Indian Journal of Traditional Knowledge
Vol 20(2), April 2021, pp 436-450

An ethnomedicinal survey of traditionally used medicinal plants from Charkhi Dadri district, Haryana: an attempt towards documentation and preservation of ethnic knowledge

A S Rao[a], S S Yadav[a,*,†], A Sheoran[a], N Singh[a], A Nandal[a], M S Bhandoria[b], S A Ganaie[c], & P Bansal[d]

[a]Department of Botany, Maharshi Dayanand University, Rohtak 124 001, Haryana, India

[b]Department of Education, Government of Jammu and Kashmir 190 001, India

[c]Department of Botany, Government College, Mahendergarh, Haryana, India

[d]Department of Botany, KLP College, Rewari, Haryana, India

E-mail: [†]ssyadavindia@gmail.com

Received 11 February 2020; revised 29 December 2020

Medicinal plants have remained an integral source of therapeutics for primary healthcare since antiquity. The information pertaining to usage of plants is either inherited from elders or acquired through trials or the experience of others but is not documented frequently. South Haryana is one such rich storehouse of ethnomedicinal knowledge. Hence, ethnomedicinally important plants from Charkhi Dadri district of Haryana state were documented in the present study. The data was collected through field surveys and in-depth interviews organized in the fields during the years 2018-19. Factor of informant consensus was also calculated. A total of 90 ethnomedicinal plants were identified, belonging to 41 families and 79 genera. Majority of plants were herbs (47.7%), followed by trees (30%). Leguminosae (10%) represented the maximum number of plants, followed by Solanaceae (6.6% each) and Amaranthaceae, Lamiaceae and Poaceae (5.5% each). A total of 64 ailments were reported to be treated traditionally by ethnomedicinal plants in the area. The most commonly treated diseases were menorrhagia, skin boils, typhoid, diabetes, piles and diarrhoea. It was observed that the majority of plants were used freshly to extract juice, followed by powder and decoction and rarely as tea or oil forms. The present study provides comprehensive ethnomedicinal data including vernacular and botanical names, names of the family, mode of preparation, administration and dosage of plant drugs and diseases treated. It was concluded that this region still possesses numerous useful ethnomedicinal knowledge and may contribute to further herbal drug development programs.

Keywords: Aravalli hills, Drug discovery, Ethnomedicine, Medicinal plants, Traditional knowledge

IPC Code: Int. Cl.[21]: A61P 3/00, A61P 5/00, A61P 11/00, A61P 17/00, A61K 36/00, A61K 45/06

Ethnomedicine refers to health practices incorporating plant, mineral and animal sources to treat illnesses or maintain well-being. The poor and marginal people of the world today still rely on various traditional health care systems. They primarily depend on traditional medicines for treating emerging diseases, specifically infectious diseases where pathogens evolve to new strains (methicillin-resistant *Staphylococcus aureus*), switch their hosts (HIV, SARS) or spread to new geographic locations (Zika, Coronavirus spreads). The Allopathic treatments available are being used extensively without question, but the dark sides of such treatments are being noticed now. The graveside effects of such medications have become a major concern around the world like non-steroidal drugs (NSAIDs) cause 12% and 5% hospitalization and deaths annually respectively[1]. Currently, the traditional system of medicine is gaining wide acceptability, particularly in developing countries, primarily due to long unsustainable economic conditions, high cost and toxicity of allopathic drugs and emergence of drug resistance. Around 80% of the world's poor and marginal population still rely on traditional medicines for curing various ailments[2,3]. Documentation of precious indigenous knowledge about medicinal plant species, supplemented by the latest scientific approaches could offer development of novel leads that are economically and environmentally more acceptable.

India is one of the mega-diverse region harbouring about 12% of the global biodiversity with having only 2.2% of world's geographical area. This is due to the

*Corresponding author

diversity in its geographical, edaphic and climatic factors. India not only harbours rich biodiversity but also has a rich ethnic diversity and versed indigenous knowledge. This indigenous knowledge has been refined over time through trials and passed from one generation to another, the literature citations of ethnomedicinal knowledge can be traced back to the Vedic period. The evolution of herbal industries in India can be credited to this indigenous knowledge and ethnic diversity with more than 9000 registered herbal industries working on the principle of the traditional system of medicine and an estimated 6000-7000 higher plant species being used in folkloric medicines[4].

Aravalli hills are one of the oldest mountain ranges of the world, often referred to as "Cradle of civilizations", and are represented by rich genetic resources. The Aravalli mountain range stretches from Delhi in the northeast to Gujarat in the southwest for about 692 km, passing through southern Haryana and Rajasthan. The region is rich in its flora, which is of great scientific curiosity, chiefly owing to its topographic variations[5].

It was hypothesized that local people particularly living in rural areas still acknowledge the therapeutic potential of medicinal plants in treating routine maladies. People in the region have practiced and learned the usage of plants growing in their close vicinity for treating routine ailments and other health conditions. It was also hypothesized that locally abundant and widely distributed medicinal plants are used in treating many diseases and many plants may be used for treating a particular disease.

During the recent past, only a few studies have been conducted to explore and document the ethnomedicinal plants of the southern Haryana[6-9]. In this context, the present study aimed on the documentation and exploration of the ethnomedicinal flora of Charkhi Dadri district of Haryana state, which has been the most neglected portion in the region. The study was oriented to not only document the ethnomedicinal flora but to also provide relevant vernacular and botanical names. Effort was also made to document the modes of preparation, administration and dosage of plant drugs and diseases treated. Besides, it will also help in the preservation and sustainable use of the flora in the region.

Materials and Methods

Study site description

The present ethnomedicinal study was conducted in Charkhi Dadri district of Haryana state, India. It lies between 28.5921° N latitude and 76.2653° E longitude and covers geographical area of 1370.11 sq km (Fig. 1). The district is situated at a distance of 112.6 km from New Delhi and 295 km from Chandigarh. This district is divided into four administrative blocks, Charkhi Dadri, Baund Kalan, Badhra and Jhoju. It consists of about 172 villages with a total population of 5,02,276 and a literacy rate of 67.04%.

Topographically, it is situated at the offshoots of Aravalli Hill Ranges and has a semi-arid climate. Though the average temperature of the region is 25°C but in summers, the temperature may reach very high (47°C) and in winters it may be very low (2°C). The normal annual rainfall is 483mm out of which about 85% of the total rainfall occurs only in July and August. The region is dominated by xerophytic vegetation with thorny trees like Indian gum Arabic tree, catechu, shami tree, caper along with neem, sheesam, peepal and other species. The majority of the rural population of the region is dependent on agriculture and animal husbandry for their livelihood. Pearl millet, cotton, sorghum are the major Kharif crops while wheat, mustard, gram are the important Rabi crops grown in the region.

Data organization and collection

Data on ethnomedicinal use of plants was collected by field surveys and structured interview schedules during the years 2018-2019. Localities around the village temples, village community forests (Bani), sacred grooves, farms and village ponds were preferred sites for data collection due to intimate relations shared by localities with these places and plants around them. The interviews were conducted in vernacular languages with local respondents preferably elders and experienced members including temple priests and traditional health practitioners (hakims/vaidyas and veterinarians). In total. 120 randomly selected informants were interviewed from different localities of Charkhi Dadri district of Haryana. Amongst the informants 103 (86%) were indigenous people and 17 (14%) were traditional health practitioners. Data on age, gender and educational background of the informants was also gathered (Table 1). Information including plant part used, mode of preparation and methods of administration, doses, ailments treated was gathered and documented in detail. To bring accuracy and reliability, multiple surveys were conducted and the ethnomedicinal knowledge was cross-checked.

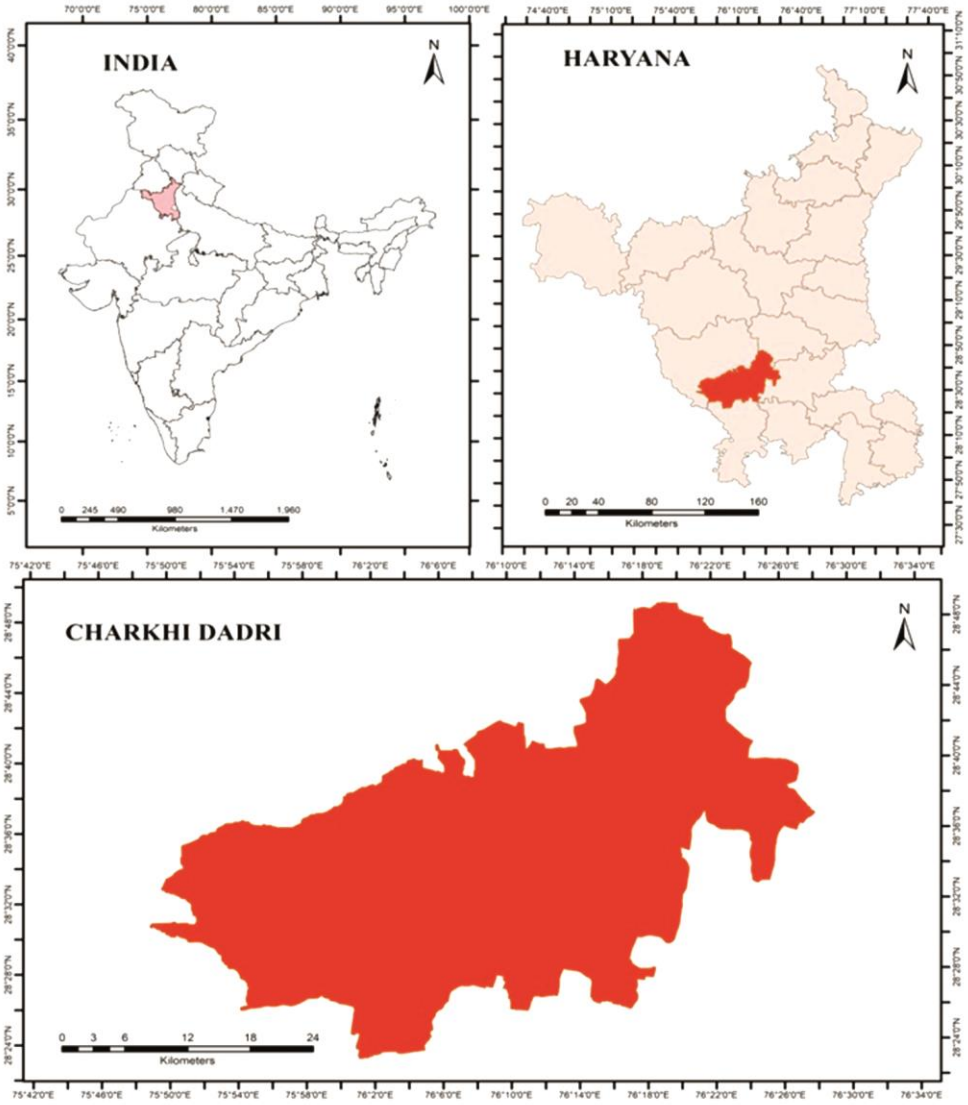

Fig. 1 — Map of the study area

Table 1 — Demographic data

Variables	Categories	No. of informants	Percentage (%)
Gender	Male	84	70
	Female	36	30
Informant category	Traditional healers	17	14
	Farmers/ local people	103	86
Age	20-40	32	27
	40-60	64	53
	60-80	24	20
Educational background	Illiterate	34	28
	Below metric	45	38
	Higher secondary	33	28
	Graduate and above	8	6

Further, the traditional healers, elders and women of the surveyed localities were also interviewed to prove the credibility.

Ethnomedicinal data was tabulated and analyzed statistically using computer. Microsoft excel spread sheets were used to categorize the ethnomedicinal plants into herbs, shrubs, trees, climbers and creepers. Plant parts used as ethnomedicine were categorized into six groups which included leaves, root, bark, seed, fruits and whole plant. Modes of administration of plant preparations were classified into oral, topical, nasal and optical applications.

Most plant specimens were identified in their natural habitats, while ambiguous specimens were brought to the Biodiversity Lab of the Department of

Botany Maharshi Dayanand University, Rohtak for further identification and confirmation from the available literature[10, 11]. The voucher specimens were deposited for preservation in the Department of Botany, Maharshi Dayanand University, Rohtak, Haryana (India). Botanical names were authenticated from the web source "The Plant List" (http://www.theplantlist.org/) and renowned taxonomists of the region.

Calculation of Informant Consensus Factor

Factor of Informant Consensus (F_{ic}) is commonly used methods to find out intercultural relevance and acceptability of use of a particular plant species in consideration. F_{ic} is used to study total usage of plant species according to culture applicability. F_{ic} was calculated as under:-

$F_{ic} = N_{ur} - N_t \div N_{ur} - 1$

N_{ur} is number of cited use in a particular category

N_t is the number of species used for that particular use

Result ranges from 0.00-1.00. Higher value of F_{ic} means that a particular plant species or only a few others can be used for a particular disease in consideration. While a lower value of F_{ic} means the population under study is not satisfied or disagrees with the use of a particular species for curing a particular disease. By use of F_{ic} we can compare the plant species for their relative importance or acceptance for treatment of a disease in consideration.

Results

Diversity of ethnomedicinal flora

A total of 90 ethnomedicinal plants belonging to 79 genera and 41 families were documented from Charkhi Dadri district of Haryana (India) (Table 2). Among them, 43 were herbs (47.7%), 27 trees (30%), 12 shrubs (13.3%), 07 climbers (7.8%) and 01 creepers (1.1%) (Fig. 2). The most commonly represented families were Leguminosae with 09 species (10%) followed by Solanaceae with 06 species (6.6%),

Table 2 — Ethnomedicinal uses of plant species in Charkhi Dadri district of Haryana, India

Family	Botanical name	Vernacular name	Part used	Mode of preparation/administration	Doses	Disease treated	Factor of Informant Consensus
Aizoaceae	*Trianthema portulacastrum* L. VSN: Singh: 621	Saati	Whole plant	Juice is extracted from taken orally.	20 mL twice a day for 5 days	Swelling	0.953
Amaranthaceae	*Achyranthes aspera* L. VSN: Singh: 226	Ultakanta	Root	Juice of roots mixed with honey and taken orally.	5 mL taken twice in a day for 2 days	Cold & cough	0.853
			Root	Roots as tooth brush.	Brushing for 3 days	Toothache	0.889
			Root	Decoction is taken orally.	100 mL for 4- 5 days	Typhoid	0.841
			Root	Powder of root along with mishri and 2 black peppers are soaked in 1 glass of water for overnight and consumed orally.	250 mL for 7- 10 days	Stones	0.912
			Root	Decoction is taken orally.	Half cup taken for 7 days	Menorrhagia	0.667
			Seed	100 g seeds are boiled in milk and made into concentrated mixture and taken.	250 mL for 7 days	Ulcer	0.957
	Aerva javanica (Burm.f.) Juss. ex Schult. VSN: Singh: 246	Bui	Whole plant	Crushed and paste is tied externally over the affected portion.	Paste applied for 4-5 days	Inner injury	0.824
				Whole plants are boiled in water. A cloth is soaked in the boiled water and applied on the affected areas.	Applied thrice a day for 3-4 days	Swelling	0.824
	Amaranthus viridis L. VSN: Singh: 164	Chaulai	Whole plant	Juice is extracted and taken orally.	50 mL for a week	Anemia and Loss of appetite	0.982
	Chenopodium album L. VSN: Singh: 536	Bathua	Seed	A decoction of 50 g seeds is taken orally.	Half cup of decoction for 5 days	Oligomenorrhea	0.988
	Digera muricata (L.) Mart. VSN: Singh: 469	Kundhra	Seed	A decoction of 50 g seeds is prepared and used orally.	100 mL twice a day for 3 weeks	Typhoid	0.877

(*Contd*.)

Table 2 — Ethnomedicinal uses of plant species in Charkhi Dadri district of Haryana, India (*Contd*.)

Family	Botanical name	Vernacular name	Part used	Mode of preparation/administration	Doses	Disease treated	Factor of Informant Consensus
Amaryllidaceae	*Allium cepa* L. VSN: Singh: 128	Onion pyaj	Bulb	1-2 onion bulbs are chopped and squeezed to extract juice. The juice is then mixed with honey and taken orally.	100-150 mL juice for 4-5 days	Cholera	1.000
	Allium sativum L. VSN: Singh: 118	Lehsun	Bulb	Juice is squeezed out from clove and used as eardrop.	1-2 drops thrice a day	Earache	0.848
	Crinum asiaticum L. VSN: Singh: 951	Sukhdarshan	Leaf	Juice is used as ear drops.	2-3 drops twice a day till cure	Earache	0.857
Apiaceae	*Coriandrum sativum* L. VSN: Singh: 107	Dhaniya	Leaf	Cooled water of boiled leaves is used as eye drops.	1-2 drops twice a day for a month	Eye sight	0.944
	Cuminum cyminum L. VSN: Singh: 362	Jeera	Seed	Seeds are chewed before breakfast.	20 g for two weeks	Agalactia	0.971
	Daucus carota L. VSN: Singh: 111	Gajar	Seed	100 g seeds boiled in 1 liter water and the decoction is used orally.	100 mL for 2-3 days	Abortion	0.971
Apocynaceae	*Calotropis procera* (Aiton) Dryand. VSN: Singh: 167	Aak	Flower	Fresh flowers are taken orally with water.	5-7 flowers for 3 to 4 days	Fever	0.926
			Leaf	Lightly heated leaves are tied externally over affected area.	7-8 leaves for a week	Muscular pain	0.680
			Stem	Mixture of latex and butter is applied over the affected teeth with the help of cotton.	5 to7 min twice a day till cure	Toothache	0.857
			Leaf and stem	Latex is externally applied over bee sting.	2-3 drops once in a day till cure	Bee sting	0.957
			Root	Soil from rhizosphere is taken and lightly heated and applied over the affected area.	1 kg for 10-15 min for 4 days	Muscular pain	0.680
			Root	Fresh root is used as toothbrush.	Twice a day till cure	Toothache	0.897
	Leptadenia pyrotechnica (Forssk.) Decne. VSN: Singh: 615	Kheep	Stem and leaf	Latex is applied externally over affected area.	2-3 drops twice a day till cure	Thorn puncture	0.982
			Whole plant	Decoction is taken orally.	100 mL once a day for one week	Tetanus	0.929
			Fruit	Fruit is cooked as vegetable for eating.	Two weeks	Indigestion	0.925
			Root	Decoction is taken orally.	70 mL daily for 3 days	Typhoid	0.731
	Thevetia peruviana (Pers.) Schum. VSN: Singh: 455	Kaner	Leaf	Crushed leaves are tied externally over affected area.	250 g twice a day for 3-4 days	Snake bite	0.946
Asparagaceae	*Asparagus racemosus* Willd. VSN: Singh: 313	Satavar	Root	Powder is taken orally with water	10-15 g powder	Agalactia	0.952
Asteraceae	*Artemisia scoparia* Waldst. & Kit. VSN: Singh: 203	Banna	Leaf	Juice is squeezed from leaves and used as ear drop.	2-3 drops thrice a day for 3-4 days	Earache	0.891
	Cirsium arvense (L.) Scop. VSN: Singh: 290	Barhmdandi	Whole plant	Pills are taken orally with water.	2-3 pills daily for 5 weeks	Diabetes, muscular pain	0.811
	Launaea procumbens (Roxb.) Ramayya & Rajagopal VSN: Singh: 296	Desi gobhi	Whole plant	A mixture of whole plant juice and 500 g butter is taken orally.	50 mL daily for 4 days	Piles	0.821
	Tridax procumbens L. VSN: Singh: 426	Sadahari, beldi, harikaghas	Whole plant	Juice is used externally over affected area.	Once a day till cure	Cut, wound	0.963
			Leaf	A mixture of leaf juice, sugar and milk is taken orally.	One glass for a week	Menorrhagia	0.870

(*Contd*.)

Table 2 — Ethnomedicinal uses of plant species in Charkhi Dadri district of Haryana, India (*Contd*.)

Family	Botanical name	Vernacular name	Part used	Mode of preparation/administration	Doses	Disease treated	Factor of Informant Consensus
Bignoniaceae	*Tecomella undulata* (Sm.) Seem. VSN: Singh: 250	Roheda	Wood	Wood oil is applied topically over affected area.	Twice in a day for 4-5 days	Skin disease	0.727
	Cordia dichotoma G.Forst. VSN: Singh: 346	Lashua	Fruit	Fresh fruits are eaten.	3-4 fruits twice a day for 2-3 days	Mouth sores	0.981
	Cordia sinensis Lam. VSN: Singh: 275	Gundni	Fruit	Fresh fruits are eaten.	4-5 fruits for 2 to 3 days	Mouth sores	0.965
Brassicaceae	*Brassica juncea* (L.) Czern. VSN: Singh: 393	Rai	Seed	Seeds are crushed, mixed with jaggery and applied externally over boils.	Applied for 4 to 5 days	Skin boils	0.909
			Seed	Powder mixed with curd is taken orally.	Once a day for 10 days	Stones	0.885
	Raphanus raphanistrum subsp. *sativus* (L.) DominVSN: Singh: 389	Muli	Root	Raw radish is eaten	1-2 radish for two weeks.	Jaundice	0.976
			Root	Juice is extracted from roots and taken orally.	200 mL for a month	Stones	0.959
Burseraceae	*Boswellia serrata* Roxb. ex Colebr. VSN: Singh: 677	Saalhr	Bark	Decoction is taken orally.	100 mL for a week	Arthritis	0.909
Cactaceae	*Opuntia dillenii* (Ker Gawl.) Haw. VSN: Singh: 631	Nagfhani	Stem	Stem pulp is rubbed with turmeric powder and tied externally over affected area.	4-5 times for a month	Arthritis	0.906
Capparaceae	*Capparis decidua* (Forssk.) Edgew. VSN: Singh: 224	Kair	Fruit	A mixture of fruit powder and black salt is taken orally.	10-15 g for a week	Indigestion	0.978
			Root	Root is boiled in mustard oil and is applied externally over skin.	For a week	Skin disease	0.842
Cleomaceae	*Cleome viscosa* L. VSN: Singh: 161	Kukerbhungra	Leaf	Juice is squeezed from leaves and used as eardrop.	2-3 drops twice a day till cure	Ear ache	0.808
				Decoction of leaves taken orally with water.	20 leaves for a week	Piles	0.848
			Seed	Seeds are crushed into powder which is taken orally with water.	10 g for 3 days	Diarrhoea	0.688
Combretaceae	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn. VSN: Singh: 160	Arjun	Bark	Bark is soaked in water for 12 hours during night and filtered decoction is taken orally in morning.	5-10 g for 6 weeks	Heart disease	1.000
Convolvulaceae	*Cuscuta reflexa* Roxb. VSN: Singh: 400	Amerbel	Whole plant	Boiled in salt water and used for bathing.	4 to 5 days	Muscular pain	0.918
				Paste from the whole plants is applied externally over cracked heels.	5-7 times for two weeks	Cracked heels	0.977
Crassulaceae	*Bryophyllum daigremontianum* (Raym.-Hamet & Perrier) A. Berger VSN: Singh: 920	Patherchat	Leaf	Fresh leaves are chewed before breakfast.	3-4 leaves till cure	Stones	0.964
Cucurbitaceae	*Citrullus colocynthis* (L.) Schard. VSN: Singh: 459	Gadumba	Fruit	A mixture of fruit powder, black salt and carom seed is taken orally with water.	10g daily for 3 weeks	Constipation	0.980
			Root	Fresh root is used as tooth brush.	2-3 times till cure	Toothache	0.947
	Cucumis melo L. VSN: Singh: 1009	Kachri	Fruit	Powder from dried fruits is taken orally with water.	10 g for 2-3 days	Stomach ache	0.907
	Luffa acutangula (L.) Roxb. VSN: Singh: 281	Tori	Fruit	Ash of fruit is applied externally over skin boils	4-5 days	Skin boils	0.765
	Momordica balsamina L. VSN: Singh: 255	Janglikarela	Whole plant	Powder of whole plant is applied externally over affected area.	2 to 3 times	Pus, wound	0.840

(*Contd*.)

Table 2 — Ethnomedicinal uses of plant species in Charkhi Dadri district of Haryana, India (*Contd*.)

Family	Botanical name	Vernacular name	Part used	Mode of preparation/administration	Doses	Disease treated	Factor of Informant Consensus
Euphorbiaceae	*Euphorbia hirta* L. VSN: Singh: 132	Dudhi	Whole plant	Whole plant powder is taken orally with water.	10 g for twice a day for 5 days	Menorrhagia, leucorrhoea	0.714
	Ricinus communis L. VSN: Singh: 454	Arand	Seed	150 mL milk mixed with 3-4 drops of oil is taken orally.	One glass once a day for a month	Labour pain	1.000
			Leaf	Leaves are warmed; mustard oil is applied on them and then tied externally over affected area.	5-7 leaves for a week	Muscular pain	0.917
Lamiaceae	*Clerodendrum phlomidis* L. f. VSN: Singh: 396	Arno	Leaf	Paste of fresh leaves is applied topically over burnt skin.	2-3 days	Burnt skin	0.939
				Cloth soaked in hot aqueous extract is tied externally on the effected parts.	For a week	Pain	0.933
			Root	Mixture of root powder, butter, muscovado and flour is boiled and taken orally.	50 g for two weeks	Muscular pain	0.742
	Leucas cephalotes (Roth) Spreng. VSN: Singh: 124	Dadgal, dholphuliya	Whole plant	Whole plant is kept in water overnight and then its decoction is taken orally in the morning.	100 mL once a day for 2 days	Malaria	0.913
			Leaf	Juice is squeezed from fresh leaves and taken orally.	20 mL for 5 times in an intervals of 3 hour for a week	Snakebite	0.945
	Mentha spicata L. VSN: Singh: 403	Podina	Leaf	Extract mixed with water is taken orally.	1 glass thrice a day 3-4 days	Sunstroke	0.980
	Ocimum basilicum L. VSN: Singh: 349	Maurava	Leaf	Juice extracted from leaves is used as ear drops.	2-3 drops twice a day till cure	Earache	0.926
	Ocimum tenuiflorum L. VSN: Singh: 617	Tulsi	Leaf	Leaves are chewed before breakfast.	3-4 leaves daily for 3-4 days	Halitosis	0.977
			Leaf	2-3 leaves are used for making tea.	1 cup three times in a day for atleast 4 days	Cold, cough	0.956
Leguminosae	*Acacia leucophloea* (Roxb.) Willd. VSN: Singh: 273	Ronj	Bark	250 g bark is boiled in 2000 mL water. A cloth is soaked in the boiled mixture and applied.	1 to 1.5 l boiled mixture once in a day for 5 to 7 days	Skin boils	0.860
	Acacia nilotica (L.) Delile VSN: Singh: 261	Kikar	Leaf	Paste is applied externally overhead.	500 g paste for 2 to 3 days	Headache	0.750
			Leaf	Powder of leaves is taken orally with water.	20 g powder daily for 15 days	Leucorrhoea, male sexual weakness	0.742
			Fruit	Powder of dried fruit is taken with water orally.	10-15 g powder twice in a day for 1 month	Arthritis	0.943
			Fruit	Fruits are crushed to powder and taken with water orally.	10 g powder once in a day for 2 months.	Diabetes	0.904
			Bark	Decoction of 250 g bark is prepared in one liter water and then is taken orally.	100 mL decoction for 4 days	Pneumonia, cold	0.964
			Thorn	50 g thorns are boiled in half litre water to make decoction and taken orally.	50-100 mL decoction for 3 to 4 days	Whooping cough	0.981
	Acacia senegal (L.) Willd. VSN: Singh: 643	Khairi	Root	Warm aqueous decoction is taken orally.	50-100 mL decoction for 3 days	Typhoid	0.851
			Gum	Gum is crushed and made into powder and then taken orally with water.	20 g powder for 40 days	Leucorrhoea	0.929

(*Contd*.)

Table 2 — Ethnomedicinal uses of plant species in Charkhi Dadri district of Haryana, India (*Contd*.)

Family	Botanical name	Vernacular name	Part used	Mode of preparation/administration	Doses	Disease treated	Factor of Informant Consensus
	Albizia lebbeck (L.) Benth. VSN: Singh: 249	Siris	Seed	Powder is taken orally with water.	10-15 g twice a day for 1 month	Arthritis	0.952
			Leaf	Juice is extracted from the leaves and mixed with *Aloe vera* gel. The mixture is used as eye drop.	1-2 drops twice a day for 3-4 days	Eye infection	0.929
	Cicer arietinum L. VSN: Singh: 423	Chana	Seed	Flour is taken as food.	For one month	Diabetes, blood impurity	0.920 0.934
	Dalbergia sissoo DC. VSN: Singh: 361	Sisham	Leaf	A mixture of leaves and water is kept overnight and taken orally in morning.	250 mL water for two weeks	Menorrhagia, leucorrhoea	0.848
			Leaf	Leaf powder is applied externally over burnt skin.	Twice a day till cure	Burnt skin	0.909
			Leaf	A paste from young leaves is applied externally over affected area.	2-3 times daily till cure	Minor cut	0.850
	Prosopis cineraria (L.) Druce VSN: Singh: 374	Jaati	Fruit	A decoction of 100g fruits is taken orally.	100 mL twice a day for a week	Diarrhoea	0.939
			Leaf	Decoction of 250g leaf is prepared in one litre water and then taken orally.	100 mL thrice a day for a month	Miscarriage	0.980
			Leaf	Leaves boiled in water are tied externally over wounds.	4-5 days	Wounds	0.956
			Leaf	Leaf paste mixed with *Jaggery* is applied topically over the affected area.	4 to 5 days	Inner injury	0.962
	Senna occidentalis (L.) Link VSN: Singh: 530	Ritwa	Leaf	Leaf paste is applied topically over affected area.	Paste applied for two weeks	Vitiligo	0.972
			Leaf	Leaves are boiled in water and used for bathing.	Thrice a day till cure	Skin boils	0.667
	Trigonella foenum-graecum L. VSN: Singh: 451	Methi	Seed	A mixture of 5g seeds and black salt is taken orally with water.	5 g once in a day for a week	Acid reflux	0.988
			Seed	Seeds are kept in water overnight and used for washing hair.	Twice in a week	Dandruff	0.987
Lythraceae	*Punica granatum* L. VSN: Singh: 605	Anar	Fruit	Fruit husk is used in making tea.	1 cup twice a day for 2-3 days	Cold, cough	0.883
Malvaceae	*Corchorus depressus* (L.) Stocks VSN: Singh: 547	Kurand	Whole plant	Paste is applied externally over the affected portion.	Paste applied for two weeks	Inner injury	0.965
	Corchorus tridens L. VSN: Singh: 627	Kaglahar	Leaf	Fresh leaves of *C. tridens* and neem are chewed before breakfast.	6 leaves each for a week	Piles	0.861
Meliaceae	*Azadirachta indica* A. Juss. VSN: Singh: 117	Neem	Bark	Ash of bark is applied externally over mustard oil on the affected skin.	Applied for 2 to 3 days	Skin boils	0.927
			Leaf	3 to 4 leaves mixed with butter and taken orally.	Mixture for 3-4 days	Malaria	0.990
			Leaf	Young leaves are chewed in the morning.	3-4 leaves daily for 15 days	Bleeding gums	0.990
			Leaf	Fresh leaves are chewed.	5-6 leaves once a day for a week	Snake bite	0.985
			Leaf	Leaves are crushed to extract juice and used as ear drop.	5 drops for 2 days	Ear boils	0.977
			Seed	Paste of dried seeds mixed with sugar and butter is taken orally.	50 g daily for 1 month	Piles	0.935
			Seed	Seed powder is taken orally with water.	15-20 g powder twice a day for 2 months	Diabetes	0.714

(*Contd*.)

Table 2 — Ethnomedicinal uses of plant species in Charkhi Dadri district of Haryana, India (*Contd*.)

Family	Botanical name	Vernacular name	Part used	Mode of preparation/administration	Doses	Disease treated	Factor of Informant Consensus
	Melia azedarach L. VSN: Singh: 318	Bakain	Seed	Seeds are crushed to make fine powder; sieved with fine cloth and then taken orally with lukewarm water.	10 g powder once in a day for 10 days	Piles	0.902
			Leaf	Leaves are boiled in mustard oil; allowed to cool and then used as eardrop.	1-2 drops twice a day till cure	Earache	0.732
Menispermaceae	*Cocculus pendulus* (J.R. Forst. & G.Forst.) Diels VSN: Singh: 145	Peelwanibel	Leaf	A cloth is soaked in the hot aqueous extract of leaves is applied externally.	Twice a day for 3-4 days	Swelling	0.935
	Cocculus pendulus (J.R. Forst. & G.Forst.) Diels VSN: Singh: 145	Peelwanibel	Whole plant	Ash of whole plant is applied externally over affected area.	Till cure	Chronic injury	0.985
	Tinospora sinensis (Lour.) Merr. VSN: Singh: 238	Ghiloye	Twigs	Twigs are boiled in water and allowed to cool and then taken orally in morning.	250 mL for 3 days	Dengue Fever	1.000
			Leaf	Mature leaves are boiled in water and the decoction is taken orally.	100 mL for 6-7 weeks	Diabetes	0.829
Moraceae	*Ficus benghalensis* L. VSN: Singh: 228	Bargad	Leaf	Lightly heated leaves are tied externally over affected area.	10-12 leaves for 5 to 7 days	Muscular pain	0.879
			Leaf	Cotton is dipped in latex and kept externally over lumps.	Twice a day for one week	Armpit lumps	0.984
			Leaf	A mixture of latex and muscovado is taken orally.	Twice a day for 3 days	Menorrhagia	0.808
			Leaf	Latex is taken along with sweet batasha (sugar dish) and taken orally.	5-7 drops for 1 month	Sexual weakness in males	0.982
			Prop root	A decoction is prepared from prop roots and taken orally.	50 mL for two weeks	Menorrhagia	0.870
			Prop root	A mixture of root powder and muscovado is taken orally with water.	20 g for 2 months	Female sterility	0.988
			Bark	A mixture of bark powder and muscovado is used orally with water.	50 g for 1 to 2 months	Female sterility	0.987
	Ficus religiosa L. VSN: Singh: 282	Peepal	Bark	Dried bark is made into powder and applied externally over affected area.	Till cure	Burnt skin	0.958
Moringaceae	*Moringa oleifera* Lam. VSN: Singh: 266	Sahjana	Fruit	Fruits are cooked as vegetable for eating.	2 months	Diabetes	0.712
Myrtaceae	*Eucalyptus globulus* Labill. VSN: Singh: 369	Safeda	Leaf	A cloth is soaked in the warm aqueous is applied externally over affected area.	3 days	Swelling	0.953
			Leaf	Leaves are boiled in water and steam/fumes are inhaled.	Twice in a day till cure	Cold, cough	0.941
	Psidium guajava L. VSN: Singh: 149	Amrud	Leaf	Juice extracted from leaves and is taken orally.	150 mL daily for 2 to 3 days	Diarrhoea	0.932
	Syzygium cumini (L.) Skeels VSN: Singh: 114	Jamun	Seed	Seed powder is taken orally with water before breakfast.	10-15 g once a day till cure	Diabetes	0.936
Nyctaginaceae	*Boerhavia diffusa* L. VSN: Singh: 622	White saati	Root	Juice is extracted from roots and taken orally	10 mL juice for 5 days.	Jaundice	0.971
			Whole plant	Juice is extracted from whole plant and taken orally.	10-15 mL per day for a week	Constipation	0.714

(*Contd*.)

Table 2 — Ethnomedicinal uses of plant species in Charkhi Dadri district of Haryana, India (*Contd*.)

Family	Botanical name	Vernacular name	Part used	Mode of preparation/administration	Doses	Disease treated	Factor of Informant Consensus
Papaveraceae	*Argemone mexicana* L. VSN: Singh: 156	Satyanashi	Stem	Latex is extracted from stem and used as eye drop.	1-2 drops for 2 days	Eye infection	0.982
			Whole plant	Whole plant is boiled in water and used for sitz bath.	3 to 4 days	Muscular pain	0.765
			Seed	Paste of seed mixed with muscovado and butter is taken orally.	40-50 g for a week	Menorrhagia	0.730
			Seed	Seed paste is applied externally over the skin boils.	Paste applied for 4-5 days	Skin boils	0.860
Pedaliaceae	*Pedalium murex* L. VSN: Singh: 188	Vilaytigokhru	Seed	A mixture of seed powder, muscovado and butter is taken orally.	150 g for a week	Leucorrhoea	0.935
			Seed	50 g seeds are soaked in water for 12 hours during night and taken orally in morning.	250 mL water for 20 days	Piles	0.933
Phyllanthaceae	*Phyllanthus emblica* L. VSN: Singh: 452	AamLa	Fruit	A mixture of amla, beetroot and carrot juices is taken orally.	250 mL once a day for a week	Menorrhagia	0.895
	Phyllanthus fraternus G.L. Webster VSN: Singh: 664	Sitaraghas	Leaf	Leaves are crushed and juice is taken orally.	20-30 mL for 5-6 days	Ulcer	0.968
Poaceae	*Cynodon dactylon* (L.) Pers. VSN: Singh: 101	Dub	Leaf	A mixture of juice from leaves, onion and muscovado are taken orally.	2-3 days	Diarrhoea	0.944
			Leaf	Juice extracted from leaves is used as nasal drops.	2-3 drops once a day till cure	Nosebleeds	1.000
			Root	Decoction from Root is used orally.	Half cup for 10-15 days for a week	Urinary tract infection	0.979
	Desmostachya bipinnata (L.) Stapf. VSN: Singh: 263	Dabh	Leaf	Ash of leaves is applied topically over the burnt skin.	Twice a day till cure	Burnt skin	0.879
	Pennisetum typhoides (Burm.f.) Stapf & C.E. Hubb.VSN: Singh: 508	Bajra	Root	Roots are boiled in water and warm decoction is taken orally.	50 mL once a day for 3 days	Typhoid	0.917
	Saccharum bengalense Retz. VSN: Singh: 150	Jhunda, sarkanda	Root	Decoction of roots are prepared in hot milk and then taken orally.	7 days	Agalactia	0.946
			Root	Roots are boiled water and the decoction is taken orally.	70 mL daily for 3 days	Typhoid, leucorrhoea	0.889, 0.921
	Saccharum spontaneum L. VSN: Singh: 233	Kaans	Root	A decoction of root is taken orally.	100 mL for 2-3 days	Cough & cold	0.918
Rhamnaceae	*Ziziphus jujuba* Mill. VSN: Singh: 472	Badberi	Leaf	Leaves are chewed.	2-3 leaves twice a day till cure.	Mouth sores	0.971
			Leaf	Young leaves are crushed and the paste is applied topically over skin boils.	2-3 days	Skin boils	0.896
			Root	Root bark is boiled in water and used for bathing.	Twice a day for 4-5 days	Skin boils	0.893
			Root	Aqueous root extract is taken orally.	20-30 mL daily for a week	Menorrhagia	0.787
	Ziziphus nummularia (Burm.f.) Wight & Arn. VSN: Singh: 461	Jadi	Root	Bajra seeds are soaked in hot water extract of jadi roots and eaten.	4 to 5 days	Typhoid	0.929
Rutaceae	*Aegle marmelos* (L.) Correa VSN: Singh: 171	Belpater	Leaf	Dried leaf powder is taken orally with water.	10-15 g powder twice a day for 3-4 days	Diarrhoea	0.956
			Leaf	Paste of dried leaves is applied externally over skin boils.	Long time	Skin boil	0.879
			Fruit	Dried fruits are made into powder and taken orally with water.	10-15 g powder for one week	Menorrhagia	0.884

(*Contd*.)

Table 2 — Ethnomedicinal uses of plant species in Charkhi Dadri district of Haryana, India (*Contd*.)

Family	Botanical name	Vernacular name	Part used	Mode of preparation/administration	Doses	Disease treated	
Salvadoraceae	*Salvadora persica* L. VSN: Singh: 353	Jaal	Fruit	A decoction of fruits and sugar is prepared and taken orally.	50 mL once a day for a week	Typhoid	0.916
Solanaceae	*Datura innoxia* Mill. VSN: Singh: 105	Datura	Leaf	Leaves are tied externally over affected area.	8-10 leaves for a week	Muscular pain	0.875
			Fruit	Smoke from burned fruits is inhaled.	Twice a day for 6 weeks	Asthma	1.000
	Lycium barbarum L. VSN: Singh: 315	Mural	Young leaf	Fresh young leaves are chewed.	5-6 leaves twice for 3-4 days	Stomach ache	0.982
	Physalis minima L. VSN: Singh: 179	Pilpotan	Leaf	Juice of young leaves is taken orally.	20 mL for 5 days	Jaundice	0.957
	Solanum nigrum L. VSN: Singh: 210	Aakhphod	Leaf	Juice is extracted from leaves and taken orally.	50 mL daily for a week	Ulcer	0.974
	Solanum surattense Burm.f. VSN: Singh: 573	Pasarkandai, katheli	Whole plant	Juice is extracted from whole plant and taken orally.	10 mL daily for a week	Blood impurity	0.977
			Fruit	Fruits are burnt and smoke inhaled.	1-2 times for few seconds	Tooth worm	0.985
	Withania somnifera (L.) Dunal VSN: Singh: 597	Aksand	Leaf	A paste of leaves mixed with butter milk is applied over hair.	500 mL once for 2-3 days	Head louse	0.968
			Root	Decoction of root powder is taken orally with milk.	One glass for two weeks	General weakness	0.989
Tamaricaceae	*Tamarix aphylla* (L.) H. Karst. VSN: Singh: 277	Firansh	Bark	Bark powder is applied externally over affected area.	Once a day till cure	Burnt skin	0.938
Vitaceae	*Cissus quadrangularis* L. VSN: Singh: 974	Hadjode	Whole plant	Powder prepared from whole plant is taken orally with milk.	10 g for two weeks	Bone fracture	1.000
Xanthorrhoeaceae	*Aloe vera* (L.) Burm.f. VSN: Singh: 499	Gwarpatha	Leaf	Gel is extracted from leaves and applied externally over the wound.	1-2 days	Wound	0.964
			Leaf	Gel is extracted from leaves and taken orally before breakfast.	10-15 mL for a week	Constipation	0.964
			Leaf	Gel is extracted from leaves in the evening, kept overnight and taken orally with milk in the morning before breakfast.	1 glass for 2-3 weeks	Menorrhagia	0.844
Zygophyllaceae	*Balanites aegyptiaca* (L.) Delile VSN: Singh: 215	Hingor	Fruit	Fruits are eaten before breakfast.	1-2 fruits for 6 weeks	Diabetes	0.829
			Bark	Powdered bark is taken orally with water.	5 g powder for 1 to 2 times.	Acid reflux	0.981
	Tribulus terrestris L. VSN: Singh: 129	Bhakhri	Seed	A decoction of 100g seeds is taken orally.	100 mL once a day for a week	Urinary tract infection	0.990

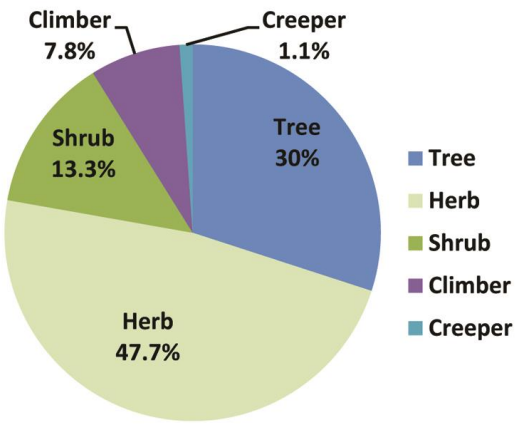

Fig. 2 — Life form of medicinal plants used in Charkhi Dadri district (Haryana), India

Poaceae, Amaranthaceae and Lamiaceae (5 species, 5.5% each), Cucurbitaceae and Asteraceae (4 species, 4.4% each), Amaryllidaceae, Apocynaceae, Apiaceae and Myrtaceae, (3 species, 3.3% each) (Fig. 3). Ten of the reported families viz., Meliaceae, Euphorbiaceae, Manispermaceae, Malvaceae, Brassicaceae, Rhamnaceae, Moraceae, Boraginaceae, Zygophyllaceae and Phyllanthaceae had 2 species each while remaining 20 families had only single plant species.

Disease types and treatment methods

Local people of Charkhi Dadri district of Haryana use the medicinal plants for treating and managing more than 60 diseases. Menorrhagia, constipation, diarrhoea, stones, arthritis, piles, typhoid, cough and

cold, skin boils, diabetes and earache were the most commonly reported health problems in the study area. Among the documented diseases, some ailments were being treated by more than one plant species while others by a single plant species (Table 3). Moreover, most of the plant species surveyed in this study were used to treat more than one ailment (Table 4). For example, *Azadirachta indica* was reported to be used in the treatment of diabetes, skin boils, bleeding of gums, malaria, migraine, piles and snake bite. Methods of treatment used by the people largely depend on the type of ailment. External skin problems are treated by applying paste or decoction of medicinal plants topically while sores and ulcers were treated by chewing or spitting the juice on them. For internal problems, herbal preparations were mainly administered orally in different doses, depending on the severity of the problem. For eye infection and earache, latex and juices of the plants are utilized in the form of drops.

Fig. 3 — Dominant families of ethnomedicinal plants in the study area

Most commonly used plant parts

Different plant parts including leaves, fruits, seeds, root, bark and whole plant either single or in combination were used as an herbal remedy. However, leaves (33%) were the most commonly used plant parts in the area were followed by whole plant and seeds (15% each), fruit and root (14% each) and bark (9%) (Fig. 4). Freshly collected plant parts were predominantly used in preparations followed by dried parts of medicinal plants.

Table 3 — No. of species used as ethnomedicine for a particular disease

Disease	No. of species used
Menorrhagia	11
Skin boils	9
Typhoid	8
Diabetes	8
Muscular pain	8
Earache	6
Cold & cough	6
Piles	6
Leucorrhoea	6
Diarrhoea	5
Skin burns	5
Stones	4
Arthritis	4
Constipation	3
Toothache	3
Ulcers	3
Jaundice	3
Mouth sores	3
Agalactia	3
Snake bite	2
Malaria	2
Others	1 each

Table 4 — Multiple ailments treated by a single plant species

Plant species	No of diseases treated	Type of diseases treated
Azadirachta indica	7	Skin boils, bleeding gums, malaria, ear boils, snake bite, piles and diabetes
Acacia nilotica	7	Leucorrhoea, diabetes, male sexual dysfunction, arthritis, headache, Pneumonia and Whooping cough
Achyranthes aspera	6	Cold & cough, toothache, typhoid, stones, ulcers and menorrhagia
Ficus benghalensis	5	Menorrhagia, sexual weakness in males, armpit lumps, muscular pain and female sterility
Calotropis procera	4	Fever, muscular pain, toothache and bee sting
Argemone mexicana	4	Menorrhagia, eye infection, skin boils and muscular pain
Leptadenia pyrotechnica	4	Thorn punctures, tetanus, indigestion and typhoid
Prosopis cineraria	4	Miscarriage, internal bleeding, wound and diarrhoea
Ziziphus jujuba	3	Menorrhagia, mouth sores and skin boils
Clerodendrum phlomidis	3	Muscular pain, skin burn and chronic pain
Cleome viscosa	3	Diarrhoea, earache and piles
Aloe vera	3	Menorrhagia, wound and constipation
Cynodon dactylon	3	Diarrhoea, nasal bleeding and urinary tract infection
Dalbergia sissoo	3	Menorrhagia, skin burn and wounds
Saccharum benghalense	3	Leucorrhoea, typhoid and hypogalactia
Aegle marmelos	3	Menorrhagia, skin boil and diarrhoea

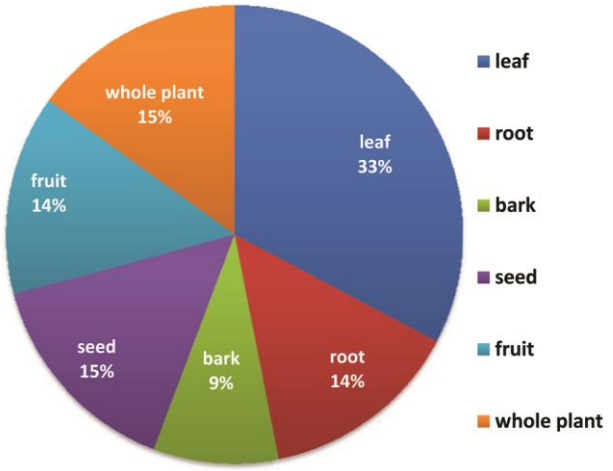

Fig. 4 — Plant parts used in ethnomedicine

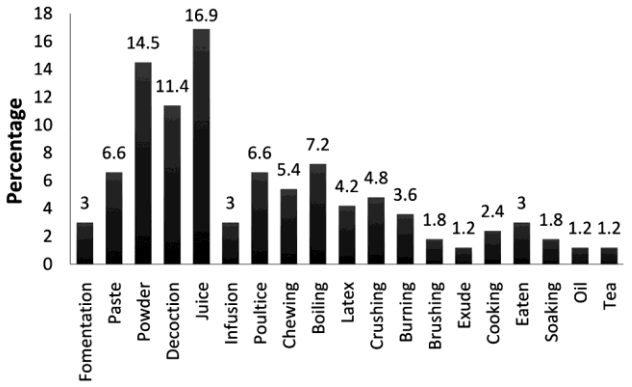

Fig. 5 — Mode of remedy preparation and administration in the study area

Factor of Informant Consensus (F_{ic})

High values of Informant Consensus Factor (F_{ic}) were observed if maximum respondents acknowledge one or few plants to treat a specific disease. In the present study, high F_{ic} value was observed for *Cissus quadrangularis* for treating bone fracture particularly bone setting, *Cynodon dactylon* for nosebleeds, *Tinospora sinensis* for dengue fever, *Terminalia arjuna* for heart disease, *Datura innoxia* for asthma and *Ricinus communis* for labour pain. Medicinal plants having high F_{ic} value can be considered pharmacologically more specific as compared to low F_{ic} value. High F_{ic} value means only specifically few plants were used for treating a particular disease while low F_{ic} value means many plants were used for treating a particular ailment.

Route of herbal preparation and administration

Various methods were being used for the preparation of herbal remedies such as decoction, poultice, powder, paste, fomentation, juice, infusion, latex, tea, fomentation etc. The major modes of herbal preparation were juice (16.9%), powder (14.5%), decoction (11.4%), poultice and paste (6.6%) (Fig. 5). Different modes of administration of medicinal plants were observed. In the present study, oral application (100 preparations, 62.9%) followed by topical (53 preparations, 31.9%) were the most popular modes of administration. The other preparations were administered through nasal (4 preparations, 2.4%) and optical (3 preparations, 1.8%), depending on the type of ailment.

Dosages

Most of the herbal preparations taken by the patients were without any standardized doses. However, approximate dosages were taken based on the age, gender and physical appearance of the patients. Decoctions and juices were taken in certain milliliters while powder and paste were practiced in grams. Additionally, some traditional methods of measurement of herbal drugs *viz*. handful, spoonful or size of a finger were also used.

Ethnomedicinal potential of the region

In terms of gender, a greater number of plants were reported by males as compared to females. However, a considerable difference was observed in the types of herbal plants reports by elders (40-70 years old) as compared to youngsters and middle-aged (20-40 years old). In addition to common informants, traditional practitioners, snake charmers, shepherds, hakims, vaidyas, nomads etc. had more traditional knowledge of medicinal plants and their practices.

Marketability of medicinal plants

In this region, majority of the medicinal plants were directly collected from wild. Aravalli Hill ranges and village community forests are specifically rich reservoir of many useful medicinal plants. Some medicinal plants growing in this region are also sold in market. Out of the total plant species documented, only nine wild plant species (10%) including *Amaranthus viridis*, *Capparis decidua*, *Chenopodium album*, *Cordia dichotoma*, *Cucumis melo*, *Pedalium murex*, *Phyllanthus emblica*, *Prosopis cineraria* and *Salvadora persica* were available in the market during the study period.

Discussion

Results of the present study showed that Charkhi Dadri district is a treasure chest of diversified herbal flora- as many as 90 plant species belonging to 41 families having different growth forms (43 herbs,

12 shrubs, 27 trees, 07 climbers and 01 creeper). Results have also demonstrated that the local community possesses immense ethnomedicinal knowledge. A large number of people particularly living in rural and remote areas still use them for primary healthcare purposes.

Local people rely on ethnomedicinal plants primarily because of their accessibility, efficacy and affordability. It was observed during the tenure of study, males were having comparatively more ethnomedicinal knowledge as compared to females and maximum participation was also observed from males, this could be attributed to social enigmas related to females in this part of the country towards gender disparity. While it was observed that maximum participation was from individuals who were either illiterate or those who studied till 10th standard as the majority of people from this region who pursue education above metric move to cities and lose their bonds with practicing of traditional knowledge.

The large number of ethnomedicinal plant species from Leguminosae followed by Solanaceae, Amaranthaceae, Poaceae, Lamiaceae, Cucurbitaceae and Compositae families could be attributed to prevailing edaphoclimatic conditions. These plant families are dominating this region. Moreover, chemical constituents of these families might be more effective against the reported health conditions[12]. The dominance of Leguminosae members as ethnomedicine in Aravalli hill range were also reported by Bhardwaj *et al.*[19] (Aravalli hill range of south Asia), Yadav and Bhandoria[20] (Mahendergarh district of Haryana), Singh[21] (Bhiwani district of Haryana).

Herbaceous plants (47.7%) were dominating life form in this region. These findings are similar to other previous studies, reported by Yadav *et al.*[6] and Sanjay *et al.*[7]. This could be attributed to their easy accessibility in the nearby areas than the other forms like trees and shrubs, needed to be collected from the forest patches which are usually distantly located from the residential areas. The findings of the present study are in agreement with the findings of the other studies[13,14].

In this study, leaves were the most frequently used plant part followed by the whole plant, seeds, roots, fruits and bark. Leaves have been reported as the most commonly used plant part in many other ethnomedicinal and ethnopharmacological studies[6,7,17,19,21]. Leaves are rich reservoir of diverse phytocompounds. Additionally, harvesting of leaves ensures the survival of the plants unlike the roots, stem bark and whole plant.

Findings of the present study also showed maximum use of freshly collected plant parts for medicinal purposes for the treatment of various ailments. The extensive use of fresh medicinal plant materials in the area may be related to the notion that active constituents could be lost on drying. Other ethnomedicinal surveys like Lulekal *et al.*[15]and Yineger *et al.*[16] have also opined that fresh parts possess better efficacy as compared to the dried plant parts. The use of juice as the dominant mode of preparation might be due to easy preparation process.

In the present study, menorrhagia was found to be the most commonly treated disorder followed by skin boils, typhoid, diabetes, muscular pain, diarrhoea, earache, cold & cough, stones and piles etc. Menorrhagia is currently a major gynecological disorder among the women folk. The use of herbal medicine for the management of menorrhagia is most likely associated with the presence of tannins in plant parts[22]. The most probable reason for the dominancy of this disorder being treated by traditional formulations can be attributed to the socio-cultural boundations faced by the women in some parts of the region towards expressing their problems with others, similar observations were also observed in disorders pertaining to UTI and STDs[23].

It was observed that the younger generation in the study area is less interested in traditional medicines, possibly due to the modernization. Similar other reports are in favor of the present investigations from other communities[15,17,18]. Our analysis confirmed the availability hypothesis and revealed that majority of medicinal plants are growing naturally as wild flora in this region.

Conclusions

The native people of the Charkhi Dadri district were found to be enriched with the knowledge of usage of medicinal plant species for curing various health remedies. However, the region is losing its native flora at a fast pace due to heavy mining of Aravalli hill ranges of the region, the encroachment of forest land for agricultural use, deforestation, soil erosion and last but not the least increase in the population of invasive flora in the region. Many ethnomedicinal plants have become confined to specific location unlike earlier and as predicted by elders of the region majority will become extinct in the coming decade. Similarly, the usage of traditional knowledge is at its lowest and is confined to elders of the society as the younger generations show little or no interest in restoring this

rich heritage. But the efforts to conserve such medicinal wealth and the associated traditional knowledge are poor. Therefore, it is recommended to establish medicinal plant nurseries, and to strengthen the involvement of local communities in order to conserve the available medicinal plant wealth of the area. It is recommended to launch a special drive to explore and document the traditional knowledge, which is eroding at a fast pace. Heavy fines should be imposed by the government agencies on the mining and sand mafia working in the region. The biodiversity management committees working at the district level should also actively participate in conserving this knowledge either through the making of people's biodiversity register or through sensitizing the natives about the significance of such studies. Further, more studies should be carried in the state with special emphasis on medicinal plants growing in the wild which will help in the conservation of these neglected gems. Such studies provide baseline information for further study in the field of pharmacognosy, pharmacology and phytochemistry.

Acknowledgements

The authors are grateful to the informants of Charkhi Dadri district for sharing their traditional knowledge and their cooperation during the study. The financial assistance from Haryana State Council for Science and Technology (HSCST) and Council for Scientific and Industrial Research (CSIR), New Delhi and DST-FIST, New Delhi is thankfully acknowledged.

Conflict of Interest

Authors have no conflict of interest.

Author Contributions

SSY designed and supervised the study; SSY, ASR, AS, MSB & PB conducted the field survey, SSY, ASR, AS, NS, AN & SAG analyzed the data and interpreted the result, SSY, ASR & AS wrote the manuscript.

References

1 Shinwari Z K & Qaiser M, Efforts on conservation and sustainable use of medicinal plants of Pakistan, *Pak J Bot*, 43 (1) (2011) 5-10.

2 Ijaz F, Iqbal Z, Rahman I U, Ali N & Afzal M, People-plants interaction and its uses: a science of four words "ethnobotany", *Altern Integr Med*, 6 (2017b) 235. http://dx.doi.org/10.4172/2327-5162.1000235.

3 Rahman I U, Hart R, Afzal A, Iqbal Z, Ijaz F, *et al.*, A new ethnobiological similarity index for the evaluation of novel use reports, *Appl Ecol Environ Res*, 17 (2) (2019b) 2765-2777.

4 Ved D K & Goraya G S, *Demand and supply of medicinal plants in India*, (Bishen Singh & Mahendra Pal Singh Publication, Uttarakhand), 2008.

5 Kohli M S, *Mountains of India: Tourism, Adventure, Pilgrimage*, (Indus Publishing), 2004, 29.

6 Yadav S, Arya V, Kumar S & Yadav J, Plants of Haryana useful in dermatological disorders: An ethnobotanical survey, *Pharmacogn Rev*, 3 (5) (2009) 104-107.

7 Sanjay Y, Vedpriya A, Sandeep K, Manila Y & Yadav J P, Ethnomedicinal flora of Dosi hills of Mahendergarh District (Haryana), India, *Ann Biol*, 28 (2) (2012) 152-157.

8 Chahal M & Yadav J, Enumeration of ethnobotanical plants of family Poaceae from central and south Haryana, *J Econ Taxon Bot*, 37 (4) (2013) 786-793.

9 Rani J, Ethnobotanical survey and traditional uses of medicinal plants in Jind district of Haryana, India, *Plant Arch*, 19 (1) (2019) 1241-1247.

10 Maheshwari J K, *Flora of Delhi*, Council of Scientific and Industrial Research (CSIR), Delhi, 1963.

11 Jain S P, Verma D M, Singh S C, Singh J S & Kumar S, *Flora of Haryana*, Central Institute of Medicinal and Aromatic Plants, Lucknow, India, 2000.

12 Gazzaneo L R S, Lucena R F P & Albuquerque U P, Knowledge and use of medicinal plants by local specialists in a region of Atlantic Forest in the state of Pernambuco (Northeastern Brazil), *J Ethnobiol Ethnomed*, 1 (9) (2005) 1-8.

13 Muthu C, Ayyanar M, Raja N & Ignacimuthu S, Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India, *J Ethnobiol Ethnomed*, 2 (1) (2006) 43.

14 Tabuti J R S, Lye K A & Dhillion S S, Traditional herbal drugs of Bulamogi, Uganda: plants, use and administration, *J Ethnopharmacol*, 88 (2003) 19-44.

15 Lulekal E, Kelbessa E, Bekele T & Yineger H, An ethnobotanical study of medicinal plants in Mana Angetu District, southeastern Ethiopia, *J Ethnobiol Ethnomed*, 4 (1) (2008) 10.

16 Yineger H, Kelbessa E, Bekele T & Lulekal E, Ethnoveterinary medicinal plants at Bale Mountains National Park, Ethiopia, *J Ethnopharmacol*, 112 (2007) 55-70.

17 Giday M, Asfaw Z, Woldu Z & Teklehaymanot T, Medicinal plant knowledge of the Bench Ethnic group of Ethiopia: an ethnobotanical investigation, *J Ethnobiol Ethnomed*, 5 (1) (2009) 34.

18 Balemie K, Kelbessa E & Asfaw Z, Indigenous medicinal plant utilization, management and threats in Fentalle area, Eastern Shewa, Ethiopia, *Ethiop J Biol Sci*, 3 (2004) 37-58.

19 Bhardwaj M, Bharadwaj L, Trigunayat K, & Trigunayat M M, Insecticidal and wormicidal plants from Aravalli hill range of India, *J Ethnopharmacol*, 136 (1) (2011) 103-110.

20 Yadav S S & Bhandoria M S, Ethnobotanical exploration in Mahendergarh district of Haryana (India), *J Med Plant Res*, 7 (18) (2013) 1263-1671.

21 Singh A, An ethnobotanical study of medicinal plants in Bhiwani district of Haryana, India, *J Med Plants Stud*, 4 (2) (2016) 212-215.

22 Fathima A & Sultana A, Clinical efficacy of a Unani formulation 'Safoof Habis' in menorrhagia: A randomized controlled trial, *Eur J Integr Med*, 4 (3) (2012) 315-322.

23 Hossan S, Agarwala B, Sarwar S, Karim M, Jahan R, *et al.*, Traditional use of medicinal plants in Bangladesh to treat urinary tract infections and sexually transmitted diseases, *Ethnobot Res Appl*, 8 (2010) 061-074.