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Ethnobotany of gout remedies among the Madurese People in Pamekasan District, East Java, Indonesia

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Abstract. *Andriansyah, Fathir A, Antika LT. 2026. Ethnobotany of gout remedies among the* Madurese *People in Pamekasan District, East Java, Indonesia. Asian J Ethnobiol 9: y090101. https://doi.org/10.13057/asianjethnobiol/y090101.* Traditional herbal medicine represents an important component of Madurese Cultural Heritage and continues to be widely used for managing chronic conditions such as gout. However, ethnobotanical studies that specifically document gout-related herbal practices within the Madurese Cultural context remain limited. This study aimed to document medicinal plant species used for gout treatment among the Madurese Community in Pamekasan District, East Java, Indonesia, including plant parts, preparation methods, and the cultural rationale underlying their selection. Fieldwork was conducted from October to November 2024 using purposive sampling and semi-structured interviews with 30 informants across 17 villages. The study documented 27 medicinal plant species belonging to 13 families, incorporated into 30 traditional herbal formulations. The Zingiberaceae family was the most dominant, comprising 10 species, with *Curcuma longa* and *Zingiber officinale* showing the highest cultural prominence (RFC = 0.70 and 0.57, respectively). Rhizomes were the most frequently utilized plant parts, while decoction was the primary preparation method (60%), reflecting both practical efficiency and cultural preference. The predominance of rhizome-based remedies is culturally linked to the Madurese perception of “warming” plants that restore bodily balance and alleviate joint discomfort associated with gout. Although therapeutic efficacy is interpreted empirically rather than biochemically, these practices align with the known anti-inflammatory and uric acid-related potential of rhizomatous plants reported in previous studies. This research addresses a key gap in Indonesian ethnobotanical literature by providing the first systematic documentation of gout-specific herbal practices among the Madurese Community, integrating quantitative ethnobotanical indices with cultural interpretation. The findings emphasize traditional medicine as a biocultural system that connects health practices, ecological availability, and cultural identity, while offering a foundation for future pharmacological validation, biodiversity conservation, and culturally responsive health strategies.

Keywords: Ethnobotany, gout, Madurese Culture, traditional herbal medicine

INTRODUCTION

Traditional herbal medicine, locally known as *jamu*, remains an important part of Indonesian cultural heritage and local wisdom. For centuries, *jamu* has been widely used to treat various ailments and is valued for its effectiveness and perceived safety with minimal side effects (Sumarni et al. 2019; Estiasih et al. 2025). Despite the increasing availability of modern pharmaceutical products, *jamu* continues to play a significant role in community health, particularly in rural areas where traditional practices are strongly maintained. Its persistence reflects not only health-related needs but also the preservation of biodiversity and traditional ecological knowledge, as herbal preparations are closely linked to local plant resources. Documenting plant use, preparation methods, and therapeutic applications is therefore essential to understanding how indigenous knowledge supports sustainable health practices and biodiversity conservation (Jadid et al. 2020; Husain et al. 2021).

In recent decades, the use of *jamu* has declined in some regions due to lifestyle changes and the dominance of modern medicine (Kulkova et al. 2023). Nevertheless, traditional knowledge continues to be transmitted through oral traditions, family practices, and local healers. Ethnobotanical research plays a crucial role in bridging traditional knowledge with scientific inquiry by documenting medicinal plant use and providing evidence for their therapeutic potential. Many plants used in *jamu* contain bioactive compounds such as flavonoids, alkaloids, and phenolics that contribute to anti-inflammatory, analgesic, and antioxidant effects. This is particularly relevant for chronic diseases such as gout, where conventional treatments may be costly or associated with side effects, making traditional remedies culturally acceptable alternatives (Fathir et al. 2021).

Gout, or gouty arthritis, is a metabolic disorder caused by the accumulation of monosodium urate crystals in joints and tissues. The condition is commonly linked to the consumption of purine-rich foods, including red meat, offal, poultry, seafood, and processed foods, which increase serum uric acid levels (Li et al. 2018; Wu et al. 2022; Zhang et al. 2022; GBD 2021 Other Musculoskeletal Disorders Collaborators 2023). Prolonged hyperuricemia can lead to recurrent gout attacks, kidney dysfunction, muscle pain, and reduced mobility (Galozzi et al. 2021; Zheng et al. 2023). Clinically, gout is characterized by sudden inflammation, swelling, redness, and tenderness, most often affecting the big toe, ankle, knee, hand, or wrist (Lee et al. 2022; Gu et al. 2023). Although pharmaceutical treatments such as allopurinol and non-steroidal anti-inflammatory drugs are effective, their long-term use may cause side effects, highlighting the need for alternative approaches based on traditional knowledge (Sekine et al. 2023).

Ethnobotanical studies in various regions have documented medicinal plants used for inflammatory and arthritic conditions. Research in Mowila, Indonesia, reported local remedies for gout (Fitriana et al. 2022), while studies in Morocco identified plants used as analgesics and anti-inflammatory agents (Amrati et al. 2021; Lefrioui et al. 2024). Similar findings were reported from north-western Nigeria, where medicinal plants are traditionally used to manage arthritis (Salihu et al. 2018). These studies demonstrate the global relevance of ethnobotanical knowledge in addressing chronic inflammatory diseases. However, research focusing specifically on traditional gout treatments in Indonesia remains limited, particularly in regions with strong herbal traditions such as Madura.

In Madurese society, gout is perceived not only as a metabolic disorder but also as a condition closely related to lifestyle, diet, and aging. Although epidemiological data are limited, gout is commonly associated with frequent consumption of purine-rich foods such as red meat, offal, seafood, salted fish, and preserved dishes served during social and religious events. Culturally, gout is often interpreted as a result of bodily imbalance or excessive consumption rather than purely biomedical dysfunction. Symptoms are commonly explained through local health concepts such as *panas dalam*, impaired circulation, or the accumulation of harmful substances, reinforcing reliance on traditional herbal remedies believed to restore balance and reduce inflammation.

Traditional healing practices in Madura are supported by a culturally embedded system involving traditional healers, herbal drink vendors, and intergenerational knowledge transmission within families. Women often play a central role in maintaining household health and preparing herbal remedies using locally available plants from home gardens or traditional markets. Despite the strong continuity of these practices, ethnobotanical research systematically documenting medicinal plants, preparation methods, and cultural interpretations related to gout treatment among the Madurese Community remains scarce.

Therefore, this study was conducted in Pamekasan Regency, East Java, Indonesia, where traditional herbal knowledge is actively practiced and transmitted. The objectives of this research are to identify medicinal plant species used for gout treatment, document the plant parts utilized and their preparation methods, and explore cultural reasons underlying preferences for specific plant organs. By achieving these objectives, this study contributes to the preservation of ethnobotanical knowledge and supports biodiversity conservation.

MATERIALS AND METHODS

Study area

This research was conducted using a purposive sampling method in 17 villages within Pamekasan District, East Java, Indonesia, namely Nyalabu Laok, Murtajih, Kowel, Akkor, Rombuh, Klampar, Jambringin, Jarin, Waru Barat, Bandungan, Ban-Ban, Palengaan Laok, Panglegur, Barurambat Kota, Pangtonggal, Bugih, and Plakpak (Figure 1).

Sampling and informant selection

This study employed a descriptive qualitative approach using an ethnobotanical method. Informants were selected through purposive sampling, targeting individuals considered to possess in-depth knowledge and direct experience related to the use of medicinal plants for the treatment of gout. The inclusion criteria for informants were as follows: (i) residency in Pamekasan District; (ii) age ≥ 30 years; (iii) recognized as traditional herbal sellers, herbal formulators, community leaders, or individuals who actively use and understand traditional remedies; and (iv) willingness to provide information voluntarily.

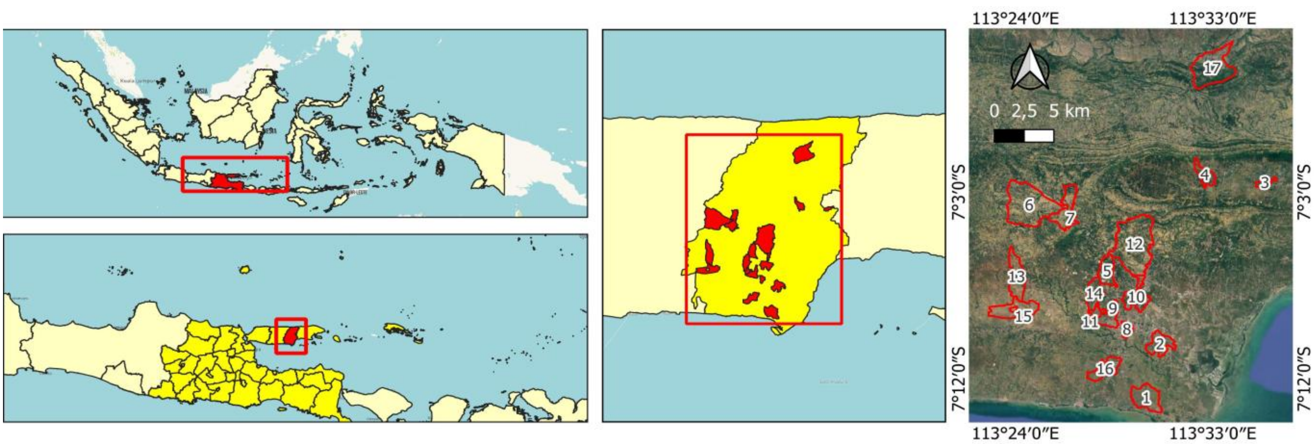

Figure 1. Map of the research location in Pamekasan District, East Java, Indonesia. 1. Jarin, 2. Murtajih, 3. Banban, 4. Bandungan, 5. Akkor, 6. Palengaan Laok, 7. Rombuh, 8. Barurambat Kota, 9. Bugih, 10. Kowel, 11. Nyalabu Laok, 12. Plakpak, 13. Jambringin, 14. Klampar, 15. Pangtonggal, 16. Panglegur, 17. Waru Barat

Key informants were intentionally identified based on their reputation and social recognition within the community as knowledgeable sources of traditional herbal medicine. In several locations, additional informants were identified through recommendations from initial informants using a snowball sampling technique to reach other individuals with similar knowledge who were not easily accessible through direct contact. This approach enabled the researcher to obtain culturally rich and relevant data. A total of 30 informants from 17 villages in Pamekasan District participated in this study. The sample size was determined based on the principle of data saturation, defined as the point at which additional interviews no longer yielded substantial new information. In this study, data saturation was reached at the 28th interview; therefore, 30 informants were considered sufficient to represent local knowledge regarding gout treatment.

Ethical considerations

This study received official ethical approval from the Faculty of Teacher Training and Education, Universitas Islam Madura, East Java, Indonesia (Ethical Approval No.: 100/A.6/FKIP.UIM/XI/2025), confirming that the ethnobotanical research was ethically appropriate to be conducted. Approval was granted following an administrative and substantive review of the study, including its objectives, data collection methods, and measures to protect the rights and interests of informants. Prior to the interviews, each informant was provided with a clear and comprehensive explanation of the study objectives, the type of data to be collected, and the intended use of the information for academic purposes and scientific publication. Participation consent was obtained in the form of verbal informed consent, and all informants participated voluntarily without any coercion. Informants were also informed of their right to refuse or withdraw from the study at any time without any consequences. Confidentiality and anonymity were ensured by omitting names, addresses, and any other personal identifiers from all research documents and publications. The data collected were used solely for scientific purposes. All research procedures were conducted in accordance with the ethical guidelines of the International Society of Ethnobiology (ISE 2006).

As a form of benefit sharing, the research findings were disseminated in a limited and community-oriented manner through educational activities. The results were communicated through discussions and educational sessions with members of local women's community groups (PKK) in the study area, representing the local community. This dissemination was conducted as part of efforts to share research-based knowledge, enhance community understanding of medicinal plant use, and support the sustainable preservation of local knowledge.

Data collection

Data were collected between October and November 2024 through semi-structured interviews using an interview guide covering respondent identity, local plant names, plant parts used, preparation methods, modes of administration, and cultural beliefs or reasons underlying the selection of medicinal ingredients. The semi-structured approach was chosen to provide flexibility for informants to freely convey their narratives and experiences. Interviews were conducted face-to-face by the researcher with the assistance of two local interpreters fluent in Madurese and Indonesian. The presence of interpreters aimed to minimize misinterpretation, particularly regarding local plant names and cultural terminology. All interviews were audio-recorded using a mobile phone with the informants' consent. Plant identification was initially based on local names and morphological information provided by the informants. However, during the study, many herbal sellers used medicinal materials that had already been processed into dried spices or powdered forms, making direct morphological observation impossible. Therefore, plant identification relied primarily on informants' descriptions of the original plant sources. Voucher specimens were not collected due to resource limitations and ethical considerations. Species identification was subsequently verified using botanical literature and official taxonomic databases, namely Plants of the World Online (POWO) and World Flora Online. Scientific names were standardized according to the official nomenclature of POWO (2024).

Data analysis

Quantitative analysis was conducted to identify medicinal plant species and patterns of use through the calculation of the Use Value (UV). The Use Value (UV) was calculated as the total number of use reports for each species provided by all informants, divided by the total number of informants interviewed. UV serves as an indicator of the cultural importance of a species, with higher values reflecting species that are more frequently cited or recognized within the community (Phillips et al. 1994). In this study, the term "use" refers to reported or cited uses obtained from semi-structured interviews, representing informants' ethnobotanical knowledge and recollection rather than directly observed practical applications. Accordingly, the UV values reflect the frequency of documented ethnobotanical knowledge rather than actual usage behavior. The UV was calculated using the following formula (Phillips et al. 1994):

$$UV = \frac{\sum Ui}{N}.$$

Where Ui represents the number of use reports cited for a particular species by each informant, and N is the total number of informants. The resulting UV values were used to identify and rank medicinal plant species with the highest cultural significance for gout treatment. This index reflects the relative prominence of each species in local ethnomedicinal knowledge and forms the basis for the results presented in Table 2. In addition to UV, the Relative Frequency of Citation (RFC) was calculated to assess the level of recognition and frequency with which each plant species was mentioned by informants. The RFC index was calculated by dividing the number of informants who cited a particular species (Frequency of Citation, FC) by the total number of informants (N), following the method proposed by Bano et al. (2014):

RFC = FC / N

The RFC value indicates how frequently a species is cited by informants, reflecting its level of recognition, popularity, and cultural relevance within the community. RFC values range from 0 to 1, where higher values denote species that are more widely known and frequently used. For interpretative purposes, RFC values were classified into three categories: values approaching 1 indicate species that are frequently cited and widely recognized by the community (high category); values between 0.3 and 0.6 represent species that are moderately known and used (medium category); and values below 0.3 indicate species that are less recognized or rarely utilized (low category). In this study, RFC was applied alongside UV to provide a more comprehensive understanding of the ethnobotanical importance of medicinal plants used for gout treatment in Pamekasan District.

RESULTS AND DISCUSSION

Socio-demographic characteristics

This study involved 30 respondents distributed across 17 villages in 8 districts of Pamekasan District, namely Pademawu (Murtajih and Jarin), Pakong (Bandungan, Ban-Ban), Palengaan (Akkor, Rombuh, and Palengaan Laok), Pamekasan (Nyalabu Laok, Kowel, Barurambat Kota, and Bugih), Pegantenan (Plakpak), Proppo (Klampar, Jambringin, and Pangtonggal), Tlanakan (Panglegur), and Waru (Waru Barat). This distribution reflects the ecological and sociocultural diversity of Pamekasan communities, where most areas remain rural and depend on local natural resources. Such conditions allow traditional plant-based healing practices to persist due to the availability of natural materials and the intergenerational transmission of knowledge. Based on gender, the respondents were predominantly female (87%), while males accounted for only 13%. This indicates that women play a central role in maintaining knowledge and practices of traditional medicine. In the Madurese sociocultural context, women generally act as caregivers and household health guardians, making them more familiar with the use of medicinal plants. This finding aligns with Costa et al. (2021), who reported that women tend to have greater knowledge of traditional medicine due to their direct involvement in domestic activities and empirical experience in caring for family members.

In terms of age, most respondents were between 40-49 years old (37%), followed by those aged 50-59 (33%), while the 30-39 (17%) and ≥60 (13%) age groups were less represented. The dominance of the middle-aged group indicates that respondents were in their productive years and had accumulated extensive experience in recognizing and using medicinal plants. Generally, older individuals possess broader traditional knowledge due to long-term learning processes passed down through generations within their social environment (Ndavaro et al. 2024). The lower participation of younger groups may result from shifting interests toward modern medicine and reduced interaction with nature, which could lead to a gradual decline in ethnobotanical knowledge among future generations. Educational levels among respondents also varied. Most had completed only elementary school (43%), followed by senior high school (30%), higher education (17%), junior high school (7%), and no formal education (3%). This distribution suggests that knowledge of medicinal plants is more prevalent among people with lower formal education, who generally rely on empirical experience and oral traditions rather than academic learning. According to Adiyasa and Meiyanti (2021), individuals with lower education levels tend to preserve traditional healing practices due to strong beliefs in ancestral heritage and limited access to modern healthcare facilities. Moreover, most respondents worked as farmers or housewives, occupations that involve direct interaction with land and surrounding plants, facilitating observation and use of medicinal flora.

Overall, the socio-demographic characteristics of the Pamekasan Community indicate that women of productive age with basic education levels constitute the key group in preserving local ethnobotanical knowledge. Ecological factors, such as rural environments rich in biodiversity, along with social factors, including strong trust in traditional medicine and limited access to modern healthcare services, are the main reasons why the practice of using medicinal plants continues to thrive to this day (Table 1).

Table 1. Socio-demographic characteristics of respondents

Variable	Category	Total	Percentage
Gender	Male	4	13%
	Female	26	87%
Age (years)	30-39	5	17%
	40-49	11	37%
	50-59	10	33%
	≥60	4	13%
Education level	No formal education	1	3%
	Elementary school	13	43%
	Junior high school	2	7%
	Senior high school	9	30%
	University	5	17%
Village	District		
Murtajih	Pademawu	1	3%
Jarin		5	17%
Bandungan	Pakong	1	3%
Ban-Ban			3%
Akkor	Palengaan	1	3%
Rombuh		1	3%
Palengaan Laok		1	3%
Nyalabu Laok	Pamekasan	1	3%
Kowel		1	3%
Barurambat Kota		2	7%
Bugih		2	7%
Plakpak	Pegantenan	5	17%
Klampar	Proppo	3	10%
Jambringin		1	3%
Pangtonggal		1	3%
Panglegur	Tlanakan	1	3%
Waru Barat	Waru	2	7%

Plant diversity

The study identified 30 traditional *jamu* recipes used by the Pamekasan Community for the treatment of gout (Table 2). These recipes involved 27 medicinal plant species belonging to 13 families. Of these, 10 species were members of the Zingiberaceae family, 4 species within the Piperaceae family, 2 species each belonged to the Myrtaceae and Poaceae families, while the remaining species were distributed across the Acanthaceae, Annonaceae, Apiaceae, Arecaceae, Euphorbiaceae, Fabaceae, Lamiaceae, Lauraceae, and Pandanaceae families (Table 2).

Based on the graph presented in Figure 2, Zingiberaceae emerged as the family with the highest curve, showing a total sum of 65 and a family count of 10. The dominance of the Zingiberaceae family in herbal medicine has also been reported by Fathir et al. (2021), who noted that this family is among the most frequently used plant groups in the preparation of *jamu* recipes for medicinal purposes by the Pamekasan Community. Representative species of this family include *Curcuma longa* L. (*kunyit kuning*), *Curcuma zedoaria* (Christm.) Rosc. (*kunyit putih*), *Boesenbergia rotunda* (L.) Mansf. (*temu kunci*), *Curcuma aeruginosa* Roxb. (*temu ireng*), *Zingiber officinale* Rosc. (*jahe putih*), *Z. o.* var. *rubrum* (*jahe merah*), *Curcuma xanthorrhiza* Roxb. (*temulawak*), *Kaempferia galanga* L. (*kencur*), *Alpinia galanga* (L.) Willd. (*lengkuas*), and *Zingiber zerumbet* (L.) Roscoe ex Sm. (*lempuyang*). The dominance of the Zingiberaceae family in the Pamekasan region is influenced by both ecological and cultural factors. Ecologically, the humid tropical climate and lateritic soil conditions in Pamekasan are highly favorable for the growth of rhizomatous plants such as *Z. officinale* (*jahe putih*), *C. longa* (*kunyit kuning*), and *C. xanthorrhiza* Roxb. (*temulawak*) (Azizah et al. 2019; Wahyuni et al. 2023).

Culturally, the Madurese people have long utilized rhizomes as primary ingredients in traditional herbal preparations, as they are believed to possess “warming” properties that help balance the body’s condition. In addition, plants from this family are easily accessible, being commonly cultivated in home gardens and sold in traditional markets, which contributes to their dominant use compared to other plant families. All recorded plant species are presented with their full botanical names, including authorship, following accepted taxonomic nomenclature.

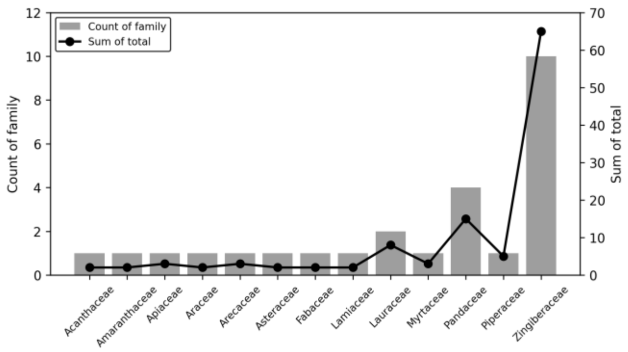

Figure 2. Medicinal plant family

Table 2. Medicinal plant species and plant parts used in traditional gout remedies in Pamekasan District, East Java, Indonesia

Local name	Scientific name	Family	Plant part used
Sambiloto	*Andrographis paniculata* (Burm.fil.) Nees	Acanthaceae	Leaf
Daun sirsak	*Annona muricata* L.	Annonaceae	Leaf
Ketumbar	*Coriandrum sativum* L.	Apiaceae	Seed
Pinang	*Areca catechu* L.	Arecaceae	Fruit
Meniran	*Phyllanthus urinaria* L.	Euphorbiaceae	Leaf
Asam Jawa	*Tamarindus indica* L.	Fabaceae	Fruit
Kumis kucing	*Orthosiphon aristatus* (Blume) Miq.	Lamiaceae	Leaf
Kayu manis	*Cinnamomum verum* J.Presl	Lauraceae	Bark
Cengkih	*Syzygium aromaticum* (L.)	Myrtaceae	Fruit
Daun salam	*Syzygium polyanthum* (Wight) Walp.	Myrtaceae	Leaf
Pandan	*Pandanus amaryllifolius* Roxb.	Pandanaceae	Leaf
Cabe jamu	*Piper retrofractum* Vahl	Piperaceae	Fruit
Sirih merah	*Piper ornatum* N.E.Br.	Piperaceae	Leaf
Lada hitam	*Piper nigrum* L.	Piperaceae	Seed
Sirih hijau	*Piper betle* L.	Piperaceae	Leaf
Serai wangi	*Cymbopogon citratus* (DC.) Stapf	Poaceae	Stem
Beras Putih	*Oryza sativa* L.	Poaceae	Seed
Jahe putih	*Zingiber officinale* Rosc.	Zingiberaceae	Rhizome
Lengkuas	*Alpinia galanga* (L.) Willd.	Zingiberaceae	Rhizome
Temu kunci	*Boesenbergia rotunda* (L.) Mansf.	Zingiberaceae	Rhizome
Jahe Merah	*Zingiber officinale* var. *rubrum*	Zingiberaceae	Rhizome
Temulawak	*Curcuma xanthorrhiza* Roxb.	Zingiberaceae	Rhizome
Kunyit kuning	*Curcuma longa* L.	Zingiberaceae	Rhizome
Kencur	*Kaempferia galanga* L.	Zingiberaceae	Rhizome
Kunyit putih	*Curcuma zedoaria* (Christm.) Rosc.	Zingiberaceae	Rhizome
Temu ireng	*Curcuma aeruginosa* Roxb.	Zingiberaceae	Rhizome
Lempuyang	*Zingiber zerumbet* (L.) Roscoe ex Sm.	Zingiberaceae	Rhizome

Species identification was based on local names and morphological descriptions provided by informants and subsequently verified using authoritative taxonomic databases, namely Plants of the World Online (POWO) and World Flora Online (WFO). Due to the widespread use of processed herbal materials (dried or powdered forms) and ethical considerations, voucher specimens were not collected. However, taxonomic verification through cross-referencing ethnobotanical literature and online databases ensured the reliability of species identification.

Quantitative analysis

The Relative Frequency of Citation (RFC) was used to assess the level of shared knowledge and recognition of medicinal plant species used for gout treatment among informants in the Pamekasan Community. The RFC values for each recorded species are presented in Table 3.

As shown in Table 3. The Relative Frequency of Citation (RFC) values indicate differences in the level of shared knowledge and recognition of medicinal plants used for gout treatment in the Pamekasan Community. RFC values ranged from 0.03 to 0.70, reflecting variation in how widely each species is known and cited among informants. *C. longa* showed the highest RFC value (0.70), identifying it as the most widely recognized species, followed by *Z. officinale* (0.57). The high citation frequency of these rhizomatous plants suggests strong cultural embeddedness, easy accessibility, and consistent intergenerational knowledge transmission. Moderate RFC values were observed for *A. galanga* (0.23), *Syzygium polyanthum* (Wight) Walp. (0.20), and *Piper betle* L. (0.20), indicating that these species are relatively well known but used more selectively, often as complementary ingredients in traditional formulations. In contrast, several species exhibited low RFC values (≤0.07), suggesting limited recognition or context-specific use within the community. Overall, the RFC distribution reveals a hierarchical pattern in local ethnobotanical knowledge, where a small number of highly cited species form the core of traditional gout remedies, while other plants play supporting or situational roles.

Meanwhile, the Use Value (UV) index was used to evaluate the intensity and diversity of medicinal plant utilization for gout treatment among informants in the Pamekasan Community. The UV values of each recorded species are presented in Table 4.

The Use Value (UV) analysis reflects the intensity and versatility of medicinal plant use for gout treatment in the Pamekasan Community. UV values ranged from 0.03 to 0.37, indicating variation in how frequently and diversely each species is utilized. *Curcuma longa* L. showed the highest UV value (0.37), demonstrating its central role in traditional herbal practices. This high UV suggests that turmeric is not only widely recognized but also frequently incorporated into various formulations, highlighting its multifunctional importance in local ethnomedicine. Moderate UV values were observed for *S. polyanthum* (0.17), *P. betle* (0.17), and *Z. o.* var. *rubrum* (0.10), indicating regular but more selective use.

Table 3. Relative Frequency of Citation (RFC) of medicinal plants used for gout

Local name	Scientific name	FC	RFC
Kunyit kuning	*Curcuma longa*	21	0.70
Jahe putih	*Zingiber officinale*	17	0.57
Lengkuas	*Alpinia galanga*	7	0.23
Daun salam	*Syzygium polyanthum*	6	0.20
Sirih hijau	*Piper betle*	6	0.20
Temu kunci	*Boesenbergia rotunda*	5	0.17
Jahe merah	*Zingiber officinale* var. *rubrum*	5	0.17
Temulawak	*Curcuma xanthorrhiza*	5	0.17
Pinang	*Areca catechu*	4	0.13
Cabe jamu	*Piper retrofractum*	4	0.13
Ketumbar	*Coriandrum sativum*	3	0.10
Kayu manis	*Cinnamomum verum*	3	0.10
Daun sirsak	*Annona muricata*	2	0.07
Meniran	*Phyllanthus urinaria*	2	0.07
Asam jawa	*Tamarindus indica*	2	0.07
Cengkih	*Syzygium aromaticum*	2	0.07
Serai wangi	*Cymbopogon citratus*	2	0.07
Kencur	*Kaempferia galanga*	2	0.07
Sambiloto	*Andrographis paniculata*	1	0.03
Kumis kucing	*Orthosiphon aristatus*	1	0.03
Sirih merah	*Piper ornatum*	1	0.03
Lada hitam	*Piper nigrum*	1	0.03
Beras putih	*Oryza sativa*	1	0.03
Kunyit kuning	*Curcuma zedoaria*	1	0.03
Temu ireng	*Curcuma aeruginosa*	1	0.03
Lempuyang	*Zingiber zerumbet*	1	0.03
Pandan	*Pandanus amaryllifolius*	1	0.03

Note: Thirty (30) informants were interviewed in this study

Tabel 4. Use Value (UV) of medicinal plants used for gout treatment

Local name	Scientific name	U_i	UV
Kunyit kuning	*Curcuma longa*	11	0.37
Daun salam	*Zingiber officinale*	6	0.20
Sirih hijau	*Alpinia galanga*	5	0.17
Jahe merah	*Syzygium polyanthum*	5	0.17
Pinang	*Piper betle*	3	0.10
Kayu manis	*Boesenbergia rotunda*	3	0.10
Temulawak	*Zingiber officinale* var. *rubrum*	3	0.10
Daun sirsak	*Curcuma xanthorrhiza*	2	0.07
Ketumbar	*Areca catechu*	2	0.07
Asam jawa	*Piper retrofractum*	2	0.07
Cabe jamu	*Coriandrum sativum*	2	0.07
Serai wangi	*Cinnamomum verum*	2	0.07
Temu kunci	*Annona muricata*	2	0.07
Jahe putih	*Phyllanthus urinaria*	2	0.07
Lengkuas	*Tamarindus indica*	2	0.07
Sambiloto	*Syzygium aromaticum*	1	0.03
Meniran	*Cymbopogon citratus*	1	0.03
Kumis kucing	*Kaempferia galanga*	1	0.03
Cengkih	*Andrographis paniculata*	1	0.03
Sirih merah	*Orthosiphon aristatus*	1	0.03
Lada hitam	*Piper ornatum*	1	0.03
Beras putih	*Piper nigrum*	1	0.03
Kunyit kuning	*Oryza sativa*	1	0.03
Temu ireng	*Curcuma zedoaria*	1	0.03
Kencur	*Curcuma aeruginosa*	1	0.03
Lempuyang	*Zingiber zerumbet*	1	0.03
Pandan	*Pandanus amaryllifolius*	1	0.03

Note: Thirty (30) informants were interviewed in this study

These species are often included as complementary ingredients, contributing specific perceived benefits such as enhancing efficacy, improving flavor, or supporting the primary components of herbal preparations. Species with lower UV values (≤0.10), including *Areca catechu* L., *Cinnamomum verum* J.Presl, and *C. xanthorrhiza*, appear to be used in limited contexts or specific recipes rather than as core ingredients. Plants with very low UV values (0.03) were reported by only a small number of informants, suggesting sporadic, situational, or specialized use. A comparable ethnobotanical study among the Dawan (Amanatun) community in Hoineno Village, East Nusa Tenggara, also identified *Z. officinale* (UV = 0.97) and *C. longa* (UV = 0.88) as species with the highest cultural importance (Tefu et al. 2023). Overall, the UV distribution highlights a functional hierarchy within the local ethnobotanical system, where a few species particularly *C. longa* serve as key multifunctional plants, while others play supporting or niche roles in traditional gout remedies.

Plant parts used

This dominance not only reflects the long-standing cultural tradition of using rhizomes, passed down through generations, but also their accessibility and availability in the local environment. However, variations in recipes and species selection highlight the cultural flexibility within traditional healing practices. Pharmacologically, the prevalence of rhizomes is supported by the presence of bioactive compounds such as curcumin and gingerol, which exhibit anti-inflammatory activity and xanthine oxidase inhibitory potential (Matin et al. 2025). In traditional herbal preparations, various plant organs are utilized, each contributing distinct effects to the body. Some formulations rely solely on rhizomes, while others use leaves or combine multiple plant parts. The inventory of plant organs used for gout-related remedies indicates that rhizomes are the most frequently employed part, followed by leaves, mainly due to their abundance and ease of processing. Other parts such as fruits, seeds, stems, and barks are used in much smaller proportions. The distribution of plant parts used is presented in Figure 3.

The most frequently used plant organ in traditional herbal formulations for gout treatment in Pamekasan District is the rhizome, as illustrated in Figure 3, followed by leaves, whereas other plant parts are utilized to a considerably lesser extent. This distribution indicates a distinct local preference for rhizomatous plants in herbal preparations. Information obtained from traditional herbal traders and informants suggests that, although leaves are generally easier to handle during extraction than stems or woody roots, rhizomes are perceived to provide more pronounced and sustained therapeutic effects, thereby positioning them as the primary component in most formulations. This pattern differs from ethnobotanical findings reported in several other regions of Indonesia. In Mowila Regency, for example, leaves and tubers dominate herbal preparations and are predominantly processed by boiling (Fitriana et al. 2022). Similarly, Jadid et al. (2020) documented that leaves represent the most frequently utilized plant organ (61.5%), while sap, bark, and tubers are rarely employed. Research conducted in Pasuruan Regency further confirmed the predominance of leaves (47%), followed by fruits (27%), seeds (7%), and rhizomes (5%), with other plant organs contributing relatively small proportions (Hildasari and Hayati 2021). Comparable patterns were observed in the Ungaran Mountain region of Central Java, where leaves accounted for 49% of plant organ usage (Utami et al. 2019). Collectively, these variations indicate that plant organ utilization is highly context-dependent and influenced by differences in local ecological availability, inherited herbal preparation traditions, and community perceptions regarding the therapeutic value of specific plant parts. The preference for rhizomes in Pamekasan reflects not only entrenched cultural practices but also empirical reasoning derived from sensory experience. Within Madurese ethnomedical understanding, plants that generate warming or pungent sensations upon consumption are believed to be more effective in alleviating joint discomfort associated with gout. Consequently, rhizomes are regarded as particularly suitable for the management of chronic musculoskeletal conditions, as they are perceived to contribute to the restoration of bodily balance through sustained internal warmth.

Pharmacological studies provide supportive evidence for this traditional preference, as rhizomes are known to contain substantial levels of flavonoids, phenolic compounds, and bioactive constituents such as curcumin and gingerol, which exhibit anti-inflammatory, antioxidant, and xanthine oxidase inhibitory activities associated with uric acid regulation (Chumroenphat et al. 2019; Fathir et al. 2021; Matin et al. 2025). Previous investigations have demonstrated that rhizomes, including *C. xanthorrhiza*, contain flavonoids, alkaloids, glycosides, and triterpenoids capable of inhibiting xanthine oxidase, with flavones and flavonols playing a central role in this process (Mohos et al. 2020; Xue et al. 2023). Aziz and Jamil (2021) further reported that phenolic and polyphenolic metabolites in rhizomes contribute to antioxidant activity and the suppression of purine metabolism. Nevertheless, while these findings underscore the therapeutic potential of rhizome-derived compounds, traditional efficacy should not be equated with pharmacological safety or clinical effectiveness. Certain bioactive constituents, including essential oils, alkaloids, and phenolic derivatives, may pose cytotoxic or hepatotoxic risks if consumed excessively or over prolonged periods (Stati et al. 2021; Nirvanashetty et al. 2022). Accordingly, the widespread use of rhizomes in Madurese gout treatment highlights the importance of further toxicological and safety evaluations to support the rational and responsible application of traditional herbal remedies.

Preparation and consumption methods

Beyond pharmacological factors, rhizomes are also favored by the Pamekasan Community due to cultural and geographical influences. Culturally, rhizome-based herbal preparations (*jamu*) have been passed down through generations, regarded as safer, and believed to restore body balance by alleviating conditions associated with internal discomfort. Geographically, the agroecological conditions of Pamekasan support the growth of rhizomatous plants such as ginger (*Z. officinale*), turmeric (*C. longa*), and *C. xanthorrhiza*, ensuring their abundance, accessibility, and affordability (Abdullah et al. 2020). The combination of traditional beliefs and ecological availability explains the predominance of rhizomes in local herbal practices. The use of key medicinal plant species in the Pamekasan Community is closely linked to local cultural beliefs and traditional health concepts. Highly cited species such as *C. longa* and *Z. officinale* are culturally perceived as "warming" plants and are believed to help restore body balance and reduce joint discomfort associated with gout. These species are commonly prepared by grating or boiling the rhizomes, either as single ingredients or in combination with other plants, reflecting long-established household practices. Leaves such as *S. polyanthum* and *P. betle* are often included as complementary components, valued for their perceived ability to enhance efficacy, improve taste, or support the primary ingredients. Across species, rhizomes emerge as the most frequently used plant part, indicating a strong cultural preference for underground organs that are believed to store higher "strength" or medicinal potency. Overall, these preparation methods and plant part selections illustrate how traditional knowledge in Pamekasan integrates practical experience, cultural beliefs, and inherited practices in the treatment of gout. Furthermore, this study documented the composition and preparation methods of herbal formulations commonly used by the Pamekasan Community, as presented in Table 4.

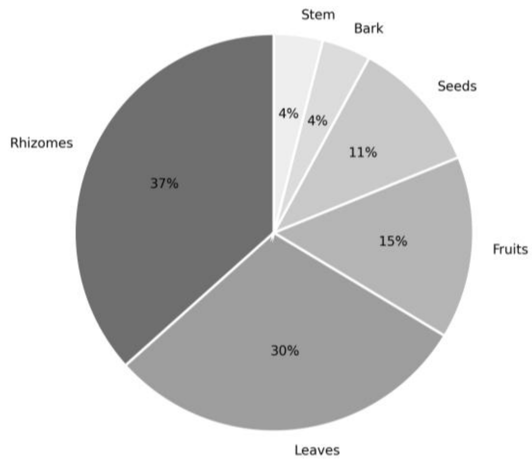

Figure 3. Percentage of plant parts utilized in *jamu* preparation for gout treatment

Table 4. Composition and preparation methods of jamu based on interview results

Recipe ingredients	Preparation method	Processing methods
Jahe putih (*Zingiber officinale*), *kencur* (*Kaempferia galanga*), *kunyit kuning* (*Curcuma longa*), *kunyit kuning* (*Curcuma zedoaria*), *pinang* (*Areca catechu*), *temulawak* (*Curcuma xanthorrhiza*)	Ingredients purchased in powdered form, mixed with honey and brewed with hot water.	Ready to use powder
Cabai jawa (*Piper retrofractum*), *kunyit kuning* (*Curcuma longa*), *lengkuas* (*Alpinia galanga*), *temulawak* (*Curcuma xanthorrhiza*), *temu kunci* (*Boesenbergia rotunda*)	Washed, peeled, thinly sliced, sun-dried, then ground into powder.	Drying and grinding
Kayu manis (*Cinnamomum verum*), *kunyit kuning* (*Curcuma longa*), *lengkuas* (*Alpinia galanga*), *serai wangi* (*Cymbopogon citratus*)	Washed, peeled, thinly sliced, sun-dried, then ground into powder.	Drying and grinding
Jahe putih (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *lengkuas* (*Alpinia galanga*)	Washed, peeled, thinly sliced, sun-dried, then ground into powder.	Drying and grinding
Jahe putih (*Zingiber officinale*), *lempuyang* (*Zingiber zerumbet*), *lengkuas* (*Alpinia galanga*), *temu ireng* (*Curcuma aeruginosa*), *temulawak* (*Curcuma xanthorrhiza*), *temu kunci* (*Boesenbergia rotunda*)	Washed, thinly sliced, roasted, then pounded into powder.	Drying and grinding
Jahe putih (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *daun sirih* (*Piper betle*), *temu kunci* (*Boesenbergia rotunda*)	Washed thoroughly, high-quality parts selected, oven-dried, finely ground, then stored in plastic or glass containers.	Drying and grinding
Cabai jawa (*Piper retrofractum*), *Jahe putih* (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *pinang* (*Areca catechu*)	Washed, drained, sun-dried, ground into powder, then stored in glass containers.	Drying and grinding
Jahe putih (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *madu, telur ayam kampung*	Ginger, turmeric, and egg were washed; ginger and turmeric blended, boiled for 6 minutes, filtered, then mixed with egg and honey.	Boiling
Kayu manis (*Cinnamomum verum*), *ketumbar* (*Coriandrum sativum*)	Water boiled, cinnamon and coriander added, simmered until the water changes color, cooled, and ready to drink.	Boiling
Daun sirih (*Piper betle*), *pinang* (*Areca catechu*)	Areca nut is peeled, washed, and pounded together with betel leaf until smooth.	Boiling
Cabai jawa (*Piper retrofractum*), *cengkeh* (*Syzygium aromaticum*), *jahe*	High-quality ingredients are selected,	Drying and

putih (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *manis jangan* (*Cinnamomum verum*)	washed, oven-dried, finely ground, and then stored in plastic containers.	grinding
Cabai jawa (*Piper retrofractum*), *jahe merah* (*Zingiber officinale* var. *rubrum*), *kunyit kuning* (*Curcuma longa*), *manis jangan* (*Cinnamomum verum*), *pinang* (*Areca catechu*)	Peeled, cut into small pieces, sun-dried, blended, then combined.	Drying and grinding
Daun salam (*Syzygium polyanthum*), *jahe putih* (*Zingiber officinale*), *Kayu manis* (*Cinnamomum verum*), *kunyit kuning* (*Curcuma longa*), *meniran* (*Phyllanthus urinaria*)	Peeled, washed, cut into small pieces, blended, oven-dried, then packed in special plastic.	Drying and grinding
Daun salam (*Syzygium polyanthum*), *jahe merah* (*Zingiber officinale* var. *rubrum*), *kunyit kuning* (*Curcuma longa*), *kumis kucing* (*Orthosiphon aristatus*), *daun sambiloto* (*Andrographis paniculata*)	Washed, dried, ground into powder, sieved, then stored in airtight containers and labeled.	Drying and grinding
Cengkeh (*Syzygium aromaticum*), *daun sirih* (*Piper betle*), *jahe putih* (*Zingiber officinale*), *ketumbar* (*Coriandrum sativum*), *kunyit kuning* (*Curcuma longa*), *temu kunci* (*Boesenbergia rotunda*)	Washed, sun-dried, roasted, then ground using a traditional *jamu* grinder.	Drying and grinding
Daun sirih (*Piper betle*), *kunyit kuning* (*Curcuma longa*), *temulawak* (*Curcuma xanthorrhiza*)	Peeled, washed, cut, boiled, pounded or blended, filtered, then consumed warm.	Boiling
Asam jawa (*Tamarindus indica*), *gula aren*, *kunyit kuning* (*Curcuma longa*)	Turmeric is washed and grated, boiled with tamarind and palm sugar until boiling, then filtered before drinking.	Boiling
Asam jawa (*Tamarindus indica*), *gula aren*	Water boiled, tamarind and palm sugar added, cooked until dissolved, then filtered.	Boiling
Gula aren, *jahe merah* (*Zingiber officinale* var. *rubrum*)	Ginger was washed, grated, boiled with palm sugar until dissolved, then filtered before drinking.	Boiling
Beras putih (*Oryza sativa*), *gula aren*, *kencur* (*Kaempferia galanga*)	Rice and *kencur* were washed, blended, boiled with palm sugar, stirred until boiling, then filtered.	Boiling
Gula aren, *jahe putih* (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *temulawak* (*Curcuma xanthorrhiza*)	*Temulawak* and ginger are washed, grated, boiled with palm sugar until dissolved, then filtered.	Boiling
Jahe merah (*Zingiber officinale* var. *rubrum*), *lengkuas* (*Alpinia galanga*), *madu*, *serai wangi* (*Cymbopogon citratus*), *daun sirih* (*Piper betle*)	All ingredients are blended, boiled until reduced, filtered, and then consumed with honey.	Boiling
Daun salam (*Syzygium polyanthum*), *jahe putih* (*Zingiber officinale*), *kayu manis* (*Cinnamomum verum*), *kunyit kuning* (*Curcuma longa*)	Turmeric and ginger peeled, all ingredients washed, boiled until reduced, then filtered and consumed twice over two days.	Boiling
Daun salam (*Syzygium polyanthum*), *daun sirsak* (*Annona muricata*), *jahe putih* (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *lengkuas* (*Alpinia galanga*), *temulawak* (*Curcuma xanthorrhiza*)	Turmeric, ginger, and *Lengkuas* are peeled, cut, blended with bay and soursop leaves, boiled for 10-15 minutes, then filtered.	Boiling
Daun sirsak (*Annona muricata*)	Leaves washed, then directly boiled.	Boiling
Daun sirih (*Piper betle*), *gula aren*, *kunyit kuning* (*Curcuma longa*)	Turmeric peeled and cut, boiled with betel leaf and palm sugar until boiling, then filtered.	Boiling
Daun salam (*Syzygium polyanthum*), *jahe putih* (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *meniran* (*Phyllanthus urinaria*)	Ginger and turmeric washed, thinly sliced, boiled with bay leaf and *meniran* for 15-20 minutes, left for 20 minutes, then filtered.	Boiling
Daun salam (*Syzygium polyanthum*), *kunyit kuning* (*Curcuma zedoaria*), *jahe putih* (*Zingiber officinale*), *madu*, *daun pandan* (*Pandanus amaryllifolius*)	Ginger and turmeric grated, bay and pandan leaves chopped, boiled until boiling, filtered, then honey added.	Boiling
Gula aren, *jahe putih* (*Zingiber officinale*), *kunyit kuning* (*Curcuma longa*), *lada hitam* (*Piper nigrum*), *temu kunci* (*Boesenbergia rotunda*), *temulawak* (*Curcuma xanthorrhiza*)	All ingredients are washed, pounded, squeezed, boiled, and then stored in containers.	Boiling
Daun salam (*Syzygium polyanthum*), *kunyit kuning* (*Curcuma longa*)	Turmeric peeled and sliced, boiled with a bay leaf for 15-20 minutes, then filtered before drinking.	Boiling

Note: *: Each recipe listed in Table 3 was obtained from a single informant. A total of 30 informants each contributed one unique recipe for gout treatment, resulting in 30 distinct formulations corresponding to the number of respondents in this study

Analysis of Table 4 reveals a relatively consistent and recurrent pattern of ingredient combinations in gout herbal formulations traditionally used by the Pamekasan Community. *Curcuma longa* (turmeric) appears as the most dominant ingredient, present in almost every recipe, either as a single component or in combination with others. This dominance can be explained by the presence of curcumin, which possesses significant anti-inflammatory and antioxidant properties essential for alleviating joint inflammation caused by gout. Although natural curcumin does not directly inhibit xanthine oxidase activity, nanocurcumin formulations have been shown to inhibit the enzyme by 67-91%, approaching the effectiveness of allopurinol the standard synthetic drug for hyperuricemia (Al-Dulaimy et al. 2023; Bisset et al. 2023). This finding supports the use of turmeric as the core ingredient in many *jamu* formulations.

In addition to turmeric, *Z. officinale* (ginger), particularly white ginger, frequently appears in the recipes. Ginger contains active compounds such as gingerol and shogaol, which exhibit anti-inflammatory, analgesic, and antioxidant effects through the suppression of prostaglandin E_2, Nitric Oxide (NO), Tumor Necrosis Factor-α (TNF-α), and NF-κB pathways (Ballester et al. 2022). Further experimental studies indicate that combining ginger extract with synthetic anti-inflammatory drugs enhances analgesic effects while reducing oxidative stress (Boarescu et al. 2023). Therefore, the frequent pairing of turmeric and ginger may be regarded as a synergistic core formulation. Other common combinations include turmeric + ginger + bay leaves, with the latter believed to balance the flavor and medicinal efficacy of *jamu*, while also reflecting the cultural significance of bay leaves in local traditions. Similarly, turmeric + ginger + palm sugar or honey are frequently reported, with sweeteners mainly serving to improve palatability and ensure better acceptance for daily consumption. In addition to rhizomes and sweeteners, other additives include warming spices such as cayenne pepper, cinnamon, and cloves. These spices particularly *Cinnamomum* sp. contain cinnamaldehyde and polyphenols with anti-inflammatory activity through the suppression of pro-inflammatory cytokines (IL-6, IL-8, TNF-α) and inhibition of NF-κB activation, thereby contributing to analgesic and warming effects consistent with local cultural beliefs (Lagha et al. 2021).

The percentage distribution of processing techniques used in the preparation of gout *jamu* among the Pamekasan Community reflects the diversity of local knowledge and adaptation to the availability of resources and tools. Each method serves specific purposes and benefits, influencing the efficacy, taste, and shelf life of the resulting *jamu* (Figure 4).

The study revealed that 60% of the Pamekasan Community consumes *jamu* prepared by boiling, with variations in preparation such as blending before boiling, grating before boiling, or directly boiling the fresh ingredients. Boiling is the most commonly used method because it has been practiced for generations and is believed to dissolve bioactive compounds such as flavonoids, alkaloids, and essential oils into water, making them more easily absorbed by the body (Gackowski et al. 2021). Moreover, boiling is relatively simple, requires no special equipment, and can be applied to various plant parts, including leaves, rhizomes, seeds, and fruits. A previous study similarly reported that 59.1% of households in Pagar Ruyung Village used boiling as the primary preparation method (Rizal et al. 2021).

Drying and grinding methods are popular because they extend the shelf life of ingredients and make distribution easier. The majority of drying techniques are carried out by sun-drying or roasting. Sun-drying is typically applied during the dry season, while roasting is used to accelerate the drying process and to impart a distinctive aroma to the ingredients. Communities also mention that turning ingredients into powder makes jamu more convenient to brew anytime and supports large-scale commercial production. At the household level, this method provides a reliable supply of jamu without the need for repeated preparation. Fresh grinding helps preserve the freshness, taste, and aroma of ingredients, which are often believed to affect efficacy, although this method is only suitable for immediate use since it doesn't have long-term stability. Additionally, some people prefer ready-to-use powdered jamu for convenience, especially those who lack the time or skills to process ingredients themselves. Extraction through pressing after pounding is used for plants with sap or viscous extracts, which are considered effective for direct consumption without heating. However, this method has limitations in storage stability and may not be suitable for all plant types. These various processing techniques show how the community adapts to resource availability, intended use, and traditional knowledge passed down through generations.

After processing, additional ingredients such as palm sugar, honey, and eggs are commonly incorporated. Functionally, palm sugar serves not only as a natural sweetener that enhances flavor but also as a source of minerals such as potassium, calcium, and iron (Syahidah et al. 2025).

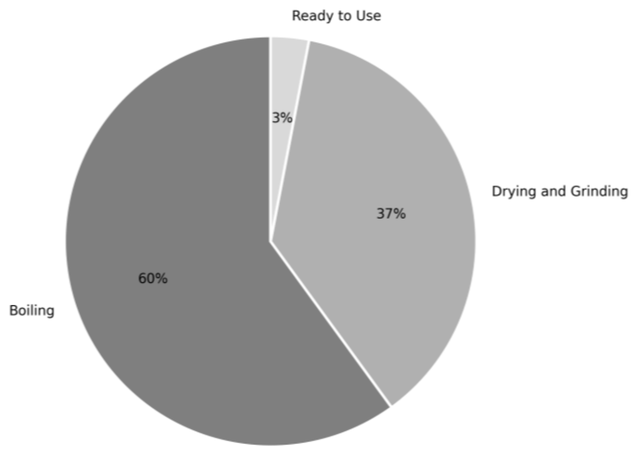

Figure 4. Percentage of *jamu* processing methods

Honey, besides imparting a distinct sweetness, provides antimicrobial, anti-inflammatory, and antioxidant properties that strengthen the therapeutic efficacy of *jamu*, particularly in reducing joint inflammation in gout sufferers (Afriani and Pangesti 2023). Meanwhile, free-range chicken eggs, especially the yolk, are added as a source of protein, vitamins, and healthy fats believed to improve stamina and aid recovery (Myers and Ruxton 2023; Sokołowicz et al. 2023). Culturally, the addition of these ingredients forms part of traditional practices, believed to "enhance" the effectiveness of *jamu*. From an ethnobotanical perspective, combining medicinal plants with non-plant ingredients is a common strategy to balance taste, increase consumer acceptance, and strengthen therapeutic effects (Pieroni and Price 2020; Husain et al. 2021). Therefore, the inclusion of palm sugar, honey, and eggs is not merely a flavor modification but represents a holistic processing strategy that maintains nutritional value, therapeutic efficacy, and cultural acceptance within the community. Comparable ethnobotanical patterns have been reported among Javanese and other Indonesian ethnic groups, where rhizome-based plants particularly turmeric (*C. longa*) and ginger (*Z. officinale*) are widely used for treating gout and musculoskeletal disorders. Studies conducted in Central Java and East Java indicate that these species are preferred due to their warming properties and perceived ability to alleviate joint pain and stiffness (Nisyapuri et al. 2018; Utami et al. 2019; Jadid et al. 2020; Hildasari and Hayati 2021). Nevertheless, variations in plant part selection and preparation methods have been observed, reflecting differences in local ecological availability, cultural interpretations of illness, and inherited traditional knowledge systems. This comparison suggests that while rhizome-based herbal therapy represents a shared ethnobotanical framework across Indonesian communities, its specific applications remain strongly shaped by local cultural contexts.

Discussion

This study demonstrates that local knowledge within the Pamekasan Community continues to play a central role in traditional plant-based healing practices, particularly in the treatment of gout. The documentation of 27 medicinal plant species from 13 families reflects both the biological richness of the region and the resilience of Madurese ethnobotanical knowledge systems. The dominance of the Zingiberaceae family particularly *C. longa* and *Z. officinale* illustrates a strong continuity between long-standing cultural preferences and pharmacological evidence already cited in this manuscript. Empirically, the Madurese Community relies heavily on rhizomes, which are culturally perceived as possessing warming properties capable of neutralizing *angin dalam*, a local explanatory concept associated with bodily imbalance and pain. Scientifically, this empirical preference aligns with the presence of curcuminoids and gingerols, compounds that have been reported to exhibit anti-inflammatory, antioxidant, and xanthine oxidase inhibitory activities mechanisms directly relevant to the pathophysiology of gout. Importantly, the community does not conceptualize these effects in biochemical terms; instead, therapeutic efficacy is interpreted through sensory experience and bodily response. This correspondence suggests that local knowledge neither contradicts nor replaces biomedical explanations, but rather represents a culturally framed interpretation of therapeutic effectiveness.

The high Use Value (UV) and Relative Frequency of Citation (RFC) of *C. longa* indicate a strong level of trust and reliance on this species within the community, not only due to its perceived effectiveness but also because of its symbolic status in Madurese herbal culture. As noted by Jadid et al. (2020), medicinal plants in Indonesian societies often serve dual roles as therapeutic agents and cultural symbols. The predominance of rhizomes further reinforces the idea that the effectiveness of *jamu* is shaped by an interaction between pharmacological properties, empirical tradition, and ecological adaptation. The humid tropical climate of Pamekasan supports the cultivation of rhizomatous plants, ensuring continuous availability and economic accessibility. This ecological suitability fosters a sustainable symbiosis between local environments and traditional medical knowledge systems.

From a cultural and anthropological perspective, traditional gout treatment among the Madurese is inseparable from local identity, dietary patterns, and belief systems. Gout is commonly perceived as a consequence of excessive consumption of certain foods, particularly purine-rich dishes served during social and religious gatherings. Consequently, treatment strategies emphasize restoring bodily balance rather than targeting a single pathological mechanism. The transmission of medicinal knowledge occurs primarily through oral and intergenerational pathways, with elders, traditional herbal vendors, and experienced family members acting as key knowledge holders. Women play a particularly dominant role in the preparation and administration of herbal remedies, reflecting their social position as household health custodians and reinforcing gendered patterns of ethnobotanical knowledge transmission. The preference for decoction as the primary preparation method further illustrates the intersection between scientific rationality and cultural practice. From a chemical perspective, boiling facilitates the extraction of polar compounds such as flavonoids and alkaloids. Socially, however, decoction is perceived as a process of purification and body warming, reinforcing its cultural legitimacy. Similar patterns have been reported in other Indonesian regions, where decoction remains the dominant method due to its simplicity, effectiveness, and adaptability to diverse plant materials (Rizal et al. 2021; Fitriana et al. 2022).

From an ethnobotanical standpoint, the frequent combination of primary species such as turmeric and ginger with complementary ingredients including bay leaves, honey, and palm sugar reflects a culturally informed strategy emphasizing multi-component synergy. These combinations enhance palatability, improve consumer acceptance, and are believed to strengthen therapeutic efficacy. This polyherbal approach parallels principles in modern phytotherapy, where synergistic interactions among compounds are thought to enhance bioavailability and overall effectiveness. Comparable ethnobotanical patterns have been reported among Javanese and other Indonesian ethnic groups, where rhizome-based remedies dominate gout and musculoskeletal treatments (Nisyapuri et al. 2018; Utami et al. 2019; Jadid et al. 2020; Hildasari and Hayati 2021). Nevertheless, differences in plant part selection and formulation practices highlight the influence of local ecological conditions and culturally specific interpretations of illness.

Beyond documenting species diversity and preparation methods, this study contributes to ethnobiology by highlighting the role of traditional medicine in maintaining local health resilience and preserving biocultural knowledge. However, this knowledge system faces potential threats, including cultural erosion, urbanization, declining interest among younger generations, and reduced availability of medicinal plants due to habitat alteration. Without deliberate conservation strategies and community-based educational efforts, both biological resources and the associated knowledge systems may be at risk.

Scientifically, these findings open opportunities for future phytochemical validation and pharmacological evaluation of dominant species particularly within the Zingiberaceae family to assess their efficacy and safety in gout management. Interdisciplinary research integrating ethnobotany, natural product chemistry, and clinical pharmacology is essential to bridge traditional wisdom with modern scientific frameworks. Ultimately, this study serves not only as an inventory of Madurese ethnobotanical knowledge but also as a foundation for culturally grounded phytotherapy development that supports public health, biodiversity conservation, and cultural sustainability.

In conclusion, this study underscores the contribution of ethnobotanical research in revealing how traditional medical knowledge functions as an integrated biocultural system rather than a mere inventory of medicinal species. The documentation of Madurese gout treatment practices demonstrates that plant-based healing is shaped by the interplay of cultural beliefs, ecological adaptation, and long-term empirical experience. As such, this knowledge system represents an important component of local cultural heritage that warrants continue. Beyond its cultural significance, the findings of this study provide a conceptual foundation for future pharmacological validation of culturally prioritized medicinal plants, particularly those frequently cited and deeply embedded in local practice. While no pharmacological testing was conducted, the ethnobotanical evidence presented here offers direction for interdisciplinary research that bridges traditional knowledge with modern biomedical inquiry. The study also carries implications for local health strategies and biodiversity conservation. Recognizing traditional herbal medicine as a complementary health resource may support culturally responsive healthcare approaches, especially in rural communities.

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