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DIVERSITY AND ETHNOBOTANICAL USES OF MEDICINAL ZINGIBERACEAE

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ABSTRACT

This study aims to document medicinal Zingiberaceae taxa and examine patterns of plant-part use, preparation, administration, and acquisition in Tambakromo, Pati, Central Java. A descriptive qualitative study was conducted from February to March 2025 in Karangmulyo, Keben, Sinomwidodo, and Angkatan Kidul Villages. Data were collected through structured face-to-face interviews with 13 community informants, field observations, documentation, and plant identification using botanical literature. The informants comprised 10 women and 3 men aged 41–84 years. Twelve Zingiberaceae taxa were documented. Field surveys recorded the highest number of individual plants for ginger (Zingiber officinale Roscoe) (n = 34), followed by Javanese turmeric (Curcuma zanthorrhiza Roxb.) (n = 30), turmeric (Curcuma longa L.) (n = 27), and galangal (Alpinia galanga (L.) Willd.) (n = 26). Informant citation analysis showed that turmeric had the highest Frequency of Citation (FC = 9; RFC = 0.692), followed by Javanese turmeric and aromatic ginger (FC = 7; RFC = 0.538 each). Rhizomes dominated plant-part records (87.9%), boiling was the most common preparation method (54.5%), and drinking was the predominant route of administration (72.7%). Home cultivation was the main source of acquisition (49%).

INTRODUCTION

Indonesia holds extensive plant diversity and interconnected systems of local knowledge. Communities use plants for food, health care, rituals, and environmental management. This knowledge forms a biocultural resource because people connect local names, habitats, plant parts, preparation techniques, and use purposes. Ethnobotanical research documents these relationships systematically and helps researchers identify culturally important species and research priorities. A recent systematic review of Indonesian ethnobotany confirmed substantial medicinal plant diversity but also found geographic imbalance, weak taxonomic validation, and inconsistent methodological reporting (Febriyanti et al., 2026).

The Zingiberaceae family plays a major role in tropical Asian traditional medicine. Its aromatic rhizomes are easy to cultivate, store, and obtain from home gardens or markets. Communities in Kalimantan, Sumatra, Java, and other parts of Southeast Asia use ginger, turmeric, Javanese turmeric, aromatic ginger, galangal, and related taxa for various traditional health purposes (Ege et al., 2022; Inta et al., 2023; Silalahi et al., 2021; Supiandi et al., 2024). These patterns show that Zingiberaceae functions as a medicinal material and as part of household economies and daily cuisine.

Medicinal plant knowledge faces social pressure. Access to modern pharmaceuticals, occupational change, urbanization, and reduced interaction between younger people and home gardens can restrict knowledge transmission. Research across Asian communities shows that age, experience, habitat access, and language continuity shape medicinal plant knowledge (Phumthum & Balslev, 2019; Phumthum et al., 2020; Susanti et al., 2023). Local documentation remains important because names and use practices may change quickly even when the plants continue to grow around settlements.

Studies in Indonesia and neighboring Southeast Asian communities have documented the dominance of particular plant parts, especially leaves or rhizomes, together with boiling and oral administration (Jadid et al., 2020; Julung et al., 2023; Nugroho et al., 2022; Inta et al., 2023). Quantitative ethnobotanical studies commonly employ indices such as Use Value, Fidelity Level, and Informant Consensus Factor to summarize patterns of plant use and informant agreement (Albar et al., 2025; Hussain et al., 2022). However, such indices should be interpreted cautiously because they summarize only selected dimensions of primary ethnobotanical data (Leonti, 2022).

Research focused specifically on medicinal Zingiberaceae among Javanese communities in Tambakromo and its surrounding Kendeng landscape remains limited. Tambakromo Sub-district was selected based on a preliminary survey conducted on 10 February 2025, which indicated that Zingiberaceae taxa were widely available and continued to be used in household traditional health practices. The area is located near the limestone Kendeng landscape, and medicinal plants are encountered in home gardens, agricultural areas, unmanaged sites, and areas bordering semi-natural vegetation. Residents also obtain selected medicinal rhizomes from traditional markets and herbal-material sellers.

The focus on Zingiberaceae was based on its prominent role in local daily life. Members of this family are used not only as traditional medicinal ingredients but also as spices, beverages, and household plants. Several taxa are relatively easy to cultivate vegetatively through rhizomes and are maintained in home gardens, facilitating repeated household use. Preliminary observations further indicated that knowledge concerning species, plant parts, preparation methods, and reported uses was mainly transmitted orally and had not been systematically documented. Therefore, documenting medicinal Zingiberaceae in Tambakromo provides a focused baseline for examining the relationship between plant availability, household use, and continuity of local ethnobotanical knowledge.

This study provides a taxonomically focused documentation of medicinal Zingiberaceae and examines their diversity, plant parts used, preparation methods, administration routes, and acquisition pathways. It aimed to identify the medicinal Zingiberaceae used by Tambakromo communities and analyze their utilization patterns according to plant part, preparation method, administration route, and source of acquisition.

MATERIALS AND METHODS

Study area and period

This research was conducted from February to March 2025 in Tambakromo Sub-district, Pati District, Central Java. The study covered four stations located in Karangmulyo, Keben, Sinomwidodo, and Angkatan Kidul Villages. The four stations were purposively selected based on the presence of Zingiberaceae, preliminary survey information, field accessibility, and representation of local conditions. Tambakromo covers approximately 7,247 ha and is situated near the limestone Kendeng landscape. A preliminary survey conducted on 10 February 2025 indicated the continued presence and household use of medicinal Zingiberaceae in the area, which supported the selection of Tambakromo as the study location.

Design, data sources, and instruments

This study used a descriptive qualitative research design. Primary data covered informant characteristics, local and scientific plant names, plant parts used, reported health purposes, preparation techniques, administration routes, acquisition sources, household dosage measures, harvesting information, and local names. Secondary data consisted of botanical, pharmacological, ethnobotanical, and regional literature. Data were collected using an interview guide and an observation sheet.

The study involved 13 community informants with experience using Zingiberaceae in daily life. They comprised 10 women and 3 men aged 41 to 84 years and came from Sinomwidodo (4), Keben (4), Karangmulyo (3), and Angkatan Kidul (2). Participants were not formally categorized according to specific ethnobotanical roles, such as traditional healers, customary elders, or recognized key knowledge holders. Accordingly, they were characterized as experienced community members possessing practical knowledge of plant use, rather than as specialist traditional practitioners. Qualitative methods support interpretation of experience, practice, and meaning in a local context (Busetto et al., 2020).

Data collection and identification

Interviews were conducted face-to-face using a standardized interview guide comprising 11 predefined, primarily open-ended questions administered consistently across participants. The questions covered experience with Zingiberaceae use, perceived economic potential, taxa used, plant parts utilized, reported health benefits and treated complaints, acquisition sources, preparation methods, household dosage measures, harvesting time, and local plant names. This research also conducted direct observations of home gardens, agricultural land, plant-growing sites, and plant materials available within the community. Plant identification was conducted through field observation and comparison with relevant botanical literature, while species classification was determined using supporting secondary sources.

Data analysis

This research involved reducing field notes, grouping responses by taxon and use category, and presenting the findings in tables, a graph, and narrative form. Informant profiles were summarized through frequencies, percentages, age range, and mean age. Field abundance was summarized as the number of individual plants observed for each taxon during the field survey, and these counts were analyzed separately from informant-based citation measures. Plant-part percentages were calculated from 58 records, whereas preparation and administration percentages were each based on 55 records. Because a single informant could contribute more than one record, these categories were treated as non-mutually exclusive.

To complement the qualitative analysis, we calculated informant-based citation measures from taxa explicitly reported by each participant in response to the species-use question. We defined Frequency of Citation (FC) as the number of informants who reported using a given taxon. In contrast, Relative Frequency of Citation (RFC) was calculated as FC/N, where N was the total number of informants (N = 13) (Leonti, 2022). Only taxa explicitly reported by individual informants were included in these calculations. Use Value (UV), Fidelity Level (FL), and Informant Consensus Factor (ICF) were not calculated because the interview records did not consistently provide complete taxon-specific use reports or explicit associations between individual taxa and each reported health complaint.

We conducted an exploratory age-group comparison descriptively by dividing informants by the sample median age into a younger subgroup (≤54 years; n = 7) and an older subgroup (≥55 years; n = 6). We then compared the mean number of taxa cited per informant between the two groups. No inferential statistical test was applied because of the small sample size and the exploratory nature of the comparison. Local patterns were interpreted in relation to recent ethnobotanical and pharmacological studies. As the study did not assess clinical efficacy, all medicinal uses were treated as community-reported practices rather than evidence of therapeutic effectiveness.

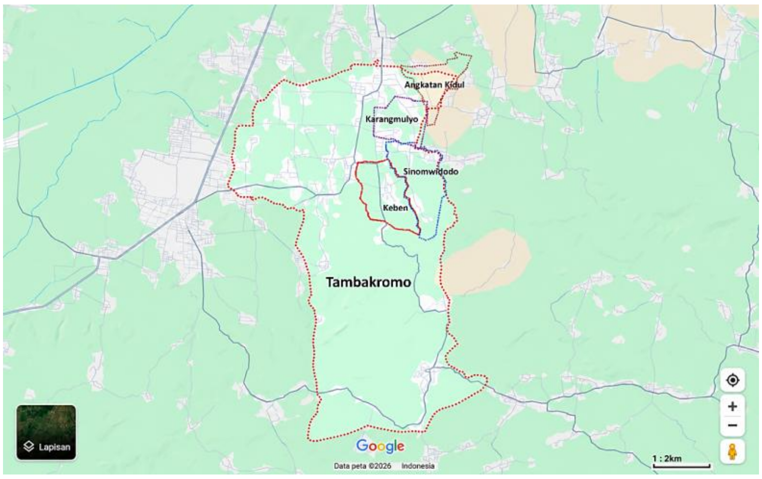

Figure 1. Study locations in Tambakromo Sub-district, Pati District

RESULTS AND DISCUSSION

Informant characteristics

All 13 informants reported experience in using Zingiberaceae in daily life. The informants comprised 10 women (76.9%) and 3 men (23.1%), aged 41 to 84 years, with a mean age of 55.5 years. They represented four villages and seven occupational groups. Most informants were women engaged in household or agricultural activities, reflecting the predominance of these groups within the study sample (Table 1).

Table 1. Characteristics of the study informants

Variable	Category	n	Percentage (%)
Sex	Women	10	76.9
	Men	3	23.1
Age	≤ 54 years	7	53.8
	≥ 55 years	6	46.2
	Overall range: 41-84 years; mean: 55.5 years	13	100
Village	Sinomwidodo	4	30.8
	Keben	4	30.8
	Karangmulyo	3	23.1
	Angkatan Kidul	2	15.4
Occupation	Farmer	4	30.8
	Homemaker	3	23.1
	Daily laborer	2	15.4
	Farmer and homemaker	1	7.7
	Livestock farmer	1	7.7
	Teacher	1	7.7
	Trader	1	7.7

An exploratory age-group comparison showed that informants aged ≥55 years cited a mean of 4.83 Zingiberaceae taxa per person, compared with 4.00 taxa per person among informants aged ≤54 years. Thus, the older subgroup reported a slightly greater number of taxa on average. However, this difference should be interpreted descriptively because of the small sample size, the unequal representation of informants across villages and occupations, and the fact that the study was not specifically designed to test intergenerational differences in ethnobotanical knowledge.

Plant diversity and reported uses

The study recorded 12 Zingiberaceae taxa used in traditional health practices. These taxa represented five genera: Zingiber, Curcuma, Alpinia, Boesenbergia, and Kaempferia. Curcuma and Zingiber contributed the most taxa. Every taxon served multiple functions as a health ingredient, spice, beverage, or fitness preparation. Table 2 summarizes local names, normalized scientific names, plant parts, and community-reported uses.

Table 2. Zingiberaceae taxa, plant parts, and uses reported by the community

No	Local name	Scientific name	Part	Reported use
1	Ginger	*Zingiber officinale* Roscoe	Rhizome	Common cold symptoms, cough, and runny nose
2	Javanese turmeric	*Curcuma zanthorrhiza* Roxb.	Rhizome	Gastric complaints, appetite support, hypertension, hepatitis symptoms, and immune maintenance
3	Turmeric	*Curcuma longa* L. (syn. *Curcuma domestica* Valeton)	Rhizome	Menstrual pain, diarrhea, traditional antibiotic use, and immune maintenance
4	Galangal	*Alpinia galanga* (L.) Willd.	Rhizome	Cholesterol-related complaints, sore throat, traditional antiseptic use, and pain
5	Fingerroot	*Boesenbergia rotunda* (L.) Mansf. (syn. *Boesenbergia pandurata* (Roxb.) Schltr.)	Rhizome	Breast-milk support, general health preparations, and spice use
6	Aromatic ginger	*Kaempferia galanga* L.	Rhizome	Appetite support, cough, cold, and stomachache
7	Purple ginger	*Zingiber purpureum* Roscoe	Rhizome, leaf, stem	Breast-milk support, traditional antibiotic use, and malaria
8	Red ginger	*Zingiber officinale* var. *rubrum* Theilade (syn. of *Zingiber officinale* Roscoe)	Rhizome	Common cold symptoms, cholesterol-related complaints, rheumatism, and hypertension

No	Local name	Scientific name	Part	Reported use
9	Bitter ginger	*Zingiber zerumbet* subsp. *zerumbet* (syn. *Zingiber aromaticum* Valeton)	Rhizome, leaf, stem	Rheumatism and sore throat
10	Black turmeric	*Curcuma aeruginosa* Roxb.	Rhizome	Asthma
11	Temu giring	*Curcuma heyneana* Valeton & Zijp	Rhizome	Fitness preparations, skin care, and traditional slimming remedies
12	White turmeric	*Curcuma zedoaria* (Christm.) Roscoe	Rhizome	Sore throat, gastric complaints, rheumatism, and cooling preparations

The field survey recorded 34 individual ginger plants, followed by 30 individual Javanese turmeric plants, 27 turmeric plants, 26 galangal plants, 24 fingerroot plants, 22 aromatic ginger plants, 22 purple ginger plants, and 21 red ginger plants. Bitter ginger, black turmeric, temu giring, and white turmeric were represented by 11, 10, 9, and 5 individual plants, respectively. These counts represent individual plants observed during the field survey and do not represent informant citation frequencies, Use Values, or treatment success rates.

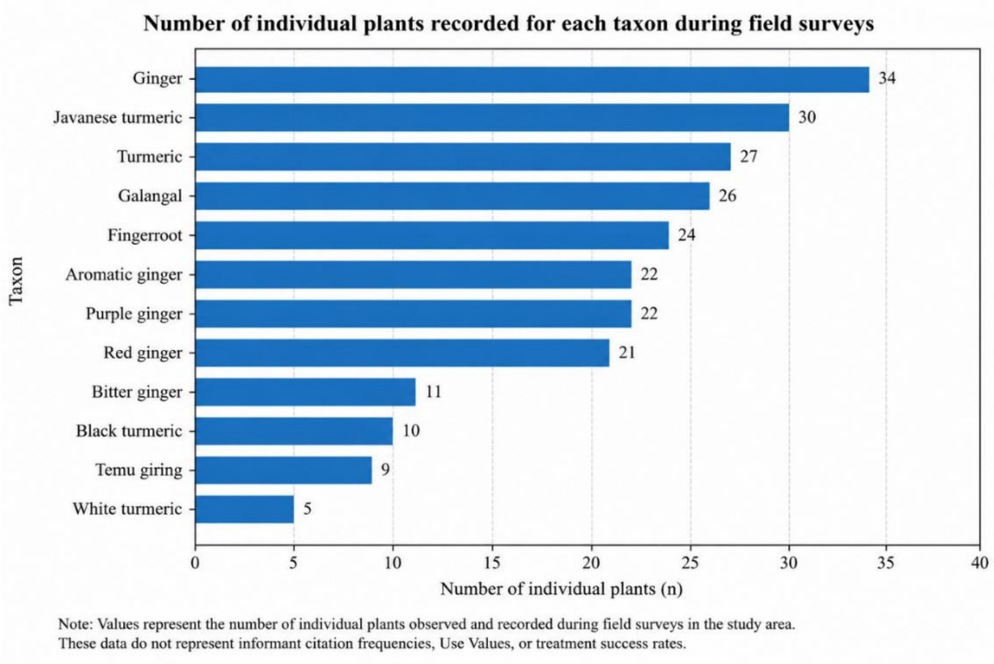

Figure 2. Number of individual medicinal Zingiberaceae plants recorded during field surveys.

Table 4. Number of Students with Misconceptions per Item Number

Item No.	Indicator/Topic	No. of Misconceptions	% of Total
1	Basic Concept – Definition of Global Warming	4	28.6%
2	Basic Concept – Greenhouse Effect	3	21.4%
3	Basic Concept – Global Warming vs Climate Change	4	28.6%
4	Basic Concept – History of Global Warming	4	28.6%
5	Causes of GHG – Carbon Cycle	2	14.3%
6	Causes of GHG – Agricultural Contribution	6	42.9%
7	Causes of GHG – Deforestation	5	35.7%
8	Causes of GHG – Electricity Use	2	14.3%
9	Impact – Polar Ice Melting	3	21.4%
10	Impact – Clean Water Availability	3	21.4%
11	Impact – Coral Reefs	5	35.7%
12	Impact – Animal Adaptation	2	14.3%
13	Scientific Evidence – Weather vs Climate	4	28.6%
14	Scientific Evidence – Scientific Consensus	4	28.6%
15	Scientific Evidence – Impact in Indonesia	1	7.1%
16	Mitigation & Adaptation – Definition of Mitigation	2	14.3%
17	Mitigation & Adaptation – Definition of Adaptation	5	35.7%
18	Mitigation & Adaptation – Renewable Energy	2	14.3%
19	Human Activity – Causal Attribution	3	21.4%
20	Human Activity – Individual Action	2	14.3%

Informant-based citation frequency

Informant-based citation patterns differed from field abundance. Turmeric had the highest citation frequency, being reported by 9 of the 13 informants (FC = 9; RFC = 0.692). Javanese turmeric and aromatic ginger were each reported by seven informants (FC = 7; RFC = 0.538), followed by ginger with six citations (FC = 6; RFC = 0.462). Galangal and red ginger were each cited by five informants (RFC = 0.385). Fingerroot, purple ginger, and temu giring were each cited by four informants (RFC = 0.308), while bitter ginger, black turmeric, and white turmeric showed lower citation frequencies.

Table 3. Frequency of Citation (FC) and Relative Frequency of Citation (RFC) of medicinal Zingiberaceae reported by informants

No	Taxon	FC	RFC
1	Turmeric	9	0.692
2	Javanese turmeric	7	0.538
3	Aromatic ginger	7	0.538
4	Ginger	6	0.462
5	Galangal	5	0.385
6	Red ginger	5	0.385
7	Fingerroot	4	0.308
8	Purple ginger	4	0.308
9	Temu giring	4	0.308
10	Bitter ginger	3	0.231
11	Black turmeric	2	0.154
12	White turmeric	1	0.077

FC = number of informants citing a taxon; RFC = FC/13.

Patterns of plant part, preparation, administration, and acquisition

Rhizomes dominated 51 of 58 plant-part records or 87.9%, followed by leaves with 4 records or 6.9% and stems with 3 records or 5.2%. Boiling dominated 30 of 55 preparation records (54.5%). Other methods included pounding followed by boiling (16.4%), drying (12.7%), cutting (9.1%), and grating (7.3%). Drinking accounted for 40 of 55 administration records (72.7%), followed by eating (10.9%), applying as a paste (9.1%), and rubbing (7.3%). The acquisition summary showed home cultivation at 49%, traditional markets at 21%, herbal-material sellers at 12%, wild growth at 11%, and ornamental-plant sellers at 7%.

Table 4. Plant-part, preparation, and administration patterns

Aspect	Category	Percentage (%)
Preparation	Boiled (n=30)	54.5
	Pounded then boiled (n=9)	16.4
	Dried (n=7)	12.7
	Cut (n=5)	9.1
	Grated (n=4)	7.3
Administration	Drunk (n=40)	72.7
	Eaten (n=6)	10.9
	Applied as a paste (n=5)	9.1
	Rubbed (n=4)	7.3
Plant part	Rhizome (n=51)	87.9
	Leaf (n=4)	6.9
	Stem (n=3)	5.2

Ethnobotanical meaning and pharmacological relevance

The relatively high numbers of ginger, Javanese turmeric, turmeric, and galangal individuals recorded during field surveys indicate their local availability within the surveyed sites. However, field abundance did not fully correspond to informant citation patterns. Ginger had the highest number of individuals recorded in the field (n = 34), whereas turmeric had the highest informant citation frequency (FC = 9; RFC = 0.692). This distinction indicates that local availability and ethnobotanical citation prominence represent related but different dimensions of plant–community relationships. Studies among Dayak communities and medicinal plant traders also identify Zingiberaceae as an important group because households can process and trade its rhizomes in many formulas (Silalahi et al., 2021; Supiandi et al., 2021, 2023, 2024). Studies across Indonesian communities report a similar relationship between local availability, frequency of use, and continuity of practice (Az-Zahra et al., 2021; Rambey et al., 2024; Supiandi et al., 2019).

Rhizomes store starch, essential oils, phenolics, and other secondary metabolites that support aroma, taste, storage, and hot-water extraction. Reviews describe gingerols and shogaols in ginger, curcuminoids and xanthorrhizol in Javanese turmeric, and diverse active compounds in aromatic and bitter ginger (Ayustaningwarno et al., 2024; Chan et al., 2024; Kumar, 2020; Mao et al., 2019; Rahmat et al., 2021; Wang et al., 2021; Zhang et al., 2022). Pharmacological findings provide a biological basis for further research but do not establish the clinical efficacy of household remedies.

Boiling produces a practical aqueous extract and matches the common practice of preparing warm drinks. Studies in Langgudu, Tengger, and several Asian communities also report frequent boiling and oral administration (Albar et al., 2025; Jadid et al., 2020; Numpulsuksant et al., 2021; Xiong et al., 2020). However, temperature, heating time, particle size, dose, and storage can alter chemical composition. Pharmacological research should examine these variables before researchers or health practitioners formulate dosage recommendations.

Cross-study comparison and documentation quality

Taxonomic normalization improves documentation accuracy and prevents one species from appearing under several names. This article uses *Curcuma longa* L (syn. *Curcuma domestica* Valeton) for turmeric recorded as *Curcuma domestica* in the source document, *Boesenbergia rotunda* for fingerroot recorded as *Boesenbergia pandurata*, and *Zingiber zerumbet* subsp. *zerumbet* (syn. *Zingiber aromaticum* Valeton) for bitter ginger recorded as *Zingiber aromaticum*. Plants of the World Online treats the older names as synonyms or non-accepted names (Royal Botanic Gardens, Kew, 2026). These adjustments do not change local names or reported uses. They clarify botanical identity so readers can consistently trace pharmacological, conservation, and distribution literature.

Comparison with recent studies shows stable patterns and local variation. Langgudu communities also prioritize boiling and drinking, while Pancur Batu traders treat Zingiberaceae rhizomes as major medicinal commodities (Albar et al., 2025; Silalahi et al., 2021). Research in Mae Hong Son recorded 33 Zingiberaceae species and applied Use Report, Cultural Importance, Fidelity Level, and Informant Agreement Ratio to assess their importance (Inta et al., 2023). Dayak Tamambaloh communities use broader combinations of taxa and indications because their environment, cultural history, and knowledge networks differ (Supiandi et al., 2024). Similar techniques do not imply identical formulas, doses, or meanings.

Ethnobotanical documentation also requires careful risk communication. Community reports include hypertension, hepatitis, asthma, malaria, and other conditions that require professional diagnosis and monitoring. This article does not convert those reports into treatment recommendations. Researchers and practitioners should explain evidence limits, possible drug interactions, dose variation, special conditions such as pregnancy, and the risk of misidentification. Pharmacological literature can support biological plausibility, but clinical and toxicological research must determine safe human use. A clear distinction between traditional knowledge and clinical evidence strengthens responsible ethnobotanical publication.

Table 5. Comparison of major patterns with recent ethnobotanical studies

Study	Location and focus	Comparable pattern	Implication
Albar et al. (2025)	Langgudu, multiple families	Boiled 52%; drunk 76%	Similar preparation and administration patterns; quantitative indices provide additional measures of ethnobotanical importance.

Study	Location and focus	Comparable pattern	Implication
Silalahi et al. (2021)	Pancur Batu market, Zingiberaceae rhizomes	Rhizomes form the main material	Traditional markets support access to and circulation of medicinal Zingiberaceae rhizomes.
Supiandi et al. (2024)	Dayak Tamambaloh, Zingiberaceae	Diverse taxa and indications	Differences in experience and knowledge acquisition contribute to variation in plant use.
Pratami et al. (2024)	Leuwiliang, medicinal plants	Local access and home gardens matter	Home-garden cultivation supports medicinal plant conservation.
This study	Tambakromo, 12 taxa and 13 informants	Rhizome 87.9%; boiled 54.5%; drunk 72.7%; FC and RFC calculated from informant citations	Field abundance and informant citation provide complementary measures of local availability and ethnobotanical prominence.

Access and conservation implications

Home cultivation, which contributed almost half of the acquisition sources, confirms home gardens as sites of production, conservation, and knowledge transmission. Home gardens provide fresh materials and help families maintain taxa they consider important. Traditional markets supplement taxa that residents find more difficult to cultivate, such as red ginger, black turmeric, and white turmeric. Studies of markets, home gardens, and rural communities show that households and local cultivation systems help maintain medicinal plant resources and associated knowledge (Dapar et al., 2020; Inta et al., 2023; Pratami et al., 2024).

Documentation of local and scientific names, plant parts, preparation methods, and acquisition sources provides baseline information for conserving medicinal plant diversity and associated knowledge in Tambakromo. Home gardens are particularly important because they maintain frequently used taxa near households and facilitate the intergenerational transmission of cultivation and utilization practices. Conservation initiatives should therefore address both plant resources and the cultural knowledge associated with medicinal Zingiberaceae.

Study limitations

This study has several limitations. The sample included only 13 informants and was unevenly distributed across four villages; therefore, the findings do not capture the full variation of medicinal plant knowledge in Tambakromo. Participants represented experienced community users rather than formally identified traditional healers or key knowledge holders, and structured interviews limited deeper narrative exploration. Although FC and RFC could be calculated from explicitly reported taxa, the available interview records did not consistently link each taxon with each specific use report or health complaint, preventing reliable calculation of UV, FL, and ICF. The small and uneven sample also limited the exploratory age-group comparison and should therefore be interpreted descriptively. Future studies should recruit larger, more diverse samples; include recognized local knowledge holders where appropriate; use semi-structured interviews; and prospectively document taxon-specific use reports to enable more comprehensive quantitative ethnobotanical analyses (Dapar et al., 2020; Febriyanti et al., 2026; Inta et al., 2023; Leonti, 2022).

CONCLUSION

Field surveys recorded the highest number of individual plants for ginger (*Zingiber officinale*) (n = 34), whereas informant-based citation analysis identified turmeric (*Curcuma longa*) as the most frequently cited taxon (FC = 9; RFC = 0.692). Javanese turmeric and aromatic ginger followed with FC = 7 and RFC = 0.538 each. Rhizomes were the dominant plant part used, boiling was the most common preparation method, drinking was the principal route of administration, and home cultivation was the main acquisition source. An exploratory age-group comparison showed a slightly higher mean number of taxa cited by older informants, although this pattern should be interpreted descriptively because of the small sample size. Overall, field availability and informant citation represented complementary dimensions of local ethnobotanical patterns and provided baseline information for conserving medicinal plant diversity and associated community knowledge. Future studies should involve larger, more diverse informant samples; include recognized local knowledge holders where relevant; collect detailed taxon-specific use reports; and evaluate the safety and biological activity of reported remedies.

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