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The study of the variety of ethnobotanical plants and spices used in the cuisine of the Indian tribes of Bilaspur, Chhattisgarh

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Abstract

The present investigation aimed to identify and document herbs and spices used by the tribal communities for culinary purposes in the district of Bilaspur, Chhattisgarh, India. It is a report about this field using an ethnobotanical viewpoint, and it includes a quantitative analysis of the plants that were reported. A questionnaire was used to gather data from the indigenous communities in the study area. The collected data was analyzed through fidelity level (FL) and use value (UV). The plant samples were collected identified and then processed as voucher specimens following standard ethnobotanical practice. In total, there are 24 species of plants belonging to 15 families and 22 genera. These plants were mainly used as fruits (34%), leaves (23%), seeds (17%), rhizomes (10%), aril (4%), barks (3%), bulbs (3%), flower buds, and stigmas (3%). There are many medicinal and commercially significant plants in the region, which have a wealth of greenery. The tribal communities still regularly use these plants to produce herbs and spices for both culinary and medicinal uses. However, the traditional indigenous knowledge of these plants is gradually disappearing among the younger population. As a consequence, it will be useful as a reference as well as a way to record and keep alive the local knowledge of these herbs and spices in the district of Bilaspur, Chhattisgarh.

Keywords

cuisine; ethnobotanical study; herbs; medicinal plants; spices; tribes

Introduction

Spices have a rich history of incorporation into culinary traditions worldwide. They are utilized for their flavor, color, and preservative properties, as well as their therapeutic attributes (1). The global trend of using spices to enhance the taste of food is widespread. Moreover, spices play a role in averting both acute and chronic non-communicable diseases, contributing to overall health maintenance. Additionally, they enhance the sensory attributes of food and beverages, including flavor, aroma, and color. Generally, spices encompass seeds, fruits, roots, barks, and other plant components that are employed to season or color food. These encompass aromatic and pungent plant materials such as cumin, pepper, and cloves. Cuisine herbs and spices, as per the European Spice Association (ESA), are plant parts traditionally added to recipes for their flavor, fragrance, and aesthetic qualities (2). For example, sage, parsley, basil, oregano, rosemary, dill, and thyme are considered herbs, while cloves, cinnamon, cassia, ginger, cinnamon bark, peppercorn berries, and seeds fall under the category of spices. Spices have been historically employed for a variety of medicinal purposes, and this practice continues to the present

day. Various spices, including turmeric, fenugreek, mustard, ginger, onion, and garlic, are believed to protect against numerous health challenges due to their diverse biological properties. The inclusion of spices in diets has traditionally yielded positive health outcomes. Certain herbs and spices, such as cardamom, ginger, ginseng, turmeric, cinnamon, cayenne pepper, and garlic, are of particular interest due to their modulatory effects on conditions like cancer, obesity, diabetes, atherosclerosis, inflammation, arthritis, immunological deficiency, free radicals, microorganisms, aging, and mental health. Ethnic cuisines are renowned for their distinctive use of "signature" herbs and spices (3). For instance, turmeric is a staple in Indian cuisine, while Italian and Greek cuisines feature basil, garlic, and oregano. Thai cuisine relies on lemongrass, ginger, cilantro, and chili peppers. However, there is limited historical evidence regarding the use of spices in the diet of Chhattisgarh. Information regarding the plant species used for spices and condiments is either insufficient or unavailable. Nevertheless, some spices like *Coriandrum sativum* L., *Carum carvi* L., *Foeniculum vulgare* Mill, *Ferula asafoetida* H. Karst, *Cinnamomum zeylanicum* Blume, and *Piper nigrum* L. are significant potential sources of novel flavors for the food industry, despite their relative scarcity in Chhattisgarh (4). Although there is a lack of data regarding the use of common herbs and spices in culinary practices, there is a wealth of information affirming their utilization in traditional medicine, offering promising prospects.

Chhattisgarh, India's tenth-largest state, is often referred to as the "Rice Bowl" of Central India. With 44% of its land covered in lush greenery, Chhattisgarh boasts a dense forest cover, constituting 12% of India's total forest area. The state is renowned for its diverse array of medicinal plant species, which have been extensively employed in traditional indigenous medicine by various tribal communities, including Gond, Baiga, Maria, Kawar, Kol, and Abujhmaria, among others (5-6). Tribal populations make up the majority of the region's inhabitants, and their traditional way of life still plays a significant role in daily activities. In the Bilaspur district of Chhattisgarh, for instance, the 2011 census recorded a tribal population of 14.37%, underscoring the area's ethnic diversity and preservation of traditional knowledge regarding the value and utility of local flora. Despite prior research on native plants in Chhattisgarh, there are no documented instances of species being utilized as herbs or spices. Therefore, this study aims to explore and document, for the first time to our knowledge, the traditional knowledge and utilization of spices for culinary purposes and their medicinal significance for the people in Bilaspur district, Chhattisgarh state. This research endeavor aspires to identify promising spices for potential large-scale production, contributing to both culinary and medicinal uses, with the ultimate goal of enhancing the economic well-being of the local population.

Materials and Methods

Study area

District Bilaspur is named after the female fisherman *"Bilasa"* which is about 400 years old. Bilaspur district is situated between 21°47′ to 23° 8' north latitude and 81° 14' to 83° 15' east longitude. Bilaspur district is surrounded by Pendra-Gaurela-Marwahi in the north, Baloda Bazar, Bhatapara in the south, Korba, Janjgir-Champa in the east, and Mungeli and Kabirdham in the west, the total population of the district is 1625502 and the total area is 3508.48 square kilometers. The Bilaspur district currently includes 5 tehsils, 4 blocks (Belha, Kota, Takhatpur, and Masturi) and 708 villages. It is the second largest city after the Raipur-Bhilai-Durg Tri-city metropolitan area. Chhattisgarh State High Court is located in Bodri village in Bilaspur district, it has been privileged with the title of *'Nyayadhani'* (Law Capital) of the state and Bilaspur is the administrative headquarters of Bilaspur district (Created map by QGIS 3.32.2 Software) (Fig.1 & 2).

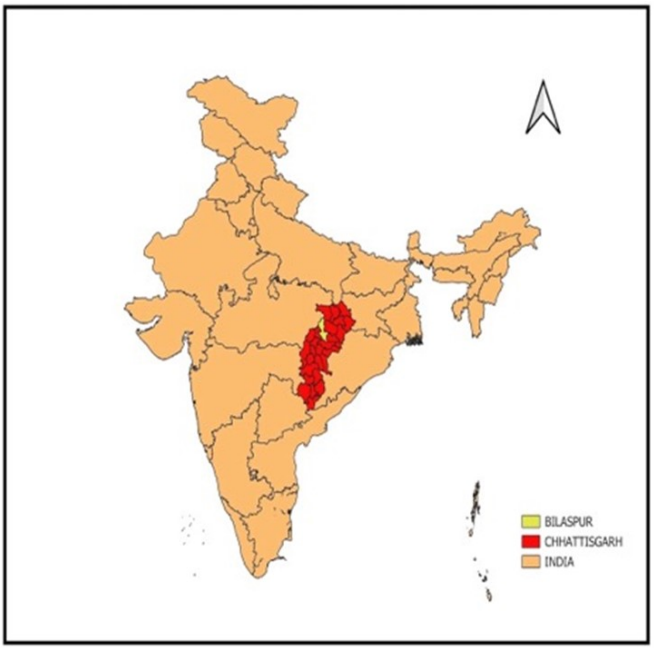

Fig. 1. Location map of study area

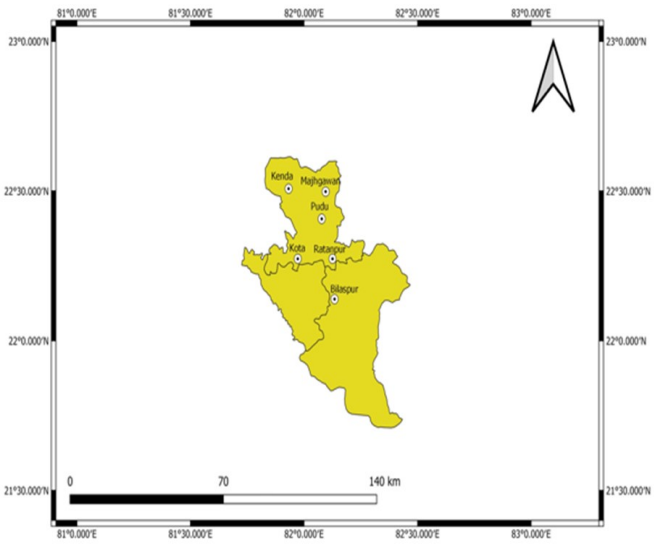

Fig. 2. Location map of the study area showing the location of the sampling sites

Ethnobotanical survey

Our fieldwork took place from January 2021 to January 2022. We utilized a semi-structured questionnaire approach to document the utilization of plant species (7). This approach encourages active community involvement in a relaxed setting and is often deemed more effective in ethnobotanical surveys as it acts as a bridge between traditional surveys and less formal methods such as field observations and interviews. In total, 62 community members participated in the study, encompassing women, traditional healers, and farmers aged between 40 and 80 years. Of these participants, 52 were male (83.87%), and 10 were female (16.12%).

In our research, we engaged an Aboriginal-speaking individual as a translator to ensure the precise and culturally sensitive capture of information that might otherwise be lost in translation. Our study focused on rural areas in Belgahna, Majhgaon, Parsada, Ratanpur, Pudu, and Kenda. Informants from these regions were queried about various aspects of local spices and medicinal plants, including their indigenous names, the specific plant parts utilized, their roles in local cuisine, their applications in traditional medicine, methods of preparation, and any other cultural uses. We validated a plant's status as a spice, and its culinary and medicinal uses, by requiring consensus among informants. In essence, two or more respondents had to concur on a specific plant's usage, regardless of the method of preparation, to confirm its role in local traditions. This meticulous approach allowed us to ensure the reliability and accuracy of the collected data.

Collection and identification of herbs and spices

Voucher specimens were collected for all the plants mentioned except plants with established voucher specimens. These were pressed and mounted on herbarium sheets and deposited at the Department of Botany, Guru Ghasidas Vishwavidyalaya (A Central University) Bilaspur, Chhattisgarh, India. Plant species were identified by Flora of Madhya Pradesh (8) and their updated scientific names are taken from (https://www.worldfloraonline.org/). They were later verified at the Botanical Survey of India (BSI), Central Regional Centre, Allahabad, Uttar Pradesh, India.

Statistical analysis

The data collected were summarized in Microsoft Word and Excel 2019, highlighting plant names, families, parts used, preparation, and therapeutic applications.

Use value (UV)

The use-value (UV), which shows quantitatively the relative importance of spices known locally, was calculated as.

$UV = \Sigma Ui/N$,

Where UV = use value of a spice/herb; Ui = number of citations, N = number of informants (9).

Fidelity level (FL)

The fidelity level (FL)index was calculated by using the following formula as described (10) to determine the most preferred species used in the treatment of a particular ailment as more than one plant species is used in the treatment in the same category:

$FL = (N_P/N \times 100)$

Where N is the total number of informants citing the species for any illness, and Np is the number of informants citing the use of the plant for a specific illness. A high FL value indicates a high frequency of use of the plant species for treating a particular ailment category by the informants of the study area.

Results and Discussion

Sociocultural-demographic information

The study involved 62, consisting of a wide range of people, including traditional healers, herbalists, and lay individuals aged 40 to 80 years. (Table 1). The diversity in terms of age, gender, and roles (laypeople, traditional healers, or herbalists) among the participants holds profound implications for our understanding of the culinary and medicinal knowledge related to herbs and spices in Bilaspur District, Chhattisgarh. In terms of age distribution, it is noteworthy that 85% of the participants were aged 40 years and above, with only 15% falling below this age bracket. This demographic composition points towards a gradual erosion and jeopardy of indigenous knowledge concerning spice usage among the younger generation in the studied region. This trend is not unique to our area but aligns with broader findings that suggest many young people across various indigenous populations do not see immediate practical benefits in acquiring traditional knowledge (11-12). Regarding gender, 16.12% of the informants were women, who traditionally bear the primary responsibility for culinary activities. This holds particular significance, especially in rural settings, where women are tasked with nourishing their families and addressing common household health concerns (13). This

Table 1. Socio-demographic analyses of informants.

Variables	Respondent categories	Total	Percentage (%)
Gender	Male	52	83.87
	Female	10	16.12
Age groups	40-50 years	9	14.51
	51-60 years	30	48.38
	61-70 years	17	27.41
	71-80 years	6	9.67
Occupation	Housewives	10	16.12
	Shopkeepers	5	8.06
	Farmers	16	25.8
	Labours	13	20.96
	Traditional healers	18	29.03
Literacy	Illiterates	49	79.03
	Primary education	12	19.35
	Secondary education	1	1.61

observation resonates with existing reports (14) emphasizing the vital roles of women in traditional healthcare, particularly in their capacities as mothers, cooks, and home garden cultivators.

Traditional healers and herbalists act as custodians of medicinal practices within tribal communities. Consequently, knowledge and the application of spices as remedies for major health conditions, such as diabetes, hypertension, cancer, tuberculosis, and infertility, remain predominantly within the purview of these specialists, while lay individuals tend to manage more minor health issues, such as constipation, colds, skin disorders, and loss of appetite. This distinction underscores the specialization and the division of knowledge and practices within the community.

Plant diversity and use value of herbs and spices utilized for cuisine and medicinal purposes

The botanical names of the spices along with their local names, habits, parts used, cuisine and medicinal uses, use value, and mode of administration are presented (Table 2) and the plants mentioned and identified as herbs and spices. These constitute twenty-four plant species distributed among fifteen families (Fig. 3). This is an indication of a good diversity of plants used as spices in the study area and could be attributed to the rich diversity of plants in the Chhattisgarh state. The families contributing the most taxa were Apiaceae (5 species), Zingiberaceae (4 species), Lauraceae, and Piperaceae (2 species each) while the other families had one species each.

A broad assortment of spices is harnessed within the framework of local ethno-medicinal systems. In the context of this research, spices emerge as commonly used remedies for addressing various prevalent ailments, which encompass colds, coughs, skin conditions, antimicrobial infections, respiratory disorders, parasitic infections, immune deficiencies, diabetes, ulcers, and cancer. Two of the plant species most cited as herbs and spices in the study area and the highest use value of 0.18 and the lowest use value of 0.02. These include *Curcuma longa* author name (Zingiberaceae), and *Coriandrum sativum* author name (Apiaceae). *Curcuma longa* author name is mostly used in cancer, wounds, Indigestion, cough, and cold (Sahoo et al., 2021). Others such as garlic and pepper have been documented to have hypoglycemic, hypolipidemic, antioxidant, and antidiabetic properties (15). Similarly, the antimicrobial and chemopreventive (16), anticancer as well as the beneficial effects of herbs and spices have been documented.

Parts used and preparation methods of cuisine and medicinal uses

The fruits are the most frequently used parts as spices (34%), followed by leaves (23%), Seeds (17%), rhizomes (10%), aril (4%), barks, bulb, flower bud and Stigma (3% each species) (Fig. 4). Spices have been reported for 35 ailments to be used for different medicinal purposes, such as anodyne, antibacterial, anticancer, antidiabetic, antifungal, antimicrobial, anti-obesity, antioxidant, antiulcer, antiviral, blood pressure, carminative, cold, colic spasmodic, cough, digestive aid, diuretic earache, flatulence, gastrointestinal disorders, jaundice, pregnancy disorders, respiratory infections, scorpion bite, sexual tonic, skin diseases as protection against witchcraft, and several other medicinal uses (17-18). The methods utilized for the medicinal preparation of these spices are as shown in Fig. 5. This includes infusion (29%), decoction (25%), decoction or infusion (25%), decoction or tincture (17%), and tincture (4%) (Fig. 6). A few of them required a mixture of plant species and preparation for more potency. Of the 24 plant species, herbaceous plants comprised 71%, trees (25%), and climbers (4%) (Fig. 7). Most of the preparations involved the use of single spices or a single plant part while those mixing different species or plant parts were less encountered in the study area.

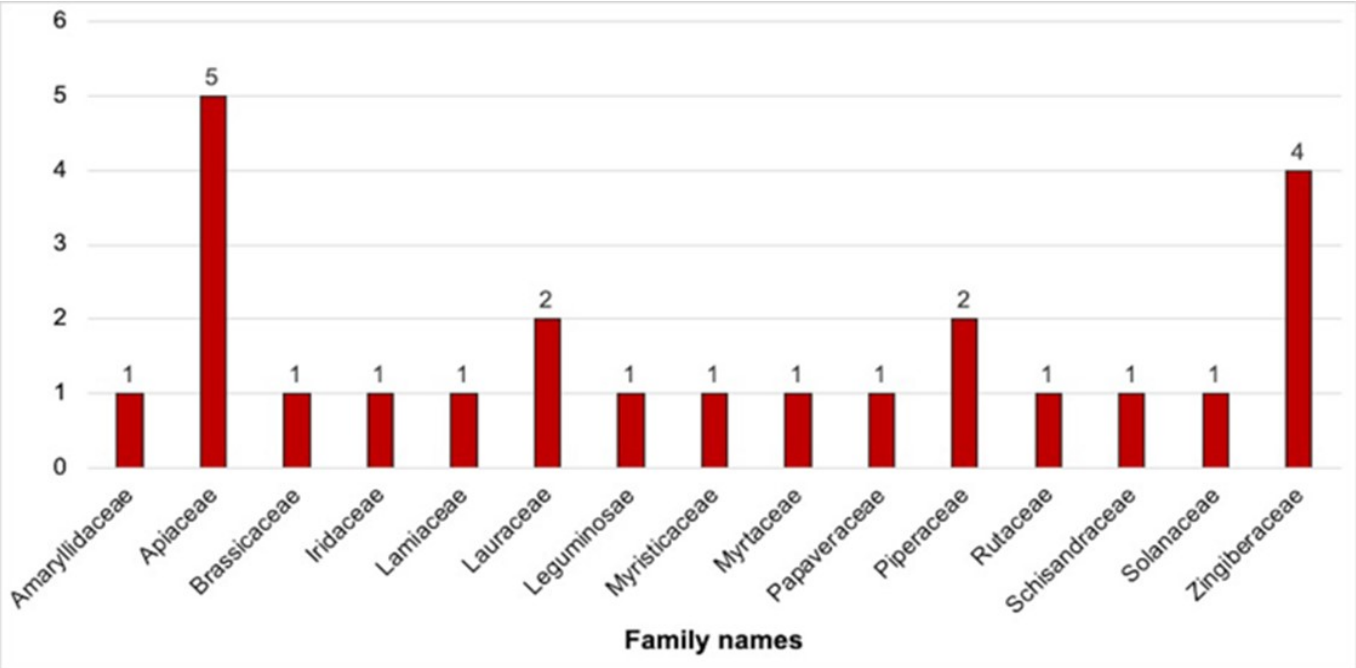

Fig. 3. Plant families used as herbs and spices

Table 2. Ethnobotanical study of culinary herbs and spices used by the tribes of Bilaspur, Chhattisgarh

Family	Scientific name	Local name	Life Form	Parts used	Preparation methods	UV	Ethnomedicinal uses	Culinary uses	Administration	References
Amaryllidaceae	*Allium sativum* L.	Lahsun	Herb	Bulb, Leaves	Decoction	0.06	Stomach ache, Cold, and cough	Chutney, Salad, Boiled with meat and vegetables	Oral	(19-20)
Apiaceae	*Carum carvi* L.	Shah jeera	Herb	Fruits	Decoction	0.08	Anti-diabetic, Indigestion, Pneumonia, and as Appetizer and carminative	flavoring confectionaries, meat products	Oral	(21)
	Coriandrum sativum L.	Dhania	Herb	Leaves, Fruits	Decoction	0.1	Diabetes, Diuretic, Bronchitis, Sore throat, Blood cleanser	Chutney, Salad, Boiled with meat and vegetables	Oral	(20, 22)
	Cuminum cyminum L.	Jeera	Herb	Fruits	Decoction, Infusion	0.05	Cancer, Diabetes	Boiled with meat and vegetables	Topical	(23)
	Ferula asafoetida H. Karst.	Hing	Herb	Resin	Infusion	0.06	Asthma, Gastrointestinal disorders, Intestinal parasites	Boiled with meat and vegetables	Oral	(23)
	Foeniculum vulgare Mill	Souf	Herb	Fruits	Infusion, Decoction	0.05	Indigestion, Intestinal pains,	Boiled vegetables, Making pickle	Oral	(19,23)
Brassicaceae	*Brassica nigra* (L.) K. Koch	Sarso	Herb	Seeds, Leaves	Decoction	0.03	Lice infestations	Dry seed make chutney and leaves are used for vegetable	Oral, Topical	(20)
Iridaceae	*Crocus sativus* L.	Kesar	Herb	Stigma	Infusion	0.05	Anti-diabetic, Anti-cancer	Uses for take with milk and other dishes food colour	Oral	(24)
Lamiaceae	*Mentha arvensis* L.	Pudina	Herb	Leaves	Infusion	0.05	Cough, cold, Asthma,	Fresh or dried leaves used for mint flavour	Oral	(19)
Lauraceae	*Cinnamomum zeylanicum* Blume	Chaili	Tree	Barks	Infusion	0.02	Anti-diabetic	Boiled with meat	Oral	(23)
	Cinnamomum tamala (Buch.-Ham.) T. Nees & Eberm.	Tejpatta	Tree	Leaves	Decoction, Infusion	0.02	Dental pain	Uses for meat curry and vegetable	Oral	(20)

Leguminosae	*Trigonella foenum-graecum* L.	Methi	Herb	Seeds, Leaves	Decoction, Infusion	0.03	Anti-diabetic	Vegetable and cooked meat	Oral	(23)
Myristicaceae	*Myristica fragrans* Houtt.	Javitri	Tree	Aril	Decoction, Tincture	0.06	Diarrhea, Rheumatism, Headaches	Cooking meat curry	Oral, Topical	(23,25)
Myrtaceae	*Syzygium aromaticum* (L.) Merr. and L. M. Perry	Laung	Tree	flowers bud	Decoction, Oil	0.06	Anti-inflammatory, immunostimulatory, Antiviral	Cooking meat curry, Dietary Uses	Oral, Topical	(26)
Papaveraceae	*Papaver somniferum* L.	Khuskhus	Herb	Seeds	Decoction,	0.03	Fever and flu	Cooking meat curry aroma and colour	Oral	(23)
Piperaceae	*Piper nigrum* L.	Kalamirch	Climber	Fruits	Infusion	0.05	Indigestion, body ache, bone fracture	Boiled meat	Oral	(23)
	Piper longum L.	Peeper	Herb	Fruits	Infusion	0.08	Bronchitis, Cough, Cold, Snakebite, Scorpion-sting	Cooking food	Oral	(23,27)
Rutaceae	*Murraya koenigii* (L.) Spreng.	Mitha neem	Tree	Leaves	Decoction	0.05	Antimicrobial, Anticancer, Antioxidant	Cooking food and vegetable	Oral	(22)
Schisandraceae	*Illicium verum* Hook.f.	Karanphool	Tree	Fruits	Decoction, Oil	0.03	Antibacterial and antifungal activity	Cooking meat curry aroma and colour	Oral, Topical	(23)
Solanaceae	*Capsicum annum* L.	Mircha	Herb	Fruits	Tincture	0.08	Toothache, Cough, Sore throat, Parasitic infections	Cooking food and vegetable, Chutney, and pickle	Oral	(20,22)
Zingiberaceae	*Amomum subulatum* Roxb.	Donda	Herb	Fruits, Seeds	Infusion, Oil	0.06	Antimicrobial activity, Antioxidant and anti-inflammatory	Cooking meat curry	Oral	(20,23)
	Curcuma longa L.	Hardi	Herb	Rhizomes	Decoction	0.18	Pneumonia, Bronchial complaints, Leucorrhoea, Diarrhoea, Dysentery, Infectious wounds, Abscesses, insect bites, Anti-cancer	Cooking food and colour	Oral	(22)
	Elettaria cardamomum (L.) Maton	Elaichi	Herb	Fruits, Seeds	Decoction, Infusion	0.06	Anti-microbial, Anti-bacterial and Anti-oxidant activity	Food cooking	Oral	(28)
	Zingiber officinale Roscoe.	Adrak	Herb	Rhizomes	Decoction	0.03	Respiratory disorder	Cooking with meat and vegetables, Prepare Chutney	Oral	(20,23)

Abbreviations: UV, Use value; FL, Fidelity Level; N, Number of informants.

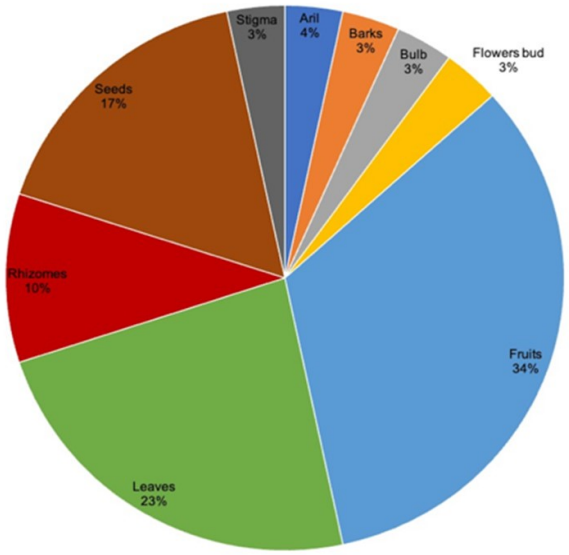

Fig. 4. Plant parts used as herbs and spices in the study area

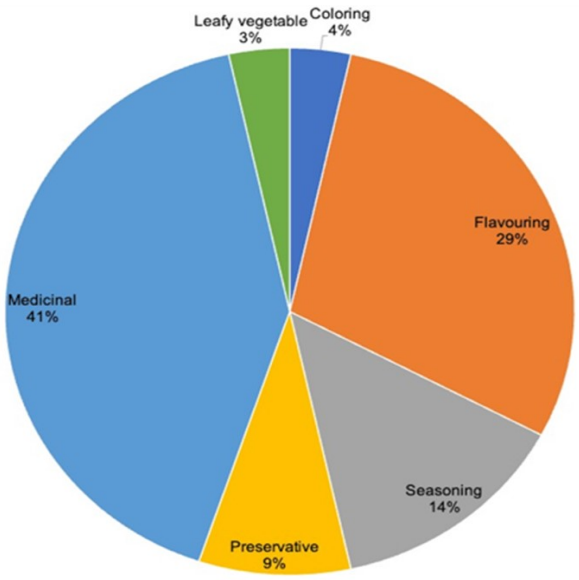

Fig. 5. Traditional methods of preparation of herbs and spices for medicinal uses

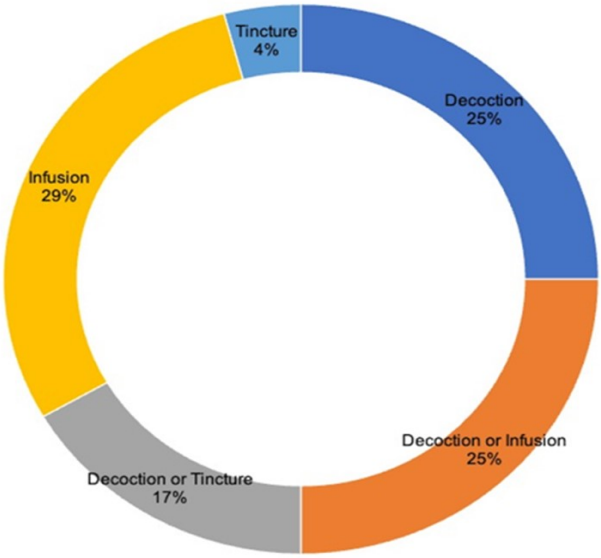

Fig. 6. Representing mode of preparation

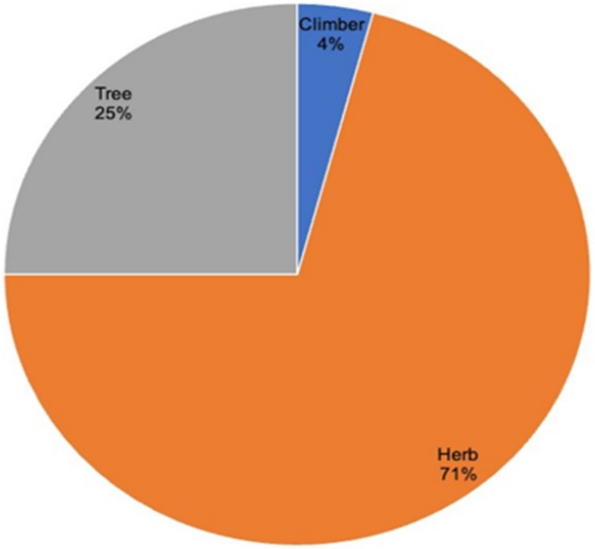

Fig. 7. Life forms of herbs and spices in the study area

Newly recorded ethnomedicinal and cuisine uses of herbs and spices plants

A total of nine similar uses were reported of the plants in this study area and seventeen dissimilar uses were reported of some plants in this study area (Table 3).

Use reports (UR) and Fidelity level (FL)

The fidelity level (FL) of twenty-four plant species was found against a given ailment category (Table 4). Fidelity level was 100% calculated for five plant species i.e., *Curcuma longa* L. (Pneumonia, Bronchial complaints, Leucorrhoea, Diarrhea, Dysentery, Infectious wounds, Abscesses, insect bites, Anti-cancer), *Coriandrum sativum* L. (Diabetes, Diuretic, Bronchitis, Sore throat, Blood cleanser), *Carum carvi* L. (Anti-diabetic, Indigestion, Pneumonia, and as Appetizer and carminative), *Piper longum* L. (Bronchitis, Cough, Cold, Snakebite, Scorpion-sting) and *Capsicum annum* L. (Toothache, Cough, Sore throat, Parasitic infections). Our findings indicate that despite local access to government healthcare, medicinal plants continue to hold significant value among the local population. Based on our research, we propose that a high Frequency of Citation (FL) suggests the prevalence of specific diseases in the region that are commonly treated using medicinal practices with correspondingly high FL values.

Conclusion

This study was conducted to explore the traditional use of medicinal and culinary herbs and spices in the Bilaspur district of Chhattisgarh. The research identified a total of twenty-four plant species from fifteen different plant families and twenty-two genera. Notably, the most frequently cited plant families included Zingiberaceae, Apiaceae, Piperaceae, and Solanaceae, encompassing species such as *Curcuma longa, Coriandrum sativum, Carum carvi, Piper longum,* and *Capsicum annum.* These spices were primarily employed for flavoring, seasoning, and preservation, as ingredients in leafy vegetable dishes, and in traditional medicine.

Table 3. New recorded ethnobotanical study of culinary herbs and spices used by the tribes of Bilaspur, Chhattisgarh

Family	Scientific name	Local name	Ethnomedicinal use from the present study	Active compounds	References
Amaryllidaceae	*Allium sativum* L.	Gondali	♣ Applying mustard oil and turmeric paste after cutting the onion bulb in half and roasting it on a hot flame provides relief in a sprain of hands and feet.	Allicin, Alliin, Diallyl sulfide, Diallyl disulfide, Diallyl trisulfide, Ajoene, and S-allyl-cysteine.	(29)
Apiaceae	*Carum carvi* L.	Shah jeera	♣ Cumin seeds are boiled in mustard oil and then cooled and massaged to give relief to hand and leg pain.	α-pinene, α-terpineol, α-farnesene, β-caryophyllene, β-myrcene, β-ocimene, β-pinene, γ-terpinene, carvone, camphene, citronellol, cuminaldhyde, eugenol, germacrene-D, limonene, linalyl acetate, nerol, p-cymene, terpinene-4-ol, and thymol	(30)
	Coriandrum sativum L.	Dhania	♣ Mixing coriander leaves, green chilies, and tomatoes (Chutney) and consuming them in the morning for a week provides relief from constipation.	terpenes, phenolic acids, flavonoids, fatty acids, and phytosterols.	(31)
	Cuminum cyminum L.	Jeera	♣ Mixing 1 gm black salt in 5 gm roasted Cumin powder in a glass of water and taking it every morning for a week provides relief indigestion.	fatty acids, numerous free amino acids, and a variety of flavonoid glycosides, including derivatives of apigenin and luteolin	(32)
	Ferula asafoetida H. Karst.	Hing	♣ Heat asafoetida in mustard oil and apply lukewarm oil on the chest and soles of the feet of a child suffering from pneumonia it provides instant relief.	Franesiferol A, Franesiferol B, Franesiferol C, Asacoumarin A, Assafoetidin, Ferocaulicin, Assafoetidinol A, Assafoetidinol B, Polyanthinin Kamolonol, Foetidine, Saradaferin, R-Acetoxy-11-hydroxyumbelliprenin, 10-R-Karatavicinol, Methyl galbanate, Lehmferin Feselol, Ligupersin A, Epi-conversion, Microlobin, Umbelliferone (7-hydroxycoumarin	(33)
	Foeniculum vulgare Mill.	Souf	♣ Put fennel in water and keep it for 1 hour, then filter this water and drink it to get relief from the problem of indigestion.	Phenols, Phenolic glycosides,	(34)
Brassicaceae	*Brassica nigra* (L.) K. Koch	Sarso	♣ Hot mustard oil is used for massaging in body aches.	p-Hydroxybenzoic acid, Salicylic acid, p-Coumaric acid, Caffeic acid, Ferulic acid, Sinapic acid, Luteolin , Quercetin , Kaempferol , Luteolin-O-hexoside, Kaempferol-O-hexoside, Quercetin-O-hexoside, Kaempferol-sinapoyl-trihexoside I, Kaempferol-sinapoyl-trihexoside II	(35)

Iridaceae	*Crocus sativus* L.	Kesar	♣ Mixing saffron in lukewarm milk and drinking it increases the power of virility.	Isophorone, β-carotene, α-carotene, Crocetin, Crocins, Lycopene, Zeaxanthin, Safranal, Picrocrocin	(36)
Lamiaceae	*Mentha arvensis* L.	Pudina	♣ Drinking sorbet of mint leaves gives instant relief when you feel heat stroke.	Terpenes, α-menthol, neomenthol, isomenthol, d-menthone, iso menthone, menthofuran, menthyl acetate, Carvomenthone, cineol, p-cymene, aromadendrene, limonine, -phellandrene, pipertone, -pinene, carvacrol, α-pinene, α-phellandrene, -pinene, dipentene, cardinene, thujone	(37)
Lauraceae	*Cinnamomum zeylanicum* Blume	Chaili	♦ It is used in Diabetes.	Anthracene glycosides, cyanogenic glycosides, cardenoloid glycosides, saponins, polyphenols, alkaloids, flavonoids, tannins, reducing sugars, proteins	(38)
	Cinnamomum tamala (Buch.-Ham.) T. Nees & Eberm.	Tejpatta/Tejpat	♦ It is used for toothache.	Phenolics, flavonoids, alkaloids, terpenoids	(39)
Leguminosae	*Trigonella foenum-graecum* L.	Laung	♣ Soaking fenugreek seeds in water overnight and filtering it in the morning and drinking its water provides relief in diabetes, or eating 2 teaspoons paste of fenugreek seeds on an empty stomach provides relief in diabetes.	Vitamins, phenolics, alkaloids, saponins, tannins, oils, gums	(40)
Myristicaceae	*Myristica fragrans* Houtt.	Javitri	♣ Mace is boiled in mustard oil and it is used in pain relief.	Tannin, saponin, alkaloid, protein, steroid, anthraquinone, terpenoids	(41)
Myrtaceae	*Syzygium aromaticum* (L.) Merr. And L. M. Perry	Laung	♣ Clove oil is used in toothache and clove is used to get rid of bad breath.	Phenolic, flavonoids	(42)
Papaveraceae	*Papaver somniferum* L.	Khuskhus	♦ It is used to make food.	Alkaloids, Phenolic, anthocyanins, flavonols	(43)

Piperaceae	*Piper nigrum* L.	Kalamirch	♦ Black pepper is used along with honey offered to children with cough.	Phenolic, alkaloids, flavonoids, carotenoids, terpenoids	(43)
	Piper longum L.	Peeper	♦ Pepper is used along with honey offered to children with coughs.	Caryophyllene, nerolidol, cinnamyl acetate, α-pinene, eugenol, acetate, acetate, humulene-(v1), 2-heptanol, phytol, pinene, α-elemene, limonene	(27)
Rutaceae	*Murraya koenigii* (L.) Spreng.	Mithaneem	♦ it is used in make food.	Terpenoids, flavonoids, phenolics, carbohydrates, carotenoids, vitamins, nicotinic acid	(44)
Schisandraceae	*Illicium verum* Hook.f.	Karanphool	♦ It is used to make food.	Alkaloids, steroids, proteins, phenols, glycosides, cardenolides and amino acids	(45)
Solanaceae	*Capsicum annum* L.	Mircha	♣ Dry red chillies are used in food preservation and green chillies are used in food.	Ascorbic acid, flavonoids compounds, phenolic	(46)
	Amomum subulatum Roxb.	Donda	♦ It is used to make food. ♣ It is used in constipation.	Flavonoids, terpenoids, tannins, alkaloids, steroids, cardiac glycosides, phenols, saponins, quinones	(47)
Zingiberaceae	*Curcuma longa* L.	Hardi	♣ Applying turmeric powder to the wound heals the wound quickly. ♣ Taking turmeric powder and jaggery tablets and coming every morning for just 2 days gives quick relief in cold.	Alkaloids, Carbohydrates, Glycosides, Saponins, Steroids, Proteins, Terpenoids, Flavonoids, Anthraquinones, Phlobotannins, Tannins	(48)
	Elettaria cardamomum (L.) Maton	Elaichi	♦ It is used to make food.	Phenolic, flavonoids, tannins	(49)
	Zingiber officinale Roscoe.	Adrak	♣ Mixing a small quantity of ginger juice and honey and giving it to the child, his cough gets cured quickly.	Alkaloids, flavonoids, saponin, and terpenoids	(50)

♣ = Dissimilar uses; ♦ = Similar uses

Table 4. Fidelity level (FL) of medicinal plants used by tribes as herbs and spices of the study area.

Scientific name	The number of informants reported the taxa (N)	Number of ailments treated	Number of use most frequently determined by informants (Np)	FL
Allium sativum L.	25	4	24	96
Amomum subulatum Roxb.	10	4	6	60
Brassica nigra (L.) K. Koch	26	2	19	73.1
Capsicum annum L.	12	5	12	100
Carum carvi L.	12	5	12	100
Cinnamomum zeylanicum Blume	10	1	6	60
Cinnamomum tamala (Buch.-Ham.) T. Nees & Eberm.	15	1	7	46.7
Coriandrum sativum L.	25	6	25	100
Crocus sativus L.	13	3	9	69.2
Cuminum cyminum L.	12	3	10	83.3
Curcuma longa L.	15	11	15	100
Elettaria cardamomum (L.) Maton	11	4	8	72.7
Ferula asafoetida H. Karst.	15	4	14	93.3
Foeniculum vulgare Mill	25	3	21	84
Illicium verum Hook.f.	13	2	6	46.2
Mentha arvensis L.	20	4	17	85
Murraya koenigii (L.) Spreng.	12	3	8	66.7
Myristica fragrans Houtt.	10	4	7	70
Papaver somniferum L.	11	2	7	63.6
Piper nigrum L.	25	3	20	80
Piper longum L.	21	5	21	100
Syzygium aromaticum (L.) Merr. and L. M. Perry	15	4	13	86.7
Trigonella foenum-graecum L.	13	2	9	69.2
Zingiber officinale Roscoe.	26	2	17	65.4

What makes this study particularly significant is that, beyond their culinary and medicinal uses, these plants also play a crucial role in addressing various health issues, including diabetes, anticancer properties, antimicrobial effects, respiratory disorders, and pregnancy -related ailments. This research represents a valuable contribution to the field of ethnobotany in the Bilaspur district of Chhattisgarh, being the first documented report on the utilization of these plants as spices. Many of these spices are also integral to the local ethno-medical system practiced by tribal communities. Therefore, this study will serve as a valuable reference for future research into the diverse uses of these spices.

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Authors' contributions

RKA carried out conceptualization, methodology, investigation, data curation, and writing-original draft. DKB carried out visualization and validation. RJ participated in the writing review and editing. All authors read and approved the final manuscript.

Compliance with ethical standards

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