



RESEARCH ARTICLE

Ethno-botanical study of medicinal plants in Kalesar, Haryana, India

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Abstract

The current study focuses on the identification and gathering of data from the rangers, guides, and locals of the Kalesar village and Kalesar National Forest in the Yamunanagar district of Haryana. The ethnomedicinal qualities of the plants that were growing there and were used by the locals to treat illnesses are the focus of this study. Nearly 100 distinct plant species were identified, of which 77 were confirmed to exhibit ethno-medicinal qualities. Species belonging to families of Compositae, Rutaceae, Moraceae, Apocynaceae, Rosaceae, etc. were identified. With the aid of locals and the literature that was readily available, the plants were identified. The components of the plants that the locals utilized most frequently were the leaves, roots, seeds, and fruits, and these plants have shown notable success in treating conditions like as skin disorders, dental issues, gastrointestinal issues, and more. Additionally, it has been observed that they have anti-bacterial, anti-inflammatory, and anti-microbial characteristics.

Keywords

Biodiversity protection; diseases; ethnobotany; ethno-medicine; restorative plants

Introduction

The word Ethnobotany has been derived from two Greek words: Ethnos and Botane meaning 'people', and 'herb' respectively, thus it can be reviewed as 'the study of people and herbs' or 'the study of people and plants (tree, shrubs and herbs)'. The term Ethnobotany was stamped by American taxonomic botanist John W. Harshberger in 1895. According to him, Ethnobotany is 'the study of the utilitarian relationship between human beings and vegetation in their environment, including medicinal uses. Ethnobotany can also be described as 'the study of the interaction between plants and people having a priority for the traditional tribal cultures' (1).

Today ethnobotany is a most established branch of science and has recently been focused on by the USA, UK, France, and Mexico and in many other countries of the world. Up to the sixth decade of the last century, there have been limited projects done on Ethnobotany.

In India, many writings pertinent to ethnobotany can be found in the Vedic literature, Charak and Shusruta and Charak Samhita which have appeared to be one of the prominent works. A large part has been covered with forests that are enriched with several medicinal plants and were

instigated in the Ayurvedic system of medicine for many centuries. India has one of the most bountiful mega biodiversity of the world having a large variety of plants with enormous medicinal values (2). The World Health Organization (WHO) has remarked that the traditional medicine obtained from plants is crucial for achieving health goals. A recent survey proved that in India 65% people of in rural areas use traditional medicinal plants to combat their primary diseases. And even showed that for the manufacturing of modern-day drugs for curing many human diseases, ethnobotanical knowledge can be very helpful. Over 7500 plant species have been reported which are being used in the Indian traditional medicinal systems including ethno medicines (3).

However, keeping in view the vast surface, the richness of the biodiversity of the country, and the astonishing bifurcation of culture and traditional customs spread widely throughout this area has made clear that excessive ethnomedicinal surveys should be conducted so that documentation regarding their use and even protection is done (4).

During the 1980s, ethnobotanical studies gained pace all over the country. Though it came to Haryana very late nearly in the 21st century only and still all the parts of the state have not yet been surveyed. With this framework, the present work was planned to study and record ethnobotanical information about some medicinal plants of the Kalesar Reserve Forest of Yamunanagar District of Haryana. However, some ethnobotanical surveys have been carried out in some districts of Haryana like Kurukshetra, Bhiwani, Panchkula, Ambala, Mewat, Mahendergarh particularly Karnal, Panipat, Sonipat and Jind districts. etc. (5,6), but the Reserve Forest of the state has remained unexplored to date.

The objectives of this study were to collect and document information about the ethnomedicinal plants which is effectively used by the local people in curing diseases of the Kalesar forest reserve, district of Yamunanagar Haryana (India). Plants are considered the pillars for supporting life on Earth and are even considered an eminent resource for human well-being. Thus, the use of plants for curing diseases is common, specifically in the areas that have less access to the latest health services of which villages and hamlets of India are a part. While writing this paper, it was also important to take the diversity of plant species into account. Moreover, this work was carried out to know the status of indigenous plants in the modern era of allopathic medicines.

Materials and Methods

Study Site:

With an elevation of 275 meters above sea level, Kalesar is situated between the coordinates 30.3575° N and 77.5734° E in the Yamunanagar District of Haryana, adjoined by Kalesar National Forest which is bordered to the east by the Yamuna River, northeast by Rajaji National Park in Uttarakhand, and north by Simbalbara National Park in the main Shivalik range (Fig. 1). Haryana shares this border with Himachal Pradesh. Maximum and minimum temperatures typically reach 44 degrees Celsius, and from February onwards till the start of the monsoon, the temperature rises significantly. Kalesar receives the second-highest rainfall in the state after Panchkula district. The district's average annual rainfall works out to 970.33. It is covered in dry deciduous forest, with Sal being particularly noticeable and having tiny communities near the southwest corner of the forest. Animal husbandry and

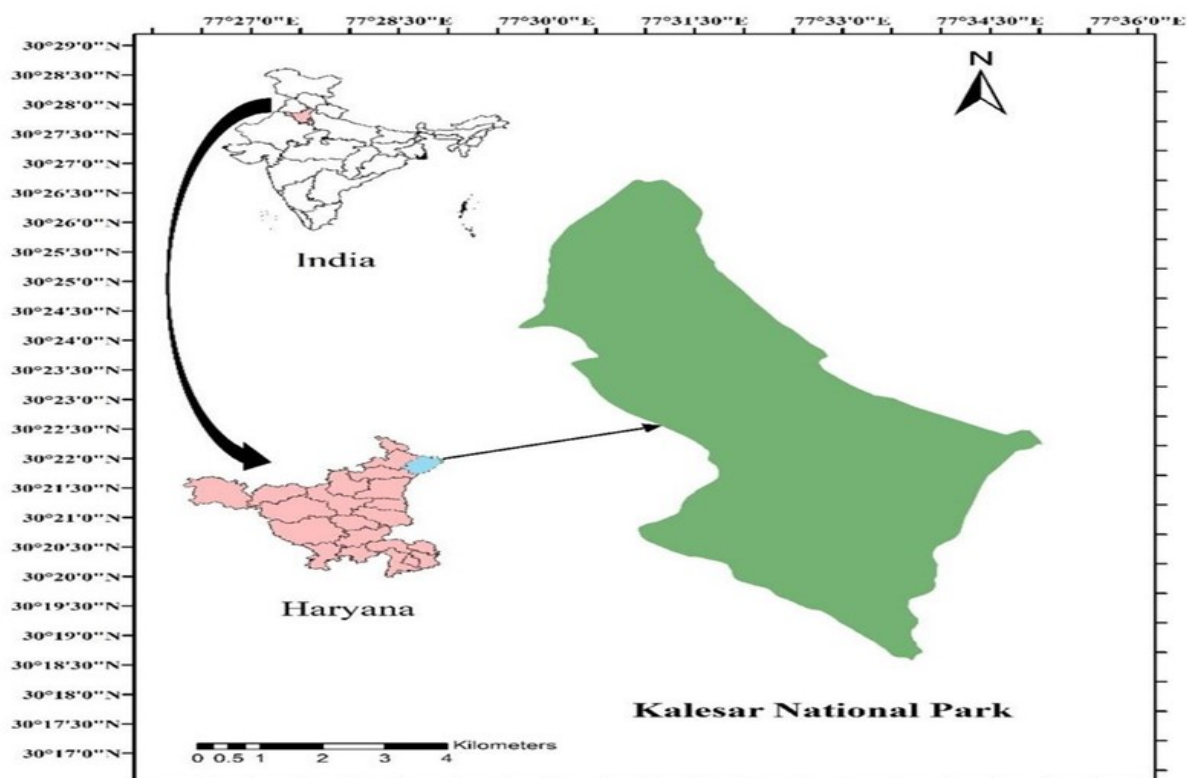


Fig. 1 Map of Kalesar Reserve Forest showing the borders adjoining with Different States

the form of agriculture known as cut-slash-burn are the main sources of income for the residents of these settlements. Wheat is their main crop for the summer, and farming fields extend into the forest. The region is separated into three domains based on the vegetation: sal, mixed forest, and mixed forest with farming.

This study was carried out in the village of Kalesar in the Indian state of Haryana's Yamunanagar District's Chhachhrauli Tehsil. It is a part of the Ambala Division. It lies 42 kilometers to the east of Yamuna Nagar, the district headquarters. Chhachhrauli is 23 KM away. Chandigarh, the state capital, is 101 km away. The community has 512 dwellings and a total population of 2976. The literacy rate in the village is 49.2%, with females reading at a rate of 20.2% and males at a rate of 29%. (Details of the 2011 Kalesar Census). The majority of the inhabitants are farmers. In Kalesar, there aren't many medical facilities; hence the majority of illnesses are treated conventionally using native drugs. People with chronic illnesses must travel to nearby cities to receive care at medical facilities. Women and older people still reside in the villages, but the majority of the younger population, particularly men, migrate to cities in search of employment.

Types of Vegetation

1. Sal Forest:

Kalesar is mostly covered by the sal (*Shorea robusta*) woodland. *Adina cordifolia*, *Ficus racemosa*, *Ficus semicordata*, *Holarrhena pubescens*, *Holoptelea integrifolia*, *Mallotus philippensis*, *Millettia extensa*, *Mitragyna parvifolia*, *Senegalia catechu*, *Terminalia elliptica*, etc. are some of the common allies of *Shorea robusta*. *Clerodendrum infortunatum*, *Justicia adhatoda*, *Helicteres isora*, *Carissa spinarum*, *Woodfordia fruticosa*, *Desmostachya bipinnata*, *Flemingia macrophylla*, and other species make up the shrub layer. In the sal woodland, climbers like *Phanera vahlii* can also be found.

Alysicarpus vaginalis, *Crotalaria spectabilis*, *Eleusine coracana*, *Evolvulus alsinoides*, *Apluda mutica*, *Saccharum spontaneum*, *Ageratum conyzoides*, and others are common herbs.

2. Scrub Forest:

These woods are found in dry environments on exposed, steep hill slopes and ridges. In contrast to the scant tree layers and discontinuous vegetation caused by biological intrusions and high grazing stress, shrubs have grown quite dense. These exhibit stunted development and have several stemmed trees and shrubs with tiny prickly bushes. Common plants found in this area include *Butea monosperma*, *Carissa spinarum*, *Euphorbia neriifolia*, *Flacourtia indica*, *Mimosa rubicaulis subsp. himalayana*, *Nyctanthes arbor-tristis*, *Premna barbata*, *Premna mollissima*, *Senegalia catechu*, *Senegalia gageana*, *Senegalia torta*, *Woodfordia fruticosa*, etc.

3. Miscellaneous Forest:

Large areas of Kalesar National Park are covered with a variety of forests. *Senegalia catechu*, *Butea monosperma*, *Dalbergia sissoo*, *Ficus semicordata*, *Garuga pinnata*,

Helicteres isora, *Mitragyna parvifolia*, *Nyctanthes arbor-tristis*, *Sterculia villosa*, *Terminalia elliptica*, etc. are significant trees that make up this forest.

Data Collection:

From February 2021- July 2022, the study was carried out. Kalesar was chosen as the study location on purpose for two reasons: first, it is located on the outskirts of the main city thus has less pollution and the plant species are in their optimum condition. Second, because Kalesar borders three states—Haryana, Himachal Pradesh, and Uttarakhand—it boasts a wide variety of species. Nearly 250 people were interviewed for the study, and among them, a few important volunteers who had a wealth of information about the medicinal flora were chosen for the collecting and identification of indigenous medicinal plants. All interviews were done only after receiving verbal and written prior informed consent from each participant.

A household survey was carried out using field surveys, one-on-one consultations, and discussions in groups. For greater convenience and accuracy, interviews were conducted in Hindi and the native language of Haryana rather than the English in which the questionnaires were written. Since the initial author is a native of the area, talks with locals and simple understanding resulted in more information.

A list of the common names of the local medicinal plants was created, and images were included to provide additional information on identification and usage. Disease-based questionnaires were adopted for more credible information. The native name, plant parts involved, medicine formulation, route of administration, and doses were documented, along with information about therapeutic plants. Information provided by a respondent was discussed in households as a group conversation to ensure agreement on the medical uses.

Interviews were conducted with 15 important participants, including 5 v aids, 7 residents of the area, and 3 forest rangers of Kalesar National Park. The results of the interviews included information on each participant's background, knowledge of medicinal plants, methods of drug preparation, proficiency with traditional tools, and other factors. In the months of June and July 2022, programs for gathering data and plants, including in the Kalesar National Park that borders the village of Kalesar, were made (Table 3). As a result, the subjects were questioned at their residences or the National Park. Voucher specimens for medicinal plants were gathered and cataloged. Using 0.1% HgCl₂ and ethyl alcohol, dried specimens were poisoned before being placed on herbarium sheets. The collected samples were recognized with the aid of local flora, and their identification was further confirmed by comparing them to earlier specimens from the Indian Botanical Survey (BSI, Northern Circle Herbarium, Dehradun). The "Plant List" (<http://www.theplantlist.org>) and "Tropicos" (<http://www.tropicos.org>) were also searched for plant names.

Table 3. Plants Found in the Kalesar Village and Kalesar National Park

| S. No. | PLANT NAME | VERNACULAR NAME | FAMILY | PART(S) USED | MEDICINAL PROPERTY |
|--------|---|------------------------------------|-----------------|--|--|
| 1. | <i>Cannabis sativa</i> | Bhang | Cannabaceae | Leaves, Flowers, Resinous secretion | In treating cancer, HIV AIDS, Seizures also in treating severe Nausea |
| 2. | <i>Cryptomeria japonica</i> | Japanese Cedar, Sugi | Capressaceae | Leaves, Resin | Depurative in nature and also in treating gonorrhoea. |
| 3. | <i>Rudbeckia laciniata</i> | Cutleaf, Coneflower | Compositae | Roots and Flowers | In treating indigestion and even applying on burns |
| 4. | <i>Tradescantia pallida</i> | Purple Queen | Commelinaceae | Leaves and Roots | Anti-inflammatory and anti-oxidant in nature and even for treating kidney, stomach, and blood infections. |
| 5. | <i>Murraya paniculata</i> | Chinese Box | Rutaceae | Leaves, Flowers, Bark, and Stem | Analgesic astringent, anti-amoebic in nature. Even helps in blood circulation, treating diarrhea, and toothache. |
| 6. | <i>Euphorbia thymaloides</i> | Redbird Flower | Euphorbiaceae | Roots and Plant's latex | Antiinflammatory, emetic in nature, helps in treating <i>diabetes mellitus</i> , mouth ulcers, ear aches, and skin cancer. |
| 7. | <i>Duranta erecta</i> | Sky Flower | Verbenaceae | Seed, leaf, and fruit | Anti-microbial, anti-oxidant in nature. |
| 8. | <i>Ficus retusa</i> | Indian Laurel | Moraceae | Roots, leaves, and bark | Treating toothache wounds and bruises. |
| 9. | <i>Clivia miniata</i> | Kaffir - Lily | Amaryllidaceae | Root, Leaves, and bulbs | Treating depression, diarrhoea, also in infertility |
| 10. | <i>Petiveria alliacea</i> | Garlic Weed, Guinea hen weed | Phytolaccaceae | Bark, leaf | Antiseptic, diuretic, antispasmodic in nature. |
| 11. | <i>Catharanthus roseus</i> | Cape Periwinkle | Apocynaceae | Roots, leaves, flowers | Anti-cancerous, depurative, diuretic in nature. |
| 12. | <i>Picea rubens</i> | Red Spruce | Pinaceae | Roots, barks, leaves and trunk | Treating chest, and stomach pain and even lung and throat problems. |
| 13. | <i>Oxalis corniculata</i> | Creeping wood - Sorrel | Oxalidaceae | Leaves and whole plant | Anti inflammatory, analgesic, depurative, diuretic in nature |
| 14. | <i>Citrus hystrix</i> | Kaffir- Lime | Rutaceae | Roots and leaves | Antioxidant, chemical exfoliants for skin |
| 15. | <i>Malvastrum coromandelianum</i> | Broom Weed | Malvaceae | Leaves and Roots | Anti-fungal, anti-diarrhoeal, analgesic, and anti-bacterial in nature. |
| 16. | <i>Stellaria media</i> | Common chickweed | Caryophyllaceae | Leaves and Roots | Treating constipation, Arthritis, bronchitis, menstrual cramps, kidney problem |
| 17. | <i>Commelina erecta</i> | Erect day flower | Commelinaceae | Mucilaginous sap | Treating Skin Irritation. |
| 18. | <i>Prunus serotina</i> | Rum Cherry | Rosaceae | The bark of root, trunk, and branches, Fruit | As a tonic, anti-tussive, sedative in nature. Even for treating diarrhea, laryngitis, ulcers, and dysentery. |
| 19. | <i>Capparis decidua</i> (Forssk.) Edgew | Teend teet | Capparaceae | Fruit | Used as an antioxidant and used by diabetic persons. |
| 20. | <i>Pteris cretica</i> | Cretan brake | Pteridaceae | Whole plant | Used for treating diarrhoea and dysentery and as an anthelmintic |
| 21. | <i>Hypoestes phyllostachya</i> | Flamingo plant | Acanthaceae | | |
| 22. | <i>Fraxinus angustifolia</i> | Narrow-leaved Ash | Oleaceae | Leaves | Used in antirheumatic, astringent, cathartic, diaphoretic, mildly diuretic, laxative and purgative |
| 23. | <i>Diospyros virginiana</i> | American Persimmon | Ebenaceae | Boiled fruit, Leaves | Treating bloody stools leaves are rich in vitamin C and are used as an antiscorbutic. |
| 24. | <i>Boerhavia chinensis</i> (L.) Rottb | Santi | Nyctaginaceae | Roots | Roots are used in curing skin problems and also in Hepatitis B |
| 25. | <i>Kigelia africana</i> | Sausage Tree | Bignoniaceae | Fruits | Used in digestive problems, fainting, anaemia, sickle-cell anaemia, epilepsy |
| 26. | <i>Cestrum nocturnum</i> | Night Jessamine, lady of the night | Solanaceae | Leaves, Flowers | The extract is used as an antispasmodic and as a treatment for epilepsy. |
| 27. | <i>Kalanchoe blossfeldiana</i> | Flaming Katy | Crassulaceae | Flowers, seeds | Used for treating ailments such as infections, rheumatism, and inflammation. |
| 28. | <i>Pachira aquatic</i> | Water chestnut | Malvaceae | Fruits, Seeds, Bark | Treating hepatitis is even used as an anesthetic. |
| 29. | <i>Gustavia augusta</i> | Heaven Lotus | Lecythidaceae | Inner Bark, Leaves, Stem | To treat leishmaniasis and a remedy for treating vomiting in infants. |
| 30. | <i>Achyranthes aspera</i> | Ola Kanta | Amaranthaceae | Leaves Roots Stem | Snakebite, toothache, diuretic, dropsy, piles. |

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|-----|--|-----------------------|----------------|---|---|
| 31. | <i>Acacia catechu</i> (L.f.) Willd. | Khair | Fabaceae | Bark | Fever, leucorrhoea, piles, hemoptysis, gonorrhoea, and chest infections. |
| 32. | <i>Chenopodium album</i> Linn | Bathua | Chenopodiaceae | Leaves | Wound healing, laxative and anti-helminthic. |
| 33. | <i>Nerium indicum</i> Mill. | Kaner | Apocynaceae | Leaves | Wound healing |
| 34. | <i>Cynodon dactylon</i> (L.) Pers | Dub ghas | Poaceae | Roots | Diuretic and laxative |
| 35. | <i>Argemone mexicana</i> L. | Kandiali | Papaveraceae | Seed Latex | Seed oil is mixed with the oil of <i>Ricinus communis</i> to cure skin irritation. |
| 36. | <i>Cassia fistula</i> | Amaltash | Fabaceae | Bark | Leucoderma. |
| 37. | <i>Cascabela thevetia</i> (L.) Lippold | Pila Kaner | Apocynaceae | Leaves Seeds Bark | To induce vomiting even used in abortions and several other gynecological problems. |
| 38. | <i>Lantana camara</i> L. | Nilgiri | Verbenaceae | Flower and Leaves | In rheumatic pain. |
| 39. | <i>Tinospora sinensis</i> (Lour.) Merr | Giloy | Menispermaceae | Stem | Treating fever and even diabetes and viral infections |
| 40. | <i>Withania somnifera</i> (L.) Dunal | Ashwagandha Aksand | Solanaceae | Fruits Leaves | Warmed leaf covered with a thin layer of mustard oil applied on swollen joints, lesions, and sore eyes. |
| 41. | <i>Chenopodium album</i> L. | Bathua, Bathu | Chenopodiaceae | Leaves | Relieves from indigestion, cold, and cough. Even acts as a blood purifier, killing intestinal worms and loosening the bowl. |
| 42. | <i>Solanum linnaeanum</i> | Devil's Apple | Solanaceae | Leaves | In the treatment of insomnia and for stopping excessive blood flow in menses. |
| 43. | <i>Hymenolobium flavum</i> | _ | Fabaceae | Bark | In treatment of sores |
| 44. | <i>Bromelia anti acantha</i> | Wild Banana | Bromeliaceae | Leaves | In treatment of coughs, mouth, and skin ulcers. |
| 45. | <i>Adiantum capillus-veneris</i> L. | Hansraj | Pteridaceae | fronds, rhizomes, and roots | Dental analgesic, Hepatitis, Jaundice |
| 46. | <i>Cyperus iria</i> L. | Motha | Cyperaceae | Rhizomes | Used as a stimulant, stomachic, febrifuge, astringent, and for amenorrhoea. |
| 47. | <i>Melia azedarach</i> L. | Bakain | Meliaceae | Fruits | Fruits are crushed to make a paste and applied on the head to kill lice, especially by females |
| 48. | <i>Nyctanthes arbor-tristis</i> L. | Kutta | Asteraceae | Leaves | In fever, enlargement of the spleen, malaria, blood dysentery, cough, and gastritis. |
| 49. | <i>Datura metel</i> L. Miller | Dhatura | Solanaceae | Leave, Seeds | Treating cough, male fertility disorders, mental disorders, and even respiratory problems. |
| 50. | <i>Ricinus communis</i> Linn. | Arandi | Euphorbiaceae | Seeds, Leaves, bark | Boils, swelling, and helps in starting labour pain |
| 51. | <i>Eucalyptus globulus</i> Sm. | Safeda | Myrtaceae | Seeds Leaves | Malaria, antibacterial and antiseptic properties |
| 52. | <i>Zizyphus nummularia</i> (Burm.f.) Wight | Jhar-Beri | Rhamnaceae | Fruit, Leaves Roots | Jaundice |
| 53. | <i>Equisetum ramosissimum</i> | Branched horsetail | Equisetaceae | Stem | hemorrhage, arthritis, jaundice, hepatitis, HIV and immune system, hepatoprotective, cosmetics, astringents, anti-cancer disease, swelling and fractures, and for frostbite |
| 54. | <i>Lygodium flexuosum</i> | maidenhair creeper | Lygodiaceae | Rhizome, ash of plant | jaundice, dysmenorrhoea, wound healing and eczema |
| 55. | <i>Marsilea minuta</i> | Water Clover | Marsileaceae | Juice of the fresh shoots and decoction of leaves | Treatment of psychopath, diarrhea, respiratory diseases, and skin diseases. |

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|-----|----------------------------------|-------------------------|------------------|---|--|
| 54. | <i>Ampelopteris prolifera</i> | Riverine scrambler | Thelypteridaceae | FronDS | stomach ache |
| 55. | <i>Clematis gouriana</i> | Indian Traveler's Joy | Ranunculaceae | Leaves | Puerperal fever and bruises. |
| 56. | <i>Ranunculus sceleratus</i> | celery-leaved buttercup | Ranunculaceae | Whole plant | anti-inflammatory, analgesic, sedative, and expectorant properties and it is recommended against skin diseases such as eczema, herpes, pruritus, burns and swellings |
| 57. | <i>Lepidium didymum</i> | lesser swine-creSS | Brassicaceae | Whole plant | treatment for allergies and wounds |
| 58. | <i>Diospyros montana</i> | Bombay Ebony | Ebenaceae | Whole plant (particularly leaves and stem) | InflamMations, viral fevers |
| 59. | <i>Wrightia arborea</i> | Dhudhi | Apocynaceae | Crushed fresh leaves | Toothache |
| 60. | <i>Cuscuta reflexa</i> | giant dodder | Cuscutaceae | Whole plant | treat difficulty in urinating, jaundice, muscle pain, and coughs |
| 61. | <i>Mazus pumilus</i> | Asian mazus | Scrophulariaceae | Whole plant | Typhoid |
| 62. | <i>Blepharis maderaspatensis</i> | Creeping Blepharis | Acanthaceae | Whole plant | Fracture healing |
| 63. | <i>Justicia adhatoda</i> | Malabar nut | Acanthaceae | leaves, roots, flowers, and bark | cough, colds, asthma, liquefy sputum, as a bronchodilator, bronchial catarrh, bronchitis, and tuberculosis |
| 64. | <i>Callicarpa macrophylla</i> | Dahiya | Verbenaceae | Bark, leaves | treat fever and burning sensation in the body |
| 65. | <i>Rungia pectinata</i> | Comb Rungia | Acanthaceae | Leaves | given to children suffering from smallpox |
| 66. | <i>Leucas decedentata</i> | Flaccid Leucas | Lamiaceae | Whole plant | cough, cold, diarrhea, and inflammatory skin disorder |
| 67. | <i>Plantago major</i> | broadleaf plantain | Plantaginaceae | Seed, mucilage | Stop bleeding, |
| 68. | <i>Pupalia lappacea</i> | Forest Burr | Amaranthaceae | Leaf paste | bone fractures and inflammatory conditions |
| 69. | <i>Persicaria glabra</i> | Dense flower Knotweed | Polygonaceae | decoction of the whole plant | diarrhea, dyspepsia, itching skin, excessive menstrual bleeding, and hemorrhoids |
| 70. | <i>Ouret sanguinolenta</i> | Climbing Wool-Plan | Amaranthaceae | Whole plant | haematuria and irregular or painful menstruation |
| 71. | <i>Mallotus philippensis</i> | Kamala tree | Euphorbiaceae | Hairs and glands of stem and root | bronchitis, abdominal diseases, and spleen enlargement |
| 72. | <i>Dendrophthoe falcata</i> | Honey Suckle Mistletoe | Loranthaceae | Whole plant | pulmonary tuberculosis, asthma, menstrual disorders, swelling wounds, ulcers, renal and vesicle calculi |
| 73. | <i>Bridelia retusa</i> | Spinous Kino Tree | Euphorbiaceae | leaf, stem bark, and root | lumbago, hemiplegic; bark is good for the removal of urinary concretions |
| 74. | <i>Trema orientale</i> | Indian Charcoal Tree | Ulmaceae | Bark and leaves | fever and toothache |
| 75. | <i>Asparagus adscendens</i> | Pili Satavari | Asparagaceae | Root, tubers | diarrhoea, galactagogue, dysentery, and general debility, and also increase sperm count |
| 76. | <i>Arundo donax</i> | Giant Reed | Poaceae | root or rhizome stems | Cancer, treatment of burning sensation, herpes, improving breast milk in lactating women. |
| 77. | <i>Cyperus mindorensis</i> | White Water Sedge | Cyperaceae | decoction of the rhizomes, the entire plant | Fever, sprains and bruises |

Data Analysis:

The informant consensus factor (ICF) introduced by Trotter and Logan (7) was used to simply evaluate the data, while ethnomedicinal data was verified and compared with published studies for fresh reports. The ICF evaluates the group's cooperation in using plants to combat disease in the area of study. The ICF was calculated as follows:

$$ICF = \frac{Nur - N_{taxa}}{Nur - 1}$$

Where N_{taxa} denotes the total number of taxa used by participants, and Nur is the total number of use reports for a certain disease category. ICF value is in the range of 0 to 1. It ought to be noted that a high ICF value (around 1.0) denotes that a large percentage of participants use a relatively small amount of taxa. In contrast, a low ICF score (around 0) suggests that people may have used plants inadvertently to treat their illnesses as mentioned by Heinrich (8).

Results and Discussion

Socio-Economy:

Between February 2021- July 2022, 234 individuals participated in the ethno-medical survey, including farmers of the village, rangers in the forests, and residences. Table 1 and 2 contains the social information about the participants. The age range of the majority of participants was 54 to 60. The core informants for this study were only 15 participants—traditional healers (Vaidyas). A majority of the young practitioners have a degree or diploma, and only roughly 30% of participants were under 40 years old and illiterate. Nearly the majority of them were older than 50.

Ethno-Medicinal Plants:

A total of 77 medicinal plant species, belonging to 65 families were described. Asteraceae and Polygonaceae, Ranunculaceae, Rosaceae as well as Euphorbiaceae, Poaceae, and Solanaceae, were among the families of plants that are represented. Nearly all, participants used *Melia azedarach* and *Acacia catechu* as their primary ethno-medicinal plants because of their cultural significance (they have been used for generations) and the abundance of bioactive molecules in these plants.

Life forms and plant parts used:

Similar to past studies done in Haryana, the present study found that 56% of the species were herbs, followed by trees (23%), shrubs (12%), and climbers (9%). Because they are readily available, herbs and trees are the most prevalent treatments used by traditional healers. In addition, herbs can be easily worked with in terms of herbal preparation techniques and bioactive ingredient extraction. Less availability and difficulty in harvesting from the massive growth of supporting material (Trees) in temperate areas may be the cause of the lower percentage of climbers. These plants are used for a variety of purposes, with availability ranking above cultural considerations. In the current investigation, several plant parts were employed to make herbal medication preparations. The most frequent plant parts were the roots (26%) followed by the leaves (20%), fruit (8%), bark and rhizome (7%), whole plant, tuber and seeds (each 6%), aerial part and stem or branches (each 5%), latex resin or gum, and bulb (each 1%) (Fig. 2 and 3). For herbal

remedies similar to root proportion is high, roots were extensively utilized in *Kalesar folklore*, perhaps because they contain a wealth of active components. Due to their widespread availability and the fact that they are expected to contain more readily extractable phytochemicals, crude medicines, and other combinations that may be useful for phytotherapy, leaves were the second most useful plant portion (9).

Table 2. Participants' average level of literacy

| EDUCATIONAL LEVEL | NUMBER OF INDIVIDUALS | PERCENTAGE |
|----------------------------------|-----------------------|------------|
| Illiterate | 39 | 16.6 |
| 1 ST -5 TH | 67 | 28.6 |
| ≤ 10 TH | 75 | 32.05 |
| ≤ 12 TH | 45 | 19.2 |
| Degree/diploma | 8 | 3.41 |
| TOTAL | 234 | |

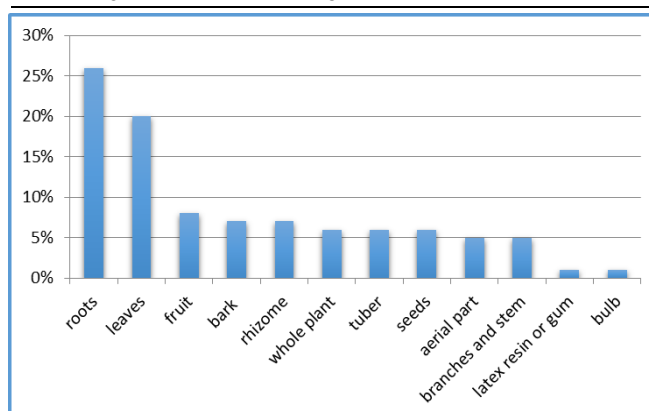


Fig. 2: Plant Parts Used For Treatment of Ailments

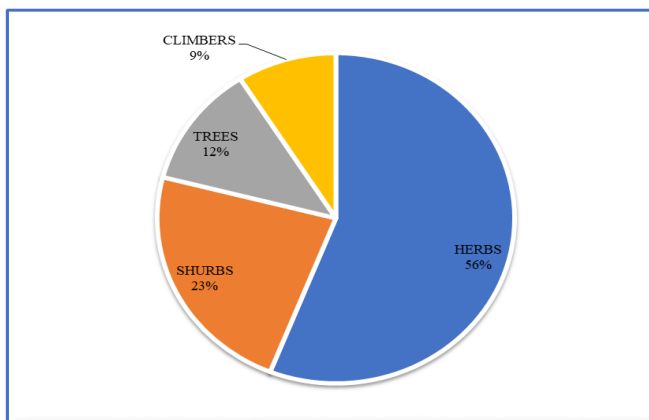


Fig. 3. Proportion of different life forms of medicinal plants used by inhabitants of Kalesar

Table 1. Age and gender demographics for residents and regional experts

| AGE-GROUP | GENDER | | VAIDS (MALES AND FEMALES) | RANGERS (MALES AND FEMALES) | NUMBER OF PERSON | PERCENTAGE |
|-----------|--------|--------|------------------------------|--------------------------------|------------------|------------|
| | MALE | FEMALE | | | | |
| 30-39 | 17 | 14 | --- | 1 | 32 | 13.6 |
| 40-49 | 34 | 29 | --- | 2 | 65 | 27.7 |
| 50-59 | 43 | 38 | 2 | --- | 83 | 35.4 |
| 60-69 | 20 | 16 | 1 | --- | 37 | 15.8 |
| 70-79 | 7 | 8 | 2 | --- | 17 | 7.2 |
| 80+ | --- | --- | --- | --- | --- | --- |
| TOTAL | 121 | 105 | 5 | 3 | 234 | |

Conventional Instruments and Methods of Drug Preparation:

The most popular methods of treatment appear to be either applying a plant dressing directly to the wound or using a plant concoction as a wash followed by the application of a plant paste. The following are the traditional uses for herbal medicine formulations made following: paste (lepa) is the most common substance, followed by juice or extract (rasa) (29%), powder (churn) (21%), decoction (kwath/kaada) (6%), semi-dried (avleha) (4%), oil (taila/ghee), solid extract (sattva), and boiled with milk (paka) (1%) (Fig. 4). Because paste and juice are so simple to make and herbal medicines work so well, they may be used the most frequently. To prepare things, water was utilized generally as a solvent. According to a previous study, milk or honey was occasionally added to the concoction to boost its viscosity or employed as a binder. Crushed plant pieces are combined with water or oil to create a paste. Most often twice and three times each day, dosages were administered. In addition to the aforementioned, some participants claim that the dosage is based on the patient's age and physical characteristics (10).

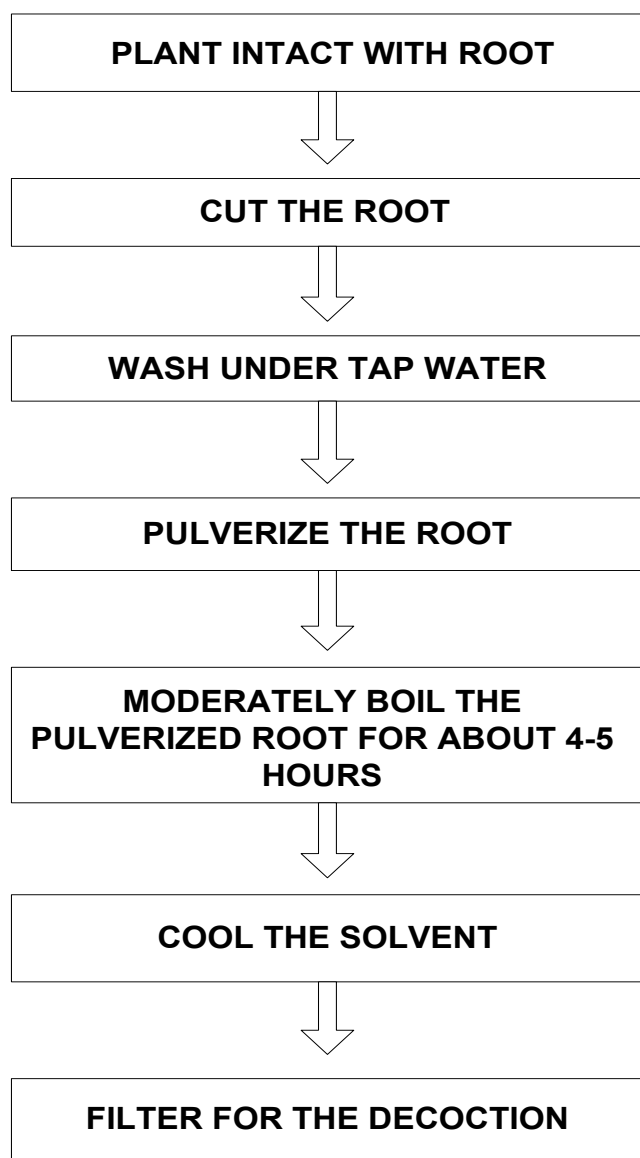


Fig. 4. Flow Chart Depicting the Preparation of Decoction

The most common traditional tools used by locals to prepare drugs are the Chhonthri, which is a stone plate that is 10–12 mm thick, 15–20 cm in diameter, and weighs 0.5–1.0 kg, the Kharad, which is also made of stone and measures 20–45 cm and weighs 3–5 kg, the Silbatta/Silotu, which is 30–60 cm and weighs 15–25 kg, and the Imaamdasta, made from stone or china ceramic weighing about 3–5 kg.

Informant consensus factor (ICF):

Quantitative analysis was done on the participants' consensus of the medicinal plants they claimed to use to treat various illnesses. All diagnosed disorders are divided into 17 groups to reach this consensus. The ICF value varied from 0.91 to 0.99, indicating a high level of participant agreement, albeit the 100% consensus was not reported. The conditions with the highest ICF values (0.94) were kidney issues, discomfort, and bites from dogs, snakes, and insects (0.93) (Table 4) (11).

Past and Present Status of Ethno-Medicinal Plants:

Plants and herbs have been used for medicinal or medical purposes far before recorded history. Since time immemorial, they have served as the foundation for practically all traditional medical practices around the globe, and they still provide the human race with innovative treatments in the form of crafted and prepared herbal medicines. Numerous plants are mentioned as having medical uses in ancient Chinese and Egyptian papyrus literature. Many indigenous societies around the world used herbs in their healing rituals, while other cultures created traditional medical systems like Ayurveda, Unani, and Traditional Chinese Medicine that included the use of herbal therapies and medications. Herbs are still the main component of Unani, Ayurvedic, homeopathic, naturopathic, traditional oriental, Native American, and Indian remedies today. Plant-derived chemicals play a sizable role in contemporary allopathic medicines. At least one active component derived from plants is present in about 25% of allopathic prescription medications. If over-the-counter (OTC) allopathic medications were included, the percentage would be significantly higher (12).

In the past, herbal remedies were offered as straightforward preparations like tinctures, teas, poultices, powders, and other herbal preparations. These simple herbal preparations served as the fundamental therapeutic components of all traditional systems of medicine and have long been used to treat illness in small-town or regional healthcare settings. However, practitioners of allopathic medicine have long regarded herbal treatments as archaic, and colonial authorities frequently deemed such traditional medicinal practices to be unlawful (13). As a result, despite their contributions to addressing the population's basic health requirements, particularly those of the rural population, doctors and other medical professionals continue to avoid traditional herbal medicine practitioners. Furthermore, scientists started to extract and alter the medicinally active substances present in plants in the early 19th century when chemical analysis first became feasible so that they might

Table 4. ICF (Informant Consensus Factor) per category of illness in the current study

| S.NO. | Category of ailment | Number Of Use Reports (Nur) | Number of Species (Nt) | ICF Value |
|-------|--|-----------------------------|------------------------|-----------|
| 1 | Digestive system disorders: Gastritis, diarrhea, ulcers, constipation, digestive aid, piles, carminative, flatulence, indigestion, colic, anthelmintic | 213 | 25 | 0.88 |
| 2 | Parasitic infection: malaria, liver cyst, scabies | 45 | 5 | 0.9 |
| 3 | Kidney disorders: kidney and bladder stones, irregular urination, urinary problems, diuretic | 53 | 4 | 0.94 |
| 4 | Respiratory disorders: Asthma, bronchitis, pneumonia | 24 | 8 | 0.69 |
| 5 | Microbial infection: Cholera, dysentery, measles, jaundice, ear infection, fungal infection, chicken pox | 34 | 11 | 0.7 |
| 6 | Rheumatism and fracture: Rheumatism, bone fracture, paralysis | 17 | 9 | 0.5 |
| 7 | Dermatological: Allergy, albinism, eczema, ringworm, dandruff, itch, urticaria, cracked heels, baldness, vitiligo | 211 | 15 | 0.93 |
| 8 | Sexual and related disorders: Dampened sexual desire, excessive bleeding during menstruation and childbirth, enlarged breasts, leucorrhoea, uterine disorders, infertility, spermatorrhea, impotence, abortion, dysmenorrhea. | 67 | 6 | 0.92 |
| 9 | Neurological and psychological disorders: insanity, analgesic, psychological disorders | 4 | 3 | 0.33 |
| 10 | Inflammation: Inflammation, tonsillitis | 60 | 19 | 0.69 |
| 11 | Diabetes, blood circulation, and “blood purifiers” | 37 | 16 | 0.56 |
| 12 | Cancer | 22 | 5 | 0.8 |
| 13 | Pain: Abdominal pain, naval pain, toothache, stomachache, earache, breast pain, chest pain, headache, migraine, knee pain, liver pain, sore throat, gout | 218 | 15 | 0.94 |
| 14 | Boils, abscesses, carbuncles, swellings, cuts and wounds | 167 | 23 | 0.86 |
| 15 | Fever and cough | 203 | 21 | 0.91 |
| 16 | Snake, dog, and insect bites | 119 | 8 | 0.94 |
| 17 | General disorders: beautification of hair and teeth, longevity, multivitamins, dehydration, general weakness, toothpowder, source of calcium, tonic, vomiting, external injuries | 118 | 24 | 0.8 |

be used as components of allopathic medications. The use of herbal remedies gradually decreased in favor of allopathic pharmaceuticals as chemists started to synthesize or create their versions of the plant substances. The use of herbal medicinal preparations as the primary treatment method is prevalent in nearly all traditional medical systems, and they are now progressively receiving major attention in international health forums. To keep up with the advancement of civilization, herbal medical treatments are gradually changing how they are presented. The majority of them are currently made with the aid of contemporary pharmaceutical technology and administered in contemporary pharmaceutical dosage forms. In this way, natural remedies are making a classy comeback (14).

Conclusion

Medicinal plants have curative and healing properties and it has not been hidden from anyone. It is predictable that the total world population and the population of developing countries 60% and 80% respectively dependent on traditional herbal medicines for treating several health ailments. Several studies have been conducted in different areas to explore the properties of ethnomedicinal plants, that are focused on curing

particular diseases by using medicinal plants like the study for to cure various gastrointestinal disorders by using medicinal plants, (15). Medicinal plants are important resources as they constitute the potential sources of new products and bioactive compounds for drug development and utilization. From the present study area, a total of 100 plant species were screened from their nativity. 52 plants were found to have ethno-medicinal properties belonging to 41 families and have various traditional medicinal uses in various ailments by the local people residing near the Reserve Forest. The present study found that the dominant plant form for the various health ailments treatment was herb plants then followed by tree and shrub forms of plants with the number and percentage of plant species 20 (38%), 17 (33%) & 15 (29%) respectively. The more utilization of herb forms may be the presence of a high percentage of bioactive compounds.

The plants studied have many common ailments treating properties and some even have the properties of treating diseases like diarrhoea, cancer, hepatitis B, etc. The present study revealed that people used different parts of plants like leaves, bark, rhizomes, roots, fruit, flowers, seeds, etc. It has been found that the most used plant part is the leaf as most of the secondary metabolites are formed in the leaf, by the process of photosynthesis and metabolic activities, and secondly their easy

collection and availability (16,17). Decoction, infusion, cooked form, etc. was the common method used for medicine preparation by the local people and generally used by oral means. During the study, it was observed that mostly local people dependent on the ethnomedicinal plant to cure fever, malaria, blood dysentery, cough and gastritis, bleeding, wounds, etc. Thus, it becomes important to be conscious regarding the unceasing use of the essential flora. Therefore, giving exceptional consideration to the restorative plants found in the space might assist the benefits provided by these plants in medical services and even in biodiversity protection.

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Authors' contributions

RS & NS carried out the Ethno botanical studies with a survey and drafted the manuscript. AK participated in the sequence alignment. MN & SK participated in the design of the study and performed the statistical analysis. NS & DN conceived of the study and participated in its design and coordination. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None.

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