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Ethnobotanical study of medicinal plants for postpartum remedies by the Dayak Bakumpai Tribe in Central Kalimantan, Indonesia

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Abstract. *Hujjatusnaini N, Fitri DRK, Nirmalasari R, Mila, Amin AM. 2025. Ethnobotanical study of medicinal plants for postpartum remedies by the Dayak Bakumpai Tribe in Central Kalimantan, Indonesia. Biodiversitas 26: 2946-2956.* Numerous studies on the ethnobotany of the Dayak Bakumpai Tribe in Central Kalimantan have been conducted, yet those focused on medicinal plants with particular remedial purpose is limited. This research aims to investigate the ethnobotanical knowledge of Dayak Bakumpai for postpartum remedies. Field surveys were conducted in seven districts: Seruyan, Katingan, East Barito, North Barito, South Barito, East Kotawaringin, and West Kotawaringin, involving 250 respondents selected using snowball method. The research identified 47 plant species from 40 genera, and 27 families used as remedies to treat postpartum ailments. Leaves are the most commonly used plant part with 25 species (67.57%), followed by entire plant with 10 species (21.28%). The modes of application include in the form of liquid preparations (27 species), solid preparations (12 species), topical preparations (4 species), and hydrotherapy preparations (18 species). Plant with the highest Cultural Significance Index values are *Ageratum conyzoides, Curcuma domestica*, and *Ficus deltoidea.* Preserving ethnobotanical knowledge of medicinal plants for postpartum treatment is a key aspect of maintaining the local wisdom and culture of the Dayak Bakumpai Tribe.

Keywords: Bakumpai Tribe, ethnobotanical, herbal remedies, postpartum

INTRODUCTION

Indonesia has a great level of biological diversity with the potential for development. Such biodiversity is primarily contained in the vast extent of tropical forest across the country (Mingga et al. 2019). Indonesia has around 30,000 plant species, of which ≤80% are utilized by the community for medicinal purposes (Fuadi 2018). Nevertheless, around 9,600 plant species with medicinal properties remain underutilized, thus continuous research and development are crucial to obtain the greatest benefits of medicinal plants to generate health and economic values from such plants.

Central Kalimantan Province is home to a staggering 20,000 types of medicinal plants, ranging from shrubs to trees (Miranda 2021), including tubers (Putra and Estiasih 2016), epiphytic plants (Gunadi et al. 2017), and vascular plants (Umar 2017). In a study conducted in Katingan and Seruyan Districts, Central Kalimantan (Hujjatusnaini et al. 2021) successfully identified 45 plant species, each with unique medicinal benefits. Another study in South Kalimantan, there were 72 plant species used for herbal medicine (Rosita et al. 2017). The preservation of plants with ethnomedicinal uses is not just a scientific necessity but a moral imperative, as it is deeply intertwined with local culture and wisdom. Local wisdom is expressed through unique cultural practices (Nkoko et al. 2023), including in the usage for food and medicine (Saranraj et al. 2019).

Ethnobotanical knowledge, a cornerstone in preserving the cultural heritage of indigenous community, plays significant role in managing natural resources. Ethnobotany explores the complexity of the relationship between humans and plants, not only including their use but also ecological, economic, social, and cultural aspects (Maheshwari et al. 2018; Supiandi et al. 2019; Mulu et al. 2020; Navia et al. 2020). This field of study includes how humans use plants for various purposes, such as food, medicine, and more. Additionally, ethnobotany also considers ecological aspects, such as how human activities and interactions impact the environment where plants grow and how to manage these natural resources. The social and cultural aspects are also important, considering that traditional uses and knowledge about plants influence society, including religious practices or traditional ceremonies. Therefore, it is crucial to investigate ethnobotanical knowledge of indigenous community to avoid it from extinction by passing it to future generations.

Cultural wealth is a significant part of national heritage in Indonesia and must be preserved (Silalahi 2016). Some earlier studies have documented the ethnomedical practices of different tribes and cultures across the country (Silalahi

et al. 2020; Navia et al. 2020; Ibo and Arifa 2021; Lestariningsih et al. 2023). Cross-context investigation across various regions and community groups is crucial for validating and ensuring the consistency of previous findings and verifying the reliability of information more broadly. Therefore, it is crucial to investigate and document cultural characteristics of each community group in a region to preserve particular cultural traditions so that information of natural wealth will not disappear over time.

The Dayak Bakumpai is an indigenous tribe in Central Kalimantan with strong ethnobotanical knowledge and practices. Despite the availability of modern medical treatments, the use of medicinal plants in ethnomedical traditions remains a preference in some Dayak Bakumpai communities. They have long relied on its cultural heritage knowledge of medicinal plants to treat various illnesses, including post-natal infections. Ethnobotanical research related to the plant combination formulations used by the Dayak Bakumpai tribe is essential to explore, as the validation of ethnomedical information about plant utilization and ethnobotany remains limited (Pereus et al. 2019).

While there are several ethnobotanical studies on the uses of plant for medicinal uses with the context of Central Kalimantan, there is limited scientific documentation that focus on the specific use of such plant to treat particular ailments. Several previous studies have revealed that the Dayak community possesses extensive knowledge of medicinal plant usage. Supiandi et al. (2019) documented the utilization of medicinal plants by the Dayak Desa community in Sintang, West Kalimantan. This study demonstrated that various plant species have been used for generations; however, the absence of pharmacological analysis means their effectiveness has not been scientifically validated. Wardah and Sundari (2019) research on the ethnomedicine of the Dayak Uut Murung in Central Kalimantan also recorded the use of medicinal plants unique to the Dayak community. However, the study remained general and did not specifically address their application in postpartum care. Milad et al. (2023) conducted a study in Sukamara, Central Kalimantan, revealing that ethnobotanical knowledge in the region remains poorly documented, despite its significant economic potential. Unlike the three previous general studies, this article focuses on the use of medicinal plants for postpartum maternal care.

Therefore, this study aims to investigate the ethnobotanical knowledge of Dayak Bakumpai in Central Kalimantan in using medicinal plants to treat ailments related to postpartum. These medicinal plants are inventoried for their uses and also for specific formulations with particular medicinal values and cultural history in the Dayak Bakumpai community. This documentation identifies the plant types used and explore their methods and cultural significance to the local community. We expected the result of this study to provide an opportunity to develop more comprehensive and sustainable public health strategies that combine local wisdom with modern scientific discoveries to improve maternal health after birth.

MATERIALS AND METHODS

Study area and period

Central Kalimantan Province consists of one city and 13 districts. This province is located geographically at 0°45′ N - 3°30′ S and 111° - 116° E. The province covers an area of 153.564 km², or 8.04% of Indonesia's total land area. The study was conducted in seven districts in Central Kalimantan (Figure 1), namely Seruyan (111°49' - 112°84' N, and 0°77'- 3°56' S), Katingan (1°14'4.9" - 3°11'14.72' S and 112°39'59" - 112°41'47" N), Barito Utara (114°27'00"- 115°49'00" E and 0°58'30" N - 1°26'00" S), East Barito (1°19 - 3° 36' S and 110°25' - 112°50' E), South Barito (1°15' - 2°36' S and 114°35' - 115°36' E), East Kotawaringin (112°7'29 "- 113°14'22" E and 1°11'50"- 3°18'51" S), and West Kotawaringin (1°19' - 3°36' S and 110°25' - 112°50' E).

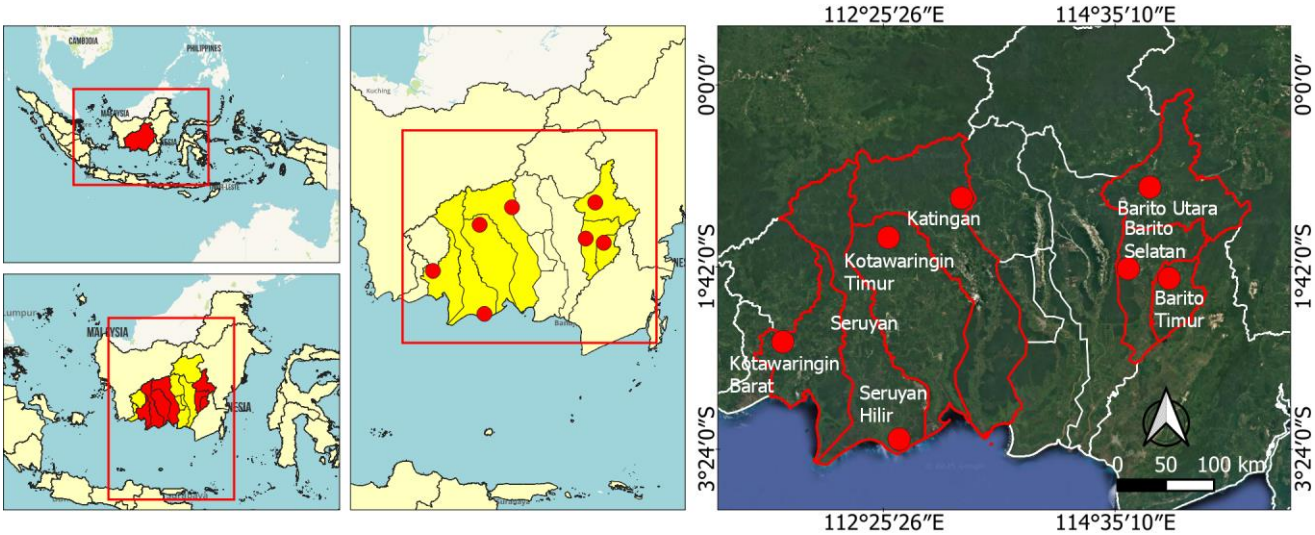

Figure 1. Map of research locations in seven districts: Seruyan, Katingan, Barito Utara, Barito Timur, Barito Selatan, Kotawaringin Timur, Kotawaringin Barat in Central Kalimantan Province, Indonesia

Approximately 45.98% of the population comprises Dayak people scattered throughout the Central Kalimantan territory (Lestariningsih et al. 2023). The Müller Schwarze mountains and hills characterize the northern part, while the southern part mainly consists of lowlands, swamps, and plains. The region experiences a humid tropical climate and is located on both sides of the equator. About 80% of the area is covered by forest, with primary forests accounting for approximately 25% of the total area (BPS-BPS Central Kalimantan Province 2022). This study was conducted from February to June 2022 to document the ethnobotanical knowledge of medicinal plant use among the Dayak communities. The time-specific nature of this research underscores the importance of considering environmental and socio-cultural dynamics during this period. Including this timeframe provides valuable context for future comparative studies.

Procedures

Data collection and sample

This research employed an exploratory method, utilizing both emic and etic approaches. The emic approach refers to the framework of local knowledge systems, while the etic approach refers to the framework of scientific theory. The emic approach investigates and collects data about the community's understanding of the observed object from their perspectives and language (Iswandono 2015). Furthermore, we develop and analyze general knowledge in conceptual rules, categories, codes, and cognitive rules (emic) based on the conceptual categories obtained from scholarly backgrounds (etic).

Table 1. Characteristics of the respondents

Parameter	Specification	Frequency	Percentage (%)
Gender	Female	250	100
Age	Youth (20-35th)	45	18.0
	Adult (36-64th)	130	52.0
	Elder (>64th)	75	30.0
Ethnic	Bakumpai	250	100
Education	None	38	15.2
	Elementary school	25	10.0
	Junior high school	32	12.8
	Senior high school	88	35.2
	University	67	26.8
Occupation	Government employees	42	16.8
	Private employed	57	22.8
	Self-employed	43	17.2
	Farmer	28	11.2
	Fisherman	17	6.8
	Medicine maker	30	12.0
	Birth midwife	33	13.2

Data collection had three stages: informant selection, data exploration, and data collection and analysis. In the initial stage, informants were selected as data sources through purposive sampling to ensure that they met the qualifications as sources of information. Among them were the Dayak Ethnic Group, local indigenous people, Batra or individuals with knowledge and experience in using medicinal plants as sources of postpartum infection therapy, and users of medicinal plants based on personal or close family experiences. The research obtained and utilized data from 250 informants across seven districts (Table 1). The interview included questions about the participants' names, ages, genders, ethnicities, education levels, and occupations. Information gathered on medicinal plants for postpartum infection therapy included local plant names, compositions used in concoctions, parts of plants used, methods of concoction and usage, and sources of plant usage information.

The second stage involved a comprehensive data exploration. Data collection techniques included interviews and direct observations, ensuring a thorough understanding of the subject. Sampling of the informant employed the snowball method in which selected informants will recommend the next informant who meets the criteria. The interview technique used a semi-structured interview by administering sheet approved by both parties. The semi-structured interview instrument was modified and adapted from previous ethnobotany survey instruments (Alduhisa and Demayo 2019; Aati et al. 2019; Silalahi et al. 2020; Kadir et al. 2022; Lu et al. 2022). The third stage included gathering and analyzing data. The data and information were gathered from various secondary sources and inputted using Microsoft Excel for analysis and comparison.

Collection and identification of plants

The specimens of medicinal plants were collected, along with data about local names, plant parts, habitats, medicinal uses, and methods for treating postpartum infections. Identification took place at the Microbiology Laboratory of IAIN Palangka Raya. Unidentified specimens were sent to the Indonesian Institute of Sciences (LIPI) in East Java. The scientific names of the plants are confirmed using the Plantlist Database (www.theplantlist.org). The wet specimens are stored in the bio-herbal laboratory at IAIN Palangka Raya as part of the collection.

Data analysis

The data was analyzed using qualitative and quantitative methods. We conducted a qualitative analysis using descriptive statistics. Plants were grouped based on their usage categories. Calculation for The Cultural Significance Index (CSI) using techniques developed by Turner (1988). The Cultural Significance Index (CSI) is the level of importance of a cultural value in a group or society, determined by the frequency index score of plant use.

The frequency index data was analyzed to determine the relative importance comparison of each plant species obtained. According to Nuneza et al. (2021), the frequency index is a numerical expression representing the frequency percentage for a plant species as reported by informants. It has been analyzed using the following formula:

$$\text{IF} = \frac{CF}{\text{N}} x\ 100$$

Where CF is the number of informants mentioning the use of a particular plant type, and N the total number of informants in each area. The frequency index will be high if many informants mention the plant and low if only a few report it (Navia et al. 2020; Tsioutsiou et al. 2023). Several factors besides the IF value are necessary for analyzing the CSI value, including the Culture Factor (CF) value, Traditional Use Score (TUs), Culture Significance Value (CS), and Sustainable Score (S). The formulas for calculating these variables are outlined in Table 2.

Table 2. The formula for calculating variables of Cultural Significance Index (CSI) and the range of scores applied

Formula for calculating variables of CSI	Scale	Instrument/question
Culture Factor (CF): $CF = \frac{\sum CFi}{N}$ Where: Cfi = The overall total value of CF from the measurement instrument N = The number of questions	1-10	• Frequency of use in rituals (How frequently is this plant utilized in traditional ceremonies or community rituals?) • Historical and cultural value (Does this plant have historical value in the local culture?) • Community perception (What does the community think about the cultural significance of this plant?) • Connection to myths or legends (Does this plant have any connection to local myths or legends?) • Role in traditional medicine (Does this plant play a role in traditional medicine or other health practices?
Traditional Use Scores (TUs): $TUs = (FIx0,5)$ Where: Tus = Traditional Use Score FI = The Index Factor, calculated by determining the score of the plant parts used	1-5	• Usage frequency (How frequent is this plant utilized in traditional medicine?) • Effectiveness of treatment (How well does this plant work in treating particular health problems?) • Parts of the plant used (Which parts of the plant are utilized?) • Processing ease (How simple is to process the plant into remedies or medicine?) • Accessibility and availability (How easy this plant is found and accessed by the community?)
Culture Significance (CS): $CS = \frac{\sum QS}{N}$ Where: CS = Culture Significance QS =Total Score of Questions N = Number of Questions	1-5	• Importance in customary rituals (How frequent and how important is the plant used in customary rituals or traditional ceremonies?) • Symbolic or spiritual value (What is the symbolic or spiritual value attributed to the plant in the community's beliefs?) • Role in traditional medicine (How significant is the plant in traditional medicine or local health practices?) • Use in traditional cuisine (How frequent and significant is the plant used in traditional dishes or cuisine?) • Role in conservation and sustainability (How does the plant influence the conservation of the environment or the sustainability of natural resources?)
Sustainable score (S): $S = \frac{\sum QS}{N}$ Where: S = Sustainable score QS = Total Score of Questions N = Number of Questions	1-5	• Natural occurrence of the plant (How plentiful or numerous is the plant in its native habitat?) • Replanting and cultivation capability (How readily can the plant be replanted or cultivated?) • The ecological implications of consumption (What are the impacts on the ecosystem due to the usage of the plant?) • Restoration actions (What actions have been undertaken to restore and maintain the plant?) • Vulnerability to overexploitation (To what extent is this plant susceptible to overharvesting or exploitation beyond sustainable limits?) • Role in the ecosystem (How significant is the plant for the stability of the ecosystem?)

The CSI value is a quantitative measure of the importance of a plant species in the cultural and ecological spheres. By amalgamating the variables previously elucidated, this value is subsequently evaluated using the formula:

$$CSI = \sum_{k=1}^{n} (q\ x\ i\ x\ e)nl$$

The CSI is the sum of individual values and uses values from 1 to n, where n represents the last described use, and subscription represents values from 1 to n sequentially. For each given use, q = quality value, i = intensity value, and e = exclusivity value (Silalahi et al. 2020).

RESULTS AND DISCUSSION

The diversity of medicinal plants to treat postpartum ailments

Across the seven districts in Central Kalimantan Province, the Dayak Bakumpai community uses 47 plant species belonging to 40 genera and 27 families to treat postpartum ailments (Table 3). Table 3 lists the plants used for various medicinal purposes related to postpartum ailments. For pain and stomach cramps, only one species, *Leea indica* (Burm.fil.) Merr. (Vitaceae), is used. For wounds and swelling, there are 22 species from different plant families including Solanaceae (*Physalis angulata* L.), Zingiberaceae (*Zingiber officinale* Roscoe, *Kaempferia galanga* L., *Curcuma heyneana* Valeton & Zijp, *Curcuma domestica*), Poaceae (*Imperata cylindrica* (L.) Raeusch.), Araliaceae (*Panax ginseng* C.A.Mey.), Rutaceae (*Citrus hystrix* DC.), Apiaceae (*Anethum graveolens* L., *Foeniculum vulgare* Mill.), Fabaceae (*Trigonella foenum-graecum* L., *Tamarindus indica* L.), Myrtaceae (*Syzygium aromaticum* (L.) Merr. & L.M.Perry), Pandanaceae (*Pandanus amaryllifolius* Roxb. ex Lindl.), Euphorbiaceae (*Achillea millefolium* L.), Myristicaceae (*Myristica fragrans* Houtt.), Caricaceae (*Carica papaya* L.), Lamiaceae (*Coleus amboinicus* Lour., *Coleus atropurpureus*), Apocynaceae (*Parameria laevigata*), Plantaginaceae (*Plantago major* L.), and Acanthaceae (*Andrographis paniculata* (Burm.fil.) Nees). For postpartum bleeding and infection, there are 12 species from various families, including Asteraceae (*Ageratum conyzoides* L., *Chromolaena odorata* (L.) R.M.King & H.Rob., *Elephantopus scaber* L.), Rubiaceae (*Mussaenda frondosa* L., *Uncaria gambir* (W.Hunter) Roxb.), Malvaceae (*Sida rhombifolia* L.), Lamiaceae (*Callicarpa longifolia* Lam.), Poaceae (*Cymbopogon citratus* (DC.) Stapf), Apiaceae (*Centella asiatica* (L.) Urb.), Zingiberaceae (*Curcuma longa* L., *Alpinia zerumbet* (Pers.) B.L.Burtt & R.M.Sm.), and Piperaceae (*Piper betle* L.). For stamina recovery, there are 7 species from different families including Crassulaceae (*Kalanchoe pinnata* (Lam.) Pers.), Rubiaceae (*Morinda citrifolia* L.), Zingiberaceae (*Alpinia galanga* (L.) Willd., *Curcuma xanthorrhiza* D.Dietr.), Euphorbiaceae (*Codiaeum variegatum* (L.) Rumph. ex A.Juss.), Pandanaceae (*P. amaryllifolius*), and Phyllanthaceae (*Phyllanthus niruri* L.). For curing fever, there are 3 species from Moringaceae (*Moringa oleifera* Lam.), Cyperaceae (*Cyperus rotundus* L.), and Lythraceae (*Lagerstroemia speciosa* (L.) Pers.). Lastly, there are 2 species for vaginal discharge, vaginal muscles, antiseptic, and vaginal washing, specific species from Moraceae (*Ficus deltoidea* Jack) and Malvaceae (*Durio zibethinus* Murray).

The above-mentioned plants have various functions such as antimicrobial, antioxidant, anti-inflammatory, and speeding up the postpartum recovery. The parts of the plants used include roots, leaves, rhizomes, flowers, seeds, and stems (Figure 2). The most widely used parts are leaves with 25 species (53.19%), followed by entire plant with 10 species (21.28%), rhizomes with 6 species (12.77%), stems and seeds each with 2 species (4.26%), and roots and flowers each with 1 species (2.13%). Secondary metabolites are primarily found in plant leaves, making them to have the most used parts of plants (Sujarwo and Caneva 2015; Wakhidah et al. 2017; Hujjatusnaini et al. 2021).

The uses and cultural value of medicinal plants to treat postpartum ailments

The results shown in Table 2 highlight the substantial cultural value and consensus in the uses of medicinal plants, which vary significantly depending on the application. The cultural significance can be shown by comparing the CSI values (Figure 3). Plant with the highest CSI value is *F. deltoidea* (9.13), followed by *C. domestica* (8.67) and *A. conyzoides* (8.33), while species with the lowest CSI value are *C. citratus* (2.4), *C. odorata* (2.77), and *C. xanthorrhiza* (2.8).

According to cultural significance and consensus among the respondents, *F. deltoidea*, which is used as a therapeutic agent for vaginal discharge and vaginal muscle strengthening by the Dayak Bakumpai, holds the most prominent role in medicinal plant usage. The Dayak Bakumpai Tribe, a community known for its rich cultural heritage and traditional medicinal practices, has a deep-rooted connection with this plant. In comparison to more commonly known plants with antiseptic and vaginal washing properties, *D. zibethinus* holds lesser recognition. *C. domestica*, *Z. officinale*, and *M. fragrans* demonstrate substantial CSI due to their extensive use in addressing postpartum wounds and inflammation across a broad range of locations. *Ageratum conyzoides*, *M. frondosa*, and *U. gambir* are commonly utilized in postpartum care for the treatment of bleeding and infection. *L. speciosa* and *C. rotundus* are employed to treat fever, while *C. variegatum* and *P. amaryllifolius* are similarly utilized for this purpose.

Preparation and application of medicinal plants to treat postpartum ailments

The mode of preparation and application of medicinal plants used to treat postpartum ailments by Dayak Bakumpai in Central Kalimantan is presented in Table 4. It shows the varying combination of species and preparation methods to treat particular health problem. The synergistic effect of using several plant species in therapy increases its therapeutic efficacy (Ardiansyah et al. 2021; Hujjatusnaini et al. 2021; Nada et al. 2023).

Table 3. Plants used to treat postpartum ailments by the Dayak Bakumpai in Central Kalimantan

Scientific name	Family	Vernacular name	Part used/ Score	Habit	CF	TUs	CS	S	IF	CSI	Used
Leea indica	Vitaceae	Kayu Mali-mali	Root/ 4	Tree	6.4	6.4	5	7	4.8	6.13	Pain and stomach cramps
Physalis angulata	Solanaceae	Kecumeng	Leaf-Root/3	Tree	4	4	4	6	2	4.67	Wounds and
Zingiber officinale	Zingiberaceae	Tipakan	Rhizome / 5	Herb	8.6	8.6	6	8	7.2	7.20	swelling
Kaempferia galanga	Zingiberaceae	Kancur	Rhizome/ 3	Herb	4	4	3	5	2	4.00	
Imperata cylindrica	Poaceae	Hilalang	Leaf / 2	Herb	3	3	2	4	2	3.00	
Panax ginseng	Araliaceae	Ginseng	Leaf /2	Herb	3	3	3	5	2	3.67	
Citrus hystrix	Rutaceae	Limau purut	Leaf /3	Herb	4.5	4.5	4	6	3	4.83	
Anethum graveolens	Apiaceae	Adas Manis	Leaf /3	Herb	4.5	4.5	3	5	3	4.17	
Foeniculum vulgare	Apiaceae	Langkau	Rhizome / 3	Herb	4.5	4.5	4	5	3	4.50	
Curcuma heyneana	Zingiberaceae	Tamu	Rhizome / 3	Herb	4.5	4.5	3	5	3	4.17	
Curcuma domestica	Zingiberaceae	Janar	Rhizome / 5	Herb	9	9	8	9	8	8,67	
Trigonella foenum-graecum	Fabaceae	Panurek	Leaf /3	Herb	4.5	4.5	3	5	3	4.17	
Syzygium aromaticum	Myrtaceae	Cengkeh	Flower/4	Tree	5.5	5.5	6	7	3	6.17	
Pandanus amaryllifolius	Pandanaceae	Pudak	Leaf /3	Herb	4.5	4.5	4	6	3	4.83	
Achillea millefolium	Euphorbiaceae	Penawar seribu	Leaf /3	Tree	3.6	3.6	2	3	1.2	2.87	
Myristica fragrans	Myristicaceae	Pala	Seed/5	Tree	8	8	8	7	6	7.67	
Carica papaya	Caricaceae	Kastela	Leaf /3	Herb	5.5	5.5	5	6	5	5.50	
Coleus amboinicus	Lamiaceae	Jintan	Seed/3	Herb/ bush	5.5	5.5	5	6	5	5.50	
Parameria laevigata	Apocynaceae	Kayu rapat	Leaf /3	Tree/	5.5	5.5	5	6	5	5.50	
Plantago major	Plantaginaceae	Daun sendok	Leaf /3	Herb	5	5	4	5	4	4.67	
Coleus atropurpureus	Lamiaceae	Daun iler	Leaf /3	Shrub	5	5	4	5	4	4.67	
Andrographis paniculata	Acanthaceae	Penawar sampai	Leaf /3	Herb	5	5	5	6	4	5.33	
Tamarindus indica	Fabaceae	Asam jawa	Leaf /3	Tree	5	5	5	6	4	5.33	
Ageratum conyzoides	Asteraceae	Tambora	Leaf /3	Herb	8	8	8	9	10	8.33	Postpartum
Mussaenda frondosa	Rubiaceae	Kinkilaban	Leaf /3	Herb/ bush	5.8	5.8	6	7	5.6	6.27	bleeding and
Uncaria gambir	Rubiaceae	Gambir	Stem/3	Climber	4.6	4.6	4	5	3.2	4.53	infection
Sida rhombifolia	Malvaceae	Sapupuri	Root-Leaf / 3	Herb/ bush	4	4	3	4	2	3.67	
Callicarpa longifolia	Lamiaceae	Kareho	Leaf /3	Bush	4.6	4.6	3	5	3.2	4.20	
Cymbopogon citratus	Poaceae	Sarai	Stem/2	Herb	2.6	2.2	2	3	1.2	2.40	
Centella asiatica	Apiaceae	Jelukap	Leaf /3	Herb	3.6	3.6	2	3	1.2	2.87	
Curcuma longa	Zingiberaceae	Janar	Rhizome / 3	Herb	3.6	3.6	2	3	1.2	2.87	
Alpinia zerumbet	Zingiberaceae	Sulisial	Tuber/3	Herb	3.6	3.6	2	3	1.2	2.87	
Chromolaena odorata	Asteraceae	Sapupulut	Leaf /3	Bush	3.8	3.3	2	3	1.6	2.77	
Elephantopus scaber	Asteraceae	Patah kemudi	Root /4	Herb	6.2	6.2	5	6	4.4	5.73	
Piper betle	Piperaceae	Sirih	Leaf /3	Herb	5	5	4	5	4.0	4.67	
Kalanchoe pinnata	Crassulaceae	Sambelum	Leaf /3	Herb	4	4	2	3	2	3.00	Stamina
Morinda citrifolia	Rubiaceae	Mengkudu	Leaf /3	Small tree/ bush	6	6	8	7	6	7.00	recovery
Alpinia galanga	Zingiberaceae	Laus	Leaf /3	Herb	3.8	3.8	2	3	1.6	2.93	
Codiaeum variegatum	Euphorbiaceae	Tuntung Uhat	Leaf /3	Bush	4.4	4.4	3	4	2.8	3.80	
Curcuma xanthorrhiza	Zingiberaceae	Tamulawak	Rhizome / 5	Herb	5.4	5.4	1	2	0.8	2.80	
Phyllanthus niruri	Phyllanthaceae	Ambin buah	Leaf /3	Herb	4	4	2	3	2	3.00	
Moringa oleifera	Moringaceae	Kayu Laka	Root /4	Tree	4.8	4.8	2	3	1.6	3.00	Fever
Cyperus rotundus	Cyperaceae	Sampahiring	Root /4	Herb	5.6	5.6	3	5.4	2	4.20	
Lagerstroemia speciosa	Lythraceae	Muhur	Leaf /4	Tree	6.2	4.4	5	6	4.4	5.73	
Ficus deltoidea	Moraceae	Tabat Barito	Leaf/3	Bush	8.4	8.4	10	10	10.8	9.13	Vaginal discharge and vaginal muscles
Durio zibethinus	Malvaceae	Durian	Stem/4	Tree	4.6	4.6	2	2	1.2	3.53	Antiseptic and vaginal washing

Notes: CSI: Cultural Significance Index, CF: Culture Factor, TUs: Traditional Use Score, CS: Culture Significance, S: Sustainable score

Table 4 reveals the enduring tradition of using medicinal plants to treat postpartum ailments by Dayak Bakumpai. For wounds and swelling, they are used as pills, liquids, topical preparations, and hydrotherapy materials. In the case of postpartum bleeding and infection, medicinal plants are used as tablets, liquids, and topical preparations, maintaining their relevance in modern times. For stamina recovery, medicinal plants are exclusively used as hydrotherapy treatment and in liquid form. Liquid form is also utilized for treating fever, vaginal discharge, and vaginal muscles. Additionally, medicinal plants are employed as antiseptics and for vaginal washing in the form of hydrotherapy treatment, preserving their role in health and wellness.

A comparison of mode of preparation and application is presented in Figure 4. Medicinal plants to treat postpartum ailments can be utilized in a range of forms, primarily as liquids (27 species = 44.26%), solids (12 species = 19.67%), topical applications (4 species = 6.56%), and hydrotherapy treatments (18 species = 29.51%) (Figure 3; Table 4). Overall, the medicinal plants listed in Table 4 are commonly used in combination with other plants. For example, *P. angulata* can be combined with *C. domestica*, believed to be effective as a therapy for wounds and swelling. Similarly, *P. angulata* can also be paired with *P. betle* for the same therapeutic purpose. Other medicinal plants can also be combined with various other plants to treat different types of infections and are prepared in different application forms (Figure 4). However, not all medicinal plants are utilized in combination; for instance, *L. indica* is believed to be effective as a therapy for pain and stomach cramps when used on its own.

In Dayak Bakumpai tradition, herbal concoctions derived from plants are frequently employed for therapeutic purposes. These remedies take the form of infusions or liquid extracts, which can be consumed directly or used as postpartum vaginal cleansing solutions. The process of making liquids, including boiling and soaking, naturally elicits secondary metabolite compounds from medicinal herbs without causing damage (Budiastra et al. 2021; Belwal et al. 2022). The preparation of boiling and soaking techniques in therapeutic preparations by Dayak Bakumpai is consistent with various studies that show maceration methods are less destructive to plant chemicals than other methods (Kavitha et al. 2015; Agung 2017; Wurdianto et al. 2022; Bezruk et al. 2022).

The combination of *C. domestica* and *Z. officinale* in a relaxation beverage for postpartum women, which has been practiced through generations, provides anti-inflammatory effects. The combination of these plants with *C. papaya*, *C. amboinicus*, *P. laevigata*, *P. major*, *C. atropurpureus*, *A. paniculata*, and *T. indica* provide has been scientifically proven to be effective for their relaxing and anti-inflammatory properties. According to several sources, these plants all contain bioactive substances such as flavonoids, papain enzyme, carvacrol, phytochemicals, aucubin, forskolin, andrographolide, tartaric acid, and flavonoids with anti-inflammatory, analgesic, antibacterial, and antioxidant properties (Amiri et al. 2014; Xu et al. 2017; Prasertsin et al. 2021).

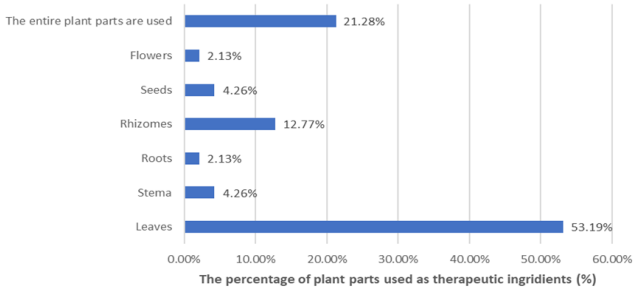

Figure 2. The composition of plant parts used treat postpartum ailments by the Dayak Bakumpai in Central Kalimantan

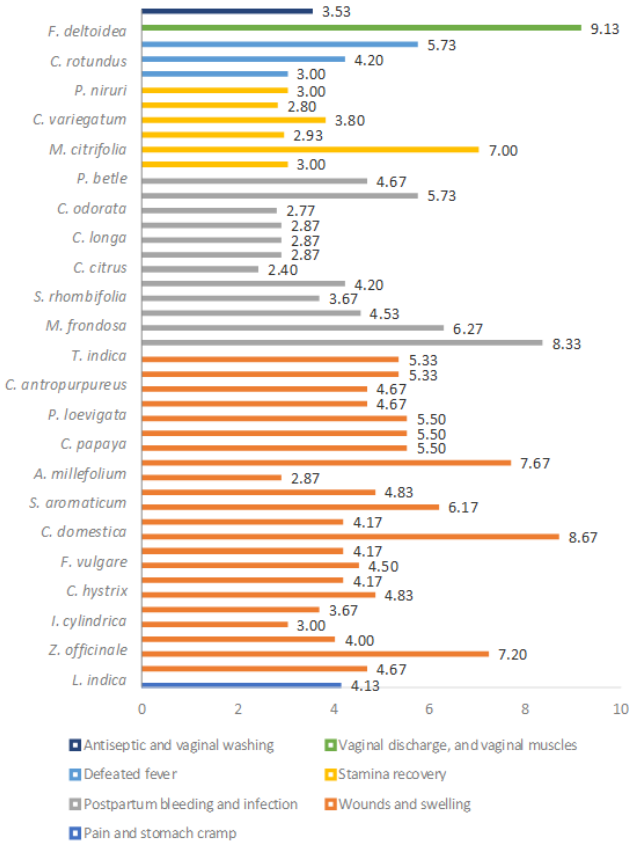

Figure 3. Comparison of CSI values of medicinal plants used treat postpartum ailments by the Dayak Bakumpai in Central Kalimantan

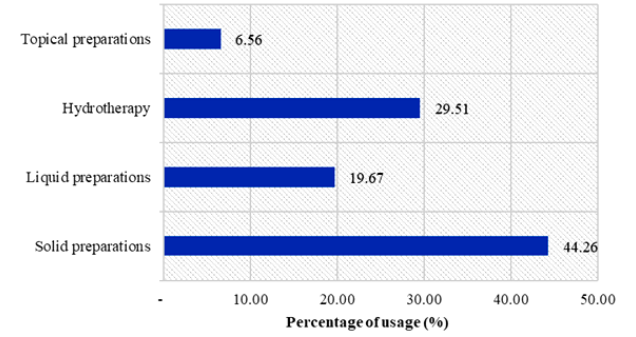

Figure 4. Comparison of mode of preparation and application of medicinal plants used to treat postpartum ailments by Dayak Bakumpai in Central Kalimantan

Table 4. The mode of preparation and application of medicinal plants used to treat postpartum ailments by Dayak Bakumpai in Central Kalimantan

Species as main ingredient	Species as additional ingredients	Ailment	Procedures for making potions	Usage and consumption instructions
Physalis angulata	*Curcuma domestica*	Wounds and swelling	The leaves are finely pulverized and combined with *C. domestica*. For every set of 10 *P. angulata* leaves, 1-2 rhizomes of *C. domestica* are added.	The concoction is produced into pills, with a daily dosage of 1-2 pills.
	Piper betle		The roots are cleaned, boiled with 1-3 *P. betle* leaves, and then filtered.	The concoction is made in liquid form, with a dosage of use once a day.
Zingiber officinale	*Myristica fragrans*		The roots are cleansed and boiled with 1-3 leaves of *P. betle*, then filtered. *Z. officinale* rhizomes are finely ground then combined with *M. fragrans* seeds and a scant amount of fine salt at a 2:1 ratio.	The concoction is prepared for external use on inflamed areas, including swollen legs that occur postpartum.
Kaempferia galanga	*Curcuma xanthorrhiza, Imperata cylindrica, Andrographis paniculata, Panax ginseng, Citrus hystrix, Anethum graveolens, Foeniculum vulgare, Curcuma heyneana, Trigonella foenum-graecum, Syzygium aromaticum, Pandanus amaryllifolius*		All the ingredients are blended and boiled.	This concoction is frequently used as a hydrotherapy material in the form of bath soaks.
Curcuma domestica	*Zingiber officinale*		Approximately 2-3 segments of rhizome are finely ground and combined with *Z. officinale*, which is then boiled.	The boiled concoction is drunk as soothing relief for relaxation.
Achillea millefolium	*Carica papaya, Coleus amboinicus, Parameria laevigata, Plantago major, Coleus atropurpureus, Andrographis paniculata, Tamarindus indica*		All components, each containing 7 grams, are combined and heated until boiling, and subsequently ingested three times daily.	The boiled concoction is drunk as soothing relief for relaxation and boasting anti-inflammatory properties.
Ageratum conyzoides	*Mussaenda frondosa, Curcuma domestica, Uncaria gambir*	Postpartum bleeding and infection	All ingredients are combined and ground in a ratio of 3:2:1:1 and consumed three times a day.	The combination can be taken in pill form as a daily herbal treatment.
Sida rhombifolia	*Callicarpa longifolia, Coleus amboinicus, Cantella asiatica, Curcuma xanthorrhiza, Curcuma longa, Zingiber officinale, Andrographis paniculata*		The root is soaked in water for seven days, then mix with additional ingredients at a proportion of 10 grams per component, and consumed three times daily.	The combination can be taken in pill form as a daily herbal treatment.
Cymbopogon citratus	*Alpinia zerumbet, Centella asiatica, Zingiber officinale, Curcuma xanthorrhiza*		Two stalks are pulverized, and the juice is filtered, combined with 10 grams of each additional ingredient, and consumed once daily.	The concoction is drunk as soothing relief for relaxation
Chromolaena odorata	*Piper betle*		The juice is extracted and taken twice daily, or applied topically.	The concoction is formulated into a topical or antiseptic elixir.
Elephantopus scaber	*Centella asiatica, Zingiber officinale, Cymbopogon citratus*		The ingredients are boiled and consumed once daily.	The concoction is drunk which has anti-inflammatory effects.
Kalanchoe pinnata	*Morinda citrifolia, Alpinia galanga, Codiaeum variegatum, Pandanus amaryllifolius*	Stamina recovery	The ingredients are boiled it and used for showers once daily.	The concoction is used as a hydrotherapy treatment.
Phyllanthus niruri	*Morinda citrifolia, Alpinia galanga,*		The leaves, in the same proportion, were boiled and consumed once daily.	The concoction is drunk as a relaxing beverage.
Moringa oleifera	*Cyperus rotundus, Lagerstroemia speciosa*	Fever	The leaves, in the same proportion, were boiled and consumed twice daily.	The concoction is drunk to deliver relaxation and boast anti-inflammatory properties.
Ficus deltoidea	*Piper betle*	Vaginal discharge, vaginal muscles	All ingredients are ground, formed into 3-5 balls and consumed once per day.	The concoction is consumed to have anti-inflammatory effects.
Durio zibethinus	*Piper betle*	Antiseptic and vaginal washing	The bark is dried and cooked by boiling, and 10 grams of *P. betle* are added. The resulting liquid is used once daily.	The concoction is used as a hydrotherapy treatment or for vaginal washing (douche)

These substances contribute to postpartum women's recovery of good health by inhibiting inflammatory mediators, curbing excessive immunological responses, promoting healing processes, and providing calming benefits to the body (Shakeri et al. 2017; Gao et al. 2018; Salah et al. 2020).

Numerous studies indicate that the combination of *C. domestica* and *Z. officinale* can provide relaxing advantages as a result of the curcumin constituents' anti-inflammatory and neuroprotective attributes. Curcumin suppresses the COX and LOX enzymes that cause inflammation, as well as neurotransmitters like serotonin and dopamine, which control mood and stress. In addition, *Z. officinale* contains gingerol and shogaol, which have anti-inflammatory and antispasmodic effects. These compounds may reduce the synthesis of inflammatory mediators while increasing the production of endorphins, providing comfort and relaxation to the body. Thus, the mixture of *C. domestica* and *Z. officinale* in a drink facilitates tension relief and give relaxation effects to postpartum women (Daily et al. 2015; Menon and Sudheer 2007; Peng et al. 2021; Sitanggang et al. 2022). Similarly, the Dayak Bakumpai Tribe's tradition of consuming a combination of plant concoctions, which has been considered beneficial through generations, contributes to a relaxing beverage with anti-inflammatory properties that can help alleviate inflammation, accelerate wound healing, and reduce swelling in postpartum women.

The CSI value of *A. conyzoides* being the highest signifies its substantial cultural value, and almost all respondents consistently report this plant's beneficial properties. The combination of *A. conyzoides*, *M. frondosa*, *C. domestica*, and *U. gambir* in certain formulations is thought to have antimicrobial and antifungal effects that could assist in postpartum bleeding and infections (Ardiansyah et al. 2021; Indah et al. 2021; Widyastuti et al. 2021). The mechanism of combining medicinal plants in formulation relies on the active compounds, including alkaloids, flavonoids, gallic acid, and curcumin, which exhibit antimicrobial and anti-inflammatory properties. These substances can limit the growth of bacteria and fungi that might cause infections during the postpartum period while also reducing inflammation (Huda et al. 2022).

Lagerstroemia speciosa, *M. oleifera*, and *C. rotundus* combined in liquid form are thought to provide therapeutic relaxing and anti-inflammatory benefits, particularly in alleviating postpartum fever, known as "Kalalah" by the Dayak Bakumpai tribe in Central Kalimantan. *Lagerstroemia speciosa* boasts anti-inflammatory and antipyretic properties due to its content of ursolic acid and oleanolic acid, which impede inflammatory intermediaries and lower body temperature. *Moringa oleifera* includes anti-inflammatory, antioxidant, and muscle-relaxant substances such as flavonoids, terpenoids, and amino acids, which assist in reducing inflammation and promote relaxation. Meanwhile, *C. rotundus* includes anti-inflammatory and analgesic components, including phenolic acid and flavonoids, which help to reduce inflammation and pain. The use of these three plants in a liquid formulation can yield significant benefits for postpartum women, including the relief of fever, the reduction of inflammation, and the promotion of relaxation within the body. The significance of this remedy to the Dayak Bakumpai Tribe is underscored by the high Cultural Significance Index (CSI) value in cultural research (Nelson et al. 2023).

The combination of *F. deltoidea* or *D. zibethinus* bark and *P. betle* is reportedly effective in providing anti-inflammatory properties in a liquid formulation, as well as serving as a hydrotherapy option for vaginal rinses. The medicinal plant *F. deltoidea* holds the greatest CSI value among its peers, as depicted in Figure 2. This is attributable to the strong intergenerational familiarity of this plant within the Dayak Bakumpai community. *F. deltoidea* includes components with anti-inflammatory effects, such as flavonoids, tannins, and phenolic acids. At the same time *D. zibenthinus* bark contains comparable compounds that can suppress inflammatory responses through several biochemical routes. *Piper betle*, with its phenolic compound eugenol and carvacrol, offers anti-inflammatory and antimicrobial benefits that contribute to the upkeep of intimate hygiene. Despite the perceived advantages of this blend, the CSI value for *D. zibethinus* as a postpartum treatment is insignificant, implying a scarcity of information regarding its utilization in postpartum therapy. A more comprehensive exploration is necessary for verification and greater insight (Darmadi et al. 2022).

Transfer of traditional knowledge of the Dayak Bakumpai tribe

The cultural influence is significant in the daily living of indigenous communities, such as the Dayak Bakumpai Tribe (Bharali et al. 2017; Navia et al. 2020). At every research location, the data obtained revealed similar trends regarding plant consumption and herbal preparation processes, which were strikingly uniform in their execution. The Dayak Bakumpai Tribe's traditional medicine practices serve as a testament to the effective passing down of traditional knowledge from one generation to the next. Almost 70% of the participants in this survey revealed that their knowledge of medicinal plants was primarily derived from their parents and grandparents (22%) or traditional elders (8%). The findings of this research are consistent with those of Lestariningsih et al. (2023), who highlighted the effectiveness of traditional knowledge transfer within the Dayak Bakumpai Tribe. Furthermore, various sources highlight the importance of parents in sharing and protecting traditional knowledge to ensure its continuity among generations (Hakim et al. 2015; Guevara et al. 2018). Similarly, the transfer of traditional knowledge from traditional elders to the younger generation has been stressed (Ahmad and Pieroni 2016). Despite the successful transfer of traditional knowledge between generations, further study is needed to verify and improve our understanding of plant usage. Parents and traditional elders play a pivotal role in safeguarding and imparting traditional knowledge, thereby preventing its loss for future generations. The conservation of traditional knowledge and the application of medicinal plants are vital elements in ensuring the health and cultural integrity of the Dayak Bakumpai tribe.

In conclusion, this research identified 47 plant species from 40 genera, and 27 families to treat postpartum ailments by Dayak Bakumpai in Central Kalimantan, with the most widely used plant parts being leaves with 25 species (53.19%), followed by entire plant parts with 10 species (21.28%) and rhizomes with 6 species (12.77%). These plants are prepared and applied in various forms, including liquid preparations (27 types), hydrotherapy preparations (18 types), solid preparations (12 types) and topical preparations (4 types). The use of medicinal plant concoctions by the Dayak Bakumpai Tribe by boiling and soaking has become a tradition. Plants with the highest Cultural Significance Index are *A. conyzoides* and *F. deltoidea*. Preserving traditional knowledge on the utilization of medicinal plants, especially to treat post-natal ailments, is a key aspect of maintaining the local wisdom and culture of the Bakumpai Dayak Tribe.

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