Quantitative and comparative analysis of ethnomedicinal plants from the Lasdana (Azad Jammu and Kashmir)

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Description of the subject. Ethnopharmacology is important because it aids in a proper knowledge of the interrelationships of many aspects, as well as the entire practical and intellectual culture of people with plants.

Objectives. The objective of this research is to document and compare traditional knowledge about medicinal plant diversity in Lasdana, District Bagh Azad, Jammu & Kashmir.

Method. Informants contributed to ethnopharmacological knowledge through interviews and group discussions, which was examined using multiple quantitative metrics.

Results. There were 140 medicinal plant species identified, divided into 123 genera and 54 families. The Asteraceae family was the most common (14 species), and herbs were the most common (72.85% contribution), with leaves being the most commonly used plant element (74 species). The most common way to produce a remedy was to make a decoction (45 plant species). Circulatory diseases had the highest informant consensus factor (ICF) score (0.92). The highest relative frequency of citation was found in *Thymus linearis* Benth. (0.89), *Geranium wallichianum* D.Don ex Sweet (0.89), and *Berberis lycium* Royle (0.88).

Conclusions. Pharmacological and pharmaceutical investigations on vital therapeutic plant species should be done to safely apply traditional knowledge to a larger population.

Keywords. Medicinal plants, indigenous peoples' knowledge, quantitative analysis, ethnobotany, Pakistan.

Analyse quantitative et comparative de plantes ethnomédicinales de Lasdana (Azad Jammu et Cachemire)

Description du sujet. L'ethnopharmacologie est importante car elle aide à une bonne connaissance des interrelations de nombreux aspects, ainsi que de toute la culture pratique et intellectuelle des personnes avec des plantes.

Objectifs. L'objectif de cette recherche est de documenter et de comparer les connaissances traditionnelles sur la diversité des plantes médicinales à Lasdana, district de Bagh Azad, Jammu et Cachemire.

Méthode. Les informateurs ont apporté des connaissances ethnopharmacologiques par le biais d'entretiens et de discussions de groupe, qui ont été examinées à l'aide de plusieurs paramètres quantitatifs.

Résultats. Cent-quarante espèces de plantes médicinales ont été identifiées, réparties en 123 genres et 54 familles. La famille des astéracées était la plus courante (14 espèces) et les herbes étaient les plus courantes (contribution de 72,85 %), les feuilles étant l'élément végétal le plus couramment utilisé (74 espèces). La façon la plus courante de produire un remède était d'en faire une décoction (45 espèces végétales). Les maladies circulatoires avaient le score le plus élevé du facteur de consensus de l'informateur (ICF) (0,92). La fréquence relative de citation la plus élevée a été trouvée dans *Thymus linearis* Benth. (0,89), *Geranium wallichianum* D.Don ex Sweet (0,89) et *Berberis lycium* Royle (0,88).

Conclusions. Des recherches pharmacologiques et pharmaceutiques sur les espèces végétales thérapeutiques vitales devraient être menées pour appliquer en toute sécurité les connaissances traditionnelles à une population plus large.

Mots-clés. Plante médicinale, savoirs autochtones, analyse quantitative, éthnobotanique, Pakistan.

1. INTRODUCTION

The study of ethnobotany is of great importance for the aid it gives to a proper understanding of the interrelations of all the several traits and of the whole material and intellectual culture of a people in its entirety. Medicinal plants have been used in traditional healing practices since ancient times. This natural

resource has been exploited in different ways by indigenous communities (Adnan et al., 2014). Many local communities in developing countries are still dependent upon herbal medicine as a less expensive, easily available, and holistic, often culturally based, resource for primary healthcare (Srithi et al., 2009; Aziz et al., 2018). According to the World Health Organization (WHO), 80% of the world population use medicinal plants for treating ailments (Shinwari, 2010).

The knowledge on medicinal plants is mostly transferred orally from older to younger generations and in this way preserved among many indigenous communities across the globe (Pieroni & Quave, 2005; Bano et al., 2014a). However, this knowledge is gradually decreasing with rapid urbanization and wider availability of modern health systems (Ladio et al., 2007; Vitalini et al., 2013; Baydoun et al., 2015). This decline makes ethnobotanical and ethnopharmacological surveys of paramount importance (Verpoorte et al., 2005; Heinrich, 2008; Bibi et al., 2014).

Pakistan is a floristically wealthy country harboring about 6,000 species of higher plants. Of these species, more than 12% are used medicinally, and active constituents of about 500 plant species have been reported (Shinwari, 2010). Due to its unique geographical location and diverse habitat, Azad Jammu Kashmir (AJK) carries a rich and diverse medicinal flora with wide indigenous usage among the rural communities.

While a variety of studies has compiled ethno-medicinal information of plants in various parts of Pakistan, including Azad Kashmir, the mountainous area of Lasdana has never been assessed ethno-botanically due to its remote location and hilly terrain, along with religious and cultural restrictions (Amjad et al., 2017). In our study, we hypothesized that socioeconomic aspects would impact the distribution of traditional knowledge and that furthermore the usage or importance of plant species may vary among the local communities although having the same culture.

Therefore, the current study was designed to explore and investigate traditional knowledge of medicinal plants utilized for health issues. The data was quantitatively analyzed and compared with previous reports to determine the novelty of the work.

2. MATERIALS AND METHODS

2.1. Study area

Lasdana is a mountainous region that lies between 73°56'E to 73°58'E longitude and 33°55'N to 33°57'N latitude. The altitude of area ranges from 1,785-2,750 m. The collection sites in the study area are

presented in **figure 1**. The area is a visitor resort and is especially popular among tourists owing to its weather and natural beauty. The climate is of temperate type.

The average annual temperature in Lasdana is 10.7 °C. July is the warmest month throughout the year with an average 19.4 °C temperature around the year. The lowest average temperature is recorded during January, when it is around -0.8 °C. The average annual precipitation is 1,554 mm. Precipitation is maximum during the month of July (212 mm) and minimum during the month of October (45 mm) (**Figure 2**). The data was provided by the meteorological department upon request.

Most of the inhabitants of the region are nomads. They spend the summer at higher altitudinal areas of the national park along with their livestock. Before the arrival of winter, they shift the livestock to the plain areas. People are mostly dependent upon summer tourism for their livelihood. Most of them are tour guides, rest house managers, restaurant workers, shop keepers and jeep drivers. Some were part-time or full-time shepherds and farmers.

2.2. Collection and identification of specimens

Field surveys were conducted during different seasons from July, 2017 to June, 2018. Specimens of each plant species were collected from different localities in triplicate. They were carefully pressed, dried and properly mounted on herbarium sheets. The collected plant specimens were identified using the Flora of Pakistan (https//:www.eflora.com) (Nasir & Ali, 1972; Nasir & Ali, 2010). APG IV 2016 was used for the correct family name (Chase et al., 2016) while 'Plants of the World online' was followed to find correct scientific names (The Plant List, 2013). Identified specimens were cross checked with vouchers in the AJK medicinal and aromatic plant herbarium of PARC (Pakistan Agricultural Research Council). The voucher specimens were deposited at the herbarium of Women University of AJK, district Bagh.

2.3. Ethnopharmacological data collection

A total of 68 participants of different ages (19-75 years) were interviewed by using semi-structured and open-ended questionnaire to collect ethnomedicinal information. Participants were selected randomly from different age groups to get maximum information. In addition, group discussions and field observations were conducted (Bruni et al., 1997; Heinrich et al., 2009; Ghorbani et al., 2011). The questionnaire was developed following Edward et al. (2005). The informants were selected randomly, and the sample size was chosen by using method of Kadam & Bhalerao (2010). The Code of Ethics of the International Society
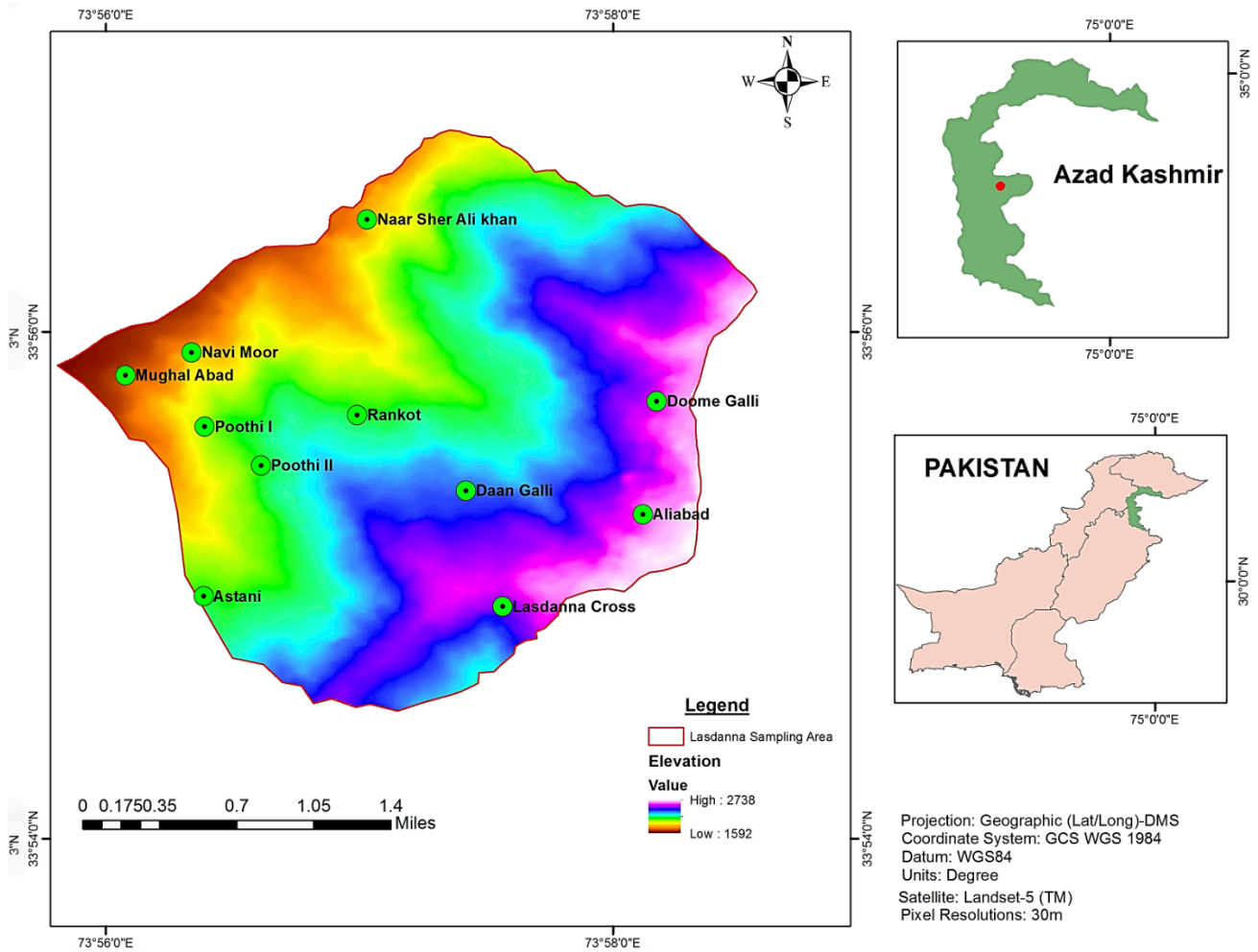
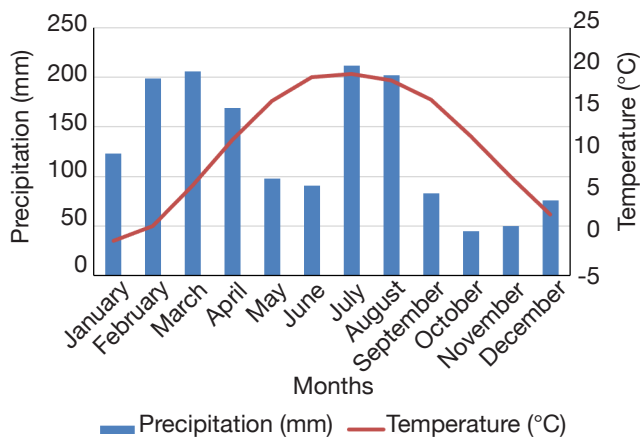**Figure 1.** Map of the study area — *Carte de la zone d'étude.*

Figure 2. Precipitation and temperature of the study area — *Précipitations et température de la zone d'étude.*

of Ethnobiology (http//:www.ethnobiology.net) was followed. Ethical approval for conducting survey was granted by the ethics approval committee of Women University of AJK, Bagh. Legal permission for interviews was granted by the municipality committee of the investigated area. Written prior informed consent was taken from the informants before acquiring information (S1).

2.4. Quantitative analysis

Quantitative indices including Use Value (UV), Relative Frequency of Citation (RFC), Informant Consensus Factor (ICF), Relative Importance (RI), Jaccard Index (JI), and Fidelity Level (FL) were used to evaluate the significance of medicinal plant species.

Use value (UV). Use value reflects the local significance of a medicinal plant in the area. It was calculated following Vijayakumar et al. (2015):

$$UV = \sum \frac{Ui}{N}$$

with Ui, the number of uses for each species by number of informants; N, the total number of informants.

Relative frequency of citation (RFC). RFC indicates the importance of each plant species based on frequency of citation. It was calculated following Vijayakumar et al. (2015):

$$RFC = \frac{FC}{N}$$

with FC, the number of respondents mentioning the use of a particular species and N, the total number of respondents.

Informant consensus factor (ICF). The consistency between the informant and plant species used for curing particular group of ailments was tested by utilizing the ICF. It was calculated following Heinrich et al. (1998):

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

where Nur is use-reports in each disease category and Nt, the total number of species reported by all informants for a particular category of disease. The value of ICF ranges between 0-1. A high value of ICF reflects plant species chosen based on well-defined selection criteria and information about the plant for curing particular diseases with a maximum coincidence among the informants. Whereas low ICF value shows that there is random selection of species and minimum exchange of information about plant species for curing particular disease categories among the community.

Relative importance (RI). RI was calculated using the formula of Khan et al. (2015):

$$(RI) = RelPH + RelBS \times \frac{100}{2}$$

$$RelPH = \frac{PH\ of\ a\ given\ plant}{Maximum\ PH\ of\ all\ reported\ plant\ species}$$

where PH represents pharmacological property of each plant species and RelPH represents the relative number of pharmacological properties attributed to a single plant.

$$RelBS = \frac{BS\ of\ a\ given\ plant}{Maximum\ BS\ of\ all\ reported\ plant\ species}$$

with BS, the number of body systems healed by an individual plant species and RelBS is the relative number of body systems treated by individual plant species.

Jaccard index (JI). The Jaccard index was applied to determine similarity of knowledge between different communities comparing uses reported in the current study with published ethnobotanical data in the region and at global level. It was calculated using Gonza et al. (2008):

$$JI = \frac{C \times 100}{(a + b) - c}$$

where *a* represents the total number of medicinal plant species of the study area; *b* is the total number of species reported in adjoining/comparing area; and *c* is the number of common plant species of both areas.

Fidelity level (FL). The fidelity level is used to elucidate the most preferred species for curing a particular disease. The fidelity level was calculated following Alexiades & Sheldon (1996) using formula:

$$FL(\%) = \frac{Np}{N} \times 100$$

where Np represents respondents' number of use reports of a plant species for curing a specific disease and N is the number of total respondents reporting the respective plant species for any ailment. A high FL value of a species reflects a high frequency of use for particular ailment by local inhabitants.

3. RESULTS

3.1. Demographic data

The ethnopharmacological data were gained from 68 participants during field visits. Information on age, gender, education and profession of the participants was documented. Of the participants 58% were men and 41% women (**Table 1**). Older participants (age ≥ 60) held wider traditional knowledge regarding preparation and administration of ethnomedicines (average known species = 13.68; average known uses = 10.95) followed by middle aged people (age = 40-60), as compared to younger informants (age = 19-40).

3.2. Ethno-floral diversity

A total of 140 medicinal plant species belonging to 54 families and 123 genera were recorded. In the study area herbaceous species were prevalent with a contribution of 72.85%, followed by shrubs (13.57%) and trees (13.57%). Asteraceae (14 species) and Rosaceae (13) were the most species rich medicinal plant families in the area (**Figure 3**).

Table 1. Demographic information of the informants — *Informations démographiques à propos des informateurs*.

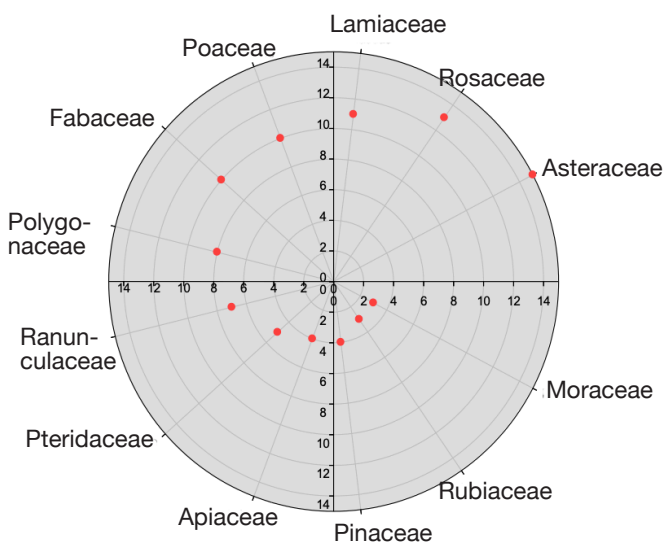| Variable	Informant category	Number	Average number of species reported by each informant	Average number of use reported by each informant
Gender	Male	40	5.85	7.35
	Female	28	6.59	8.08
	Total	68		
Age-class	20-40	24	4.83	3.30
	41-60	35	9.27	5.01
	60-80	9	13.68	10.95
Education level	Illiterate	21	6.82	4.22
	Elementary education	14	11.12	6.55
	Secondary education	12	12.78	6.05
	Traditional health practionaire	9	7.46	5.35
	Bachelor degree	7	7.02	4.81
	Higher education	5	11.66	6.49
Profession	Traditional health practionaire	14	26.44	15.24
	Midwives	9	14.02	11.55
	Herders	5	10.89	7.99
	Housewives	18	7.72	6.69
	Farmers	4	6.12	4.25
	Teachers	06	7.60	7.25
	Others	12	5.40	4.01

Figure 3. Family contribution of medicinal flora in the study area — *Contribution de la famille de la flore médicinale dans la zone d'étude*.
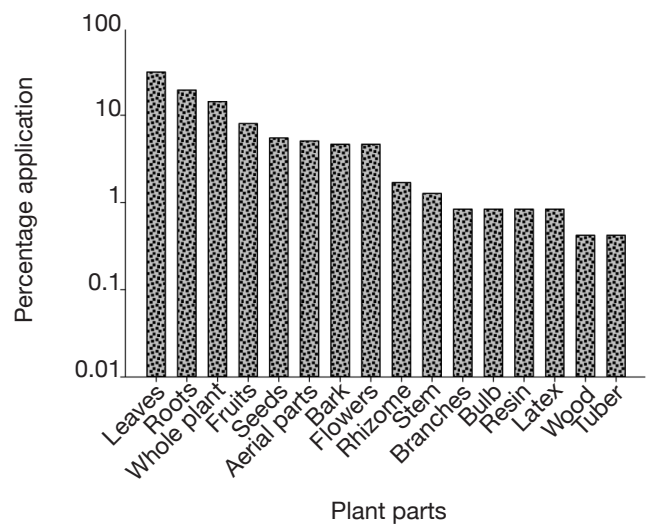

Figure 4. Plant parts used in herbal recipes — *Parties de plantes utilisées dans les recettes à base de plantes*.

3.3. Plant parts used

Various plant parts were used in preparation of different herbal remedies. Leaves (74 species) were most commonly used, followed by roots (46 species) and whole plant (34) (**Figure 4**).

3.4. Methods of preparation and mode of administration

Different modes of preparation were used by local inhabitants for the preparation of herbal remedies. Decoction was the most important method of herbal preparation (45 species) followed by paste (37 species), juice and extract (29 species each).

3.5. Relative frequency citation (RFC) and use value (UV)

The relative frequency citation is used to determine commonly occurring medicinal plants used to treat different ailments by the local inhabitants. The relative frequency of citation in the current study ranged between 0.02-0.89. The important medicinal plant species with highest RFC values were *Thymus linearis* Benth. (0.89) and *Geranium wallichianum* D.Don ex Sweet (0.89). They were followed by *Berberis lycium* Royle (0.88), *Elaeagnus umbellata* Thunb. (0.88), *Bergenia ciliata* (Haw.) Sternb. (0.88), *Cynodon dactylon* (L.) Pers. (0.86), *Viola canescens* Wall., *Eriocapitella rupicola* (0.85) and *Mentha longifolia* (L.) L. (0.80) (**Annex 1**).

3.6. Relative Importance (RI)

The highest relative importance values were found for *Allium cepa* L. (100), *Oxalis corniculata* L., *Alcea rosea* (L.) Cav. (92.5 each), *Rosa brunonii* Lindl. (85.5), *Agrimonia eupatoria* L. (72.5), *G. wallichianum*, *Allium sativum* L., *Anaphalis margaritacea* (L.) Benth. & Hook.f. (81 each) and *Plantago lanceolata* L., *Origanum vulgare* L. (79.5 each) (**Annex 1**), showing local peoples' familiarity about these plants.

3.7. Informant Consensus Factor (ICF)

The local inhabitants of the area used plants for curing a wide variety of diseases. The diseases were broadly classified into 16 categories. Data was arranged on the basis of local classification system developed by traditional healers. The ICF values range from 0.66-0.92. The highest ICF value was recorded for circulatory disorders (0.92), followed by digestive disorders (0.91) and skin ailments (0.86) (**Figure 5**). The most commonly used plants were *R. brunonii*, *B. lycium*, *A. rosea*, *M. longifolia*, *Quercus robur* L., *Aesculus indica* (Wall. ex Cambess.) Hook., *Pyrus pashia* Buch.-
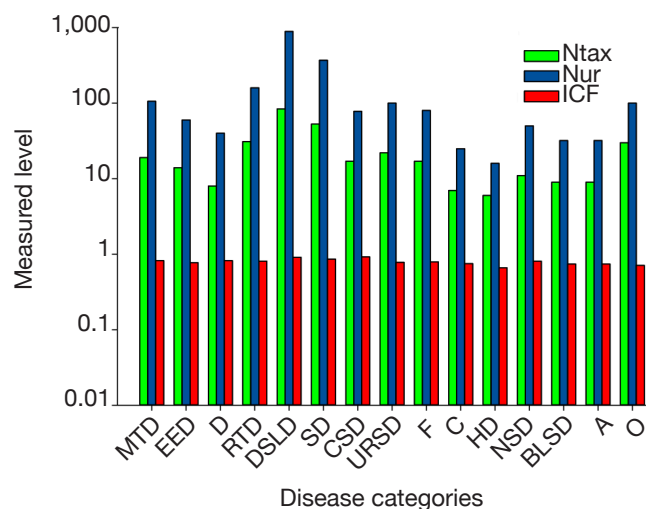

Figure 5. Informant consensus factor of diseases with use reports and total number of species used — *Facteur de consensus des informateurs sur les maladies avec rapports d'utilisation et nombre total d'espèces utilisées*.

Ntax: total species used by all the informants for group of ailments — *total des espèces utilisées par tous les informateurs pour le groupe de maladies*; Nur: total number of use reports in each group of disease — *nombre total de rapports d'utilisation dans chaque groupe de maladie*; ICF: informant consensus factor — *facteur de consensus des informateurs*; MTD: mouth-throat — *bouche-gorge*; EED: eye and ear diseases — *maladies des yeux et des oreilles*; D: diabetes — *diabètes*; RTD: respiratory diseases — *maladies respiratoires*; DSLD: digestive system and liver diseases — *maladies du système digestif et du foie*; SD: skin diseases — *maladies de la peau*; CSD: circulatory system diseases — *maladies du système circulatoire*; URSD: urinary and reproductive system diseases — *maladies du système urinaire et reproductif*; F: fever — *fièvre*; C: cancer — *cancer*; HP: hair problem — *problème de cheveux*; NSD: nervous system disorder — *désordre du système nerveux*; BLSD: blood and lymphatic system diseases — *maladies du système sanguin et lymphatique*; A: antidotes — *antidotes*; O: others — *autres*.

Ham. ex D.Don, *Vachellia nilotica* (L.) P.J.H. Hurter & Mabb., *Melia azedarach* L., *Pinus roxburghii* Sarg., *Punica granatum* L., *Pinus wallichiana* A.B.Jacks., *Cedrus deodara* (Roxb. ex D.Don) G.Don, *Abies pindrow* (Royle ex D.Don) Royle, *Ficus palmata* Forssk., *Sarcococca saligna* Müll.Arg., *Rubus niveus* Wall. and *Salix nigra* Marshall.

3.8. Fidelity level (FL)

The fidelity level of the 63 most important plant species reported by the respondents for the treatment of specific diseases ranged between 13.6 to 100% (**Annex 2**). *Berberis lycium*, *Zanthoxylum alatum* Roxb., *E. umbellata*, *V. canescens*, *M. longifolia*, *Bistorta*

amplexicaulis (D.Don) Greene and *T. linearis* showed 100% FL (**Figure 6**). These species were mostly used to treat wounds, gas, diabetes, flu, and backache. The other plant species with high FL included *G. wallichianum* (93.3%) to strengthen bones, *P. wallichiana* (91%) used to treat wounds, *Acacia nilotica* (L.) Delile (87.5%) to treat diarrhea, *Micromeria biflora* (Buch.-Ham. ex D.Don) Benth. (87.1%) used as against constipation, *Cynodon dactylon* (L.) Pers. (84.8%) to treat damaged bones, *Rumex dentatus* L. (84.6%) to treat joint pain, *Ajuga bracteosa* Wall. ex Benth. (79.4%) for blood circulation, *Euphorbia wallichii* Hook.f. (76.4 %) to treat dyspepsia, *Achillea millefolium* L. (76.1%) to treat tongue infection.

3.9. Jaccard Index (JI)

Ethnomedicinal knowledge reported in the current study was compared with previous published ethnobotanical studies from communities at regional and international level (**Table 2**).

4. DISCUSSION

4.1. Demographic data

The majority of informants were men, as due to cultural restrictions they were much more easily approachable for data collection. Women however had significantly higher knowledge about medicinal plants (average number of species = 6.59; average number of uses = 8.08) compared to male informants. The reason for this may lie in their close association with the domestic life. Women generally use herbal preparation to keep
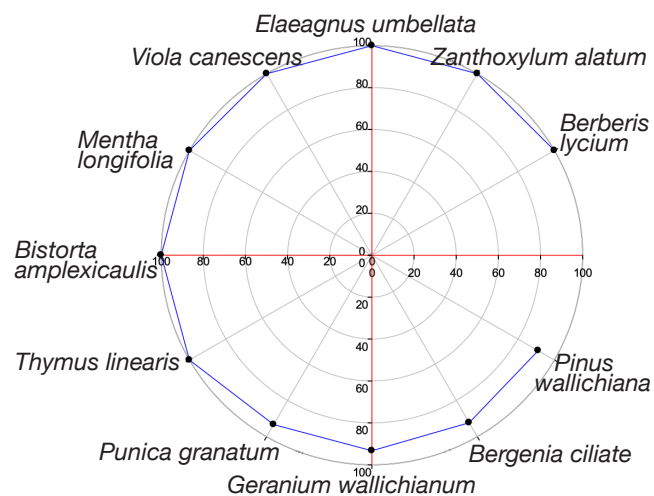

Figure 6. Top ranked plant species with above 80% fidelity — *Les espèces végétales les mieux classées avec une fidélité supérieure à 80 %.*

their family healthy. Some other studies conducted in Pakistan and abroad also reported similar trends (Albuquerque et al., 2011; Ahmad et al., 2014; Kayani et al., 2014; Shaheen et al., 2017; Umair et al., 2019). Older people had much experience, skill and awareness regarding the preparation and administration of herbal remedies. This trend is very common in literature (Butt et al., 2015; Ahmad et al., 2017; Farooq et al., 2019). Education was inversely linked to ethnomedicinal knowledge, given that many educated people lack interest to learn and practice folk uses of medicinal plants. Our results are strongly supported by other studies (Giday et al., 2009; Tugume et al., 2010; Farooq et al., 2019). Traditional health practitioners (THP's) and midwives held especially significant knowledge about medicinal plants. The trend of knowledge loss among younger generations is due to modern health facilities and changing life style. Similar trends were also observed in previous studies (Ahmad et al., 2017; Amjad et al., 2017; Farooq et al., 2019).

4.2. Ethno-floral diversity

The research area is mountainous, with a high moisture level year-round, leading to the dominance of herbaceous species, similar to many regions throughout the world (Ahmad et al., 2014; Kayani et al., 2014; Shaheen et al., 2017). Asteraceae and Rosaceae were the most species rich medicinal plant families in the area. Many other studies also reported the dominance of Asteraceae (Bano et al., 2014b; Blanco et al., 1999; Tugume et al., 2010) and Rosaceae (Ahmad et al., 2014; Kayani et al., 2014). The reason for this might be the presence of a high proportion of bioactive components among the majority of the members of these families, with strong pharmacological and organoleptic properties. Similarly, findings were also reported by other researchers (Pieroni, 2008; Menković et al., 2011; Qaseem et al., 2019).

4.3. Plant parts used

The widespread utilization of leaves in herbal remedies is explained by the richness of metabolites in leaves. Another reason is that leaves, in comparison to other plant parts, are abundant in nature and are easily available. Leaves were also the most used plant part in other studies (Cornara et al., 2009). Root was the second most commonly used plant part in the preparation of herbal recipes. It has been shown that roots often contain high concentrations of bioactive compounds as compared to other plant parts (Basualdo et al., 1995). In case of herbaceous species, the whole plants were frequently used. The removal of whole plant or roots or excessive use of fruits or seeds as medicines might however cause a decline in the plant populations, and

Table 2. Jaccard index comparing the present study with previous articles — *Index Jaccard comparant la présente étude avec des articles antérieurs.*

Area	SY	NRPS	NPSU	NPDU	TSCBA	SEAA	SESA	PPSU	PPDU	JI	Reference
From Azad Kashmir											
Pearl valley, AJK, Pakistan	2017	136	32	14	46	90	94	23.60	10.29	25.00	Shaheen et al., 2017
Toli peer, AJK, Pakistan	2017	121	34	12	---	75	94	28.00	9.91	37.30	Amjad et al., 2017
Neelum valley, AJK, Pakistan	2017	50	2	13	15	37	125	4.00	26.00	10.20	Ahmad et al., 2017
Banna valley, AJK, Pakistan	2015	86	6	25	31	55	109	6.97	29.06	23.30	Amjad, 2015
Devi gali, AJK, Pakistan	2017	98	13	26	39	59	101	13.26	26.53	32.20	Shabir et al., 2017
Kotli, Azad Kashmir	2019	80	4	18	22	58	118	5.00	22.50	12.50	Qasem et al., 2019
Samahni, Azad Kashmir, Pakistan	2021	150	6	16	22	128	118	4.00	10.67	8.21	Ishtiaq et al., 2021
Neelum valley, AJK, Pakistan	2021	103	6	19	25	78	115	5.83	18.45	11.47	Ajaib et al., 2021
Harighal, AJK, Pakistan	2020	150	24	35	59	91	81	16.00	23.33	25.54	Amjad et al., 2020
Sudhnoti District, AJK, Pakistan	2021	88	5	27	32	56	108	5.68	30.68	16.33	Khan et al., 2021
From other Pakistan											
Central Kurram, Khyber Pakhtunkhwa, Pakistan	2022	106	11	19	30	76	110	10.38	17.92	13.89	Hussain et al., 2022
Alpine and subalpine regions of Pakistan	2015	125	22	9	---	94	109	17.60	7.20	18.00	Kayani et al., 2014
Manoor valley, Northern Pakistan	2016	44	2	17	19	25	121	4.54	38.70	14.90	Rahman et al., 2016
Skardu valley, Karakoram-Himalayan range, Pakistan	2014	50	1	11	12	38	128	2.00	22.00	7.79	Bano et al., 2014a
Deosai Plateau, Pakistan	2015	13	0	1	1	12	139	0.00	7.70	0.66	Bano et al., 2014b
Mohmand Agency, FATA, Pakistan	2018	64	3	9	12	52	128	4.70	14.00	7.14	Aziz et al., 2018
Chail valley (District Swat- Pakistan)	2014	50	1	18	19	31	121	2.00	36.00	14.20	Ahmad et al., 2014
Tormik, valley, Baltistan, Pakistan	2016	63	1	4	5	58	135	1.58	6.34	2.65	Abbas et al., 2016
Naran Valley, Pakistan	2013	101	4	27	31	70	109	3.96	26.73	20.90	Khan et al., 2013
Kabal valley, Swat, KPK, Pakistan	2011	138	8	28	36	102	104	5.80	20.29	14.88	Ahmad et al., 2011
District Sialkot Punjab, Pakistan	2021	114	3	11	14	100	126	2.63	9.65	5.83	Shah et al., 2021
Wazirabad, Punjab, Pakistan	2018	31	0	4	4	27	136	0.00	12.90	2.51	Noreen et al., 2018
Chenab riverine area, Punjab, Pakistan	2019	129	3	13	16	113	124	2.32	10.07	7.23	Farooq et al., 2019
New Murree, Pakistan	2013	93	3	22	25	68	115	3.22	23.65	15.80	Ahmed et al., 2013
Thal desert, Punjab, Pakistan	2014	120	4	10	14	106	126	3.33	8.33	6.42	Shaheen et al., 2014
Mastung, Baluchistan, Pakistan	2014	102	4	8	12	90	128	3.92	7.84	5.82	Bibi et al., 2014

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Table 2 (continued). Jaccard index comparing the present study with previous articles — *Index Jaccard comparant la présente étude avec des articles antérieurs.*

Area	SY	NRPS	NPSU	NPDU	TSCBA	SEAA	SESA	PPSU	PPDU	JI	Reference
From world											
Nubra valley, India	2009	65	2	4	6	59	134	3.07	6.15	3.20	Kumar et al., 2009
Sobradinho, Luís Correia, Piauí, Brazil	2015	57	0	1	1	56	139	0.00	1.75	0.51	Silva et al., 2015
Guimaras island, Philippines	2014	142	0	4	4	138	136	0.00	2.81	1.48	Ong et al., 2014
Kerman Province, Southeast Iran	2021	402	2	11	13	389	127	0.50	2.74	2.46	Hosseini et al., 2021
Panchthar District, Kangchenjunga Landscape, Nepal	2021	140	0	8	8	132	132	0.00	5.71	2.94	Bhandari et al., 2022

SY: study year — *année d'étude*; NRPS: number of reported plant species — *nombre d'espèces végétales signalées*; NPSU: number of plants with similar uses — *nombre de plantes avec des usages similaires*; NPDU: number of plants with different uses — *nombre de plantes avec des usages différents*; TSCBA: total species common in both areas — *total des espèces communes aux deux zones*; SEAA: species enlisted in aligned areas — *espèces enregistrées dans les zones citées*; SESA: species enlisted only in study area — *espèces enregistrées uniquement dhas la zone d'étude*; PPSU: percentage of plant with similar uses — *pourcentage de plantes à usage similaire*; PPDU: percentage of plant with different uses — *pourcentage de plantes à usages différents*; JI: Jaccard index — *index Jaccard*.

therefore leaves are often more extensively used in herbal preparations (Giday et al., 2003; Ghimire et al., 2008).

4.4. Methods of preparation and mode of administration

The wide use of decoction coincided with many previous studies (Qaseem et al., 2019). The frequent use of decoction might be due to the effectiveness of heat for many active compounds (Zhang et al., 2005; Han et al., 2007; Chen et al., 2008). Decoctions can be prepared easily by mixing with water, tea and soup. Sometimes honey and sugar may also be added (Harmayani et al., 2019).

4.5. Quantitative ethnobotanical indices

Use value (UV). Use value is the measure of use types that were related to a particular plant species. A high use value reveals the importance of a species for treating different disorders. High use value also indicates that a plant species is well known and frequently used by the studied population (Kayani et al., 2014). Many of these plant species were abundant in the study area, and local inhabitants were well familiar with them. The plants with high use value are expected to be biologically more active (Trotter et al., 1986). The plants with highest RFC values should be used in phytochemical and pharmacological studies to assess their validity for possible drug development (Mukherjee et al., 2012).

Informant Consensus Factor (ICF). The maximum ICF value was reported for gastro-intestinal and parasitic disorders. Gastro-intestinal diseases were widespread in the area which can be attributed to inadequate accessibility of clean food and drinking water. Similar results for gastro-intestinal disorders were also reported by other studies (Murad et al., 2013; Malla et al., 2015; Tangjitman et al., 2015). Skin disorders were also common among the inhabitants leading to high ICF value (Shaheen et al., 2017; Farooq et al., 2019).

Fidelity level (FL). *Berberis lycium*, *Z. alatum*, *E. umbellata*, *V. canescens*, *M. longifolia*, *B. amplexicaulis* and *T. linearis* showed 100% FL. High FL indicates abundant utilization of a plant species to treat a specific disease in an area (Srithi et al., 2009; Bibi et al., 2014). Plants with high FL value have potential to be used in advanced ethnopharmacological research (Hassan-Abdallah et al., 2013).

Jaccard Index (JI). Differences in ecological (Ladio et al., 2007), historical (Moerman, 1989), organoleptic

and phytochemical factors have been elucidated as being responsible for variance and resemblance of indigenous knowledge among communities. Comparisons of communities can be giving valuable leads for the development of new drugs (Leonti et al., 2009). The data shows that the similarity percentage of uses ranged between 0% to 28% and the dissimilarity from 1.75% to 38.7%. The maximum level of similarity was found with communities studied in Toli peer (Amjad et al., 2017) and Pearl valley (Shaheen et al., 2017) with JI values of 37.3 and 25 respectively. The distances between the study area and allied communities are seen as mostly responsible for differences in the value of the JI. The communities closer to the study area had a high similarity index value. This can also be related to similar vegetation and high cultural exchange in the past between the local communities, resulting in the similarity in the ethnobotanical knowledge of allied areas.

The lowest value of similarity indices was recorded for the studies conducted in Sobradinho, Luís Correia, Piauí, Brazil (Silva et al., 2015) and Guimaras Island (Ong et al., 2014), which, given the completely different flora and cultural background, is not surprising. The comparative analysis of our research with published studies highlighted some novel uses of plants not reported so far from the region including the use of a leaf decoction of *Hepatica falconeri* (Thomson) Yuz. for diabetes, the whole plant pastes of *Clinopodium umbrosum* (M.Bieb.) Kuntze for wounds healing, a whole plant extract of *Anisomeles indica* (L.) Kuntze used as blood purifier, aerial parts of *Galium aparine* L. used to stop bleeding, and the fruits of *Daphne papyracea* Wall. ex G. Don eaten for tonsilitis. The plant species with novel medicinal uses and high RFC value should be studied to elucidate bioactive compounds and pharmacological activities for the possible development of novel drugs.

5. CONCLUSIONS

The current study is the first documentation of indigenous knowledge about the medicinal flora of Lasdana. Quantitative indices including relative frequencies of citation (RFC), use value (UV), fidelity level (FL), relative importance (RI), informant consensus factor (ICF) and Jaccard index (JI) confirmed that the area is rich in botanical and cultural diversity.

The population of the area largely depends upon wild plants for primary health care. However, traditional knowledge is gradually decreasing in the new generation.

This study provides baseline information for the conservation and sustainable use of the local flora.

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