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Research Article

Ethnobotanical documentation and quantitative analysis of edible plant species used by tribal communities in Ernakulam District, Kerala, India

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Abstract

Plants play a crucial role in ensuring food and nutritional security, particularly among tribal and rural communities in India. The present study documents the diversity and utilization of edible plant species among tribal communities in the Ernakulam district of Kerala, India. A total of 30 species belonging to 18 families were recorded, with Dioscoreaceae as the dominant family. Fruits were the most utilized plant part, followed by leaves, tubers, rhizomes, and seeds. Quantitative ethnobotanical indices, including Use Value (UV), Relative Frequency of Citation (RFC), and Informant Consensus Factor (ICF), were applied to evaluate the significance of the documented species. The UV ranged from 0.17 to 0.86, with *Begonia floccifera* Bedd., *Passiflora foetida* L., and *Hibiscus hispidissimus* Griff. showing the highest values. RFC values reflected similar trends. High ICF values (0.975-0.982) across all categories indicated strong agreement among informants. The study highlights the importance of edible plants in supporting nutrition, food security, and traditional knowledge, emphasizing the need for their conservation and sustainable utilization.

Keywords: Ethnobotany, Edible plants, Informant Consensus Factor (ICF), Relative Frequency of Citation (RFC), Tribal communities, Traditional knowledge, Use Value (UV)

Introduction

Edible plants, including both wild and semi-cultivated species, are important sources of food and nutrition across diverse ecosystems. They play a significant role in supporting the dietary needs of tribal and rural populations, particularly in regions where access to cultivated crops is limited. Historically, early human societies relied extensively on naturally available plant resources, identifying edible species through continuous observation and trial-and-error practices; many such species were later domesticated (Soni & Mohabe, 2023).

These plants are commonly gathered from forests, agricultural fields, fallow lands, and other natural habitats, and continue to contribute to the subsistence of indigenous and rural communities in developing countries (Bhatia *et al.,* 2018). Beyond their nutritional value, edible plants are deeply embedded in the socio-cultural fabric of traditional societies, forming an integral part of cultural practices, rituals, and indigenous healthcare systems. In remote tribal regions, they serve as reliable sources of nutrition, particularly during periods of food scarcity or limited market access (Mir, 2014).

In addition to enhancing dietary diversity, the collection and utilization of edible plants contribute to household income and livelihood security. Various plant parts—including fruits, leaves, tubers, seeds, and flowers—are often sold in local markets, providing supplementary income for forest-dependent communities (Mahadkar & Raut, 2022). Thus, edible plants play a dual role in ensuring both nutritional and economic stability.

Kerala, located in the Western Ghats biodiversity hotspot, harbors rich plant diversity and supports numerous tribal communities with distinct ethnobotanical knowledge systems. These communities possess extensive traditional knowledge of local flora and utilize a wide range of plant species for food, medicine, and cultural practices. Despite their importance, systematic documentation of edible plant knowledge in many regions of Kerala, particularly in the Ernakulam district, remains limited. Rapid socio-economic changes, urbanization, habitat degradation, and shifting food preferences have contributed to the gradual erosion of this traditional knowledge.

Therefore, the present study aims to (i) document edible plant species used by tribal communities in Ernakulam district, (ii) analyze their relative importance using quantitative ethnobotanical indices, and (iii) evaluate patterns of traditional knowledge and dietary dependence. This study contributes to the conservation of indigenous knowledge and sustainable utilization of plant resources.

Materials and methods

Ethnobotanical survey and data collection

Field surveys were conducted between January 2024 and April 2024 in selected tribal settlements of Ernakulam District, Kerala. Ethnobotanical data were collected from a total of 70 informants using semi-structured interviews, participatory observations, and informal discussions. The informants included tribal elders, traditional healers, and local knowledge holders belonging to the Ulladan, Muthuvan, Malayarayan, and Mannan communities. The study included wild, semi-cultivated, and cultivated edible plant species.

Information regarding vernacular names, edible plant parts, modes of preparation, and culinary uses of edible plants was systematically documented. To ensure reliability and accuracy, the collected data were cross-verified within and across villages through repeated follow-up visits. Plant specimens were collected during field surveys with the assistance of local informants. The collected specimens were identified using standard regional floras and taxonomic literature. Identification was further confirmed with the help of taxonomic experts.

Ethnobotanical information was recorded using a semi-structured data collection sheet that included informant demographics (age and gender), local plant names, plant parts used, modes of consumption, and associated uses. The demographic profile of the informants is presented in Table 1.

Quantitative analysis of edible plant use

To evaluate the relative importance and usage patterns of edible plant species, quantitative ethnobotanical indices such as Use Value (UV), Relative Frequency of Citation (RFC), and Fidelity Level (FL) were calculated (Pandey *et al.,* 2024; Hussain *et al.,* 2023; Batool & Gairola, 2025).

Use value (UV)

$$UV = \frac{\sum U}{N}$$

where
UV = Use Value of a species
U = number of use-reports cited by each informant for a given species
N = total number of informants (n = 70)

This index reflects the relative importance of plant species based on their frequency of use.

Relative frequency of citation (RFC)

$$RFC = \frac{FC}{N}$$

where
FC = number of informants citing a species
N = total number of informants

Table 1: Demographic profile of informants

Category	Sub-category	Number of Informants	Percentage (%)
Gender	Male	37	52.86
	Female	33	47.14
Age group (years)	30–40	2	2.86
	40–50	13	18.57
	50–60	20	28.57
	>60	35	50.00
Total		70	100

RFC values range between 0 and 1 and indicate the extent of local usage of each species.

Informant consensus factor (ICF)

$$ICF = \frac{N_{ur} - N_t}{N_{ur} - 1}$$

where
Nur = total number of use-reports for a specific food-use category
Nt = number of species used in that category

ICF was calculated to assess the level of agreement among informants regarding the use of edible plants within different food categories. The documented species were grouped into fruits, leafy vegetables, tubers, spices, and flour based on their primary mode of consumption.

Results

Diversity of edible plant species

A total of 30 edible plant species belonging to 18 families were documented from tribal communities in the Ernakulam district of Kerala. The distribution of species among families was uneven, with Dioscoreaceae showing the highest representation, followed by Zingiberaceae and Phyllanthaceae, while the remaining families were represented by fewer species, indicating moderate taxonomic diversity. The family-wise distribution of documented edible plant species is shown in Figure 1.

Proportionate use of plant parts

The analysis of edible plant parts revealed that fruits constituted the largest proportion of use, followed by leaves, tubers, rhizomes, and seeds. This distribution highlights a strong dependence on fruit-bearing species, reflecting their accessibility, palatability, and nutritional value. The documented edible plant species and their uses are presented in Table 2.

Fruits

In Ernakulam district, a wide variety of fruits are both dietary staples and traditional remedies in local communities. The edible portions often include fleshy pericarps, seed arils, or mucilaginous coatings surrounding the seeds. Not only are these fruits consumed fresh for their enjoyable flavors, but many also contribute to local medicinal practices. One remarkable example is *Passiflora foetida* L. (Raj *et al.,* 2025*)*, commonly known as wild passion fruit. Its fully ripe fruits are eaten raw and are also used as a folk remedy for treating scorpion stings. Additionally, the pleasantly sour or tangy fruits of *Hibiscus sabdariffa* L. are harvested, sun-dried, and then incorporated into sour-style curries, adding both flavour and nutritional value. Unripe Fruit of *Passiflora quadrangularis* L. locally called Akasha vellari can be

Table 2: List of wild edible plant species documented from tribal communities of Ernakulam district, Kerala, along with their families, local names, parts used, and traditional uses

S. No.	Scientific name	Family	Local name	Parts	Traditional uses
1.	*Amorphophallus paeoniifolius* var. *paeoniifolius (Dennst.) Nicols*	Araceae	Valluvan kizhagu	Tuber	Tuber pieces are boiled in salted water, the decoction is discarded, and the processed tuber is consumed as food.
2.	*Artocarpus heterophyllus* Lam.	Moraceae	Chakka	Fruit	Ripe fruits are consumed raw.
3.	*Baccaurea courtallensis* (Wight) Muell.-Arg.	Phyllanthaceae	Mooti thoori	Fruit	Ripe fruits are consumed raw.
4.	*Basilla alba* L.	Basellaceae	Mysoore cheera	Leaves	Leaves are consumed as vegetables, commonly prepared as *thoran*.
5.	*Begonia floccifera* Bedd.	Begoniaceae	Anakalu kuliru, kalthamara	Leaves	Leaves are boiled in salted water, the extract is discarded, and the processed leaves are consumed; they are also consumed raw to alleviate thirst.
6.	*Capsicum frutescens* L.	Solanaceae	Kanthari mulagu	Fruit	Dried fruits powdered and used as a substitute for chilli powder; fresh fruits used to add pungency in curries
7.	*Clausena anisata* (Willd.) Hook.f. ex Benth.	Rutaceae	Kattadi pazham	Fruit	Ripe fruits are consumed raw.
8.	*Curcuma zanthorrhiza* Roxb.	Zingiberaceae	Manjakoova	Rhizhome	Rhizome is processed and consumed as a food source.
9.	*Cycas circinalis* L.	Cycadaceae	Eethanga	Seeds	Seeds are washed, dried, and processed into flour, which is used for the preparation of traditional foods such as dosa and idli after detoxification.
10.	*Dioscorea bulbifera* L.	Dioscoreaceae	Adutappan kay	Tuber	Tuber pieces are boiled in salted water, the decoction is discarded, and the processed tuber is consumed as food.
11.	*Dioscorea oppositifolia* L.	Dioscoreaceae	Vellakizhagu	Tuber	Tuber pieces are boiled in salted water, the decoction is discarded, and the processed tuber is consumed as food.
12.	*Dioscorea pentaphylla* L.	Dioscoreaceae	Nooran kizhangu	Tuber	Tuber pieces are boiled in salted water, the decoction is discarded, and the processed tuber is consumed as food.
13.	*Dioscorea wallichii* Hook.f.	Dioscoreaceae	Kattu kizhangu, valli kizhangu	Tuber	Tuber pieces are boiled in salted water, the decoction is discarded, and the processed tuber is consumed as food.
14.	*Flacourtia jangomas* (Lour.) Raeusch.	Salicaceae	Thaliru maram	Fruit	Ripe fruits are consumed raw.
15.	*Flacourtia montana* Roxb.	Salicaceae	Chalam pazham	Fruit	Ripe fruits are consumed raw.
16.	*Hibiscus hispidissimus* Griff.	Malvaceae	Uppanichampuli	Leaves	Leaves are used as a salt substitute and are incorporated into curries.
17.	*Hibiscus sabdariffa* L.	Malvaceae	Mathipulli	Fruit	Dried calyces are used in the preparation of chutney and are also incorporated into curries as a flavouring agent.
18.	*Manihot esculenta* Crantz	Euphorbiaceae	Mara cheeni	Tuber	Tuber pieces are boiled in salted water, the decoction is discarded, and the processed tuber is consumed as food.
19.	*Morus rubra* L.	Moraceae	Mulberry	Fruit	Fruits are consumed raw.
20.	*Oxalis corniculata* L.	Oxalidaceae	Puliyarila	Leaves	Leaves are used for the preparation of chutney.
21.	*Passiflora edulis* Sims var. *kerii* (Spreng.) Mast.	Passifloraceae	Passion fruit	Fruit	Ripe fruits are consumed raw.
22.	*Passiflora foetida* L.	Passifloraceae	Koodapazham	Fruit	Ripe fruits are consumed raw.
23.	*Passiflora quadrangularis* L.	Passifloraceae	Akaasha vellari	Fruit	The fruit is used as a vegetable and is commonly prepared as a curry dish and incorporated into other curry preparations.
24.	*Phyllanthus acidus* (L.) Skeels	Phyllanthaceae	Cheema nelli	Fruit	Fruits are consumed raw and are also used for the preparation of pickles.
25.	*Salacia fruticosa* Wall. ex M.A.Lawson	Celastraceae	Kodali pazham	Fruit	Ripe fruits are consumed raw.
26.	*Sauropus androgynus* (L.) Merr.	Phyllanthaceae	Mysore cheera	Leaves	Leaves are consumed as a leafy vegetable and are incorporated into curries.
27.	*Schleichera oleosa* (Lour.) Oken	Sapindaceae	Poovathan pazham	Fruit	Fruits are consumed fresh in raw form.
28.	*Zingiber officinale* Roscoe	Zingiberaceae	Inchi	Rhizome	Rhizome is used as a spice and is incorporated into various culinary preparations.
29.	*Zingiber zerumbet* (L.) Sm.	Zingiberaceae	Kattinchi	Rhizome	Rhizome is used in culinary preparations and is occasionally consumed after processing.
30.	*Ziziphus xylopyrus* (Retz.) Willd.	Rhamnaceae	Kotta pazham	Fruit	Ripe fruits are consumed raw.

Table 3: Use Value (UV) and Relative Frequency of Citation (RFC) of documented edible plant species

S. No.	Scientific Name	UV	RFC
1.	*Amorphophallus paeoniifolius* var. *paeoniifolius (Dennst.) Nicols*	0.5	0.5
2.	*Artocarpus heterophyllus* Lam.	0.642857	0.642857
3.	*Baccaurea courtallensis* (Wight) Muell.-Arg.	0.657143	0.657143
4.	*Basilla alba* L.	0.514286	0.514286
5.	*Begonia floccifera* Bedd.	0.857143	0.785714
6.	*Capsicum frutescens* L.	0.685714	0.642857
7.	*Clausena anisata* (Willd.) Hook.f. ex Benth.	0.628571	0.628571
8.	*Curcuma zanthorrhiza* Roxb.	0.357143	0.357143
9.	*Cycas circinalis* L.	0.471429	0.471429
10.	*Dioscorea bulbifera* L.	0.642857	0.571429
11.	*Dioscorea oppositifolia* L.	0.571429	0.571429
12.	*Dioscorea pentaphylla* L.	0.657143	0.657143
13.	*Dioscorea wallichii* Hook.f.	0.528571	0.528571
14.	*Flacourtia jangomas* (Lour.) Raeusch.	0.314286	0.314286
15.	*Flacourtia montana* Roxb.	0.5	0.5
16.	*Hibiscus hispidissimus* Griff.	0.771429	0.657143
17.	*Hibiscus sabdariffa* L.	0.428571	0.357143
18.	*Manihot esculenta* Crantz	0.571429	0.571429
19.	*Morus rubra* L.	0.557143	0.557143
20.	*Oxalis corniculata* L.	0.671429	0.657143
21.	*Passiflora edulis* Sims var. *kerii* (Spreng.) Mast.	0.628571	0.628571
22.	*Passiflora foetida* L.	0.828571	0.771429
23.	*Passiflora quadrangularis* L.	0.485714	0.428571
24.	*Phyllanthus acidus* (L.) Skeels	0.685714	0.642857
25.	*Salacia fruticosa* Wall. ex M.A.Lawson	0.314286	0.314286
26.	*Sauropus androgynus* (L.) Merr.	0.714286	0.642857
27.	*Schleichera oleosa* (Lour.) Oken	0.485714	0.485714
28.	*Zingiber officinale* Roscoe	0.7	0.642857
29.	*Zingiber zerumbet* (L.) Sm.	0.571429	0.514286
30.	*Ziziphus xylopyrus* (Retz.) Willd.	0.171429	0.171429

Table 4: Category-wise distribution of edible plant species and informant consensus factor (ICF) values

Use category	Nur	Nt (Species count)	ICF score
Flour	58	2	0.982
Fruits	449	12	0.975
Vegetables	353	8	0.98
Spices	137	4	0.977
Tubers	198	5	0.979

prepared as a cooked vegetable. Additionally, the fruits of *Capsicum frutescens* L. are widely used as a natural spice. The dried fruits are powdered and utilized as a substitute for chilli powder, whereas fresh fruits are added to curries to enhance pungency.

Leafy vegetables

Several plants are traditionally consumed as leafy vegetables, often serving as substitutes in everyday cooking. For instance, the leaves of *Hibiscus hispidissimus* Griff. (Raj *et al.,* 2025) are crushed and used in curries as a salt alternative, imparting both flavour and seasoning. Another local practice blends leaves with ginger, unripe mango, and green chilies to prepare a tangy traditional chutney known as "Chammanthi." Similarly, the leaves of *Begonia floccifera* Bedd. locally called Anakalu kuliru—are

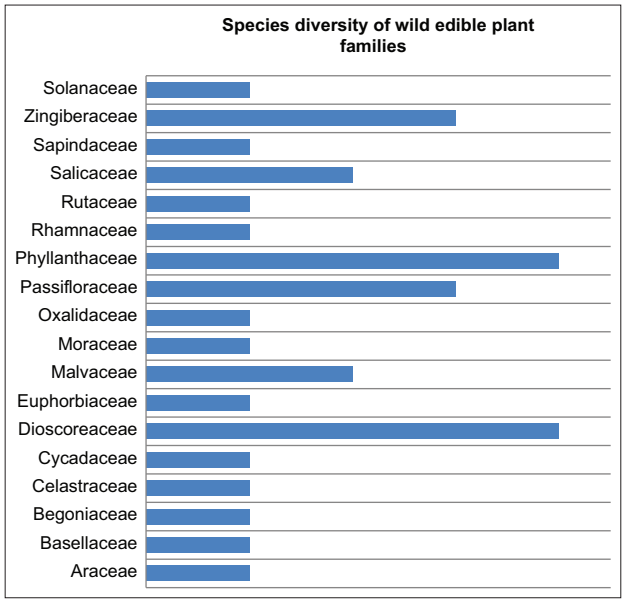

Figure 1: Family-wise distribution of documented edible plant species in Ernakulam district, Kerala

boiled with salt and consumed as a hydrating remedy for digestive discomfort or gastritis. The sour-tasting leaves of *Oxalis corniculata* L. (Puliyarila) are also incorporated into chutney and are boiled and served to children to help relieve intestinal worms.

Tubers/Rhizomes

In the forests of Ernakulam district, numerous wild tubers and rhizomes are harvested as important staples. Once dug out, their outer skin is removed, and the tubers are cut into small pieces, boiled in salted water, and consumed after draining off the cooking water. The tuber of *Amorphophallus paeoniifolius* var. p*aeoniifolius (Dennst.) Nicols* are included in their diet (Raj *et al.,* 2025). The tuber of *Dioscorea bulbifera* L., commonly called the air potato, serves as a traditional alternative to potato in local cuisine and is also utilized in folk medicine to relieve gastrointestinal disturbances such as acidity, indigestion, and colic.

Seeds

Seeds are also used, though with careful preparation. For example, the seeds of *Cycas circinalis* L. locally called "Eethanga" are inherently poisonous. They are traditionally soaked in water for a full day, with the water discarded, and this rinsing process is repeated multiple times—typically seven to eight rounds—before the seeds are dried and powdered. The resulting fine flour, resembling rice flour, is then used to prepare traditional dishes like Idli, Dosa, Puttu, and also served as gruel. Representative seed samples and plant material are shown in Figure 3.

Quantitative analysis of edible plant use

A total of 30 edible plant species belonging to multiple families were quantitatively analyzed using Use Value (UV), Relative Frequency of Citation (RFC), and Informant Consensus Factor (ICF).

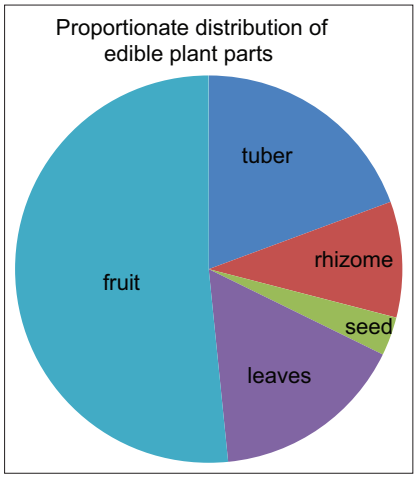

Figure 2: Proportionate distribution of plant parts used as food (fruits, leaves, tubers, rhizomes, and seeds) among tribal communities

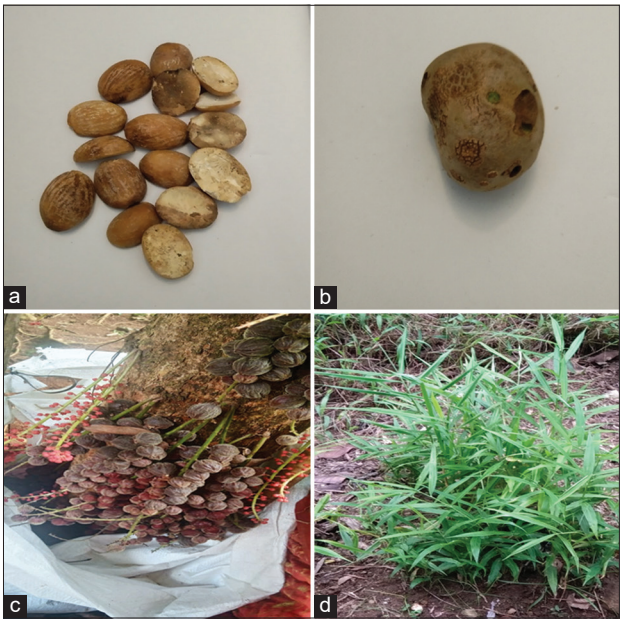

Figure 3: a) Seeds of *Cycas circinalis* L., b) *Dioscorea bulbifera L*- tuber, c) *Baccaurea courtallensis* Wight Muell.-Arg- fruits and d) *Zingiber zerumbet* (L.) Sm

Use value (UV) and relative frequency of citation (RFC)

The Use Value (UV) of the recorded species ranged from 0.17 to 0.86, indicating varying degrees of importance among the documented edible plants. The highest UV was recorded for *Begonia floccifera* Bedd. (0.86), followed by *Passiflora foetida* L. (0.83) and *Hibiscus hispidissimus* Griff. (0.77), reflecting their frequent use and high cultural significance among the tribal communities.

Similarly, the Relative Frequency of Citation (RFC) values ranged from 0.17 to 0.78, with *Begonia floccifera* Bedd. (0.78) and *Passiflora foetida* L. (0.77) being the most commonly cited species. These high RFC values indicate widespread recognition and usage among informants.

Conversely, *Ziziphus xylopyrus* (Retz.) Willd. exhibited the lowest UV (0.17) and RFC (0.17), suggesting limited utilization and lower familiarity among the studied population.

Overall, species with higher UV and RFC values represent plants of greater dietary importance and cultural relevance, while those with lower values indicate less frequent use or restricted knowledge. The UV and RFC values of the documented plant species are presented in Table 3.

Category-wise distribution of edible plants

The documented species were grouped into five food-use categories based on their primary mode of consumption: fruits, vegetables, tubers, spices, and flour.

Fruits constituted the dominant category, followed by vegetables and tubers, while spices and flour represented smaller proportions. This distribution highlights the reliance of the communities on readily available plant resources, particularly fruits and leafy vegetables, as major components of their diet. The documented species were grouped into five food-use categories based on their primary mode of consumption, as shown in Figure 2.

Informant consensus factor (ICF)

The Informant Consensus Factor (ICF) values across different food-use categories ranged from 0.975 to 0.982, indicating a high level of agreement among informants regarding the use of edible plant species.

- The highest ICF value was observed in the flour category (0.982), suggesting highly consistent knowledge regarding processing and consumption methods.
- The vegetable (0.980) and tuber (0.979) categories also showed strong agreement, reflecting well-established dietary practices.
- The spice category (0.977) demonstrated slightly lower but still high consensus.
- The fruit category (0.975), although having the largest number of species, also exhibited strong agreement among informants.

The consistently high ICF values indicate that traditional knowledge related to edible plant use is well preserved and uniformly shared among the tribal communities. The category-wise distribution and informant consensus factor values are presented in Table 4.

Discussion

The present study reveals a moderate diversity of edible plant species utilized by tribal communities in the Ernakulam district, reflecting both ecological availability and culturally embedded food practices. The dominance of families such as Dioscoreaceae and Zingiberaceae indicates their significance as staple and supplementary food resources in tropical ecosystems, where these taxa are widely distributed and traditionally preferred.

The predominance of fruits as the most frequently utilized plant part highlights the dependence of communities on readily accessible, palatable, and nutrient-rich food sources. Fruits generally require minimal processing and are often seasonally abundant, making them an integral component of traditional diets. Similar patterns have been reported from other regions of the Western Ghats, suggesting a broader ecological and cultural trend among tribal populations.

Species such as *Begonia floccifera* Bedd., *Passiflora foetida* L., and *Hibiscus hispidissimus* Griff. exhibited high Use Value (UV) and Relative Frequency of Citation (RFC), indicating their cultural importance and frequent utilization. In contrast, species with lower values reflect limited use or restricted knowledge among informants. The high ICF values across all categories indicate strong consensus among informants and reflect well-preserved traditional knowledge systems. Such high agreement is typically associated with long-term knowledge transmission and shared cultural practices.

The inclusion of both wild and cultivated edible plants demonstrates the dynamic and adaptive nature of tribal food systems, where traditional knowledge integrates forest-based resources with domesticated species. However, increasing modernization, habitat degradation, and changing food preferences pose significant threats to the continuity of this knowledge. Therefore, systematic documentation, conservation initiatives, and promotion of traditional food practices are essential to ensure sustainable utilization of plant resources and preservation of cultural heritage.

Conclusion

The study highlights the importance of edible plant species in supporting food security, nutrition, and cultural practices among tribal communities in Ernakulam district. The high values of ethnobotanical indices indicate strong knowledge retention and reliance on plant-based resources. However, socio-economic changes pose challenges to the preservation of traditional knowledge. Conservation strategies, awareness programs, and integration of indigenous knowledge into modern food systems are necessary to ensure sustainability and long-term food security.

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Author contributions

Lakshmi Raj: conceptualized the study, conducted fieldwork, collected and analyzed the data, and prepared the original draft of the manuscript. P. K. Bindu: supervised the research, contributed to study design, and critically reviewed and edited the manuscript. Arun M. Nair: assisted in data collection, data analysis, and manuscript preparation. All authors read and approved of the final manuscript.

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