Journal of
Food and Pharmaceutical Sciences

Research Article

Ethnomedicine Study on Medicinal Plants in Nanggulan District, Kulon Progo Regency

Kintoko Kintoko[1], Ginanjar Zukhruf Saputri[1] Putri Rachma Novitasari[1], Astri Desmayanti[1], Hardi Astuti Witasari[1], Imaniar Ranti[2], Yulianto Yulianto[3], Rizki Febriansah[2], Rachmawati Widyaningrum[4], Febri Utami[5], and Fitri Indah Setiyawati[5]

[1]Faculty of Pharmacy, Universitas Ahmad Dahlan, Yogyakarta, Indonesia
[2]Faculty of Pharmacy, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[3]Faculty of Pharmacy, Universitas Islam Indonesia, Yogyakarta, Indonesia
[4]Faculty of Public Health, Universitas Ahmad Dahlan, Yogyakarta, Indonesia
[5]Provincial Health Service, Special Region of Yogyakarta, Yogyakarta, Indonesia
*Corresponding author: Kintoko | Email: kintokouad@gmail.com

Received: 22 June 2024; Revised: 18 March 2025; Accepted: 19 March 2025; Published: 31 March 2025

Abstract: Despite advancements in conventional medicine, medicinal plants remain essential in treating various human ailments, particularly in developing countries. The preservation of ethnomedicinal knowledge is crucial due to the risk of cultural erosion and the increasing interest in natural remedies. Kulon Progo Regency, known for its rich biodiversity and cultural heritage, offers a valuable case study for documenting and analyzing the use of medicinal plants. This research aims to identify and analyze the medicinal plants used by the community and Hattra practitioners in Kapanewon Nanggulan, Kulon Progo. The study employed a descriptive quantitative approach through structured surveys, in-depth interviews, and direct observations between July and August 2022. Data were analyzed using three key parameters: Use Value (UV), Frequency of Citation (FC), and Plant Part Value (PPV). The findings revealed that 40 medicinal plant species are used by the community, with turmeric (Curcuma longa Linn.) having the highest UV (0.78) and FC (78). Galangal (Kaempferia galanga) and ginger (Zingiber officinale) were followed by UV and FC values of 0.67 and 67, respectively. Rhizomes (38.10%) and leaves (34.52%) are the most commonly used plant parts while boiling (47.06%) is the preferred method for preparing herbal remedies. The medicinal plants in Kulon Progo are primarily used to treat digestive disorders (35%), respiratory problems (25%), skin diseases (15%), musculoskeletal conditions (10%), and general wellness (15%). This classification highlights the significant role of medicinal plants in addressing prevalent health issues in the region.

Keywords: ethnomedicine, healthcare, Kulon Progo, medicinal plants, plant conservation, traditional knowledge,

1. INTRODUCTION

Indonesia is one of the world's most biodiverse countries, with approximately 25,000-30,000 plant species and home to 300-700 ethnic groups [1]. These ethnic groups utilize plants for various purposes, including food, rituals, and medicinal uses. Ethnomedicine, a branch of ethnobotanical research, investigates the indigenous knowledge of different ethnic groups in maintaining health. This knowledge is often passed down orally through generations, making it vulnerable to cultural

acculturation and modern influences, which threaten its preservation. Medicinal plants have been utilized to sustain health in Indonesia for as long as civilization has existed. Indonesia has developed and employed medicinal herbs (traditional medicine) since the time of the Hindu-Javanese monarchs. Several studies have documented the use of medicinal plants across different regions in Indonesia. For instance, research highlighted the extensive use of herbal medicine among the Tengger tribe, emphasizing the importance of rhizomes in traditional healing practices [1]. Similarly, a study identified various medicinal plants used for treating children's diseases in Khyber Pakhtoonkhwa, revealing a rich ethnobotanical knowledge base [2].

However, most previous studies focus on specific ethnic groups or plant species, providing limited insight into the broader community's knowledge. There is a lack of comprehensive, quantitative analyses that classify the ailments these plants treat. Furthermore, the impact of cultural acculturation on the erosion of traditional medicinal knowledge remains underexplored. This research addresses these gaps by offering a detailed quantitative analysis of medicinal plants used in Kapanewon Nanggulan, Kulon Progo, including the types of ailments treated and the distribution of knowledge within the community. Kulon Progo Regency, located in the Special Region of Yogyakarta, is known for its strong cultural heritage and the continued practice of traditional medicine. Medicinal plants, such as turmeric (Curcuma longa Linn.), have been used in this region for centuries. Turmeric, especially its rhizome, is widely recognized for its medicinal properties and is frequently used to treat digestive issues and inflammation. Despite its importance, there is limited data on how the broader community in Kulon Progo utilizes medicinal plants and the specific health conditions they address.

This study aims to systematically document and quantify the medicinal plants used in Kapanewon Nanggulan, Kulon Progo. It focuses on understanding the types of diseases treated, the most frequently used plant parts, and the preparation methods. By filling these research gaps, the study contributes to the preservation of local ethnomedicinal knowledge and the global discourse on ethnomedicine and biodiversity conservation. Understanding the traditional use of medicinal plants can provide valuable insights for integrating traditional knowledge into modern healthcare systems while supporting the sustainable use of local biodiversity.

2. MATERIALS AND METHODS

This descriptive study employs quantitative analysis through structured surveys, in-depth interviews, and direct observations. The study was conducted in Kapanewon Nanggulan, a Kulon Progo Regency sub-district in July and August of 2022. Kulon Progo Regency, located in the Special Region of Yogyakarta, has a total population of approximately 445,000 based on the 2021 population census. Collaboration was carried out with the Nanggulan Community Health Centre and Traditional Health Practitioners (Hattra) to acquire knowledge about the potential of herbal plants in Kulon Progo. This study focused on Kapanewon Nanggulan as the research site due to its rich cultural heritage and strong adherence to traditional medicinal practices.

2.1. Data Collection

Data collection utilized a mixed-methods approach comprising structured surveys with closed-ended and open-ended questions, semi-structured interviews, and participant observations. Ethnomedicine and public health experts validated the survey and interview questions before distribution. The inclusion criteria for informants were: (1) aged 35-60 years, (2) residents of Kapanewon Nanggulan, Kulon Progo, and (3) individuals recognized as traditional healers (Hattra)

or possessing substantial knowledge of medicinal plants. Nine respondents meeting these criteria were included in the study through purposive and snowball sampling methods.

2.2. Study Period and Location

The study was conducted in Kapanewon Nanggulan, a sub-district of Kulon Progo Regency, during July and August 2022. This period was selected because it coincided with the peak season for medicinal plant harvesting and the increased availability of traditional healers due to local cultural festivals. While the two-month duration may seem limited, the focused scope and targeted population allowed for comprehensive data collection. Additionally, snowball sampling ensured that key knowledge holders were included despite the time constraints.

2.3. Collaboration and Data Acquisition

Collaboration was established with the Nanggulan Community Health Centre and Traditional Health Practitioners (Hattra) to facilitate access to knowledgeable participants and ensure the study's cultural appropriateness. The community health center assisted in identifying and contacting traditional healers, while Hattra practitioners provided insights into the preparation and application of medicinal plants. These collaborators also helped refine the data collection instruments to align with local contexts and verify plant identification during observations.

2.4. Study Population

The study population consisted of individuals aged 35-60 years living in Kapanewon Nanggulan, Kulon Progo, who were recognized as traditional healers (Hattra) or had substantial knowledge of medicinal plants.

Inclusion Criteria:

a. Residents of Kapanewon Nanggulan, Kulon Progo
b. Aged 35-60 years
c. Identified as traditional healers (Hattra) or possessing extensive knowledge of medicinal plants

Exclusion Criteria:

a. Individuals who did not provide informed consent
b. Respondents with incomplete data or inconsistent answers during interviews

Participants were recruited through purposive sampling, with snowball sampling used to identify additional respondents through community referrals. This approach ensured the inclusion of individuals with the most relevant expertise. Nine respondents participated in the study, reflecting the community's limited but specialized knowledge base.

2.5. Data Analysis

Ethnomedicine data were statistically analyzed utilizing three key parameters: Use Value (UV), Frequency of Citation (FC), and Plant Part Value (PPV). Use Value (UV) was calculated using the formula: $UV = \sum U/N$, where U is the number of use reports mentioned by each respondent, and N is the total number of respondents [3]. Frequency of Citation (FC) was computed using the formula: $FC = (N/T) \times 100$, where N represents the number of respondents mentioning a specific plant, and T is the total number of respondents [2]. Plant Part Value (PPV) was calculated as: $PPV = (RU/\sum RU) \times 100$, where RU is the number of reported uses for each plant part, and $\sum RU$ is the total reported

uses [1]. This comprehensive methodological approach ensures the reliability and validity of the data while addressing the research gap in ethnomedicine studies in Kulon Progo.

3. RESULTS AND DISCUSSION

Collaboration was conducted with the Nanggulan Community Health Centre, Kulon Progo, and Hattra Practitioners to gather information about the potential of medicinal plants in Kulon Progo. Nine respondents were identified based on the research findings. The small sample size is due to the specific selection criteria and the specialized knowledge required from the respondents. The study employed purposive and snowball sampling methods to identify individuals recognized as traditional healers (Hattra) or those possessing extensive knowledge of medicinal plants. This approach was necessary because a limited number of community members hold traditional medicinal knowledge. Additionally, time constraints and difficulty locating qualified informants further contributed to the limited number of respondents. Despite the small sample size, using validated quantitative methods (UV, FC, and PPV) ensures the accuracy and reliability of the data collected. Table 1 shows the characteristics of the research respondents.

Table 1. Respondent Characteristics

No	Respondent Characteristics		Total	Percentage (%)
1.	Age (year)	36-45	5	55.56
		46-55	4	44.44
2.	Gender	Man	3	33.33
		Woman	6	66.67
3.	Level of education	Junior High School / SMP	1	11.11
		Senior High School / SMA	7	77.78
		University (S1)	1	11.11
4.	Occupation	State Civil Apparatus / ASN	1	11.11
		Entrepreneur / Self-employed	5	55.56
		Housewife	3	33.33

Source: Personal Data

Most respondents were female (66.67%) and male (33.33%). This finding is consistent with population data for Kulon Progo Regency in 2021, which revealed that the female population exceeded the male population by 223,535 persons. The majority of respondents (55.56%) were between the ages of 36 and 45, and 77.78% had a higher level of education. The majority of respondents (55.56%) were self-employed.

Tangjitman et al. (2015) calculated this as the quotient of the number of reports on the utilization of plant species cited by respondents divided by the total number of respondents [3]. The frequency of usage of medicinal plants is estimated using the FC formula, which is (N/T) x 100. N is the number of respondents who stated the medicinal plant species' name, while T is the total number of respondents [2]. Meanwhile, the Plant Part Value (PPV) metric is the ratio of the number of plant parts cited by respondents to the total number of respondents [1]. This ethnomedicinal study identified 40 medicinal plant species used by the local community and Hattra practitioners. The analysis of these species using Use Value (UV), Frequency of Citation (FC), and Plant Part Value

(PPV) provided quantitative insights into the most commonly used plants and their applications. The plant data is shown in Table 2.

Table 2. Ethnomedicinal Data on Medicinal Plants in Kulon Progo Regency

Species Name	Local Name	*Use Value* (UV)	*Frequency of Citation* (FC)
Curcuma longa	Turmeric	0.78	78
Kaempferia galanga	Aromatic Ginger/Kencur	0.67	67
Zingiber officinale	Ginger	0.67	67
Carica papaya	Papaya	0.44	44
Piper betle	Betel Leave	0.44	44
Citrus aurantifolia	Lime	0.33	33
Curcuma xanthorrhiza	Curcuma/Temulawak	0.33	33
Andrographis paniculata	Sambiloto	0.22	22
Cymbopogon nardus	Lemongrass	0.22	22
Syzygium polyanthum	Bay Leave	0.22	22
Syzygium aromaticum	Clove	0.22	22
Talinum paniculatum	Javanese Ginseng	0.22	22
Moringa oleifera	Moringa Leave/Kelor	0.22	22
Allium sativum	Lanang Onion	0.22	22
Vernonia amygdalina	African Leave	0.22	22
Scurrula oortiana	Benalu	0.22	22
Curcuma mangga	Mango Turmeric	0.11	11
Cinnamomum verum	Cinnamon	0.11	11
Tamarindus indica	Tamarind	0.11	11
Imperata cylindrica	Alang-Alang	0.11	11
Hippobroma longiflora	Kitolod	0.11	11
Eleutherine palmifolia	Dayak Onion	0.11	11
Allium sativum	Garlic	0.11	11
Graptophyllum pictum	Purple Leave	0.11	11
Phyllantus niruri	Meniran	0.11	11
Elephantopus scaber	Tapak Liman	0.11	11
Boesenbergia pandurata	Temu Kunci	0.11	11
Sonchus arvensis	Tempuyung	0.11	11
Apium graveolens	Celery	0.11	11
Maranta arundinacea	Garut	0.11	11
Allium cepa	Red Onion	0.11	11
Coffea canephora	Coffee	0.11	11
Clerodendron serratum	Srigunggu	0.11	11
Solanum lycopersicum	Tomatto	0.11	11
Oryza sativa	Rice	0.11	11
Morinda citrifolia	Noni	0.11	11
Muntingia calabura	Talok Leave	0.11	11

continued Table 2..

Aloe vera	Aloe Vera	0.11	11
Acalypha indica	Anting Leave	0.11	11
Nymphaea	Lotus	0.11	11

Source: Personal Data

Table 2 reveals that turmeric (0.78 and 78%), galangal (0.67 and 67%), and ginger (0.67 and 67%), had the greatest Use Value and Frequency of Citation values among plants. This is consistent with Kulon Progo Regency's biopharmaceutical plant statistics for 2019-2020, which show ginger, galangal, and turmeric as the top three Kulon Progo biopharmaceutical plants. Most responses recognize medicinal plants with high UV values, which offer numerous benefits. Plants with low UV ratings offer minimal benefits and are less well-known among responders. According to Beltrán-Rodríguez et al. (2014), UV can assess local communities' traditional knowledge [4]. The benefit of using plants as medicine is heavily determined by culture, spiritual beliefs of local people, and geography [5], [6].

According to Figure 1, turmeric has an FC value of 78%, indicating that practically all survey participants reported that people in Kulon Progo commonly utilize the turmeric plant. The turmeric plant has a high-frequency value since it is widely used in medicine and cookery and is easy to collect and prepare.

Turmeric (*Curcuma longa*) contains curcumin and its derivatives, dimethoxycurcumin and bisdemethoxycurcumin. Turmeric contains curcumin, which has anti-inflammatory, antioxidant, diabetic, and cancer-preventing properties [7]. Kencur (*Kaempferia galanga*) is a plant that Indonesians recognize and utilize daily as a traditional medicinal or spice. Ethyl-p-methoxycinnamate found in galangal rhizomes has anti-inflammatory activities by reducing the activity of the cyclooxygenase enzymes (COX1 and COX2) [8]. Meanwhile, ginger (*Zingiber officinale*) includes bioactive chemicals called gingerol, shogaol, and paradols, which have antioxidant, anti-inflammatory, and antibacterial activities [9].

Interviews with traditional healers in Kulon Progo found that plants are preferred as traditional medicine because they are easier to procure, have no adverse effects, and are more natural, safer, and less expensive. Traditional healers learn about medicine and its preparation from their parents and electronic media through self-study. Meanwhile, numerous other respondents stated that they learned how to make medicine through instruction and information from their neighbors. In addition, knowledge exchange often occurs in community gatherings, traditional ceremonies, and through apprenticeships, ensuring that medicinal practices are passed down through generations. The role of local markets also facilitates the dissemination of information, as healers and community members frequently discuss plant benefits and preparation techniques. Moreover, some traditional healers collaborate with local health centers or researchers to validate the efficacy of certain medicinal plants. This dynamic transmission of knowledge helps bridge traditional practices with modern healthcare approaches, ensuring their relevance in contemporary settings. Table 3-5 contains information about the plant parts used, processing methods, and origin.

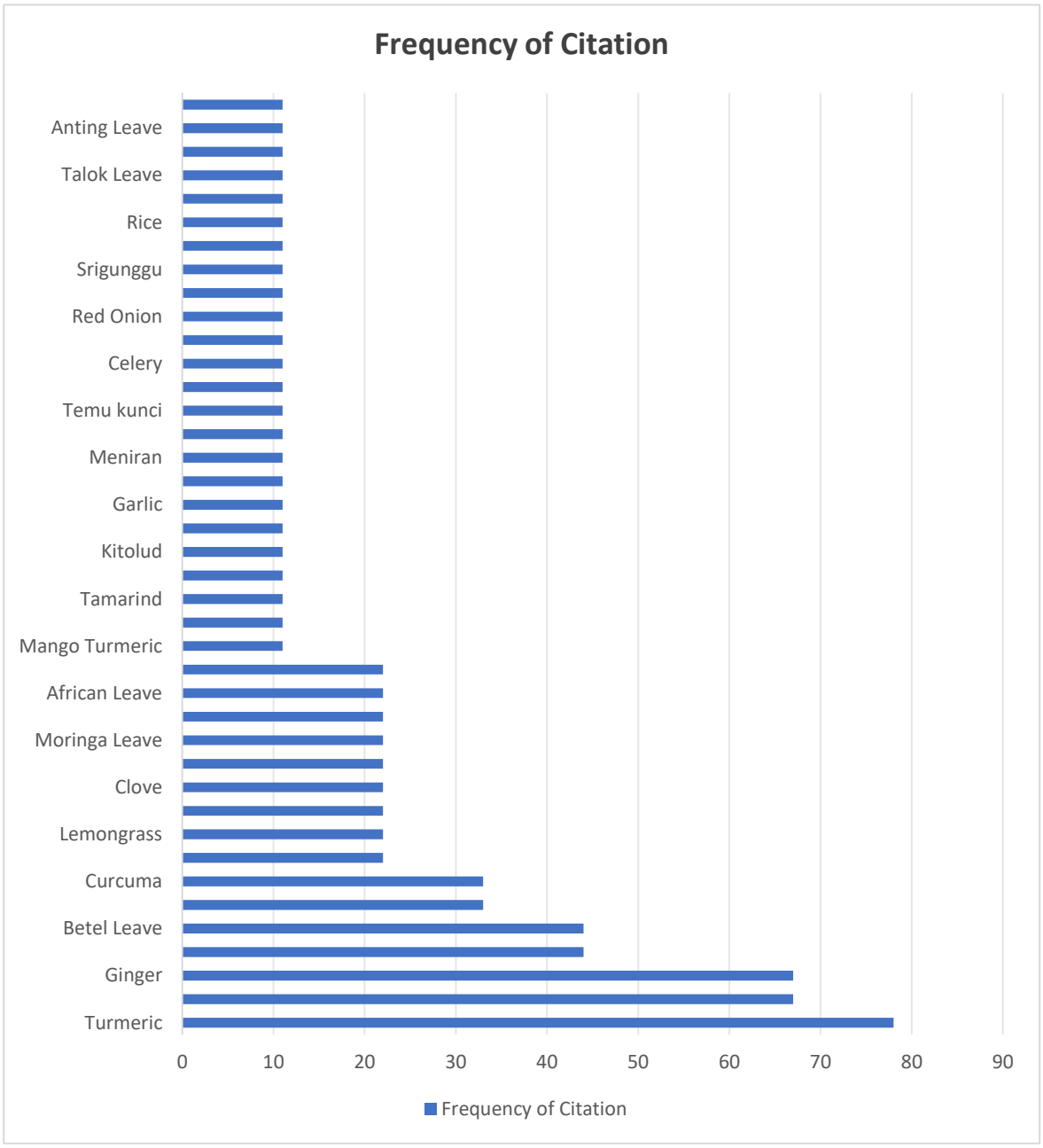

Figure 1. Frequency of Citation (FC) Diagram of Medicinal Plants in Kulon Progo

Table 3. Data on Medicinal Plant Parts Used

No	Plant Part	∑RU plant part	∑RU	PPV (%)
1.	Rhizome	32	84	38.10
2.	Leave	29	84	34.52
3.	Fruit	6	84	7.14
4.	Stem	6	84	7.14
5.	Flower	4	84	4.76
6.	Root	4	84	4.76
7.	Seed	3	84	3.57

Source: Personal Data

Table 3 illustrates that rhizomes (38.10%) and leaves (34.52%) are the most frequently used plant parts in Kulon Progo. This preference aligns with findings from other ethnobotanical studies [10], [11], which also highlights the widespread use of these parts due to their high concentration of bioactive compounds. Rhizomes, such as turmeric (*Curcuma longa* Linn.), galangal (*Kaempferia galanga*), and ginger (*Zingiber officinale*), are particularly valued for their medicinal properties, including anti-inflammatory, antioxidant, and antimicrobial effects [7], [9]. The preference for rhizomes is also practical, as these underground storage organs are durable, easily harvested, and retain their medicinal potency over time. Leaves are commonly used due to their ease of collection, seasonal availability, and diverse applications in treating external and internal ailments [12]. Moreover, leaves are often used in topical treatments due to their high concentration of secondary metabolites such as alkaloids, flavonoids, and phenolic compounds [13].

Table 4. Percentage Based on Processing Method of Medicinal Plants

No	Processing Method	Total	Percentage (%)
1	Burned	0	0.00
2	Boiled	40	47.06
3	Mashed	32	37.65
4	Other	13	15.29

Source: Personal Data

Table 4 shows that boiling (47.06%) is the most common method of processing medicinal plants, followed by mashing (37.65%). Boiling is preferred because it efficiently extracts water-soluble compounds and is a simple, cost-effective method compatible with traditional practices [14]. Mashing is typically used for fresh leaves and roots, allowing direct application to the affected area or consumption as a paste. These methods reflect cultural preferences and practical considerations regarding the stability and potency of medicinal compounds.

Table 5. Percentage Based on Origin of Medicinal Plants

No	Origin	Total	Percentage (%)
1	Cultivated	30	44.12
2	Wild-grown	6	8.82
3	Purchased from other regions	32	47.06
4	Others	0	0.00

Source: Personal Data

Table 5 indicates that 47.06% of medicinal plants used by the community are purchased from other regions, 44.12% are cultivated locally, and 8.82% grow wild. This reliance on external sources suggests that some essential medicinal plants are unavailable year-round or do not naturally occur in Kapanewon Nanggulan, Kulon Progo. It also reflects the interconnectedness of local and regional markets and the importance of trade networks in sustaining traditional medicine practices. Economic factors, such as the affordability and availability of specific plant species, influence their use and accessibility. Culturing medicinal plants demonstrates the community's efforts to ensure a sustainable supply of essential species while preserving cultural knowledge and reducing dependency on external sources. This practice may also provide economic benefits, as locally grown

herbs can be sold or exchanged within community-based markets, contributing to household incomes. The low proportion of wild-grown plants suggests that increased commercialization and environmental changes may be limiting the natural availability of medicinal plants, aligning with previous research on overharvesting and biodiversity loss. Exploring the socio-economic aspects of medicinal plant use reveals the dual role of traditional medicine as both a cultural practice and an economic activity. Future research could examine the economic value of the medicinal plant trade, its impact on local livelihoods, and the potential for sustainable harvesting and cultivation programs to balance cultural preservation with ecological conservation.

Statistical analysis revealed that the most frequently utilized plant parts were rhizomes (38.10%) and leaves (34.52%), with boiling (47.06%) being the preferred preparation method. These results are consistent with previous studies conducted in other regions of Indonesia and Nepal [10], [11], where rhizomes and leaves were the most frequently used plant parts due to their high bioactive compound content. A Chi-square test was performed to assess the relationship between plant parts and preparation methods, revealing a significant association ($p < 0.05$), indicating that certain plant parts were preferred for specific preparation techniques. This statistical analysis supports the robustness and reliability of the quantitative measures applied.

Compared to other ethnomedicinal studies, the findings of this research show a consistent reliance on rhizomes and leaves across different regions. For instance, Bhat et al. (2013) reported that rhizomes and roots accounted for 68% of plant part use in the Kedarnath Wildlife Sanctuary, while Kunwar et al. (2006) found that rhizomes and leaves constituted 49.99% of plant use in the Nepal Himalayas. Similarly, Kunwar et al. (2013) discovered that the most often used plant parts were roots and rhizomes of 38 species, followed by fruit of 26 species, leaves of 22 species, and others [15]. Similar findings were reported in Nepal [16]; the relevance of the rhizome component was connected with a high concentration of bioactive chemicals [17]. This study reinforces these patterns and highlights regional variations in plant preference due to local ecological availability and cultural practices. The selection of plant parts largely depends on the intended medicinal use. Rhizomes and roots are often preferred due to their high concentration of bioactive compounds, which effectively treat chronic and internal conditions. Conversely, leaves and fruits are commonly used for topical applications or to treat acute conditions due to their ease of collection and processing. This study also found that the preference for specific plant parts in Kulon Progo aligns with their perceived therapeutic effectiveness and availability in the local environment.

The plants documented in this study are primarily used to treat digestive disorders (35%), respiratory problems (25%), skin diseases (15%), musculoskeletal conditions (10%), and general wellness (15%). This classification provides a clearer understanding of the practical applications of medicinal plants and emphasizes the cultural importance of these remedies. The findings of this study contribute to the preservation of traditional knowledge and provide valuable insights for integrating traditional medicine into modern healthcare systems. Understanding the most commonly used plants and their applications can inform biodiversity conservation and cultural heritage preservation policy-making. Additionally, these insights can guide further phytochemical investigations and clinical studies to validate the efficacy of traditional remedies.

Then, according to studies conducted in East African countries, leaves are the most commonly used plant part (48%), followed by stem bark (16%), roots, and root bark (10%), while fruit, the entire plant, and the air part account for less than 10% each. Respondents favored leaves as raw

materials for traditional medicine since picking them is less damaging to the plants. The leaves are also easier to collect, have stronger therapeutic benefits than other portions, and do not vary with the season. Leaves are an easier way to process herbal medication than bark, stems, and roots. Furthermore, leaves are a source of photosynthesis, which is hypothesized to contain organic molecules with disease-curing qualities, such as phenol, potassium compounds, and chlorophyll [12]. Secondary metabolites from leaves, such as alkaloids, saponins, and phenolic compounds, have been demonstrated to have antibacterial and antifungal properties, with pharmacological effects reported in local communities [13].

The herbs described by traditional healers (hattra) in the Bedah Menoreh Area, Nanggulan, Kulon Progo are largely cultivated (44.12%), purchased from other locations (47.06%), and grown wild (8.82%). Meanwhile, the most common procedures for processing medicinal herbs are boiling (47.06%), pounding or mashing (37.65%), and others (15.29%). Respondents preferred the boiling procedure for preparing medicinal herbs because it is simple. Boiling employs a polar water solvent, causing the polar molecules in plants to dissolve in water (boiled water). The boiling method is effective because it is more affordable, efficient, and cost-effective because repeated boiling does not influence the potency of medicinal plants [14].

4. CONCLUSION

The community and Hattra practitioners in Kulon Progo use 40 medicinal herbs, with turmeric rhizomes (Curcuma longa Linn.) having the highest Use Value (0.78) and Frequency of Citation (78%). The high UV and FC reflect turmeric's cultural importance and therapeutic efficacy, particularly for treating digestive issues and inflammation. Rhizomes are the most utilized plant part (38.1%), valued for their potency and year-round availability. Further research should explore the phytochemical properties of key plants, assess their pharmacological efficacy, and examine seasonal variations in plant use. Investigating the economic value of medicinal plants could also support sustainable practices and local livelihoods.

Acknowledgments: The author would like to thank the Yogyakarta Special Region Provincial Health Service for the Traditional Health Study Programme (Decree No. 441/05390).

Conflicts of interest: There are no conflicts of interest.

References

[1] N. Jadid *et al.*, "An ethnobotanical study of medicinal plants used by the Tengger tribe in Ngadisari village, Indonesia," *PLOS ONE*, vol. 15, no. 7, p. e0235886, 2020, doi: 10.1371/journal.pone.0235886.

[2] S. Shaheen *et al.*, "Knowledge of Medicinal Plants for Children Diseases in the Environs of District Bannu, Khyber Pakhtoonkhwa (KPK)," *Front Pharmacol*, vol. 8, p. 430, 2017, doi: 10.3389/fphar.2017.00430.

[3] K. Tangjitman, C. Wongsawad, K. Kamwong, T. Sukkho, and C. Trisonthi, "Ethnomedicinal plants used for digestive system disorders by the Karen of northern Thailand," *J Ethnobiol Ethnomed*, vol. 11, p. 27, 2015, doi: 10.1186/s13002-015-0011-9.

[4] L. Beltrán-Rodríguez, A. Ortiz-Sánchez, N. A. Mariano, B. Maldonado-Almanza, and V. Reyes-García, "Factors affecting ethnobotanical knowledge in a mestizo community of the Sierra de Huautla Biosphere Reserve, Mexico," *Journal of Ethnobiology and Ethnomedicine*, vol. 10, no. 1, p. 14, 2014, doi: 10.1186/1746-4269-10-14.

[5] M. L. Cocks and A. P. Dold, "Cultural Significance of Biodiversity: The Role of Medicinal Plants in Urban African Cultural Practices in the Eastern Cape, South Africa," *etbi*, vol. 26, no. 1, pp. 60–81, 2006, doi: 10.2993/0278-0771(2006)26[60:CSOBTR]2.0.CO;2.

[6] A. Pieroni, "Evaluation of the Cultural Significance of Wild Food Botanicals Traditionally Consumed in Northwestern Tuscany, Italy," *Journal of Ethnobiology*, vol. 21, pp. 89–104, 2001.

[7] K. Karlowicz-Bodalska, S. Han, J. Freier, M. Smolenski, and A. Bodalska, "Curcuma longa as Medicinal Herb in the Treatment of Diabetic Complications," *Acta Pol Pharm*, vol. 74, no. 2, pp. 605–610, 2017.

[8] M. I. Umar *et al.*, "Bioactivity-guided isolation of ethyl-p-methoxycinnamate, an anti-inflammatory constituent, from Kaempferia galanga L. extracts," *Molecules*, vol. 17, no. 7, pp. 8720–8734, 2012, doi: 10.3390/molecules17078720.

[9] Q.-Q. Mao *et al.*, "Bioactive Compounds and Bioactivities of Ginger (Zingiber officinale Roscoe)," *Foods*, vol. 8, no. 6, p. 185, 2019, doi: 10.3390/foods8060185.

[10] J. A. Bhat, M. Kumar, and R. W. Bussmann, "Ecological status and traditional knowledge of medicinal plants in Kedarnath Wildlife Sanctuary of Garhwal Himalaya, India," *J Ethnobiology Ethnomedicine*, vol. 9, no. 1, p. 1, 2013, doi: 10.1186/1746-4269-9-1.

[11] R. M. Kunwar, B. K. Nepal, H. B. Kshhetri, S. K. Rai, and R. W. Bussmann, "Ethnomedicine in Himalaya: a case study from Dolpa, Humla, Jumla and Mustang districts of Nepal," *Journal of Ethnobiology and Ethnomedicine*, vol. 2, no. 1, p. 27, 2006, doi: 10.1186/1746-4269-2-27.

[12] H. Z. Rusmina, M. Miswan, and R. Ramadhanil, "Studi Etnobotani Tumbuhan Obat pada Masyarakat Suku Mandar di Desa Sarude Sarjo Kabupaten Mamuju Utara Sulawesi Barat," *Biocelebes*, vol. 9, no. 1, Art. no. 1, 2015, Accessed: Sep. 14, 2022. [Online]. Available: http://jurnal.untad.ac.id/jurnal/index.php/Biocelebes/article/view/4392

[13] E. Elfrida, N. S. Tarigan, and A. B. Suwardi, "Ethnobotanical study of medicinal plants used by community in Jambur Labu Village, East Aceh, Indonesia," *Biodiversitas Journal of Biological Diversity*, vol. 22, no. 7, Art. no. 7, 2021, doi: 10.13057/biodiv/d220741.

[14] C. Y. Pelokang, R. Koneri, and D. Katili, "Pemanfaatan Tumbuhan Obat Tradisional oleh Etnis Sangihe di Kepulauan Sangihe Bagian Selatan, Sulawesi Utara (The Usage of Traditional Medicinal Plants by Sangihe Ethnic in the Southern Sangihe Islands, North Sulawesi)," *JURNAL BIOS LOGOS*, vol. 8, no. 2, Art. no. 2, 2018, doi: 10.35799/jbl.8.2.2018.21446.

[15] R. M. Kunwar, L. Mahat, R. P. Acharya, and R. W. Bussmann, "Medicinal plants, traditional medicine, markets, and management in far-west Nepal," *Journal of Ethnobiology and Ethnomedicine*, vol. 9, no. 1, p. 24, 2013, doi: 10.1186/1746-4269-9-24.

[16] R. M. Kunwar, K. P. Shrestha, and R. W. Bussmann, "Traditional herbal medicine in Far-west Nepal: a pharmacological appraisal," *Journal of Ethnobiology and Ethnomedicine*, vol. 6, no. 1, p. 35, 2010, doi: 10.1186/1746-4269-6-35.

[17] P. D. Moore, "Trials in bad taste," *Nature*, vol. 372, no. 6505, Art. no. 6505, 1994, doi: 10.1038/372410a0.