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RESEARCH ARTICLE

Preserving threatened ethnomedicinal knowledge: Revealing some less-explored therapeutic potential of wild indigenous flora of Koraput district, Odisha, India

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Abstract

Koraput district in Odisha, India, is renowned for its rich biodiversity and traditional medicinal practices. This region, characterized by its hilly terrain and tribal population, harbours a vast array of medicinal plants that have been traditionally used for generations to treat various ailments. This study aims to document and analyse the medicinal plants of Koraput, highlighting their significance in local healthcare practices and their potential for broader pharmaceutical applications. Field surveys and ethnobotanical studies were conducted to collect data on the medicinal plants used by the indigenous communities. Interviews with local healers and practitioners provided insights into the traditional knowledge and usage patterns of these plants. A total of 58 medicinal plant species belonging to 36 families were recorded. These plants are used to treat a variety of ailments, ranging from common colds to chronic diseases. Notably, many species such as *Acacia sinuata*, *Asparagus racemosus*, *Dysphania ambrosioides* and *Ricinus communis* are integral to both medicinal and cultural practices, revealing a holistic approach to health among these communities. Methods of preparation include decoctions, pastes, juices and powders, often administered orally or topically. The study underscores the critical role of traditional knowledge in healthcare among the tribal populations of Koraput. By integrating traditional knowledge with modern scientific research, there is potential to discover novel drugs and therapies, contributing to sustainable healthcare solutions and the preservation of cultural heritage.

Keywords: ethnomedicinal; indigenous communities; Koraput district; traditional knowledge

Introduction

Traditional medicine is defined as "the sum total of the knowledge, skill and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness" (1). Many countries have their own traditional or indigenous forms of healing, which are firmly rooted in their culture and history (2). Indigenous people have been using the unique approach of their traditional system of medicine for centuries and among the most famous are the Chinese, Indian and African systems of medicine (3). Plants have formed the basis of sophisticated traditional systems of medicine that have been in existence for thousands of years and continue to provide humankind with new remedies (4).Of the 250000 higher plant species on earth, more than 80000 species are reported to have at least some medicinal value (5). According to the World Health Organization (WHO), 80 % of people still rely on plant-based traditional medicines for primary health care (6). Complex diseases require not just surgery, but also adequate diet and overall health, as damaged cells can heal themselves naturally. The treatment is only required to help the natural healing process (7, 8).

The Koraput district, located in the southern part of Odisha, India, is a region endowed with rich biodiversity and a profound ethnobotanical heritage (9). The indigenous communities of Koraput, such as the Kondh, Paraja, Gadaba and Bhatra tribes, have been utilizing the local flora for medicinal purposes for generations, relying on their intimate knowledge of the natural environment to treat a wide array of ailments (10). This district, with its undulating terrain, dense forests and significant tribal population, has long been a repository of traditional knowledge, particularly concerning the use of medicinal plants (11). However, despite the vast potential of these resources, much of the traditional knowledge remains undocumented and many medicinal plant species are threatened by overharvesting, habitat loss and environmental degradation (12).

The present investigation aims to document and analyse the medicinal plant resources of Koraput district, highlighting their ethnobotanical significance and potential for pharmaceutical use. By bridging traditional knowledge with scientific investigation, the study seeks to contribute to the conservation of these valuable resources while promoting sustainable use. Additionally, the study aims to create a comprehensive record of medicinal plants of Koraput that can serve as a reference for further research and development of

herbal medicine. Given the increasing global interest in natural and plant-based remedies, this research is not only vital for preserving local heritage but also for exploring the broader application of medicinal plants in contemporary healthcare systems. Through systematic documentation and analysis, this study seeks to safeguard the rich medicinal plant resources of Koraput for future generations, while addressing the challenges of conservation and sustainable management.

Methodology

The study was conducted in Koraput district, located in the Eastern Ghats of Odisha, India. The present Koraput district is located between 18°13' and 19°10' North Latitudes and 82°5' and 83°23' East Longitudes. On the extreme North it is bounded by Nabarangpur district, on the West by Bastar district of Chhattisgarh State, on the South by the district of Malkangiri and on the East by the districts of Vizianagaram and Srikakulam of Andhra Pradesh State. Its area is 8807 sq. km (13).

Field surveys were conducted to collect medicinal plant specimens. Each plant was carefully sampled, with emphasis on the part(s) used in traditional medicine (e.g., leaf, root, stem, flower, fruit). Detailed records, including GPS (Global Positioning System) coordinates, habitat type and the local names of plants, were maintained. High-resolution photographs were taken to document plant characteristics and their ecological context. Collected plant specimens were processed into herbarium samples through drying and pressing techniques (14). The dried specimens were mounted on herbarium sheets, labelled with key details (such as scientific and local names, collection location and date). Botanical identification was performed using taxonomic keys, reference floras (15-17) and consultation with botanists or taxonomists. Ethnobotanical information was gathered through structured and semi-structured interviews and Rapid Appraisal Approach (RAA) involving face-to-face interviews with local informants, including traditional healers known locally as "*disaris*" and community members known for their expertise in medicinal plants (Table 1).

A total of one hundred forty-two informants were interviewed. Data on plant uses, preparation methods, dosages and specific ailments treated were documented using questionnaires and audio/video recordings (with consent). Cross-verification of data was done by comparing responses from multiple informants to ensure accuracy. A comprehensive literature review was carried out to identify known medicinal plants of the region, understand previous research efforts and highlight knowledge gaps. Published books, scientific journals, herbarium records and traditional knowledge sources were consulted to provide context for the study (Table 2).

Results and Discussion

The exploration of medicinal plants of the study area reveals a remarkable diversity, encompassing 36 families and 58 species recognized for their therapeutic applications (Table 2). Notably, families such as Euphorbiaceae (6 species), Asteraceae (5 species), Lamiaceae (4 species) and Fabaceae (3 species) stand out for their substantial representation, emphasizing their pivotal roles in both traditional and modern medicine (Fig. 1). Other families, including Acanthaceae, Annonaceae, Caesalpiniaceae, Mimosaceae, Myrtaceae, Phyllanthaceae, Solanaceae and Verbenaceae, appear twice in the dataset, reflecting their consistent contribution to medicinal resources. Additionally, the dataset features a diverse

Table 1. Knowledge of medicinal plants remedies reported by local respondents

Variable	Demographic categories	Number of informants	Percentages
Gender	Female	51	36
	Male	91	64
Experience	Traditional healer	17	12
	Local people	125	88
Age groups	20-40	20	14
	41-60	35	25
	Above 60	87	61
Education	Illiterate	102	72
	Primary school	21	15
	Middle school	03	02
	High school and above	16	11

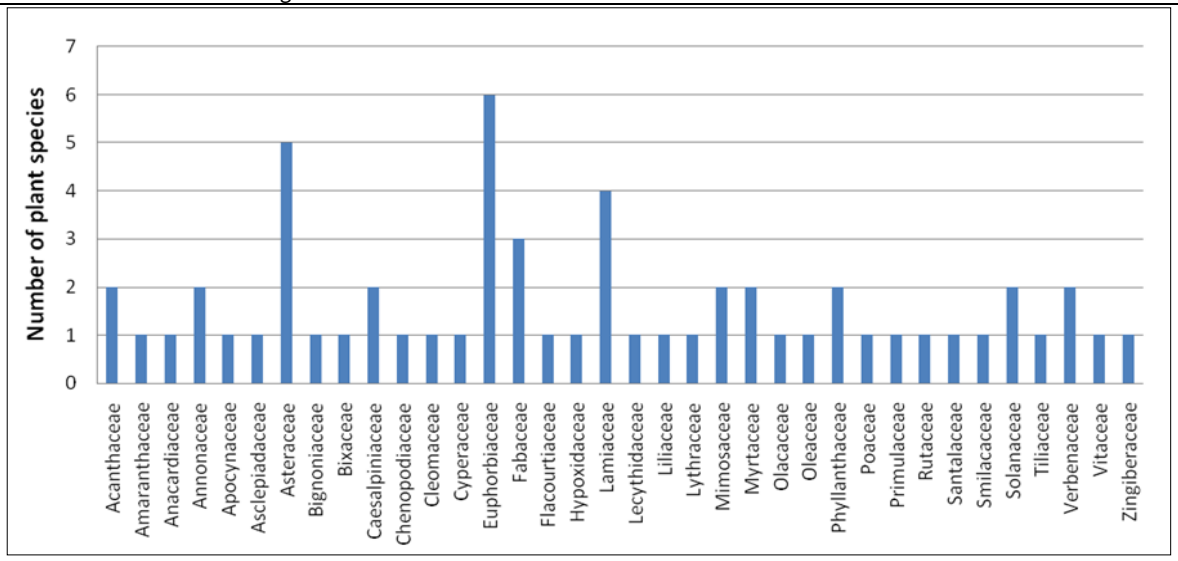

Fig. 1. Distribution of plants in their families.

Table 2. List of plants used as medicine in the study area

Sl. No.	Name of the Plant	Local Name	Family	Voucher Number	Uses
1	*Acacia sinuata* (Lour.) Merr.	Chili	Mimosaceae	MMP- 214	The fruits are boiled in water, ground into a paste, filtered and the pulp is applied to the head as a shampoo. The spicy decoction of tender leaves is taken with rice for hyperacidity.
2	*Aerva lanata* (L.) Juss.	Paunsia	Amaranthaceae	MMP- 173	The shoot part of the plant is ground to make a paste, which is then diluted and filtered. The filtrate is mixed with honey and taken orally for dysentery.
3	*Aeschynomene indica* L.	Musa	Fabaceae	MMP- 42	Leaf paste is applied to swelling and inflammation on the limbs. It is then covered with a banana leaf and tied.
4	*Ageratum conyzoides* L.	Gandhributa	Asteraceae	MMP- 178	The leaves are crushed in the palm and a few drops of juice are put inside the nostrils to get relief from a headache.
5	*Annona squamosa* L.	Sitaphal	Annonaceae	MMP- 318	The crude extract of leaves is applied to skin infections and is also applied to the head for control of dandruff.
6	*Antidesma acidum* Retz.	Amti Koli	Phyllanthaceae	MMP-467	Fruit pulp is prepared by crushing and rubbed on teeth and gums to treat diseases of the oral cavity and also for whitening teeth.
7	*Ardisia solanacea* Roxb.	Ridika	Primulaceae	MMP- 63	The roots are dried and powdered. The powder is taken along with milk against nerve weakness.
8	*Asparagus racemosus* Willd.	Satabari	Liliaceae	MMP- 367	The powder of dried tubers is taken along with warm water or milk to overcome general weakness. The twig is kept near the door to ward off evil spirits.
9	*Barleria strigosa* Willd.	Satpheni	Acanthaceae	MMP- 112	Paste is prepared from the whole plant and is applied to joints to get relief from pain.
10	*Bauhinia purpurea* L.	Kailari	Caesalpiniaceae	MMP- 425	Decoction is made from dried bark and is taken with honey two times a day to get relief from fever.
11	*Bidens pilosa* L.	Sukhali Buta	Asteraceae	MMP- 364	The whole inflorescence, which is regarded as a flower, is pounded and mixed with water to make a paste. The paste is applied to the forehead of children in case of fever. The same procedure is also useful to calm down hyperactive children.
12	*Bixa orellana* L.	Jafra	Bixaceae	MMP- 204	The seeds are fried and powdered, which is mixed with honey to make a thick consistency. The paste made thereby is put on the palm and the patient licks it to get relief from a stomachache.
13	*Breynia retusa* (Dennst.) Alston	Phulbani	Euphorbiaceae	MMP- 292	Fresh or dried roots are washed thoroughly, then boiled in water with salt and jaggery. The fluid is taken orally for the treatment of dysentery.
14	*Cajanus scarabaeoides* (L) Thouars	Jharkulath	Fabaceae	MMP- 147	The dried seeds are roasted and made into powder. The powder is mixed with mashed banana and eaten for general weakness.
15	*Careya arborea* Roxb.	Kumbhi	Lecythidaceae	MMP- 332	The paste of the leaf is applied to the skin having the wound due to a snake bite. The decoction of the leaf is also taken orally. The twig of the plant is kept near the door to ward off snakes.
16	*Casearia graveolens* Dalzell	Haldigathi	Flacourtiaceae	MMP- 186	Oil extracted from the seeds of the plant is applied and massaged to get relief from muscular pain.
17	*Cheilocostus speciosus* (J. Koenig) C.D. Specht	Keu kanda	Zingiberaceae	MMP- 81	The tubers are used as a vegetable that aids in digestion and reduces the symptoms of flatulence. These tubers are also considered to be good for diabetic patients due to their low sugar content.
18	*Cleome viscosa* L.	Hulhulia	Cleomaceae	MMP- 183	The tender leaves are made into a fine paste and applied to a scorpion bite to neutralise the poison and reduce swelling and pain.
19	*Clerodendrum infortunatum* L.	Bhandari	Verbenaceae	MMP- 258	Leaf paste is applied to affected parts to reduce inflammation and swelling. It is also used for skin infections.
20	*Colebrookea oppositifolia* Sm.	Jatjatia	Lamiaceae	MMP- 223	Roots are boiled in water and the vapour is inhaled to reduce nasal congestion. The root extract is also taken for fever and malaria.

21	*Crotalaria pallida* Aiton.	Jhunjhuna	Fabaceae	MMP- 250	To heal the wounds produced by farm implements, the paste of leaves of the plant is applied.
22	*Curculigo orchioides* Gaertn.	Talmuli	Hypoxidaceae	MMP- 389	To reduce the symptoms of swelling and pain, fresh tuberous roots of the plant are collected and ground to a paste. The paste is applied to the affected part with the help of a feather from a pigeon.
23	*Cynodon dactylon* L.	Dub	Poaceae	MMP- 308	The indigenous people believe that dogs and cats instinctively eat the leaves of this plant to induce vomiting, in case of overeating and indigestion. Taking this clue, the juice of the leaf is taken for stomach problems.
24	*Cyperus rotundus* L.	Muthaa	Cyperaceae	MMP- 377	The underground tubers are cleaned thoroughly, dried and a powder is prepared from them, which is mixed with milk and used as a tonic.
25	*Datura stramonium* L.	Dudra	Solanaceae	MMP- 163	Castor (*R. communis* L.) oil is applied to one surface of the leaf; the other side of the leaf is heated over fire to make it supple. The oiled surface is placed on the boil in warm conditions to expel pus.
26	*Dysphania ambrosioides* (L.) Mosyakin & Clemants	Kandributa	Chenopodiaceae	MMP- 118	The young shoots are fried and consumed along with rice and the juice extracted from the leaves is applied to the forehead to get relief from fever. The twig of the plant is also used against evil spirits known as *dumas*.
27	*Elephantopus scaber* L.	Majurchendi	Asteraceae	MMP- 174	The leaf is boiled in mustard oil, then cooled and smeared on the forehead to treat a headache. The juice from squashed leaves is also applied for quick relief.
28	*Euphorbia tirucalli* L.	Khadisiju	Euphorbiaceae	MMP- 21	The stem is cut into small pieces, boiled and the liquid so obtained is mixed with animal feed and given to cattle for increasing lactation.
29	*Flueggea leucopyrus* Willd.	Dhob Anla	Phyllanthaceae	MMP- 285	The leaf is dried in the sun and boiled in edible oil and stored for future use. The oil is massaged on the skin against body aches.
30	*Grangea maderaspatana* (L.) Poir.	Nakchana	Asteraceae	MMP- 274	The shoot, along with the inflorescence, is made into a paste that is applied in case of joint pain, more specifically on the knees.
31	*Guizotia abyssinica* (L.f.) Cass.	Olsi	Asteraceae	MMP- 344	Oil from seeds is used for massaging the joints to get relief from pain. The paste of seeds is also applied to painful joints.
32	*Hemidesmus indicus* (L.) R. Br. ex Schult.	Dudhmali	Asclepiadaceae	MMP- 224	A paste is prepared from leaves using stone implements. The paste is applied on and around the insect bite to reduce swelling and pain.
33	*Ichnocarpus frutescens* (L.) R.Br.	Sing loi	Apocynaceae	MMP- 22	The bark of the plant is dried in the sun and ground into powder using a mortar. The powder can be used immediately or stored for a few months. In cases of cough and cold, a pinch of the powder is mixed with hot milk and given to children and women. Older men smoke the powder mixed with tobacco in a pipe made from tendu (*Diospyros melanoxylon*) leaves.
34	*Jasminum arborescens* Roxb.	Kunda phul	Oleaceae	MMP- 158	The powder obtained from roots is mixed with honey and given to infants and children against fever and vomiting.
35	*Jatropha curcas* L.	Duma jada	Euphorbiaceae	MMP- 184	When leaves are plucked, a colourless latex is exuded, which is applied to fresh wounds to stop bleeding. Children play by blowing the latex through a loop to form bubbles.
36	*Lannea coromandelica* (Houtt.) Merr.	Doka	Anacardiaceae	MMP- 264	Fresh bark is boiled in water. Honey is added to the cooled extract and taken orally for asthma. Medicated tea is prepared using tea leaves and powdered bark of the plant and it is consumed in the morning and evening.
37	*Leea indica* Merill	Manabadkili	Vitaceae	MMP- 109	Leaves are ground into a smooth paste and water is added to thin it. The mixture is then filtered using a fine cloth. Lemon juice is added to the filtrate and the patient with a gastric problem is instructed to drink it.
38	*Leucas cephalotes* (Roth) Spreng.	Bana gubi	Lamiaceae	MMP- 312	A paste of the whole plant is applied to the skin to lighten spots and reduce pigmentation.
39	*Mallotus philippensis* (Lam.) Mull.Arg.	Sindura	Euphorbiaceae	MMP- 48	The ripe fruits are dried and powdered. A small amount of powder is mixed with the leaf extract of *Justicia adhatoda* and given to treat bronchitis.
40	*Mesosphaerum suaveolens* (L.) Kuntze	Deng Tulsi	Lamiaceae	MMP- 412	The seeds are soaked in water overnight. When the seed coats develop white mucilage, sugar or jaggery is added to it and eaten in the morning to treat constipation.

41	*Miliusa velutina* Lesch. ex A. DC.	San Sorgi	Annonaceae	MMP- 420	The bark of the plant is boiled in water; the extract is mixed with freshly collected sap of date palm and the mixture is taken for stomach problems.
42	*Murraya koenigii* (L.) Spreng.	Mersinga	Rutaceae	MMP- 330	Leaves fried in oil; salt sprinkled on the fried leaves and then mixed with boiled rice and eaten to ease stomach-ache. The extract of the leaves is also consumed to treat stomach problems.
43	*Olax scandens* Roxb.	Badar	Olacaceae	MMP- 32	The ripened fruits are eaten to reduce the severity of acidity and heartburn. The ripened seeds are dried and stored, which can be used in case of food scarcity.
44	*Oroxylum indicum* (L) Kurz	Pappeni	Bignoniaceae	MMP- 196	The decoction of the bark is taken orally in cases of a snake bite and a thick paste of the leaves is also applied to the bite area.
45	*Petalidium barlerioides* (B. Heyne ex Roth) Nees	Dhob Kerenta	Acanthaceae	MMP- 139	The leaves are pounded and boiled in any edible oil. Once cooled, the oil is mixed with the seed oil of Mahua (*Madhuca indica*). The medicated oil is then massaged onto the skin to treat dryness and make it smooth.
46	*Phyllanthus emblica* L.	Aenla	Euphorbiaceae	MMP- 222	The fruit of the plant is consumed in various ways to address general weakness. Fresh fruits are eaten with salt, or the fruits are cut longitudinally into four parts, sprinkled with salt and dried. The powder of dried seeds can also be consumed.
47	*Psidium guajava* L.	Jamba	Myrtaceae	MMP- 181	Young leaves from the apical parts of branches are collected, fresh juice is extracted and filtered using a fine cloth. The filtered juice so obtained is consumed to treat the common cold.
48	*Ricinus communis* L.	Jada	Euphorbiaceae	MMP- 1	The oil extracted from seeds is used as a purgative and as a hair tonic. When head reeling occurs while working in the sun, the oil is massaged into the hair. The leaves are kept at doors and windows at night to ward off witches (*Pongnis*).
49	*Senna tora* (L) Roxb	Chakunda Saag	Caesalpiniaceae	MMP- 272	In the rainy season, the young and delicate leaves are consumed as a vegetable, which is believed to cure worm infestations of the alimentary system.
50	*Smilax zeylanica* L.	Mutrimal	Smilacaceae	MMP- 70	The leaves of young shoots are ground and used as toothpaste. Stem is cut into small pieces and used as a toothbrush.
51	*Solanum virginianum* L.	Kanta Bhejri	Solanaceae	MMP- 161	The ripened and dry fruits are burned in charcoal and the smoke is inhaled into the oral cavity through a pipe. The smoke is supposed to relieve toothache and cure the problems of teeth and gums.
52	*Stachytarpheta jamaicensis* L.	Bathra	Verbenaceae	MMP- 91	Old and dark green leaves are selectively plucked, ground to a paste and applied to the whole area of the skin affected by an insect bite.
53	*Syzygium cumini* (L.) Skeels	Jaamkuli	Myrtaceae	MMP- 265	The fresh juice of the leaf is mixed with rice water and consumed for stomach problems. In summer, when the fruits are available, they are eaten so that they can protect the person from stomach ailments.
54	*Triumfetta rhomboidea* Jacq.	Chitka	Tiliaceae	MMP- 97	The leaves are ground with the rhizome of turmeric (*Curcuma longa*) and the paste is applied to the wound to stop bleeding.
55	*Viscum articulatum* Miq.	Khadi Modang	Santalaceae	MMP- 94	A paste made from the whole plant is rubbed on teeth with fingers for ailments relating to the tooth, gum and oral cavity.
56	*Vitex negundo* L.	Nilgundi	Lamiaceae	MMP- 116	The leaves are boiled in water. The extract is added to lukewarm water and infants are bathed in that water for the prevention of skin infections.
57	*Woodfordia fruticosa* (L.) Kurz	Tendka	Lythraceae	MMP- 9	The juice extract from the leaf is put on the wound drop-wise to stoppage of bleeding. After the formation of a clot, a thick layer of the pulp of the leaf is applied to the affected part for healing.
58	*Xylia xylocarpa* (Roxb.) Taub.	Tangeni	Mimosaceae	MMP- 7	In case of an insect bite, the affected skin is washed with the aqueous extract of the bark from time to time.

array of families represented by a single species each, such as Amaranthaceae, Anacardiaceae, Apocynaceae, Asclepiadaceae, Bignoniaceae, Bixaceae and several others. In summary, the prominence of families like Euphorbiaceae, Asteraceae and Lamiaceae underscores their key role in medicinal plant resources, while the broad representation of other families highlights the immense potential of plant biodiversity in meeting healthcare and therapeutic needs.

The medicinal plant resources utilized by the ethnic communities of the Koraput district exhibit a broad spectrum of therapeutic and preventive applications, highlighting their vital role in healthcare systems. The data indicates that digestive health (13 cases) and skin-related issues (12 cases) are the most frequently treated ailments, suggesting their prevalence and the effectiveness of plant-based remedies in addressing them (Fig. 2). Notable applications are also observed for pain management (7 cases), animal bites (6 cases), general weakness (5 cases), cold and fever (5 cases) demonstrating the adaptability of these plants in managing both common and specialized health concerns. Additional uses include dental care (4 cases) and treatments for children (3 cases), showcasing their diverse therapeutic value. Although respiratory ailments (2 cases), paediatric and veterinary applications (1 case each) are the least documented, their inclusion highlights the specialized uses of these plants. This data underlines the essential role of medicinal plants in addressing a wide range of health issues, emphasizing the importance of further research and conservation efforts.

In addition to therapeutic applications, several plants (e.g., *A. racemosus*, *D. ambrosioides*, *R. communis*) are also associated with cultural beliefs, such as warding off evil spirits or used in rituals, which highlights the integral role of medicinal flora in socio-religious contexts. The use of edible plants like *G. abyssinica*, *S. tora* and *S. cumini* for stomach-related ailments highlights the ethno-nutritional overlap in tribal health practices. This intersection suggests potential for developing nutraceuticals based on indigenous knowledge.

Among the plant parts used medicinally, leaves (41 %) are the most frequently mentioned (Fig. 3). This highlights their prominence in traditional medicine, likely due to their availability and high content of bioactive compounds. Roots and tubers (13 %) show significant usage, reflecting their importance in traditional remedies. Fruits (11 %) also have a higher representation,

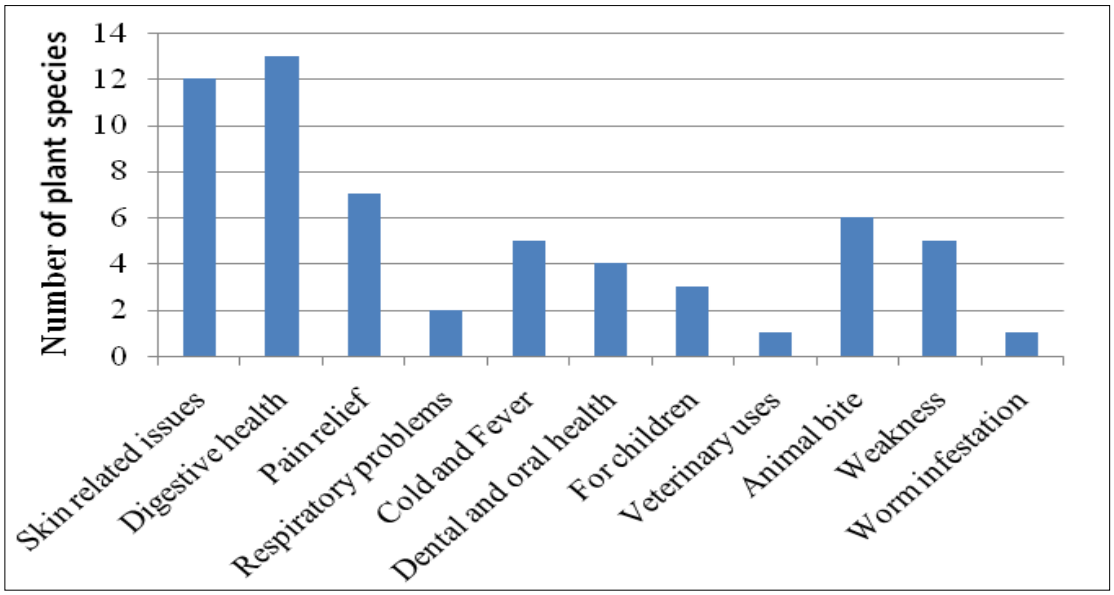

Fig. 2. Number of plant species used to treat different ailments.

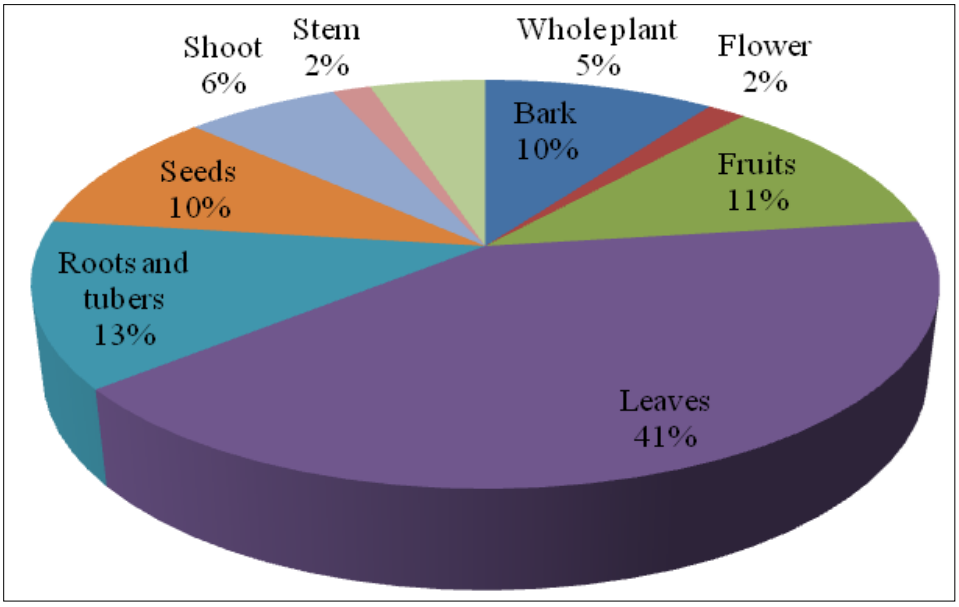

Fig. 3. Plant parts used for medicinal purposes.

suggesting they are a significant resource, possibly valued for their nutritional and medicinal properties. Seeds (10 %), Bark (10 %), shoots (6 %) and whole plants (5 %) also show notable usage, reflecting their importance in traditional remedies, often due to their rich content of secondary metabolites. Flower (2 %) and stem (2 %) are the least utilized, indicating a comparatively minor role in traditional medicinal practices. This distribution highlights a preference for leaves and fruits in ethnic medicine, possibly due to ease of harvest and potency, while less common parts like flowers and stems may require specific conditions or knowledge for use.

There are studies that have documented promising new medicine development based on the repository data of unique phytochemicals gathered from tribal places (18). There are also reports available in the literature about the Koraput District of Odisha covering the Eastern Ghat, which document indigenous ethnobotanical knowledge (19, 20) and the plants that the traditional and local people of the district use to treat rheumatism, arthritis, gout and lumbago (21). However, fewer studies have been completed to better understand medicinal plants used in the treatment of several complex physiological processes and diseases. This investigation fills this research gap by dealing with the lesser recorded medicinal benefits of some indigenous plants that claim to cure complex and chronic diseases.

Conclusion

Medicinal plants utilized by the indigenous communities of the Koraput district in Odisha hold significant cultural, medicinal and ecological value. The traditional knowledge surrounding these plants is largely oral and passed down through generations, demonstrating a profound understanding of local biodiversity and its healing potential. However, without adequate documentation and validation, this information may be lost. Furthermore, growing human activity has driven medicinal plant populations to the verge of extinction. This investigation will ensure the wise use of these medicinally important plants and will help to develop proper conservation strategies. This exploration and revelation of the phytochemical characteristics of plant species in the Koraput district will lead to the development of new medicinal compounds in the medical field.

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Authors' contributions

KBS and MMP conceived the research idea. MMP carried out the experiments. KBS and MMP analysed the data. Both authors contributed significantly to the preparation and revision of the manuscript and approved the final version.

Compliance with ethical standards

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

Ethical issues: None

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