}{N} \times 100$$

where, n is the number of informants citing medicinal plant species, while N is the total number of respondents of the study area.

Fidelity level (FL) value: The fidelity level (FL) is the percentage of indigenous informants claiming the given plant's use report for the same major ailment. It was calculated by the following formula¹⁷:

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

where, I_p is use of plant species suggested by the number of informants for a particular disease and I_u is the total number of informants who cited same plant for any disease.

Informant consensus factor (FIC): Informant consensus factor (FIC) value was used to analyze the consensus between use of plants for various ailment categories and respondents of the study area it was calculated by the following formula¹⁸:

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

where, Nur is number of use citations for a particular disease category while Nt is the number of botanical species used for a particular use category by all informants, the values of FIC range from 0 to 1. High value specifies that the informants are in favor on the use of plant species for a disease category and low value shows that plant species are randomly selected/informants do not exchange their traditional medicinal use knowledge.

RESULTS

A total of 240 informants were interviewed of which 140 were males aged 25-80 years and 100 females 25-80 years. Traditional ethno medicinal drivers, shepherds, local informants were interviewed to seek wide range of information about the *Ziziphus* plants species used for medicinal purposes. Ethnic diversity and rich flora are the key signs for the existence of rich traditional remedies. Current

study described 6 species of the genus *Ziziphus* belonging to family Rhamnaceae commonly used to treat different diseases by the local residents. Table 1 defines all the plants documented with their respective scientific, local and family names, habit, parts used and particular diseases to prepare the phytomedicines. Those plants reported by the interviewees were directed for all the local publics of the research area.

Quantitative analysis

Used value (UVI): The UVI for these *Ziziphus* species was recorded from 0.565-0.798 (Table 2). The most dominant medicinal plants with most used values were *Ziziphus jujuba* Mill. having (UVI = 0.798), *Ziziphus mauritiana* (0.770), *Ziziphus nummularia* (0.686), *Ziziphus oxyphylla* (0.683) while minimum used values of collected medicinal plants were *Ziziphus rugosa* (0.5851), *Ziziphus spina-cristi* (0.565). Maximum used values of cited *Ziziphus* species might be due to their extensive distribution and cultural driver's awareness which caused these plant species as the first choice for treatment.

Relative frequency citations (RFCs): A relative frequency citation is evaluated in order to identify the most frequently used medicinal plants for various ailments. In the existing study, it ranged from 0.58-0.798 (Table 2). Based on the RFC values, the most cited medicinal plant species by the

Table 1: List of medicinal *Ziziphus* species with scientific name, local name, parts used and ailments

Botanical name	Family	Local name	Habit	Part used	Ethnobotanical uses
<i>Ziziphus jujuba</i> Mill	Rhamnaceae	Markhanai	Tree	Fruit, leaves, bark	Fruit is used as a food, leaves are used to promote lactation, head ache and sore throat, digestive disorders, general weakness, liver complaints, skin disease, obesity, urinary troubles, diabetes, skin infections, loss of appetite, fever, pharyngitis, bronchitis, anemia, diarrhea, insomnia
<i>Ziziphus mauritiana</i>	Rhamnaceae	Bera	Tree	Fruit, leaves, bark, root	The dried fruits are used as anodyne, anticancer, pectoral, refrigerant, sedative, stomachache, styptic and tonic and also used as purifier the blood and aid digestion, root is used in the treatment of dyspepsia, a decoction of the root has been used in the treatment of fevers
<i>Ziziphus nummularia</i>	Rhamnaceae	Lanai	Shrub	Leaves, bulb	Fruit is used as food, leaves used for scabies and boils, gastrointestinal helminthiasis
<i>Ziziphus oxyphylla</i>	Rhamnaceae	Karkanda	Shrub	Fruit, leaves, Root bark	Fruit is edible, root is used as Jaundice, anti-diabetics, leaves are used in treatment of inflammatory and painful complaints, microbial infections, allergy, diabetes and as an antipyretic, gastrointestinal helminthiasis, skin disease
<i>Ziziphus rugosa</i>	Rhamnaceae	Ber	Tree	Leaves, fruit, bark	Fruit is edible, bark is used for dysentery, abdominal pain, external wound healing
<i>Ziziphus spina-christi</i>	Rhamnaceae	Ber	Tree	Leaves, fruit, bark	Leaves are used for stomach ache, anthelmintic, used for healing of wounds

Table 2: Medicinal plants of *Ziziphus* with vernacular and family name, habit, part used, disease cured, UVI, RFCs, FL, CI

Botanical name	Local name	Part used	UVI	RFCs	FL (%)	CI (%)
<i>Ziziphus jujuba</i> Mill	Markhanai	Fruit, leaves, bark	0.798	0.981	100.00	84.321
<i>Ziziphus mauritiana</i>	Bera	Fruit, leaves, bark	0.770	0.923	98.00	77.921
<i>Ziziphus nummularia</i>	Karkanda	Fruit, leaves, root bark	0.683	0.853	95.34	74.422
<i>Ziziphus oxyphylla</i>	Elanai	Fruit, leaves, bark powder	0.686	0.746	88.14	74.392
<i>Ziziphus rugosa</i>	Ber	Fruit, leaves	0.5851	0.631	83.661	73.927
<i>Ziziphus spina-christi</i>	Ber	Fruit, leaves bark powder	0.565	0.587	79.521	70.349

FL: Fidelity level, CI: Consensus index, RFCs: Relative frequency of citations, UVI: Used value

traditional drivers are *Ziziphus jujuba* Mill having (RFCs = 0.981), *Ziziphus muritiana* (0.923), *Ziziphus nummularia* (0.853), *Ziziphus oxyphylla* (0.746) while minimum used values of collected medicinal plants were *Ziziphus rugosa* (0.631) and *Ziziphus spina-christi* (0.587). Maximum used values of cited medicinal plant species might be due to their extensive distribution and cultural drivers' awareness which caused these botanical species as the first choice for treatment. Maximum relative frequency citations clarify the facts that these medicinal plant species are very well known among the most number of traditional drivers. Those medicinal plant species having maximum RFC should be further evaluated phytochemically and pharmaceutically to identify their active constituents for drug discovery.

Fidelity level (%): Fidelity level (FL %) is used to identify species that are most preferred by the inhabitants for the treatment of certain ailments. In the current study, fidelity level ranges from 79.521-100% (Fig. 1). The medicinal plant species with highest fidelity level was of *Ziziphus jujuba* Mill cited 100% for promotion lactation, head ache and sore throat, digestive disorders, general weakness, liver complaints, skin disease, obesity, urinary troubles, diabetes, skin infections, loss of appetite, fever, pharyngitis, bronchitis, anemia, diarrhea and insomnia. Some other medicinal plant species with most fidelity level were *Ziziphus muritiana* (FL = 98.00%), *Ziziphus nummularia* (95.34%), *Ziziphus oxyphylla* (88.14%) for various disorders as mentioned in Table 2. These mentioned plant species may be confirmed as important medicinal plants through further assessment and evaluation through phytochemical, biological and pharmaceutical activities. Many researchers obtained maximum fidelity level values against certain diseases like gastrointestinal problems¹⁹. However the lowest fidelity levels among these medicinal plants were of *Ziziphus rugosa* (83.661%) and *Ziziphus spina-christi* (79.521). Moreover, plants with minimum FL should not be abandoned as declining to remark them to the future generation that it could raise the threat of gradual depletion of the cultural knowledge.

Consensus index (CI%): Percentage of respondents questioned with traditional medicinal knowledge about *Ziziphus* species used to treat disorders and Consensus index (CI) of the *Ziziphus* taxa are mentioned in Table 2, which ranged from 70.349-84.321% (Table 2). CI results revealed that most respondents percentage was for *Ziziphus jujuba* Mill (CI% = 84.321%), followed by *Ziziphus muritiana* (77.921%). However, *Ziziphus nummularia* (74.422%) was followed by

Table 3: Groups of disorders and informant consensus factor (FIC) for each category

Disease categories	Number of taxa used (Nt)	Use reports (Nur)	FIC
Abdominal pain	1	240	1.00
Allergy	1	180	1.00
Anemia	1	69	1.00
Anodyne	1	65	1.00
Anticancer	1	60	1.00
Anti-diabetes	2	53	0.981
Antipyretic	1	52	1.00
Bronchitis	1	50	0.941
Diarrhea	1	36	1.00
Dysentery	4	41	0.925
Dyspepsia	1	77	1.00
Fever	1	62	1.00
Gastrointestinal helminthiasis	2	45	0.977
General weakness	1	38	1.00
Head ache	5	28	0.851
Inflammatory	4	28	0.888
Insomnia	1	43	1.00
Jaundice	1	200	1.00
Liver complaints	1	135	1.00
Loss of appetite	1	130	1.00
Microbial infections	2	125	0.991
Obesity	2	124	0.991
Painful complaints	3	120	0.983
Pectoral	2	50	0.979
Pharyngitis	1	45	1.00
Promote lactation	1	30	1.00
Blood purifier	1	23	1.00
Refrigerant	1	54	1.00
Scabies and boils	1	64	1.00
Sedative	1	74	1.00
Skin infections	2	240	0.995
Sore throat	1	99	1.00
Stomachache	3	110	0.981
Styptic and tonic	1	231	1.00
Urinary troubles	1	211	1.00
wound healing	6	234	0.978

Ziziphus oxyphylla (74.392%), *Ziziphus rugosa* (73.927) and *Ziziphus spina-christi* (70.349%). CI indicates consensus on the importance of *Ziziphus jujuba* Mill as important well known medicinal plants used in cultural folk medicines and cured a number of disorders in the Malakand Division.

Informant consensus factor (FIC): Informant consensus factor (FIC) ranged from 0.851-1 (Table 3) and their use reports (URs) from 28-240. Different diseases viz. Abdominal pain, allergy, anemia, anodyne, antipyretic, diarrhea, dyspepsia, fever, general weakness, insomnia, jaundice, liver complaints, loss of appetite, pharyngitis, promote lactation, blood purifier, refrigerant, scabies and boils, sedative, sore throat, styptic and tonic, Urinary troubles, had maximum FIC value due to representation by only 1 medicinal plant taxa/species (Nt = 1). Other most frequent and cited disease categories were skin infections (FIC = 0.995), followed by obesity (0.991), skin

disease (0.995), Painful complaints (0.983), Anti-diabetes and Stomachache (0.981 each), pectoral(0.979), wound healing (0.978), gastrointestinal helminthiasis (0.977), Bronchitis (0.941), dysentery (0.925), Inflammatory (0.888). Many disease categories having most citations or maximum number of species but their FIC values vary due to the basic indices of FIC formula as the consensus of informants on the use of medicinal plants against different disorders is described by the computed index FIC. Lowest FIC value was found in head ache (0.851).

DISCUSSION

Generally poor people consuming the plant species for the treatment of various disorders got this knowledge from their ancestors, with exception of few, who learned this from others or by hit and experimental method². The persons who contributed in this research work were poor and could not afford modern treatments. Thus it was easy for them to get plants from local area and to treat ailments with domestic formulae. During the present study it has been observed that inhabitant prefer to collect the required *Ziziphus* plant species directly from field, depending upon season and availability of plant¹⁸. It has also been witnessed that some *Ziziphus* species are very popular in specific region e.g., *Ziziphus* specie with most use values were *Ziziphus jujuba* Mill. having (UVi = 0.798), *Ziziphus mauritiana* (0.770), *Ziziphus nummularia* (0.686), *Ziziphus oxyphylla* (0.683). Based on the RFC values, the most cited medicinal plant species by the traditional drivers are *Ziziphus jujuba* Mill having (RFCs = 0.981), *Ziziphus mauritiana* (0.923), *Ziziphus nummularia* (0.853), *Ziziphus oxyphylla* (0.746). The *Ziziphus* medicinal plant species with highest fidelity level was of *Ziziphus jujuba* Mill cited 100% for promotion of lactation, Head ache and sore throat, digestive disorders, general weakness, liver complaints, skin disease, obesity, urinary troubles, diabetes, skin infections, loss of appetite, fever, pharyngitis, bronchitis, anemia, diarrhea and insomnia. Informant consensus factor (FIC) ranged from 0.851-1, Different diseases viz. Abdominal pain, allergy, anemia, Anodyne, Antipyretic, Diarrhea, Dyspepsia, Fever, General weakness, etc. had maximum FIC value due to representation by only 1 medicinal plant taxa/species (Nt = 1) had maximum FIC values. Many researchers reported abdominal pain, allergy, anemia etc as the most cited disease categories^{2,20-23}. In Ethno Medicinal treatment every part of the plant is used such as bark, roots, wood, leaves, stem, flowers, fruit, juice, resin, latex, grains, buds, bulbs and seeds^{18,24}. The communities included in the present study were customarily rural in nature. Accordingly, the

inhabitants were quite rich in the folk ethno medicinal knowledge. So the present research work was first of its manner in which Ethno medicinal Practices for control of disorders using *Ziziphus* species in hilly areas of Malakand Division, KP, Pakistan. The mode of preparation of Ethno medicines depends on active ingredient to be extracted, route of administration and the medical intent (prophylaxis or therapy)^{3,10,18,25}.

CONCLUSION

Ethnomedicinal study has made possible to investigate some active compounds from therapeutic plants, thus these motivating ethno medicinal investigations can be research frustrating for upcoming. Ethnomedicinal knowledge is under severe risk of urbanization, expanding agricultural demands and acculturating trend of village inhabitant. Due to urbanization, the ethno-medicinal knowledge can be lost in future, so it is a dire need to collect and systematically record this precious and practical indigenous information and pay due attention to protect and conserve medicinal *Ziziphus* plants species. The *Ziziphus* medicinal plant species with highest fidelity level was of *Ziziphus jujuba* Mill cited 100%. The use of herbal medicines in the research area could most likely be promoted and strengthened by initiating a coordinated programmes of research and development for assessing and testing the effectiveness of the plants in use by standardizing methods for cultivation and preservation of plants.

SIGNIFICANCE STATEMENT

This study discovers the possible use of traditional and cultural uses of *Ziziphus* species by the resident of the study area. In the study area the people were deeply dependent on medicinal plants of *Ziziphus* species for the treatment of the variety of ailments. Folk knowledge always provides a baseline for further phytochemical and pharmacological study. The documentation of these practices in study area is necessary before this valuable knowledge is lost forever due to rapid socioeconomic, environmental and technological changes. Thus, a new theory on the conservation of traditional knowledge and use of *Ziziphus* species for various ailments in the study area may be arrived at.

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