Exploring Diversity Of Plants Used For Local Therapeutic Practices In Bathinda District, Punjab: An Ethno-Medicinal Study

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Abstract
In a comprehensive ethnobotanical study in the Bathinda district of the Malwa region (Punjab), an extensive compilation of plant usage in folk medicine was undertaken through in-depth interviews. The primary objective was to gather and identify plants used for therapeutic purposes and capture information on traditional herbal medicine. Plant specimens were collected during numerous field trips. Furthermore, the study identified 87 plant taxa from 41 families and documented their use in folk medicine, with 63 taxa identified as cultivated, 18 as wild, and the remaining 6 as both cultivated and wild. The most frequently used plants primarily belong to the Fabaceae family, representing 10.3% of the total, followed by the Solanaceae at 8.04%, and the Apocynaceae, Poaceae, and Cucurbitaceae families, each representing another 5.7%. As a result of this comprehensive study, 18 ailments medicinal usages of the 87 taxa have been determined. The use values indicate the most significant medicinal plants to be *Azadirachta indica* (0.042) followed by *Cassia fistula* (0.033) and *Curcuma longa* (0.030). In conclusion, this study highlights the importance of traditional folk medicine usage, particularly among the rural population of Bathinda, and underscores the significance of preserving and understanding these valuable traditional healing practices.

Keywords: Therapeutic, medicine, plants, Bathinda, remedies

1. Introduction

India boasts a rich tapestry of biological and cultural diversity, standing as one of the 17 mega-biodiverse nations worldwide (Srivastava and Chandra, 2024). Its landscape is inhabited by a plethora of tribal, nomadic, farming, and fishing communities, each holding unique nature-based livelihoods and a wealth of traditional knowledge. In contemporary times, the utilization of traditional knowledge has expanded beyond the day-to-day activities of these communities. There is a rising international appetite for natural, herbal, and organic products crafted through traditional methods, fueling the growth of industries such as herbal medicine, cosmetics, and personal care. This burgeoning market demand for bio-resources and associated traditional knowledge presents Indigenous and local communities with fresh avenues for income generation and economic empowerment. However, the surge in biopiracy and the unprincipled use of traditional knowledge has become a growing concern. The chief factor behind this misappropriation is the unregulated access to traditional knowledge within local communities and the absence of adequate documentation of this invaluable resource (Pant, 2015). Since all medical systems have their roots in folk medicines and home remedies in some way or another, India is very rich in floristic diversity as well as ancient folk literature that can be consulted for information. According to WHO, (2020) 80% of the population residing in developing countries still rely on medicinal plants for their health care issues. Moreover, the topography of India with its varied climatic zones made it is a vast storehouse of medicinal plants. Currently, several herbal medications are used frequently in therapy. Over the course of human history, herbal medications have also been used to treat a variety of communicable ailments (Kaur *et al.,* 2020). Ethnomedicine refers to the traditional medicinal practices that are concerned with the cultural elucidation of diseases and health that address the healthcare system and healing practices (Modi and Babita, 2023). The plant-based medicines have been in practice since time is memorial. Plant-based remedies are utilized across the globe by different sections of the society. Traditional healers, vaids, and hakims are the main custodians of the knowledge related to traditional plant-based remedies. In addition to this local people, especially elders in the family also have a sound knowledge of the medicinal plants and their uses. However, due to the availability of healthcare facilities even in remote/rural areas, there has been a sharp decline in the use of these traditional remedies. Further, the present/young generation has a limited belief in these practices. It may result in the depletion of this valuable knowledge if not recorded in time. So, need of an hour is to document all these remedies so, that it can be made available for their utilization for present as well as future generations (Sidhu and Kaur, 2007). Keeping the above facts in mind the present study has been planned. In the recent past, a sharp increase in the demand of herbal products has been witnessed in different parts of the world. It may likely be due to their easy availability, cost effectiveness, and minimum or no side effects.

2. Material and Methods

2.1. Study area

Bathinda is a city and municipal corporation in Punjab, India, serving as the administrative center of Bathinda District (Figure 1). It stands as the fifth-largest city in Punjab and is situated in the Malwa Region of northwest India. The city is situated in the Indo-Gangetic alluvial plains of northwest India, with precise geographic coordinates of 30.20°N and 74.95°E (Maps, Weather, and Airports for Bhatinda, India). It stands at an average elevation of 201 meters (660 feet) above sea level and covers a forest area spanning 55.43 km^2 (Indian State of Forest Report (ISFR), 2019). The climate in Bathinda is classified as semi-arid, characterized by significant seasonal temperature variations. The annual average rainfall ranges from 20 to 40 mm, indicating relatively low precipitation levels (http://www.mapsofindia.com/).

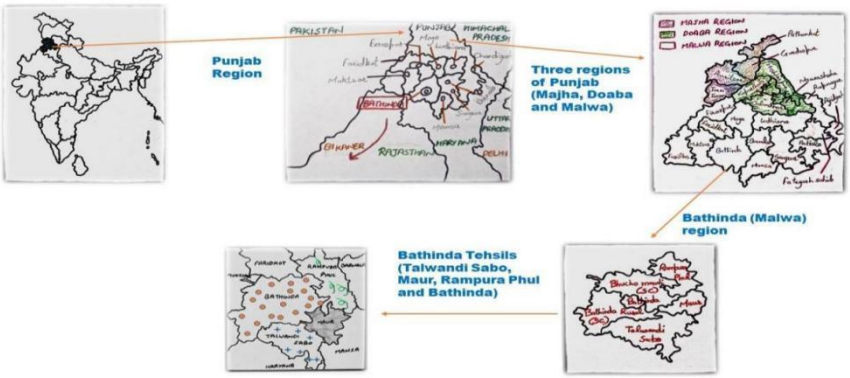

Figure 1 Map of the selected area for ethno-medicinal study

2.2. Ethnobotanical knowledge:

In order to adequately represent the entire Bathinda district, ten villages from each tehsil were chosen for ethnomedicinal studies. So, there were a total of 40 villages were taken into consideration during the study. Regardless of age, sex, or occupation, ten individuals were chosen at random from each village. But preference was given to old age people. So, a total of 420 people were consulted to gather ethnomedicinal data. The information was collected from the informants via an interview. A semi-structured questionnaire was designed including information on different diseases, medicinal plants, local names, parts used, preparation and administration methods, habits, and much more information was collected. Interviews were preferably conducted in Punjabi, the native language, to ensure effective communication and understanding between the interviewer and respondents. Along with the locals, a field study was carried out to learn more about the species that they regularly use to treat various diseases. Observations were made on the morphological traits used by locals to classify different plant species. Furthermore, information on a few medicinal plants in the research region that are at risk of extinction or are already extinct was gathered. The plants with the ethnomedicinal uses were collected and preserved, wherever possible from the study area. This comprehensive approach facilitated the gathering of valuable ethnobotanical knowledge from the local community while also contributing to the conservation of medicinal plant species in the region.

2.3. Data interpretation:

The information collected was examined for the number of medicinal plants, treatments for diseases, dominant plant families, methods of preparation, frequently used plant parts, and their habits (herbs/shrubs). Additionally, data regarding several critical illnesses, such as diarrhea, diabetes, *etc* have been collected. The socio-economic data of 420 informants were also recorded for their age, sex, education, and occupation. Ethno-medicinal data was statistically analysed using the following methods:

2.3.1. Informant Consensus Factor (ICF):

Using the method described by Rokaya *et al*., (2010), the informant consensus factor for various disease categories was determined.

ICF = Nur – Nt/ (Nur - 1)

Where, Nur = Number of use report in a particular disease category

Nt = number of taxa used to treat that particular disease by the informants

The ICF value ranges from 0 to 1, with a higher value closer to 1 indicating a greater consensus among informants in using one or a few plant species to treat a specific ailment. Conversely, a lower ICF value, closer to 0, suggests that informants have differing opinions regarding the usage of specific plant species for a given ailment.

2.3.2. Frequency of Citation (FC):

The frequency of citation of a particular species is calculated as follows:
Frequency of citation (%) =(Number of times a particular species was mentioned)/(total number of times that all species were mentioned) × 100

2.3.3. The Relative frequency of citation (RFC) index was evaluated by dividing the number of informants who mentioned the use of the species (FC) by the total number of informants participating in the survey (N).
RFC = FC/N
The RFC index ranges from '0' when nobody refers to a plant as useful to '1' when all informants refer to a plant as useful.

2.3.4. Use Value (UV):

The use value for each species can be calculated as the ratio of the number of citations to the total number of respondents.
UV= ΣU/n
Where, U= number of uses mentioned by the informants for a given species
n= total number of informants interviewed
A high UV score for a plant indicates that there have been numerous use reports for that plant, whereas a low score means that there have been fewer use reports reported by the informants.

3. Results and Discussion

A study has been conducted to document the ethno-medicinal knowledge of different villages of Bathinda district, Punjab. After conducting a thorough review of the literature, it was observed that no prior study on the ethno-medicinal plants of this region has been carried out, thus making this area an ideal choice for the current investigation. The objective of this documentation is to record and document the traditional knowledge of the local community regarding the use of medicinal plants for the treatment of various ailments. During the current study, ethno-medicinal information was collected from 420 respondents comprising 58.8% men and 41.1% women. The age of the informants varied from 20-90 years. Out of 420 informants, 10.4% were under 35 years of age, 23.8 % were 36-50 years old, 35% were 51-75 years old and 30.7% were at the age of above 76 years. Based on their education qualifications, the informants were under metric (44%), matriculate (29.2%), and above matriculation (26.6%). Profession-wise they were farmers (35.4%), housewives (30.4%), traditional healers (4.7%), and others (labourers, students, *etc* . 29.2%) (Table 1). The present study has determined that the acquisition of traditional knowledge is frequently associated with an individual's age and gender. Specifically, elderly individuals possess a greater familiarity with traditional medicinal plants due to their personal experiences and interactions with them. A noteworthy finding of the study is that male individuals aged 50 years and above exhibit a more comprehensive understanding of traditional plant medicines as compared to younger generation. This can be unequivocally attributed to their active involvement in trade-related activities, particularly in the field of agriculture.

Table 1 Demographic data of respondents in the selected area

Factors	Categories	Number	Percentage
Sex	Male	247	58.8%
	Female	173	41.1%
Age	<35	44	10.4%
	36-50	100	23.8%
	51-75	147	35%
	76-90	129	30.7%
Education	Above Metric	112	26.6%
	Metric	123	29.2%
	Below Metric	185	44%
Occupation	Housewife	128	30.4%
	Traditional healer	20	4.7%
	Farmer	149	35.4%
	Others(Students/Teachers/Workers *etc* .)	123	29.2%

Khajuria, (2021) investigated traditional medicinal plant knowledge in Pauri district, Uttarakhand, India. The study revealed that older generations possess more knowledge about medicinal plants than younger

individuals. Based on the findings from the study area, a total of 87 medicinal plant species from 41 families were documented (Table 2) and found to be used in the treatment of 18 ailments (Table 3). The majority of the species used in traditional remedies were herbs (45.9%), followed by trees, shrubs, and climbers (Figure 2). These findings suggest that traditional medicinal knowledge is influenced by generational factors and may have implications for the conservation and management of medicinal plant resources in the region.

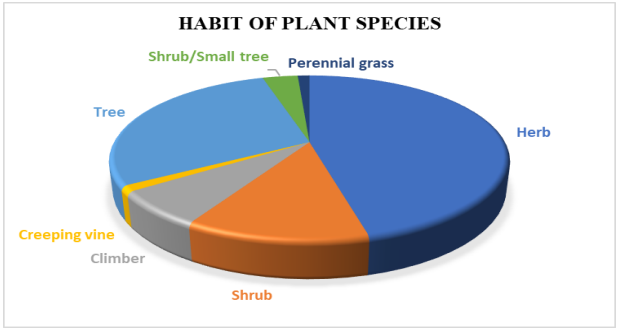

Figure 2 Habit of different traditionally used plant species

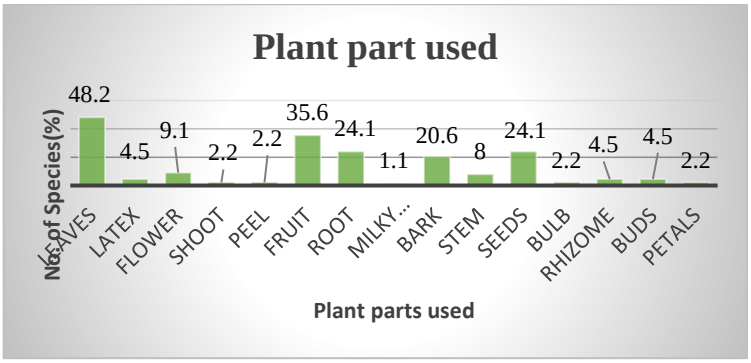

Figure 3 Various plant parts used in the preparation of different formulations

In traditional medicine, each plant or its part holds a specific significance. The formulation of remedies entails the use of different plant parts to treat various diseases. Among the plant parts, leaves are the most commonly used (48.2%), followed by fruits (35.6%), seeds and roots (24.1% respectively) *etc* (Figure 3). The widespread use of leaves and herbs in remedies may be attributed to their easy accessibility and efficacy in treating ailments compared to other plant parts. Modi *et al*., (2022) conducted a similar study that supports the higher utility of leaves and herbs in the formulation of remedies. The study also suggests that this preference for leaves and herbs may be due to their effectiveness and availability. These findings underscore the importance of utilizing plant-based remedies.

The majority of the plant species utilized in remedial formulations were procured from kitchen gardens, agricultural lands, or commercial markets. Additionally, some species were gathered from the wild. The preferential use of cultivated plant species in remedial preparations can be attributed to their ready availability and the challenges inherent in identifying wild species. Further, the availability of wild species is getting scarce with time which may be due to industrialization, land clearance, and urbanization for various purposes. Maximum number of species were used to cure gastrointestinal problems (58) followed by skin and general health issues (48 species each), circulatory (39 species) & 30 species to manage skeletomuscular problems, *etc* (Figure 4). Similar studies was reported by Kaur and Thakur, 2020. In their study, they documented that the maximum number of plants i.e., 25 were used to treat various digestive problems followed by 16 plant species to control blood sugar levels.

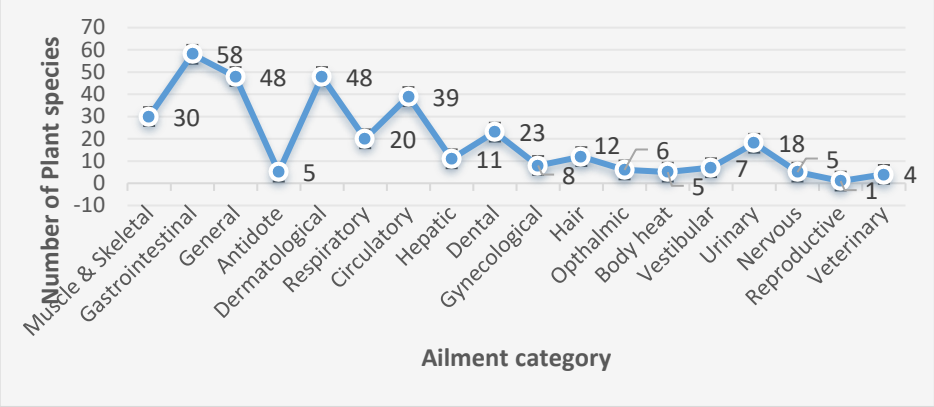

Figure 4 Number of traditionally used plant species to cure various ailments

Only a single plant species (*Asparagus racemosus*) has been recommended for the treatment of reproductive problems. Four plant species (*Citrullus colocynthis*, *Datura inoxia*, *Linum usitatissimum, Ricinus communis*) were said to be effective in the treatment of veterinary problems in animals. The unparalleled effectiveness of traditional medicine in treating jaundice, snakebites, and hair-related issues has been widely observed. The natives have always preferred traditional remedies, which have been proven to be highly successful in treating these ailments. In addition, the use of certain plant species has been known to cure livestock diseases, such as lactation and indigestion. These remedies are prepared using various methods, including direct consumption, powder, extract, paste, decoction, juice *etc*. Oral administration is the most common mode of treatment. Similarly, Sadat-Hosseini and his colleagues in 2017, reported that oral consumption were the highest mode of preparation in their study. It is worth noting that the majority of practitioners use traditional medicinal plant expertise for self-medication, while some prepare medicines for others upon request. The knowledge of this practice has been passed down from one generation to the next, with most practitioners reporting that they inherited it from their ancestors and are committed to preserving it for future generations. However, the younger generation shows little interest in these practices, potentially due to the availability of other medical facilities or challenges associated with identifying the required plant materials. The conservation of indigenous traditional knowledge is of utmost importance to prevent its imminent disappearance. The preservation of invaluable, effective remedies, which exist only in memory, is critical. While some of the modern medical facilities provide excellent treatment, but sincere efforts are required to conserve traditional medicinal plant remedies. This study highlights various popular species along with their botanical names, families, local names, and methods of preparation and administration. These remedies have been proven to be highly effective in treating various ailments and should not be lost to the sands of time.

Table 2 Ethno-medicinal uses of different plant species

S.No.	Botanical Name	Common Name	Family	Medicinal Applications	Frequency of Citation (FC(%))	Relative Frequency of Citation (RFC)	Use Value (UV)
1.	*Achyranthes aspera* L.	Puthkanda/Prickly chaff flower	Amaranthaceae	*Achyranthes* powder when mixed with honey helps to improve digestion. Seeds help to reduce excess fat in the body. *Achyranthes* leaf juice is used to treat wounds. Root paste with milk or water used to cure skin rashes and irritation. *Achyranthes* and *Tinospora cordifolia* stem powder mixture is used to treat asthma. Root ashes when mixed with honey are used to cure cold and cough.	0.83	0.0019	0.0214

				Stem is used to treat toothaches.			
2.	*Aegle marmelos* (L.) Correa	Bael/Wood apple	Rutaceae	*Aegle* extract when applied to exposed areas used to treat inflammation. Leaf juice with honey used to cure fever. Fruit is used as a mouth freshener. Its fruit pulp is used in the preparation of coolant drink in summers. Bael oil is used to cure respiratory problems. It is also used to cure diarrhoea, constipation, and diabetes. Bael dried fruit pulp is used in the preparation of drinks which is good in summer and prevents from sunstrokes.	0.57	0.0013	0.0214
3.	*Albizia lebbeck* (L.) Benth.	Shirish/Broome Raintree	Fabaceae	Bark powder paste is used to treat skin problems. Leaves powder of Shirish with milk helps to cure back pain.	0.13	0.0003	0.0047
4.	*Allium cepa* L.	Pyaaz/Onion	Amaryllidaceae	*Allium cepa* juice along with Asafoetida powder is used in the treatment of asthma. Bulb paste is used to cure skin problems. *Allium cepa* herb extract is used to cure wounds. Plant bulbs is good for gastrointestinal problems and stone disease. Its bulb when eaten raw is used to cure fever.	1.31	0.0031	0.0142
5.	*Allium sativum* L.	Lahsun/Garlic	Amaryllidaceae	Garlic is used as a vegetable which helps to lower blood pressure and diabetes. Garlic when eaten in the morning is used to cure heart-related issues. Its bulblets with *Calotropis procera* leaves are boiled in mustard oil and this oil is used to cure earache. Raw garlic helps to cure cold and cough infections. It also helps to promote relaxation.	1.53	0.0036	0.0166
6.	*Aloe vera* (L.) Burm. f.	Aloe/ Kuwar gandal	Asphodelaceae	Juice of Aloe is used to control diabetes, digestive problems, and constipation.	5.88	0.014	0.0380

				Its leaf has antioxidant properties. *Aloe* gel is used to treat skin problems and also helps to heal wounds. Its gel is used to cure sunburn, cuts, swelling, itching, pain, and hairfall. Freshly cut slice of *Aloe vera* when applied to the eye is used to cure eye irritations. Aloe gel along with lemon juice and water is used to cure lung problems. Its gel powder is used to treat menstrual problems.			
7.	*Alstonia scholaris* (L.) R. Br.	Sathi/Scholar tree	Apocynaceae	Bark is used to cure skin diseases, malaria, fever and also improve digestive system.	0.21	0.0005	0.0095
8.	*Argemone mexicana* L.	Satyanashi/Mexican prickly poppy	Papaveraceae	Oral intake of its seed powder is used to control diabetes and treat joint pain. *Argemone* is used in the treatment of various ailments such as jaundice, inflammation, malaria, asthma, and fever. Its seeds are also used as painkillers. *Argemone* root powder is used as a blood purifier. Leaves extract is used to treat skin problems.	1.22	0.0029	0.0238
9.	*Asparagus racemosus* Willd.	Shatavari/Satavar	Asparagaceae	It is a fibrous vegetable which helps to control blood pressure. Liquid form of shatavari is diluted with water or juice to cure reproductive disorders. Its powder is use to control diabetes, boost stamina and also used to cure digestive problems.	0.35	0.0008	0.0119
10.	*Azadirachta indica* A. Juss.	Nim tree/Neem	Meliaceae	Neem juice is used to control diabetes and also used for weight loss. Neem twig is used as a toothbrush (datun). *Azadirachta* fruit paste when applied externally is used to treat skin problems and is also used as an antiseptic. Neem leaf along with fitkari/fatkadi when boiled in water, applied	4.08	0.0097	0.0428

				externally to cure skin problems. Bark powder is used to cure skin disorders when applied dermally. Leaf juice is used to treat various ailments such as pimples and also treat digestive problems. Extract of leaves is used to reduce toothache. Neem is used in the treatment of inflammation, fever, dental problems, eye problems, and heart diseases. Its paste is used to cure acne, skin rashes and heal wounds. Its oil is used to cure joint pain. Its powder is also used to treat liver problems and inflammation.			
11.	*Bambusa bambos* (L.) Voss	Bamboo/Bans	Poaceae	Paste of bamboo shoot is used to cure wounds and skin pigmentation. Decoction of leaf is used in the treatment of menstrual pain. Raw seed of bamboo when eaten is used to control diabetes.	0.39	0.0009	0.0095
12.	*Bauhinia variegata* (L.) Benth.	Kachnar/Camel's foot tree	Fabaceae	Bark is used as a tonic to treat mouth ulcers. Its decoction is used to cure skin problems. Leaves of *Bauhinia variegata* with *Calotropis procera* is used to cure kidney problems.	0.35	0.0008	0.0071
13.	*Boerhavia diffusa* L. nom. cons.	Red spiderling/Punarnava	Nyctaginaceae	Stem extract of punarnava helps to treat inflammation. Its root extract helps to get rid of stress and is also used in the treatment of cough.	0.39	0.0009	0.0071
14.	*Bougainvillea glabra* Choisy	Booganbel/Paper flower	Nyctaginaceae	Leaves are used in medicine to cure gastrointestinal problems. Fresh flowers when boiled in water to prepare tea, help to treat respiratory problems and maintain the immune system. *Bougainvillea glabra* flower tea is used to treat cough and calm sore throat.	0.26	0.0006	0.0119

15.	*Calotropis procera* (Aiton) W.T. Aiton	Aak/Giant milkweed	Apocynaceae	*Calotropis procera* milky exudate when used dermally is used to cure skin problems. Decoction of bark powder with water is used to cure diarrhea. Dried leaf powder is used to heal wounds when sprinkled on the infected area. Fruit and root of plant are used to cure fever. Leaves have antimalarial properties and are used to cure cough. Leaves paste is used to cure snakebite, constipation. Aak bark powder decoction with water is used to treat diarrhoea. Leaf powder in dried form is used to cure wounds. Flower buds of aak with black pepper seeds and salt are crushed to make pills, which is used to cure malaria. Warmed leaves when smeared with oil, and applied externally help to remove rheumatic pain. Roots with mustard oil, when taken for 3 days is said to be affective against jaundice. Leaf paste when applied dermally is used to cure joint pain. From the roots of aak plant, the sand was collected and tied on the back to treat the backache.	3.03	0.0072	0.0285
16.	*Cannabis sativa* L.	Bhang/Hemp	Cannabaceae	Leaves are used in the preparation of medicines to cure urine problems. Powdered form of bhang, vetiver, cashew, almond, black pepper, and celery when mixed, is taken orally to control blood pressure. In summer a coolant drink is prepared by grinding almond, bhang, khas-khas powder and added in milk. Leaves have antidepressant properties.	1.58	0.0037	0.0190

				Extract of leaves is used to cure ear problems. It is used in the treatment of asthma, skin disorders, and gastrointestinal problems.			
17.	*Capsicum annuum* L.	Shimla mirch/Bell pepper	Solanaceae	It is used topically to treat diabetes and back pain. It helps to boost immunity and metabolism of the body. Capsaicin (substance present in Capsicum), helps to control diabetes, and improve heart health when taken orally. Oral consumption of *Capsicum annuum* helps to cure fever, toothache and heart problems.	0.52	0.0012	0.0142
18.	*Carica papaya* L.	Papaya/Papita	Caricaceae	Unripe papaya is used in the preparation of medicines to cure menstrual pain, heart problems and heal wounds. Raw leaves when eaten, are used to cure dengue and malaria. Fruits are eaten raw to cure kidney stones.	1.84	0.0043	0.0142
19.	*Cassia fistula* L.	Amaltas/Golden shower	Fabaceae	Fruit pulp is used to heal wounds. Leaves are used in the preparation of ointments and creams to cure skin problems. Bark has astringent properties. Amaltas along with *Emblica officinalis*, *Terminalia chebula*, *Embelia ribes*, *Operculina turpethum*, *Piper nigrum*, *Elettaria cardamomum*, *Syzygium aromaticum*, jaggery, and honey when mixed are used to treat skin problems, cold, cough, heal wounds and act as a blood purifier. Its root extract helps to control blood sugar level. The fruit pulp of amaltas is used to treat constipation, diabetes and also have laxative properties. Its bark powder is used to cure jaundice.	1.44	0.0034	0.0333

				Flowers of *Cassia* are used to cure fever. Its root has diuretic properties. It also has antioxidant properties.			
20.	*Catharanthus roseus* (L.) G. Don	Sadabhar/Pink periwinkle	Apocynaceae	Decoction of leaf juice is used for the treatment of diabetes. Fine paste of *Catharanthus roseus* leaves and turmeric when applied externally for 3 days is used to heal wounds. Flowers of sadabhar along with pomegranate help to relieve mouth bleeding. Leaf juice taken in the morning is used to control blood pressure. Sadabhar leaves and turmeric rhizome mixture applied externally to treat scars. Leaves are used in medicine to cure malaria. Root is used in the treatment of fever.	1.40	0.0033	0.0166
21.	*Chenopodium album* L.	Bathua/Wild spinach	Amaranthaceae	It is used in the preparation of medicines and also used as a blood purifier. Leaves help to treat digestive problems. Bathua when taken orally helps to get rid of bad breath. The high protein content of bathua helps to control hair fall.	0.43	0.0010	0.0119
22.	*Chrysopogon zizanioides* (L.) Roberty	Khus/Vetiver	Poaceae	Its root paste is used in the treatment of burn, headache, and snakebite. Decoction of stem is used to cure urinary infection. Leaf juice is used for the treatment of fever and mouth ulcers.	0.26	0.0006	0.0142
23.	*Cinnamomum camphora* (L.) J. Presl.	Camphor/Kapur	Lauraceae	Kapur with rose water when used in gargles helps to relieve tooth pain. The smell of sandal and kapur helps to cure headache. Kapur also helps to cure wounds. A pinch of kapur when added in water, drink this which helps to improve digestion.	1.18	0.0028	0.0166

				It also has antioxidant properties. Kapur when mixed with coconut oil helps to remove itching and burning sensation.			
24.	*Cinnamomum verum* J. Presl	Cinnamon/Dal chini	Lauraceae	Bark is used in the preparation of medicines to cure gastrointestinal problems. Cinnamon has antioxidant properties. Cinnamon leaf tea helps to improve digestion and remove inflammation. Cinnamon bark with honey helps to cure cough and sore throats.	0.52	0.0012	0.0119
25.	*Citrullus colocynthis* (L.) Schrad.	Bitter apple/Kaur tuma	Cucurbitaceae	Dried pulp of kaur tuma is used to treat gastrointestinal problems. Dried pulp and seed extracts of kaur tuma have anti-diabetic properties. Kaur tuma fruit with turmeric rhizome is wrapped in cloth (cotton cloth) and boiled in water. This is ground in fine powder which is used to treat asthma. Fruit powder is used to treat piles. Its fruit powder along with ajwain seeds helps to cure cattle disease. Its fruit powder along with salt and lemon juice helps to cure digestion in both humans and animals. Fruit powder is used to cure stomach pain, constipation, cure piles. Its seed extract has anti-inflammatory properties. Fruit extract of kaur tuma has laxative properties. Root extract of kaur tuma control blood sugar level.	2.06	0.0049	0.0238
26.	*Citrus* x *limon* (L.) Osbeck	Nimbu/Lemon	Rutaceae	Fruit juice of nimbu with honey is used as a coolant mouth freshener. Fruit juice helps to treat respiratory problems, digestive problems and is also good for weight loss. It has antioxidant properties.	2.37	0.0056	0.0214

				Fruit juice when applied externally on hairs helps to reduce dandruff. Bark powder is used to treat kidney problems. Nimbu fruit juice when added to tea without milk is used to treat fever and heal wounds.			
27.	*Cordia myxa* L.	Assyrian plum/Lasura	Boraginaceae	It is used in the preparation of medicine to heal wounds and also have diuretic & anti-oxidative properties. Its buds are eaten raw to cure swelling. Seeds of lasura are used to treat mouth ulcers. Lasura buds are eaten raw to cure inflammation.	0.57	0.0013	0.0142
28.	*Coriandrum sativum* L.	Dhania/Coriander	Apiaceae	It is used in medicines to treat cough, nosebleeds, and vomiting. Coriander essential oil is used to cure gastrointestinal problems. Leaves when eaten raw act as a mouth freshener. Dhania leaves help to control diabetes. Leaves paste is used in the treatment of constipation and diarrhoea.	1.27	0.0030	0.0190
29.	*Cucumis sativus* L.	Cucumber/Khera	Cucurbitaceae	Its seed powder is used to relieve muscle pain. Root decoction of cucumber has diuretic properties. Raw fruit helps to cure skin rash. Its fruit is used in the treatment of skin burns, skin rashes, and wounds. Its fruit also has diuretic and anti-diabetic properties.	0.96	0.0022	0.0142
30.	*Cuminum cyminum* L.	Jeera/Cumin	Apiaceae	Jeera water has antioxidant properties and also helps to protect skin acne & lighten scar marks. Cumin seeds lower blood sugar level, improve indigestion, diarrhoea, cure jaundice, and also has antioxidant properties. Seeds when soaked in water overnight, and then in the morning a	0.52	0.0012	0.0190

				tablespoon of honey is added to it, helps to reduce weight.			
31.	*Curcuma longa* L.	Haldi/Turmeric	Zingiberaceae	Haldi powder with mustard oil (a paste is prepared) is used to heal wounds when applied externally. Kaur tuma fruit is cut into two slices and the rhizome of haldi is sandwiched between them and kept for 4 days. Then grind them to make fine powder which is best remedy to treat pimples and dark circles. Turmeric is also used in many cosmetic products. Its powder when taken orally with milk to cure fever, cold, cough, and stomach problems. Haldi paste when applied externally helps to cure skin problems. Turmeric powder along with roasted wheat flour is taken orally for the treatment of backache. Its powder also helps to get rid of excess fat in the body. Turmeric powder with milk when taken orally helps to cure internal injury. It is also good for weight loss and also helps to cure rheumatism.	3.86	0.0091	0.0309
32.	*Cuscuta reflexa* Roxb.	Giant dodder/Amar bel	Convolvulaceae	*Cuscuta reflexa* extract helps to heal wounds and also has anti-inflammatory properties. It is also used to cure jaundice and cough. Its stem when fried in oil is used to treat nail problems. Decoction of amar bel used to cure diarrhoea. Fresh juice of *Cuscuta reflexa* plant acts as a liver stimulant. Its stem and datura fruits when fried in oil are used in the treatment of rheumatism.	0.74	0.0017	0.0190
33.	*Cynodon dactylon* (L.) Pers.	Dub Hariali/Dub grass	Poaceae	Decoction of root is used to cure irritation of urinary organs. It has astringent, diuretic properties.	0.92	0.0021	0.0190

				Plant is used in the preparation of medicines to cure burning sensation, rheumatism and heal wounds. Plant paste is used in the treatment of various skin problems. *Cynodon dactylon* powder is used to treat nausea and piles problem.			
34.	*Cyperus rotundus* L.	Mutha/Motha	Cyperaceae	Mutha rhizome powder decoction with adrak powder is used in the treatment of stomachache. Its rhizome and papita seeds paste are used to treat nausea when taken in the morning.	0.17	0.0004	0.0047
35.	*Datura inoxia* Mill.	Pricklyburr/Datura	Solanaceae	Seeds of datura have anti-inflammatory properties and is also used to treat gastrointestinal problems. Fruit juice of datura is applied on the scalp to reduce dandruff and hairfall. Flowers and seeds are used externally to treat skin rashes. Its fruit and *Cuscuta reflexa* stem fried in mustard oil. This oil is used in the treatment of rheumatic pain. Leaves are boiled in oil and are used to cure joint pain. Leaves of datura and arind are fried in oil & this oil is used to get rid of pain and swelling. Datura plants help to enhance lactation in cattle.	2.41	0.0057	0.0238
36.	*Eclipta prostrata* (L.) L.	Bhangra/Bhringraj	Asteraceae	Its plant extract is used in the treatment of hair problems.	0.26	0.0006	0.0023
37.	*Elettaria cardamomum* (L.) Maton	Cardamom/Elachi	Zingiberaceae	Seeds are added to tea to reduce stress. It is also used as a mouth freshener. Leaves of this plant are used to wrap rice, and vegetables during cooking. Seed oil is used to cure digestive problems. Seed powder when mixed with amla juice act as a diuretic agent.	1.18	0.0028	0.0119

				Cardamom seeds with mint leaves are good for hiccups.			
38.	*Ficus benghalensis* L.	Bhod/Banyan	Moraceae	Decoction of bark is used to treat vaginal diseases and is used to control diabetes. Latex of bargad when applied externally is used to cure skin diseases. Buds of *Ficus benghalensis*, *Ficus religiosa,* and *Ficus glomerata* when mixed with ghee and honey is used to cure diarrhoea. Paste of banyan root mixed with juice of *Cynodon dactylon*, *Rubia cordifolia*, *Malaxis acuminata*, *Gmelina arborea* are used to protect persons affected with snake poisoning. Its latex is used to cure inflammation and heal wounds.	0.92	0.0021	0.0166
39.	*Ficus religiosa* L.	Peepal/Bodhi tree	Moraceae	Bark powder is used as a painkiller against kidney pain. Decoction of bark or fruit is used to treat skin diseases, vomiting, and diarrhoea. Plant fruit is used as a body tonic which is used to cure fever. Its leave extract also helps to cure snakebite. Peepal leaf juice helps to cure constipation. Fine paste of peepal shoots is used to cure mouth ulcers. Leaves and fruit extract is used as a body tonic. Root powder with honey when used internally is used to heal wounds. Fresh latex of peepal is used to relieve hyperpigmentation.	2.81	0.0066	0.0261
40.	*Foeniculum vulgare* Mill.	Fennel/Sauf	Apiaceae	Fennel seeds are eaten raw to improve eyesight. Fennel seed extract helps in the treatment of hypertension. Fennel seeds when eaten raw helps to relieve menstrual pain. Its seeds when added to tea help to reduce constipation and cough.	0.57	0.0013	0.0119
41.	*Glycyrrhiza glabra* L.	Licorice/Mulathi	Fabaceae	Bark is eaten raw to cure cough and cold.	2.85	0.0067	0.0261

				Extract of mulathi is used in the treatment of sore throat and asthma. It has anti-oxidant and anti-diabetic properties. Its extract is used as a body tonic. Root is used in the preparation of medicines and also act as a flavouring agent. Its root has anti-inflammatory properties. Plant extract has laxative properties. Its root extract helps to cure skin issues. Mulathi root is used in the preparation of herbal medicines.			
42.	*Justicia adhatoda* L.	Vasaka/Bansa	Acanthaceae	Leaves powder helps to cure respiratory problems. Its leaves also help to cure cough and fever.	0.21	0.0005	0.0071
43.	*Kalanchoe pinnata* (Lam.) Pers.	Canterbury bells/Pathar chatt	Crassulaceae	Pathar chatt leaves when fried in mustard oil is used to cure skin problems. Leaves are eaten raw to cure kidney stones. Its juice is taken internally to cure diarrhoea and fever. Leaves juice along with oil is used as an ointment and applied externally to treat burns & heal wounds. Its paste is used to cure headache when applied externally. Its juice with black pepper is used in the treatment of jaundice.	2.94	0.007	0.0190
44.	*Lantana camara* L.	Lantana/Raimuniya	Verbenaceae	Leaves extract with rock salt when taken orally is used to cure cough. Lantana oil is used to treat skin problems and heal wounds. Lantana extract is used in the preparation of medicines to cure fever, asthma, control high blood pressure, malaria, and rheumatism. Leaves when boiled in water helps to treat body pain.	1.18	0.0028	0.0214
45.	*Linum usitatissimum* L.	Flaxseed/Alsi	Linaceae	Linseed acts as a lubricant which is used to cure constipation and soften the stool. It also acts as an antacid.	0.87	0.0020	0.0190

				Linseed oil is used to prevent hair loss. Its oil is used to cure wounds and itching. It has laxative properties for both humans and cattle.			
46.	*Logenaria siceraria* (Molina) Standl.	Bottle gourd/Lauki	Cucurbitaceae	Fruits are edible and is used to cure skin diseases, diabetes, and jaundice. Lauki fruit pulp also has coolant properties. Leaf juice is used to cure hair fall, jaundice, tooth problems, constipation, diabetes, and stomachache. Fruit pulp has diuretic properties. Flowers are used as an antidote for snake poison.	1.31	0.0031	0.0238
47.	*Lycopersicon esculentum* L.	Tomato/Tamatar	Solanaceae	Fruit pulp is used to cure skin problems. Tomato skin is used to treat burns. It also has antioxidant properties. Tomato fruit is used to control blood pressure and cure diabetes. The skin of tomato fruit is good for heart problems.	0.65	0.0015	0.0142
48.	*Mangifera indica* L.	Aam/Mango	Anacardiaceae	The fumes of the burning mango leaves when inhaled are used to cure hiccups. Sour mango fruit is used as a good immunity booster. Mango oil is used in the treatment of oral health problems. Fresh juice of mango young leaves is used to cure diarrhoea. Aam and jamun decoction with honey helps to treat vomiting. Aam seed and harad powder in equal amounts are mixed with milk which helps to treat dandruff problem. Mango root and punarnava leaves decoction is cooked in ghee to treat piles. Bark is used to cure rheumatism. Leaves and bark is used in traditional medicines to cure various ailments such as diabetes and constipation.	1.31	0.0031	0.0261

				Seeds are used in the treatment of asthma.			
49.	*Mentha arvensis* L.	Mint/Pudina	Lamiaceae	Mint tea is used to cure cold, cough, and digestive problems. Leaves extract is used to cure vomiting. Leaves and stems of mint are eaten raw to cure digestive problems and also act as a mouth freshener. Leaves extract with honey is used to cure ear pain. Paste of mint leaves is used to cure skin problems.	1.53	0.0036	0.0166
50.	*Momordica charantia* L.	Karela/Bitter melon	Cucurbitaceae	Decoction of karela leaves after boiling in water is used to cure diabetes. It is a good blood purifier. Fruit pulp is used to cure asthma, constipation, diabetes, cough, malaria and skin diseases.	1.14	0.0027	0.0166
51.	*Momordica dioica* Roxb. ex Willd.	Jhad karela/Spiny gourd	Cucurbitaceae	Jhad karela fruit has anti-diabetic properties. It also acts as a good blood purifier.	0.35	0.0008	0.0047
52.	*Moringa oleifera* Lam.	Suhanjana/Moringa	Moringaceae	Moringa fruit is used to cure stomach diseases. It is also used in the preparation of pickle. Moringa seeds help to control blood pressure.	0.13	0.0003	0.0071
53.	*Morus alba* L.	Shahtoot/ White mulberry	Moraceae	Shahtoot leaf powder is used to cure diabetes. It also has anti-inflammatory properties. Leaves decoction has diuretic properties. Bark helps to cure tooth pain and diabetes.	0.74	0.0017	0.0095
54.	*Murraya koenigii* (L.) Spreng.	Curry patta/Sweet neem	Rutaceae	Curry leaves when boiled in mustard oil, then after cooling down applied on hair, to reduce hairfall and dandruff. Leaves when eaten raw are used to cure digestive problems. Curry leaves when mixed with mint leaves, lemon juice, cinnamon powder, water, and honey & its juice is prepared which is used to cure skin diseases, diabetes, hair problems and also helps to loose weight.	1.93	0.0045	0.0190

				Raw curry leaves are used to cure digestive problems and also act as a blood purifier.			
55.	*Musa* x *paradisiaca* L.	Banana/Kela	Musaceae	Raw banana is used to cure diarrhoea. Banana peel helps to heal wounds. Raw banana is also used in the treatment of cough. Flowers are used in the treatment of diabetes.	1.01	0.0024	0.0095
56.	*Nerium oleander* L.	Kaner/Rosebay	Apocynaceae	Leaves decoction helps to cure swelling. Kaner leaves paste with olive oil when heated, is used in the treatment of joint pain. Its leaves are cooked in clove oil and is used to treat itching.	0.61	0.0014	0.0071
57.	*Ocimum tenuiflorum* L.	Tulsi/Holy basil	Lamiaceae	Tulsi leaf extract when mixed with adrak extract & honey, is used to cure cold and cough, when taken orally. Tulsi tea is used in the treatment of cold, cough, and typhoid. Tulsi leaf juice helps to bring down fever and also cure kidney stone & asthma. Roots decoction of tulsi has laxative properties.	3.60	0.0085	0.0166
58.	*Papaver rhoeas* L.	Red-poppy/Khas-khas	Papaveraceae	Its plant extract is used to treat diarrhoea. Flowers and petals infusion are used to treat cough and poor digestion. Its flowers have antioxidant properties.	1.14	0.0027	0.0095
59.	*Phyllanthus emblica* L.	Amla/ Indian gooseberry	Phyllanthaceae	Amla fruit when fried in oil and extract is prepared is used as a dye for hair blackening when applied externally. Its powder is used to improve indigestion and liver problems. Amla juice is used to treat dengue. Amla fruit powder with mishri is good for acidity. Fruit powder of amla is also used to treat diabetes and jaundice.	1.05	0.0025	0.0166
60.	*Piper nigrum* L.	Black pepper/Kali mirch	Piperaceae	Fruit powder is used to cure indigestion. Black pepper fruit when boiled in tea is used in the treatment of cold, cough, and fever.	0.96	0.0022	0.0095

61.	*Prosopis cineraria* (L.) Druce	Ghaf/Jhandi	Fabaceae	Root decoction of jhandi is used to treat liver problems. From jhandi fruit a pickle is prepared, which is used to treat digestive problems when eaten raw. Its fruit has a coolant effect.	0.48	0.0011	0.0071
62.	*Psidium guajava* L.	Guava/Amrood	Myrtaceae	Leaf extract is used to cure diarrhoea. Extract of leaf is used to control blood pressure. Its leaf extract also helps to reduce menstrual cramps. Leaf extract is used to cure cough, diarrhoea, and cold. Fruits are used in the treatment of stomach ache, diabetes, and indigestion. Leaf powder with black salt helps to treat rheumatism.	1.53	0.0036	0.0214
63.	*Punica granatum* L.	Anar/Pomegranate	Lythraceae	Its fruit powder is used to cure digestion. Anar seeds and juice is good for the treatment of heart problem and jaundice. Its seed powder in dried form is used to treat fever. Fruit peel powder of anar helps to cure diarrhoea. Leaves paste helps to cure skin problems.	1.31	0.0031	0.0142
64.	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Indian snakeroot/ Sarpagandha	Apocynaceae	Root powder is used to control diabetes. Sarpagandha extract is used to treat digestive problems.	0.13	0.0003	0.0047
65.	*Ricinus communis* L.	Castor bean/ Arind	Euphorbiaceae	Castor leaves when boiled in water are used to cure joint pain. Extracted castor oil is good for hair growth and is also used to cure stomach problems. Castor leaves when tied externally are used to cure rheumatism. Seeds when boiled in water help to get rid of skin dryness. Leaves help to improve lactation in cattle. Its fruit has laxative properties.	1.01	0.0024	0.0190
66.	*Rosa indica* L.	Gulab/ Rose	Rosaceae	Rose dried petals powder is used to treat menstrual problems and	1.22	0.0029	0.0071

				in preparation of many cosmetic products. Gulkand prepared after mixing rose petal paste with sugar, has a coolant effect.			
67.	*Saccharum officinarum* L.	Ganna/Sugarcane	Poaceae	Its root decoction is used to cure cough and ear pain. Sugarcane pulp is used to heal wounds. Its stem juice is used to cure jaundice.	0.39	0.0009	0.0095
68.	*Saraca asoca* (Roxb.) Willd.	Ashoka tree	Fabaceae	Bark is used in the treatment of fever and burning sensation. Its powder helps to cure cold, cough, and sore throat.	0.26	0.0006	0.0119
69.	*Solanum nigrum* L.	Black nightshade/ Peelan	Solanaceae	Its fruit extract is used to cure back pain. Raw fruit when eaten, is used to cure jaundice. Leaf extract of peelan with ghee, is used to treat eye irritation. Its leaves and fruit juice is used to treat asthma and also used to cure ear pain when heated slightly.	0.87	0.0020	0.0119
70.	*Solanum tuberosum* L.	Aloo/Potato	Solanaceae	Raw potato juice is used to cure diabetes Paste prepared by mixing raw potato and water is used to cure skin burns. Raw sliced potato when rubbed on the forehead is used to remove headache.	0.17	0.0004	0.0071
71.	*Solanum virginianum* L.	Kantakari/Yellow berried nightshade	Solanaceae	Its fruit when fried in oil helps to heal wounds when applied externally. Its fruit with garlic bulblets when fried in mustard oil helps to treat skin problems. Samak namoli roasted fruit helps to treat asthma and control blood sugar level. Decoction of roots when taken twice a day is used to cure fever. Root powder with honey is used to cure cough. Kantakari powder when mixed with honey is used to cure digestive problems. Its extract is used to cure liver problems and treat blood sugar level.	1.14	0.0027	0.0214

72.	*Syzygium aromaticum* (L.) Merr. & L.M. Perry	Laung/Clove	Myrtaceae	Flower buds of laung is used as a mouth freshener. Clove paste when applied to gums is used to treat toothache. Clove water is used to cure digestive problems.	0.17	0.0004	0.0071
73.	*Syzygium cumini* (L.) Skeels.	Jamun/Black plum	Myrtaceae	Decoction of jamun bark is used to cure diabetes. Seeds powder of jamun is used to treat diabetes. Leaves paste is used in the treatment of skin problems. Leaves of jamun are eaten raw to cure mouth ulcers.	0.70	0.0016	0.0071
74.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Arjun tree/Arjuna	Combretaceae	Arjun bark powder with milk is used to control blood pressure.	0.043	0.0001	0.0023
75.	*Terminalia bellirica* (Gaertn.) Roxb.	Bahera/Baheda	Combretaceae	Fruit powder is used in the treatment of stomach problems. It also has laxative properties.	0.39	0.0009	0.0047
76.	*Terminalia chebula* Retz.	Harar/Harad	Combretaceae	Harar powder when mixed with bahera and amla powder is good for stomachache. Fruit powder of harar when mixed with lemon juice is used in the treatment of tooth problem. A mixture of bahera and harar fruit powder is good for the eyes. Harar fruit powder is also used for digestive problems. Its powder with amla, bahera, and henna powder when mixed, a paste is prepared and this paste helps to control hairfall.	1.58	0.0037	0.0119
77.	*Tinospora cordifolia* (Thunb.) Miers	Giloy/Gurbel	Menispermaceae	Giloy leaf juice is used to treat fever. Decoction of stem is used to treat cold, typhoid, dengue, malaria, and cough. It is also used in the treatment of respiratory problems.	1.22	0.0029	0.0166
78.	*Trachyspermum ammi* (L.) Sprague ex Turrill	Thymol seeds/Ajwain	Apiaceae	Its seeds with sauf seeds when boiled in water are used to treat stomach pain. The powdered form of its fruit is used to treat cough.	1.14	0.0027	0.0071

				Raw seeds when eaten along with water help to cure menstrual pain.			
79.	*Tribulus terrestris* L.	Bakhra/Gokhru	Zygophyllaceae	Fruit are fried in desi ghee which is used to cure back pain. Its fruit also has diuretic properties. Seeds in powdered form help to cure back pain. Fruit paste helps to get rid of joint pain when applied dermally. Its fruit powder when taken with water helps to treat joint pain.	0.17	0.0004	0.0071
80.	*Trigonella foenum-graecum* L.	Fenugreek/Methi	Fabaceae	Methi seeds when boiled in mustard oil is used to cure hair fall. Seeds when eaten raw in small amount is used to cure digestive problems. Its seeds when boiled in water help to lose weight when taken orally. Its seed water is also used to cure diabetes and menstrual cramps.	1.09	0.0025	0.0119
81.	*Triticum aestivum* L.	Wheat/Kanak	Poaceae	Decoction of wheat leaves or young plant is used in the treatment of digestive problems.	0.043	0.0001	0.0023
82.	*Vachellia nilotica* (L.) P.J.H. Hurter & Mabb.	Babul/Kikar	Fabaceae	Plant extract is used to cure stomach pain and throat inflammation. Bark of kikar is boiled in water which is used as an antiseptic. Leaves decoction is used to cure eye problems. Fruits decoction is used to cure bleeding gums. Decoction made with neem bark and lahsun is used to treat ear problems.	0.52	0.0012	0.0142
83.	*Vigna radiata* (L.) R. Wilczek	Mungbean/Green gram	Fabaceae	Fine powder of green gram when mixed with water and paste is prepared, is used as a skin detoxifier. Decoction of green gram roots with milk and little jaggery is used as an energy drink. Paste of green gram seeds when mixed with sesame seeds, milk, and rice seeds paste is used to cure wounds.	0.17	0.0004	0.0071
84.	*Vitex negundo* L.	Mawa/Nirgundi	Lamiaceae	Paste of nirgundi leaves is used to cure joint pain.	1.97	0.0046	0.0142

				Decoction of leaf is used to treat fever and cough. Freshly prepared leaf is used to wash wounds. Its leaves paste along with *Catharanthus roseus* and *Azadirachta indica* leaves helps to cure diabetes. Its leaves when boiled in mustard oil help to cure ear pain.			
85.	*Withania somnifera* (L.) Dunal	Winter cherry/ Ashwagandha	Solanaceae	Powder of ashwagandha and *Achyranthes aspera*, when taken orally is used to cure cough. Ashwagandha leaves when added to tea are used to cure cold, cough and reduce inflammation. Root powder is used as a body tonic. Stem powder with milk is used to cure back pain.	0.39	0.0009	0.0119
86.	*Zingiber officinale* Roscoe	Ginger/Adrak	Zingiberaceae	Extract of adrak, mixed with garlic and honey is used to cure cough. A piece of adrak rhizome when boiled in tea is used to treat cold, fever, cough, vomiting, tiredness, and headache. Extract of adrak helps to boost immunity. Ginger rhizome with laung, elachi, and kalajira is used to cure digestive problems. Its rhizome with *Curcuma longa*, *Elettaria cardamomum,* and *Nigella sativa* is used to treat digestive problems and depression.	3.29	0.0078	0.0238
87.	*Ziziphus jujuba* Mill.	Jujube/Ber	Rhamnaceae	Fine paste of jujube root, sesame, milk, and honey is used to cure diarrhoea when taken orally. Jujube leaves when fried in ghee and after that common salt is added to it, is used to treat cough. Decoction of jujube leaves along with tulsi is used to cure fever when taken internally.	0.74	0.0017	0.0071

3.1 Statistical analysis of data

Presently documented ethnomedicinal data was analyzed statistically by calculating informant consensus factor, use value, frequency of citation and relative frequency of citation.

3.1.1. Informant Consensus Factor (ICF)

The informant consensus factor was calculated to test the consistency of knowledge among informants regarding common health problems in the area. The recommended medicinal plants uses in traditional medicine is used in the treatment of 18 different ailment categories. The results of the informant consensus factor calculation showed values ranging from 0.78 to 1 in the study area. Reproductive issues have the highest ICF value i.e., 1. This was followed by hair, body heat & vestibular problems having ICF value = 0.88 each, nervous issues (0.87), antidote, urinary & musculoskeletal problems (ICF = 0.86 each), gynecological & general health issues (ICF = 0.85 each), skin problems (0.84), gastrointestinal, circulatory & ophthalmic problems (0.83 each) *etc* (Table 3). The ICF value associated with these diseases suggests their prevalence within the study area and the effective communication among informants regarding the treatment of these specific ailments. Notably, the informants demonstrated the least consensus in relation to the implementation of plant-based remedies for veterinary and dental issues, having ICF values of 0.78 and 0.79, respectively. The low ICF value for this ailment indicates a lack of information exchange among the informants regarding the use of plant species for treating this specific disease.

Table 3 Informant consensus factor of plant species used to cure various ailments

Category of ailments	General health-related issues	Number of plants used (Nt)	Number of use reports (Nur)	Informant consensus factor (ICF)
Urinary	Kidney problems, urinary organs irritation, diuretic, kidney stone	18	124	0.86
Muscle & Skeleton	Back pain, joint pain, swelling, inflammation, body pain, muscle pain, rheumatism	30	216	0.86
Body heat	Cooling agent, noose bleeds	5	35	0.88
Hair	Hair growth, hairfall, dandruff, hair problem	12	99	0.88
Dental	Toothache, mouth freshener, mouth ulcer, bleeding gums, oral health problems	23	110	0.79
Gynecological	Menstrual problem	8	50	0.85
Respiratory	Nasal infection, asthma, lung infection	20	108	0.82
Ophthalmic	Eye irritation, eyesight problem	6	32	0.83
Circulatory	Diabetes, blood pressure, heart problem, blood purifier	39	232	0.83
Vestibular	Earache, ear infection	7	53	0.88
General	Malaria, headache, cough, fever, cold, sore throat, typhoid, dengue, hiccups	48	333	0.85
Hepatic	Jaundice	11	53	0.80
Gastrointestinal	Stomach pain, vomiting, laxative, diarrhoea, stomach problem, indigestion, antioxidant, constipation, acidity, liver problem, piles	58	357	0.83
Antidote	Snakebite/snake poisoning	5	31	0.86
Dermatological	Skin rash, sunburn, wounds, itching, cuts, astringent, nail problems, skin irritation, skin infection, pimples, skin dryness, skin allergy, hyper-pigmentation, acne, skin detoxifier, antiseptic, scars, burns, dark circle	48	313	0.84
Reproductive	Infertility, pregnancy loss	1	2	1
Nervous	Stress, depression/hypertension	5	34	0.87
Veterinary	Lactation, digestion problem	4	15	0.78

3.1.2. Frequency of citation (FC) and Relative Frequency of citation (RFC)

The present study analyzed the FC and RFC values of all documented ethnomedicinal plants (87) used in the study area. The FC value ranges from 0.043% to 5.88%, with the highest FC values recorded for *Aloe vera* (5.88%), followed by *Azadirachta indica* (4.08%) and *Ocimum tenuifolium* (3.60%). On the other hand, some of the least cited plants are *Terminalia arjuna*, *Triticum aestivum, Tribulus terrestris, Vitex negundo etc*. The RFC values range from 0.0001 to 0.014, with certain plants having high RFC values, such as *Aloe vera* (0.014), followed by *Azadirachta indica* (0.0097). The ethnomedicinal plants with high RFC and FC values are those that are commonly used and have high levels of awareness among the local populations. Further, the low RFC

and FC value suggests the less use of plant species by traditional healers for its medicinal properties. The remaining species along with their FC and RFC values are shown in Table 2.

3.1.3 Use Value (UV)

The UV values of different documented plant species used for the preparation of traditional remedies in the study area are calculated. The UV value ranges from 0.002 to 0.04, with the most commonly used plant species having the highest UV values i.e., *Azadirachta indica* (0.042) followed by *Cassia fistula* (0.033), *Curcuma longa* (0.030). These species are used for diverse purposes in traditional medicine, as outlined in Table 2. Plants with high UV values provide insights into the popularity and effectiveness of different plant species in treating various ailments. The lowest UV was recorded for the maximum number of plant species, which are either less explored or informants are not familiar with their biological importance.

3.2. Several comparable prior studies

Comprehensive ethnobotanical studies previously carried out in neighboring districts of Punjab (Sidhu *et al*., 2011; Sidhu *et al*., 2012; Kaur *et al*., 2020; Kaur and Thakur, 2020; Gautam and Adhikari, 2023; Singh *et al*., 2023).

Sidhu and his co-workers (2012), conducted an ethnomedicinal survey in Jalandhar district, Punjab. They prepared a semi-structured questionnaire to collect information on medicinal plants. They reported 119 plant species that were used to cure near about 40 diseases and mostly all plant parts have their importance which are used in the preparation of various remedies. Moreover, another study was conducted by Kaur and Thakur (2020), on floristic diversity and traditional knowledge in Bhunga Block, Hoshiarpur district, Punjab. They reported 294 plant species out of which only 78 plant species have been used for medicinal purposes such as to cure gastrointestinal problems, diabetes, *etc* along with this they also observed that mostly herbs are used for medicinal preparations. Overall, they concluded that this area has vast floristic diversity and traditional knowledge. Gautam and Adhikari (2023), give documentation on an ethnobotanical survey of medicinal plants of Harike Wildlife Sanctuary, Punjab. They reported a total of 85 species of 51 families, which helps to cure near about 40 health ailments when taken in different forms such as juice, as a drug orally, *etc.*

4. Conclusion

In this comprehensive ethnobotanical study, which for the first time evaluates the entire district, we have identified 87 folk medicinal plants from 41 families still used in Bathinda. Additionally, the study records the utilization of four taxa in veterinary medicine. Despite the availability of modern facilities and technology, rural inhabitants maintain a cultural bridge to traditional knowledge. Notably, the younger generation in villages readily shared their knowledge during the research. Although traditional knowledge continues to be passed down, the study acknowledges that if this research carried out a few decades ago, then it would have obtained more comprehensive results regarding the use of traditional knowledge based on botanical diversity. The interviews established a connection between the old and young generations, essential for the preservation of this valuable knowledge. Ethnobotanical studies could revitalize this transmission of knowledge between generations, providing a solid foundation for its preservation. In conclusion, the study highlights that Bathinda, as a historically and culturally significant province, with its rich flora, holds great potential as a source of traditional ethnobotanical knowledge.

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References

1. Gautam S and Adhikari B S 2023. Ethnobotanical documentation of Harike Wildlife Sanctuary (Ramsar Site), Punjab: A case study. Ethnobot. Res. and App. 25: 1-25.
2. Kaur K and Sarangal S 2020. People's Biodiversity Registers of Selected Gram Panchayat of Block Dasuya, District Hoshiarpur, Punjab (India). Int. J. Ayur. Pharma. Chem. 13(2): 37-52.
3. Kaur K and Thakur S 2020. Documentation of Floristic diversity & Traditional Knowledge: A Case study of Block Bhunga, District Hosiharpur, Punjab, (India) J. Indian bot. Soc. 99(3&4): 97.
4. Kaur K, Kaur A, and Thakur S 2020. Use of medicinal plants in traditional health care practices: A case study in Talwandi Sabo, Bathinda District, Punjab (India). Curr. Bot., 11: 75-86.
5. Khajuria A K, Manhas R K, Kumar H and Bisht N S 2021. Ethnobotanical study of traditionally used medicinal plants of Pauri district of Uttarakhand, India. J. Ethnopharm. 276.
6. Modi G, Gupta D & Babita 2023. A Review on Ethanomedicinal Plants and Their Traditional Uses in India. European Chemical Bulletin, 12(8): 8442-8452, doi: 10.48047/ecb/2023.12.Si8.768

7. Modi, Gajanand, & Babita. 2023. Study of Ethnomedicinal Plants Found in Different Villages of Hisar, Haryana in Winter Season. International Journal of Plant and Environment. 9(3), 282-286. DOI: 10.18811/ijpen.v9i03.12
8. Modi G, Babita 2023. Study of ethnobotanical plants found in Mirka, Tokas and Patan villages in Hisar district, Haryana, India. Int. J. Adv. Eng. Manag. 5(2):111-121.
9. Modi G, Babita, Kumar S 2022. Study of ethnobotanical plants found in Satrod Khurd and Dabra villages in Hisar district, Haryana, India. Int. J. Res. Anal. Rev. 9(3):439-451.
10. Pant R 2015. Protecting and promoting traditional knowledge in India: what role for geographical indications? IIED Working Paper. IIED, London.
11. Rokaya M B, Münzbergová Z and Timsina B 2010. Ethnobotanical study of medicinal plants from the Humla district of western Nepal. J. Ethnopharm. 130(3): 485-504.
12. Sadat-Hosseini M, Farajpour M, Boroomand N and Solaimani-Sardou F 2017. Ethnopharmacological studies of indigenous medicinal plants in the south of Kerman, Iran. J. Ethnopharm. 199: 194-204.
13. Sidhu K and Kaur R 2007. Maternal health care through medicinal plants. Ethno-Med. 1(2): 157-160.
14. Sidhu M C, Kaur K and Ahluwalia A S 2012. Ethno-medicinal studies of plants in Jalandhar District of Punjab, India. Int. J. Plant Res. 6016: 187-150.
15. Srivastava A K and Chandra V 2024. Enviro-Ethno-Archaeology in Northeast India: Prospects and Possibilities with Bodo-Kachari Tribe. Scope. 14(1).
16. Ugulu I 2011. Traditional ethnobotanical knowledge about medicinal plants used for external therapies in Alasehir, Turkey. Int. J. Med. Arom. Plants. 1(2): 101-106.