Jurnal Jamu Indonesia (2025) 10(3): 182–188
https://jamu-journal.ipb.ac.id/index.php/JJI/index

ISSN 2407-7178
eISSN 2407-7763

Research Article
Doi: https://doi.org/10.29244/jji.v10i3.376

Ethnopharmacological Study of Medicinal Plants Used by the Dayak Tunjung Benuaq Tribe in East Kalimantan, Indonesia

Studi Etnofarmakologi Tumbuhan Obat yang Digunakan oleh Suku Dayak Tunjung Benuaq di Kalimantan Timur, Indonesia

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ARTICLE INFO

Article history
Received on: 2025-03-03
Revised on: 2025-06-16
Accepted on: 2025-08-23

Keyword:
Dayak Tunjung Benuaq
Ethnopharmacology
Medicinal plants
Traditional knowledge

ABSTRACT

Ethnopharmacology is a scientific approach used to document traditional knowledge regarding the use of medicinal plants. The Dayak Tunjung Benuaq Tribe in Putak Village, East Kalimantan, Indonesia, continues to rely on herbal remedies for treating various ailments. This study aimed to identify plant species used, their therapeutic applications, and preparation methods. Data were collected through purposive and snowball sampling techniques, using semi-structured interviews with knowledgeable informants. Quantitative analysis was performed using Use Value (UV), Informant Consensus Factor (ICF), and Fidelity Level (FL). A total of 31 species from 19 families were recorded, including *Carica papaya*, *Zingiber officinale*, *Psidium guajava*, and *Eleutherine bulbosa*. Leaves were the most commonly used plant part (58%), most often prepared by boiling (93.6%) and administered orally (93.6%). *C. papaya* had the highest UV (0.23), while seven disease categories, such as malaria, fever, and joint pain, achieved perfect consensus (ICF = 1.0). Several species, including *E. bulbosa* and *Syzygium polyathum*, reached 100% FL, reflecting strong cultural preference for specific treatments. These findings emphasize the significance of traditional knowledge within the community, the need for documentation and preservation, and the potential of these plants for future pharmacological exploration and biodiversity conservation.

Kata kunci:

Dayak Tunjung Benuaq
Etnofarmakologi
Pengetahuan tradisional
Tumbuhan obat

ABSTRAK

Etnofarmakologi merupakan pendekatan ilmiah untuk mendokumentasikan pengetahuan tradisional masyarakat mengenai penggunaan tumbuhan obat. Suku Dayak Tunjung Benuaq di Desa Putak, Kalimantan Timur, Indonesia, masih mengandalkan obat tradisional untuk mengatasi berbagai penyakit. Penelitian ini bertujuan mengidentifikasi spesies tumbuhan yang digunakan, manfaat terapeutiknya, serta metode pengolahannya. Data dikumpulkan melalui teknik *purposive sampling* dan *snowball sampling* dengan wawancara semi-terstruktur kepada informan yang berpengetahuan. Analisis kuantitatif dilakukan dengan *Use Value* (UV), *Informant Consensus Factor* (ICF), dan *Fidelity Level* (FL). Sebanyak 31 spesies dari 19 famili berhasil didokumentasikan, antara lain *Carica papaya*, *Zingiber officinale*, *Psidium guajava*, dan *Eleutherine bulbosa*. Bagian tumbuhan yang paling sering dimanfaatkan adalah daun (58%), dengan cara pengolahan terbanyak perebusan (93,6%) dan cara penggunaan dominan secara oral (93,6%). *C. papaya* memiliki UV tertinggi (0,23), sedangkan tujuh kategori penyakit seperti malaria, demam, dan nyeri sendi menunjukkan konsensus penuh (ICF = 1,0). Beberapa spesies, termasuk *E. bulbosa* dan *Syzygium polyathum*, memiliki FL 100%, yang menandakan preferensi kuat masyarakat terhadap pengobatan tertentu. Temuan ini menekankan pentingnya pengetahuan tradisional, perlunya dokumentasi dan pelestarian,

serta potensi tumbuhan obat ini untuk penelitian farmakologi dan konservasi keanekaragaman hayati.

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Citation: Fadhillah, R. N., & Kustiawan, P. M. (2025). Title in English. *Ethnopharmacological Study of Medicinal Plants Used by the Dayak Tunjung Benuaq Tribe in East Kalimantan, Indonesia*, *10*(3), 182–188. https://doi.org/10.29244/jji.v10i3.376

1. INTRODUCTION

Indonesia is recognized globally for its vast natural resources and extraordinary biodiversity. Stretching from Sabang to Merauke, the country's diverse ecosystems are home to a wide range of flora and fauna, including numerous species of medicinal plants. These medicinal resources span various plant parts such as rhizomes, leaves, stems, and other botanical components, which are integral to traditional healing practices (Zildzian & Sari, 2021).

Historically, human civilizations have relied on their natural surroundings to fulfill essential needs, including the treatment of diseases. Although the environment holds immense potential for medicinal purposes, many of these resources remain underexplored and underutilized (Sulayha & Kustiawan, 2022). Long before the advent of modern healthcare and synthetic pharmaceuticals, Indonesian communities had already been using medicinal plants to manage health issues. This traditional knowledge, rooted in cultural heritage, has been passed down through generations (Marpaung, 2018).

Medicinal plants are defined as plants whose parts—whole or in part—are used as remedies to prevent or treat illnesses. These are often prepared through simple methods such as decoction or direct application (Karunia, 2016). Traditional medicine plays a critical role in Indonesia's healthcare system, particularly in remote areas. Its integration into healthcare initiatives is essential for promoting health equity and preserving cultural heritage (Azmin & Rahmawati, 2019).

Ethnopharmacology, a multidisciplinary field combining pharmacology, ethnobotany, and anthropology, focuses on how different cultures use plants for healing. It is a subset of ethnobotanical studies and emphasizes the medicinal use of plants within specific cultural contexts. Ethnopharmacological research is crucial for uncovering bioactive compounds, advancing drug discovery, and guiding conservation efforts (Süntar, 2020).

Putak Village, located in Loa Duri Ilir Village, Loa Janan District, Kutai Kartanegara Regency, East Kalimantan, serves as a unique case study. The village, inhabited predominantly by the Dayak Tunjung (Tonyooi) Benuaq Tribe, is known for its rich cultural and ecological diversity. The community's primary livelihood includes farming, livestock raising, and gardening. Medicinal plants are still widely used for traditional treatment, yet rapid environmental changes and land conversion threaten this valuable knowledge and biodiversity. Exploring the traditional use of these plants is essential for balancing ecological conservation and community well-being (Purwandari & Herdianto, 2024).

To date, no ethnopharmacological studies have been conducted in this location. Thus, the purpose of this study is to document and analyze the medicinal plant knowledge and usage practices of the Dayak Tunjung Benuaq Tribe in Putak Village.

2. METHODS

This study employed qualitative and quantitative approaches to examine the ethnopharmacological knowledge of the Dayak Tunjung Benuaq community in Putak Village, East Kalimantan. Data were collected through semi-structured interviews using open-ended questions, which allowed informants to provide comprehensive and detailed explanations of their practices. Informants were selected through purposive and snowball sampling. Initial participants were identified via community observation and recommendations, while additional participants were recruited based on referrals.

Inclusion criteria required that informants be members of the Dayak Tunjung Benuaq tribe who possessed and practiced knowledge of medicinal plants for treating illnesses. Informants who had obtained their knowledge from other ethnic traditions were excluded. Key insights were primarily provided by traditional healers, who hold authority in healing ceremonies and are considered custodians of traditional medicinal knowledge. The research site was Putak Village, located in Loa Janan District, Kutai Kartanegara Regency, East Kalimantan.

Data collection focused on documenting plant species, parts used, preparation methods, administration routes, and collection sources. Quantitative analysis employed three ethnobotanical indices widely used in ethnopharmacology (Anggreini et al., 2021; Bhagawan et al., 2020; Wirasisya et al., 2020).

The Use Value (UV) measured the relative importance of each species using the following formula:

$$\mathrm{UV} = \frac{\sum \mathrm{U}}{\mathrm{n}}$$

where *U* is the number of use-reports cited by informants for a species, and *n* is the total number of informants.

The Informant Consensus Factor (ICF) assessed the agreement among informants on plant use within disease categories, expressed as:

$$\mathrm{ICF} = \frac{(\mathrm{Nur}-\mathrm{Nt})}{(\mathrm{Nur}-1)}$$

where *N*ur is the number of use-reports for a disease category and *N*t is the number of plant species used for that category.

The Fidelity Level (FL) indicated the percentage of informants who cited a plant for the same disease, calculated as:

$$\text{FL (\%)} = \frac{\text{Np}}{\text{N}} \text{x } 100\%$$

where *N*p is the number of informants who reported the use of a species for a particular disease, and *N* is the total number of informants who mentioned the plant for any use.

These combined methods enabled systematic documentation and quantification of traditional medicinal knowledge, highlighting the plant species with the highest cultural and therapeutic value in the Dayak Tunjung Benuaq community (Alqahtani et al., 2021; Situmorang & Sihombing, 2018; Süntar, 2020).

3. RESULTS AND DISCUSSION

The results from 30 respondents revealed that the Dayak Tunjung Benuaq community utilizes 31 species of medicinal plants belonging to 19 families (**Table 1**). Among these, *Carica papaya* showed the highest Use Value (UV = 0.23), followed by *Zingiber officinale* and *Psidium guajava*, each with a UV of 0.16. The prominence of these plants demonstrates their wide recognition and frequent use for treating various ailments. The Informant Consensus Factor (ICF) analysis identified 21 categories of diseases treated with medicinal plants (**Table 2**). Seven categories, namely joint pain, cysts, ulcers, malaria, fever, vaginal discharge, and menstruation, reached the maximum consensus (ICF = 1.0).

Table 1. Use Value (UV) of Medicinal Plants among the Dayak Tunjung Benuaq Tribe

No.	Plant Species	Total Respondents (n)	Informants per Species (U)	UV
1	*Tinospora crispa*	30	2	0.06
2	*Imperata cylindrica*	30	3	0.10
3	*Uncaria sp.*	30	1	0.03
4	*Crinum arenarium*	30	1	0.03
5	*Eleutherine bulbosa*	30	2	0.06
6	*Areca catechu*	30	1	0.03
7	*Muntingia calabura*	30	2	0.06
8	*Syzygium polyathum*	30	3	0.10
9	*Psidium guajava*	30	5	0.16
10	*Carica papaya*	30	7	0.23
11	*Hibiscus rosa-sinensis*	30	1	0.03
12	*Orthosiphon aristatus*	30	4	0.13
13	*Smallanthus sonchifolius*	30	1	0.03
14	*Zingiber officinale*	30	5	0.16
15	*Alpinia galanga*	30	2	0.06
16	*Kaempferia galanga*	30	2	0.06
17	*Curcuma zanthorrhiza*	30	1	0.03
18	*Phaleria macrocarpa*	30	1	0.03
19	*Pycnarrhena cauliflora*	30	1	0.03
20	*Pluchea indica*	30	1	0.03
21	*Annona muricata*	30	2	0.06
22	*Clitoria ternatea*	30	1	0.03
23	*Piper porphyrophyllum*	30	1	0.03
24	*Bryophyllum pinnatum*	30	2	0.06
25	*Caesalpinia sappan*	30	1	0.03
26	*Piper betle*	30	2	0.06
27	*Peronema canescens*	30	2	0.06
28	*Ageratum conyzoides*	30	2	0.06
29	*Saccharum edule*	30	1	0.03
30	*Cosmos caudatus*	30	1	0.03
31	*Stachytarpheta jamaicensis*	30	2	0.06

Table 2. Informant Consensus Factor (ICF) for Disease Categories

No.	Disease Category	Use-Reports (Nur)	Species (Nt)	ICF
1	Cancer	2	2	0.00
2	Antidote to Poison	4	3	0.33
3	Diabetes	4	2	0.66
4	Joint Pain	3	1	1.00
5	Wound	3	2	0.50
6	Cyst	2	1	1.00
7	Stomach Ailment	2	1	1.00
8	Malaria	7	1	1.00
9	Jaundice	2	2	0.00
10	Fever	3	3	1.00
11	Blood Pressure	4	3	0.33
12	Immunity	7	2	0.83
13	Kidney Disorder	1	1	0.00
14	Diarrhea	1	1	0.00
15	Vaginal Discharge	2	1	1.00
16	Menstruation	2	1	1.00
17	Gout	3	2	0.50
18	Cough	4	2	0.66
19	Typhoid	1	1	0.00
20	Abdominal Pain	6	2	0.80
21	Ulcer	2	1	1.00

High ICF values suggest strong community agreement and reliability of these plants in managing such conditions. This aligns with findings in other ethnopharmacological studies where high ICF reflects cultural consensus and the perceived efficacy of treatments (Bhagawan et al., 2020).

Fidelity Level (FL) analysis revealed several species with maximum fidelity (100%), including *Eleutherine bulbosa* for cysts, *Syzygium polyathum* for stomach ailments, *Carica papaya* for malaria, *Piper porphyrophyllum* for kidney disorders, and *Ageratum conyzoides* for menstruation (**Table 3**). High FL values indicate cultural preference and consistent use of these plants for specific ailments (Wirasisya et al., 2020).

Analysis of plant parts used (**Figure 1**) revealed that leaves were the most frequently employed (58%). This predominance can be explained by their abundance, ease of collection, and year-round availability.

Table 3. Fidelity Level (FL) of Medicinal Plants Used by the Dayak Tunjung Benuaq Tribe

No.	Disease Category	Plant Species	FL (%)
1	Cancer	*Uncaria tomentosa* (50%), *Pycnarrhena cauliflora* (50%)	100
2	Antidote to Poison	*Tinospora crispa* (50%), *Caesalpinia sappan* (25%), *Saccharum edule* (25%)	100
3	Diabetes	*Orthosiphon aristatus* (75%), *Smallanthus sonchifolius* (25%)	100
4	Joint Pain	*Imperata cylindrica* (100%)	100
5	Wound	*Crinum arenarium* (33.3%), *Bryophyllum pinnatum* (66.6%)	100
6	Cyst	*Eleutherine bulbosa* (100%)	100
7	Stomach Ailment	*Syzygium polyathum* (100%)	100
8	Malaria	*Carica papaya* (100%)	100
9	Jaundice	*Orthosiphon aristatus* (50%), *Curcuma zanthorrhiza* (50%)	100
10	Fever	*Syzygium polyathum* (33.3%), *Clitoria ternatea* (33.3%), *Hibiscus rosa-sinensis* (33.3%)	100
11	Blood Pressure	*Phaleria macrocarpa* (25%), *Annona muricata* (50%), *Cosmos caudatus* (25%)	100
12	Immunity	*Zingiber officinale* (71.4%), *Alpinia galanga* (28.5%)	100
13	Kidney Disorder	*Piper porphyrophyllum* (100%)	100
14	Diarrhea	*Pluchea indica* (100%)	100
15	Vaginal Discharge	*Piper betle* (100%)	100
16	Menstruation	*Ageratum conyzoides* (100%)	100
17	Gout	*Muntingia calabura* (66.6%), *Peronema canescens* (33.3%)	100
18	Cough	*Stachytarpheta jamaicensis* (100%)	100
19	Typhoid	*Peronema canescens* (100%)	100
20	Abdominal Pain	*Psidium guajava* (83.3%), *Areca catechu* (16.6%)	100

Leaves are also rich in bioactive compounds such as tannins, alkaloids, chlorophyll, phenols, and essential oils, all of which contribute to their medicinal value (Situmorang & Sihombing, 2018).

Regarding the sources of medicinal plants (**Figure 2**), the majority were collected from household yards (74.27%), while others were sourced from fields (19.32%) and forests (6.41%). The predominance of yard-sourced plants reflects the accessibility and practicality of cultivating medicinal species close to the home, ensuring a sustainable supply for daily needs.

Preparation methods (**Figure 3**) showed that boiling was the most common technique (93.6%), while pounding and wilting each accounted for only 3.2%. Boiling reduces bitterness, improves sterility by eliminating microorganisms, and enhances safety compared to raw consumption (Puspitasari et al., 2016; Lestari & Susanti, 2020).

Routes of administration (Figure 4) indicated that oral consumption was dominant (93.6%), while topical application was less frequent (6.4%). Oral administration is preferred as it enables better absorption of active compounds through the digestive system, allowing systemic effects across the body (Alqahtani et al., 2021).

The distribution of medicinal plant families further showed that Zingiberaceae was the most dominant, represented by four species. Fabaceae and Asteraceae followed with three species each, while other families were represented by one or two species. The predominance of Zingiberaceae highlights the cultural and pharmacological importance of species such as *Zingiber officinale* and *Alpinia galanga*, which are widely recognized for their therapeutic potential.

Overall, the results indicate that the Dayak Tunjung Benuaq community maintains a rich ethnopharmacological tradition, relying on diverse plant species for primary healthcare. The strong consensus (ICF) and high fidelity (FL) values for specific species highlight their cultural significance and potential pharmacological value. However, environmental changes and land conversion pose risks to the sustainability of these practices, underscoring the need for conservation strategies (Aziza, 2025). This study not only documents valuable indigenous knowledge but also provides a foundation for further pharmacological exploration and biodiversity preservation.

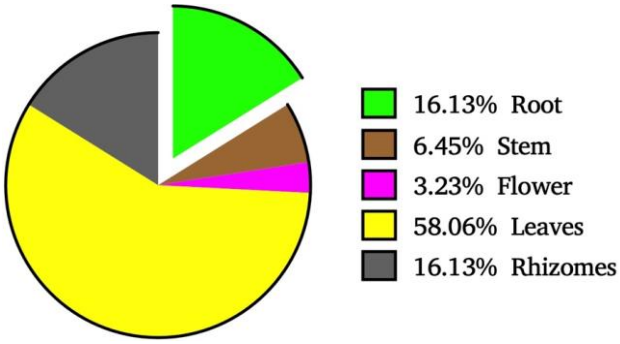

Figure 1. Plant Parts Used by the Dayak Tunjung Benuaq Community

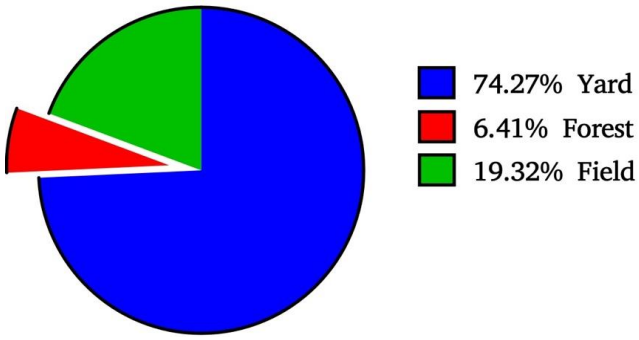

Figure 2. Sources of Medicinal Plants

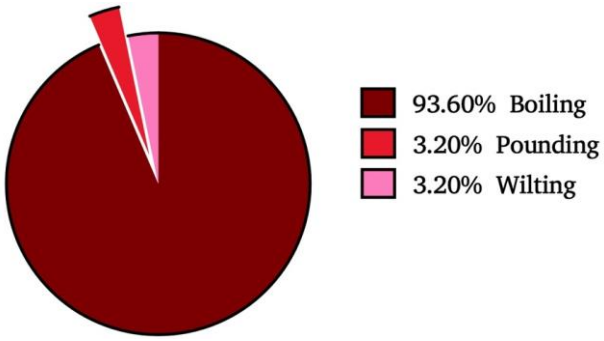

Figure 3. Preparation Methods of Medicinal Plants

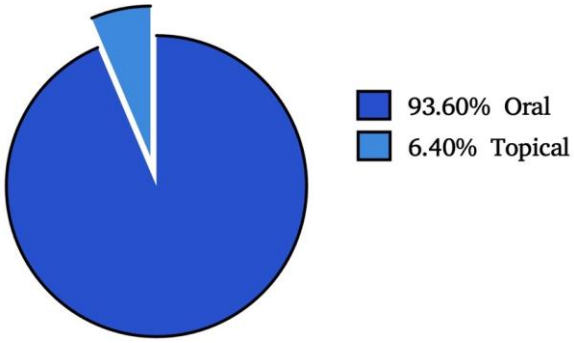

Figure 4. Routes of Administration of Medicinal Plants

4. CONCLUSION

This study documented the ethnopharmacological knowledge of the Dayak Tunjung Benuaq community in Putak Village, East Kalimantan, revealing the use of 31 medicinal plant species from 19 families. The most frequently cited species included *C. papaya*, *Z. officinale*, and *P. guajava*. Leaves were the dominant plant part used (58%), with boiling as the most common preparation method (93.6%), and oral administration as the primary route of use (93.6%).

Quantitative analysis showed that *C. papaya* had the highest Use Value (0.23). Seven disease categories, including joint pain, cysts, ulcers, malaria, fever, vaginal discharge, and menstruation, demonstrated complete informant consensus (ICF = 1.0), indicating strong cultural agreement on the efficacy of the plants used. Fidelity Level (FL) analysis highlighted several species with maximum fidelity (100%), such as *E. bulbosa* for cysts and *S. polyathum* for stomach ailments.

These findings confirm the continuing reliance of the Dayak Tunjung Benuaq community on traditional medicine as part of their primary healthcare practices. The high cultural consensus and fidelity values underscore the therapeutic importance of these species, many of which are readily cultivated in household yards.

However, threats such as land conversion and ecological change may endanger the availability of these plants. Documentation and preservation of this indigenous knowledge are therefore crucial for cultural continuity, biodiversity conservation, and as a foundation for future pharmacological research.

AUTHOR CONTRIBUTIONS

R.N.F. contributed to the conceptualization, methodology, software development, formal analysis, investigation, resources, data curation, original draft preparation, and visualization. P.M.K. was responsible for conceptualization, validation, investigation, review and editing of the manuscript, supervision, project administration, and funding acquisition. All authors have read and agreed to the published version of the manuscript.

INSTITUTIONAL REVIEW BOARD STATEMENT

Not applicable.

INFORMED CONSENT STATEMENT

Not applicable.

DATA AVAILABILITY STATEMENT

No new data were created or analyzed in this study. Data sharing is not applicable.

FUNDING

This research was funded by Kolaborasi Dosen dan Mahasiswa (KDM) research scheme, Universitas Muhammadiyah Kalimantan Timur.

ACKNOWLEDGMENT

We would like to thank Mr. Yulius Lamus as the Head of Dayak Customary Law of Dusun Putak Village and the Head of Loa Duri Ilir Village as well as the informants who were the sources in collecting research data. Thanks to Universitas Muhammadiyah Kalimantan Timur for the KDM program and partially funded the research.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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