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Ethnobotanical study of medicinal plants by indigenous community of Aek Guo Village, Mandailing Natal District, Indonesia

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Abstract. *Rambey R, Nelasufa F, Athoriez APM, Solihin, Rahmawaty, Susilowati A, Afifuddin Y. 2024. Ethnobotanical study of medicinal plants by indigenous community of Aek Guo Village, Mandailing Natal District, Indonesia. Biodiversitas 25: 1046-1056.* Aek Guo Village, Mandailing Natal District, Indonesia, falling under the jurisdiction of Forest Management Unit or *Kesatuan Pengelolaan Hutan* (KPH) IX Panyabungan, serves as a home for the Mandailing indigenous tribe, primarily engaged in agriculture with a significant dependence on the forest for sustenance. Within the cultural fabric of the Aek Guo community, there exists a profound tradition of employing medicinal plants as an alternative form of treatment, a practice deeply rooted in ethnobotanical knowledge passed down through generations. The study aimed to identify the diverse array of medicinal plants, their utilization practices, and key parameters such as Use Value (UV), Family Use Value (FUV), Plant Part Value (PPV), and Fidelity Level (FL) associated with their applications. A comprehensive approach that integrates qualitative and quantitative methods, the study involves semi-structured interviews and meticulous documentation. The findings reveal a rich repertoire of 66 plant species distributed across 36 families, constituting a vital component of the Aek Guo community. Noteworthy is the pre-eminence of ginger (*Zingiber officinale*) with the highest UV value (0.68), while *paku gajah* (*Angiopteris evecta*) being the lowest (0.01). Family Use Value (FUV) demonstrated variations, with Fabaceae leading the chart (0.39), and Simaroubaceae recording the lowest value (0.01). A closer examination of Plant Part Value (PPV) indicated a preference for leaves, comprising 56.06% of the utilized plant parts, while flowers contribute minimally at 1.51%. Fidelity Level (FL) values, crucial for assessing the significance of particular plants within the community, peak for *kumis kucing* (*Orthosiphon aristatus*) and ginger (*Z. officinale*) at 22.54%. In contrast, *jerangau* (*Acorus calamus*), *pasak bumi* (*Eurycoma longifolia*), *salam* (*Syzygium polyanthum*), and *paku gajah* (*A. evecta*) exhibit the lowest FL values at 1.41%. These findings contribute significantly to the broader understanding of ethnobotanical practices across different Mandailing communities, with potential implications for conservation, healthcare, and sustainable resource management.

Key words: Aek Guo, ethnobotany, indigenous knowledge, medicinal plants

INTRODUCTION

Indonesia is renowned for hosting the second-largest biodiversity globally after Brazil, with over 6,000 identified plant species recognized for great potential in herbal medicine (Fathir et al. 2021). This rich heritage, deeply ingrained in historical practices and transmitted across generations, contributes not only to herbal remedies but also extends to diverse preparations. Plants, integral to cultural development, serve multifaceted roles in human life, and ethnobotany, a field examining human-plant interactions, underscores how indigenous communities perceive, manage, and use plants in their surroundings (Radhakrishnan et al. 2016). Plant biodiversity yields ecosystem products and services, offering provisioning, regulating, supporting, and cultural benefits to humans (Maroyi 2017). The provisioning services of crops include food, fodder, medicine, timber, grazing, firewood, and ornamental resources, while regulating services pertain to maintaining air and water quality as well as controlling erosion (Khan et al. 2013). The traditional knowledge acquired by indigenous communities, a product of continuous interaction with nature, faces threats of extinction due to environmental changes, livelihood diversification, and cultural conflicts (Cao et al. 2020). This invaluable traditional wisdom, transmitted orally across generations without written records, is at risk of permanent loss. Therefore, the exploration and documentation of local traditional knowledge is essential (Bhandary 2021). The decrease in ethnobotanical knowledge marks the onset of forest degradation, signaling a reduced role of local institutions in ensuring sustainable forest use (Pei 2013).

Ethnobotanical knowledge serves as an indicator of the sustainable use of forest products and inherent ecosystem service. The diversity among community groups arises from differences in cultural levels and local environmental conditions. Despite the rich knowledge on useful plant species possessed by ethnic groups, only a mere fraction, not exceeding 10%, is manifested as application in daily life (Rahayu et al. 2012). In Indonesia, useful plants are categorized based on their applications, including clothing, food, shelter, equipment, medicines, cosmetics, rigging, as well as materials for social and religious activities (Jannaturrayyan et al. 2020). Ethnobotanical studies play a crucial role in documenting knowledge about useful plants, preventing the loss of local knowledge, and promoting the expanded utilization of valuable resources. Other contributions include fostering health and the economy, serving as a representation of plant biodiversity (Mechaala et al. 2022). Local knowledge, gleaned from ethnobotanical studies, can further aid in in-situ conservation efforts, preserving biodiversity in the original habitat (Suwardi et al. 2020).

Sumatra Island is renowned for its high biodiversity and endemism, holding a significant position as a hotspot for tropical plant diversity (Ismaini et al. 2015). This area, known for its abundant indigenous plant species, plays a vital role in the daily lives of local inhabitants, fulfilling their daily requirements and often contributing to the industrial and cultural practices of specific tribes or communities (Khruomo and Deb 2018). North Sumatra is one of the provinces in Indonesia known for its diverse ethnic composition, including Malay, Karo, Simalungun, Batak, Mandailing, Javanese, and other groups (Nasution 2022). The Mandailing people, specifically, reside along the southwest coast of Sumatra Island (Nasution et al. 2021), with one of their prominent settlements being Mandailing Natal District. In their study on the Mandailing tribe, Nasution et al. (2018) identified 262 plant species, of which 106 were utilized for food, 81 for traditional medicine, 29 for firewood, 35 for building materials, and 25 for animal feed. The integration of plants into local customs is shaped by various factors including their ease of acquisition, collection, and transportation, which are intricately linked to their natural abundance and accessibility. Furthermore, Mandailing Natal District stands out as the second largest district within the North Sumatra Province (Santoso et al. 2023). Therefore, the assimilation of numerous wildlife species to meet varying requirements is contingent upon the prevailing vegetation diversity in the specific region. Aek Guo Village, under the jurisdiction of KPH IX Panyabungan and predominantly inhabited by the Mandailing ethnic group, relies heavily on forest resources for sustenance. Despite the crucial role of plants in daily life, there is a dearth of ethnobiological knowledge focused on the region. Therefore, this study aimed to comprehensively investigate the ethnobotanical aspects of medicinal plants used by the residents of Aek Guo Village, elucidating plant species, usage patterns, and key parameters including Use Value (UV), Family Use Value (FUV), Plant Part Value (PPV), and Fidelity Level (FL).

MATERIALS AND METHODS

Study area

The research was conducted in Aek Guo Village, Batang Natal Sub-district, Mandailing Natal District, North Sumatra Province, Indonesia (Figure 1). Aek Guo Village is located in the Forest Management Unit (KPH) Region IX Panyabungan. Aek Guo Village derives its name from the presence of a river tributary flowing through a cave. Positioned 12 km from the sub-district center, 35 km from the district center, and 225 km from the provincial capital, the village spans an area of 3,225 hectares and is home to 63 households (KK) with 242 residents. The majority of the population identifies as Mandailing Tribes, with the Rangkuti and Nasution clans dominating the community. Aek Guo Village shares its borders with Penyabungan Barat to the North, Tarlola Village to the East, West Sumatra to the South, and Kase Rao-Rao Village to the West. Beyond its geographical features, Aek Guo stands out as a culturally rich and community-oriented locale.

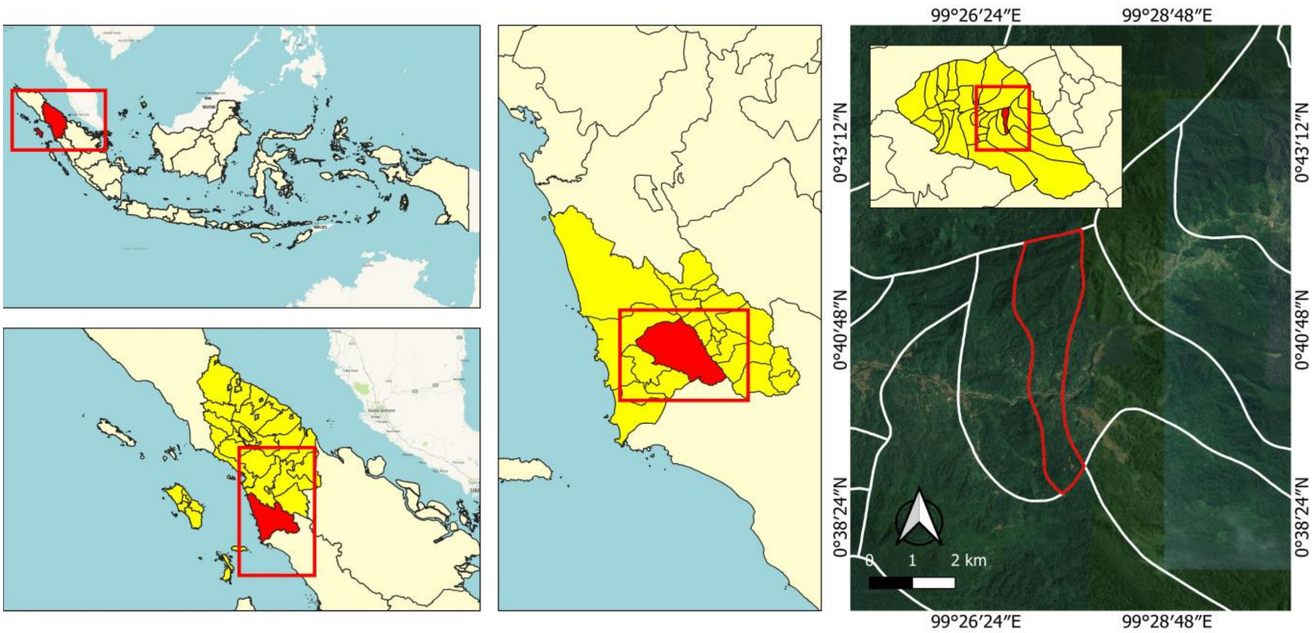

Figure 1. Map of research location in Aek Guo Village, Batang Natal Sub-district, Mandailing Natal District, North Sumatra Province, Indonesia

Data collection procedure

The data were collected from October 2022 to January 2023, encompassing both primary and secondary data. Primary data was acquired through interviews and field surveys, focusing on the documentation of various beneficial plants species in Aek Guo Village. Meanwhile, secondary data, encompassing the broader socio-cultural and general conditions of Aek Guo Village, was obtained from KPH IX Panyabungan. The Slovin Formula was employed to determine the number of respondents, given a population of 242 individuals according to village data. Following the calculation, it was determined that 71 respondents would be required to adequately represent the studied population. The method used to determine respondents was snowball sampling, where elders or individuals assuming leadership roles were identified and granted access to sample residents assumed to possess knowledge about indigenous medicinal plants. Data collection utilized the semi-structured interview method, where selected respondents were queried with a set of predetermined questions outlined in the questionnaire. Interviews were conducted by recording and documenting the information provided by the respondents.

Data analysis

Qualitative and quantitative methods were employed for data analysis. Qualitative methods aimed to elucidate local knowledge, plant benefits, utilized plant parts or organs, as well as the families and species of the plants utilized. On the other hand, quantitative methods were applied to ascertain key metrics such as Use Value (UV), Family Use Value (FUV), Plant Part Value (PPV), and Fidelity Level (FL) concerning the medicinal plants under investigation (Hoffman and Gallaher 2007).

Use Value (UV)

Species Use Value (UV) is a quantitative approach illustrating the local importance of various species. The formula to determine UV of a plant species utilized by the Aek Guo Village community is presented below:

$$UVs = \frac{\sum UVis}{n_i}$$

Where:
UV_s : Use Value of the species
UV_{is} : Number of mentioned uses of a species
n_i : Total number of respondents interviewed

Family Use Value (FUV)

Family Use Value (FUV) is used to recognize the importance of plant families, functioning as a measure of cultural significance applicable in ethnobotany for assessing the value of biological plant taxa. The formula to determine FUV of a plant species utilized by the Aek Guo Village community is as follow:

$$FUV = \frac{\sum UVs}{(n_s)}$$

Where:
FUV : Use Value to a Family
UV_s : Use Value of a species
n_s : Total number of species in a particular family

Plant Part Value (PPV)

Plant Part Value (PPV) is employed to gauge the significance of each utilized part of the plant, as indicated by the respondents. PPV of a plant species utilized by the Aek Guo Village community is calculated using the formula below:

$$PPV(\%) = \frac{\sum RU(plantpart)}{\sum RU} x100$$

Where:
PPV : Use value of plant organs
RU : Amount of use quoted for each plant part

Fidelity Level (FL)

Fidelity Level (FL) represents the proportion of informants acknowledging the uses of specific plant species for treating a particular ailment within the study area. The parameter was derived by counting the species of plants that are most widely used for certain purposes by the people of Aek Guo Village with the formula:

$$FL\% = \frac{Np}{N} x100$$

Where:
FL : Fidelity Level Value
N_p : Number of respondents who reported the use of a particular plant
N : Total number of respondents who mentioned the same plant for each type of use

RESULTS AND DISCUSSION

Socio-demographic profiles of local community in Aek Guo

In total, 71 local informants, comprising 36 men and 35 women, were interviewed. The highest number of respondents fell within the age group of 37-46 years (19.72%), while the smallest number of respondents were in the age group of 87-96 years (1.41%). The majority of respondents were farmers (66.20%), whereas village heads and laborers had the lowest representation (1.41%). The highest proportion of respondents had attained a high school education (40.85%), while the lowest percentage held a bachelor's degree (1.41%). Further details regarding the socio-demographics of the community are presented in Table 1.

List of medicinal plants utilized by the Aek Guo Village community

Through interviews conducted with the residents of Aek Guo Village, it was determined that 66 plant species belonging to 36 families were utilized for medicinal purposes (Table 2; Figure 2). Notably, the community of Aek Guo predominantly used plants from the Zingiberaceae family, constituting 15% of the total species, encompassing ten distinct plants such as *Alpinia galanga*, *Curcuma caesia*, *Curcuma longa*, *Curcuma zanthorrhiza*, *Curcuma zedoaria*, *Etlingera elatior*, *Kaempferia galanga*, *Zingiber cassumunar*, *Zingiber officinale*, and *Zingiber zerumbet*. The traditional use of Zingiberaceae in Indonesia has been well-documented, particularly among the Batak tribe in North Sumatra (Silalahi 2014). According to Fathir et al. (2021), traditional recipes incorporating 19 medicinal plants from 16 genera and 11 families were identified, with Zingiberaceae contributing the highest number of species, amounting to eight. Silalahi et al. (2021) also surveyed the traditional medicine traders in Pancur Batu which revealed the utilization of 10 rhizome species from five Zingiberaceae families as ingredients in traditional medicine. Zingiberaceae rhizomes were employed in various forms, including plain or raw material (a semi-solid medicinal herb prepared by brewing), *parem* (a solid concoction derived from various extracts), and *oukup* (a traditional preparation among the Karo Tribe).

Use Value (UV) of medicinal plants

Table 2 presents the Species Use Value (UV) for the 66 medicinal plant species utilized by the Aek Guo Village community. The highest UV values signify that a particular plant species holds substantial benefits, and the community possesses a considerable level of knowledge regarding their usage (Kurniawan 2015). Notably, *Z. officinale* (0.68), *Sesbania grandiflora* (0.39), and *Phaleria macrocarpa* (0.34) emerged as the species with the highest UV values. Conversely, *Angiopteris evecta* (0.01), *Eurycoma longifolia* (0.01), and *Syzygium polyanthum* (0.01) displayed the lowest UV values. Comparisons with other studies reveal varying UV values among different communities. Elfrida et al. (2021) reported UV values ranging from 0.03 to 0.96 for medicinal plants used by the Jambur Labu Community, East Aceh, Indonesia. Remarkably high UV values were associated with specific species such as *Breynia androgyna, Moringa oleifera, Jatropha multifida, Zingiber montanum, Z. officinale,* and *Tagetes erecta* (0.96). In a study conducted by Jadid et al. (2020) on the Tengger community, Probolinggo, East Java, Indonesia, the top five species with the highest UV values were identified as *Foeniculum vulgare* (1.01), *Aloe vera* (0.86), *Acorus calamus* (0.80), *Apium graveolens* (0.76), and *Allium fistulosum* (0.71). These findings underscore the variability in the perceived usefulness of medicinal plants across different cultural contexts.

Family Use Value (FUV) of medicinal plants

The Family Use Value (FUV) assesses the overall use value of a particular plant family, reflecting the cumulative benefits and community knowledge associated with that family. A higher FUV indicates that the family has considerable benefits and a high level of community knowledge regarding its use, while a lower FUV suggests the opposite. In the context of Aek Guo Village, the analysis revealed that the Fabaceae family had the highest FUV value (0.39), underscoring its perceived significance and extensive utilization within the community. Conversely, the Simaroubaceae family exhibited the lowest FUV value (0.01), indicating comparatively fewer perceived benefits and lower community knowledge regarding its use. Comparisons with other studies further illuminate the variability in FUV values across different regions. For instance, Sreekeesoon and Mahomoodally (2014) in Mauritius identified the Asphodelaceae family as having the highest FUV value. Similarly, Jadid et al. (2020) found that the Aloaceae (Asphodelaceae) family held the highest FUV value (0.86) among the Tengger community in their research. Meanwhile, Damayanti et al. (2021) reported the Zingiberaceae family (0.55) as the family with the highest FUV among the people of Lombok Island, followed by the Malvaceae family (0.26) and Cucurbitaceae (0.26). These findings emphasize the cultural specificity in the perceived importance of plant families across diverse communities.

Table 1. Demographic profiles of informants interviewed

Variables	Categories	Total	Percentage (%)
Gender	Male	36	50.70
	Female	35	49.30
Age	17-26	25	35.21
	27-36	7	9.86
	37-46	14	19.72
	47-56	12	16.90
	57-66	4	5.63
	67-76	2	2.82
	77-86	6	8.45
	87-96	1	1.41
Occupational status	Housewives	2	2.82
	Village head	1	1.41
	Laborer	1	1.41
	University students	4	5.63
	Miners	2	2.82
	Farmers	47	66.20
	Freelance	1	1.41
	Students	3	4.23
	Entrepreneur	10	14.08
Educational status	Primary	20	28.17
	Secondary	16	22.54
	High school	31	43.67
	University	3	4.23
	Bachelor	1	1.41

Table 2. List of medicinal plant species used by Aek Guo Village community, Mandailing Natal District, North Sumatra Province, Indonesia

Botanical name	Local name	UV	Family	FUV	Treatment	Part Use	Processing	Preparation	Source
Strobilanthes crispa T.Anderson	*Kecibeling*	0.11	Acanthaceae	0.08	Hyperglycemia	Leaves	Boiled	Drink	Cultivated
Graptophyllum pictum (L.) Griff.	*Wungu*	0.08	Acanthaceae		Skin disorder	Leaves	Mashed	Smeared	Cultivated
Strobilanthes alternata (Burm.f.) Moylan ex J.R.I.Wood	*Sarap*	0.04	Acanthaceae		Wound healing	Leaves	Mashed	Pasted	Cultivated
Acorus calamus L.	*Jerangau*	0.17	Acoraceae	0.17	Immunity, cough	Leaves	Mashed, boiled	Drink	Cultivated
Allium fistulosum L.	*Bawang Daun*	0.14	Amaryllidaceae	0.17	Hyperlipidemia	Leaves	Cooked	Consumed	Cultivated
Allium sativum L.	*Bawang Putih*	0.13	Amaryllidaceae		Hyperlipidemia	Tuber	Skinned	Consumed	Cultivated
Allium ascalonicum L.	*Bawang Merah*	0.32	Amaryllidaceae		Hypertension, hyper-glycemia, aromatherapy	Leaves, tubers	Cooked, boiled	Consumed, inhaled	Cultivated
Allium schoenoprasum L.	*Lokio*	0.10	Amaryllidaceae		Bowel disorder	Leaves	Mashed, oiled	Pasted	Cultivated
Annona muricata L.	*Sirsak*	0.07	Annonaceae	0.07	Bone fracture	Leaves	Boiled	Drink	Cultivated
Apium graveolens L.	*Seledri*	0.04	Apiaceae	0.04	High blood pressure	Leaves	Cooked	Consumed	Cultivated
Polyscias scutellaria (Burm.f.) Fosberg	*Mangkokan*	0.13	Araliaceae	0.13	Lactation improvement	Leaves	Boiled	Drink	Cultivated
Cocos nucifera L.	*Kelapa*	0.06	Arecaceae	0.06	Dehydration, stamina	Fruit	Raw	Consumed	Cultivated
Cordyline fruticosa (L.) A.Chev.	*Hanjuang*	0.07	Asparagaceae	0.07	Cough	Leaves	Boiled	Drink	Wild
Blumea balsamifera (L.) DC.	*Sembung*	0.11	Asteraceae	0.08	Malaria	Leaves	Boiled	Washed	Cultivated
Ageratum conyzoides L.	*Angur-angur*	0.07	Asteraceae		Wound healing	Leaves	Boiled	Pasted	Cultivated
Lactuca sativa L.	*Selada*	0.04	Asteraceae		Eye treatment	Leaves	Raw	Consumed	
Impatiens balsamina L.	*Pacar air*	0.08	Balsaminaceae	0.08	Skin disease	Leaves	Mashed	Smeared	Cultivated
Brassica rapa L.	*Caisin*	0.08	Brassicaceae	0.08	Hyperlipidemia, eye treatment	Leaves	Cooked	Consumed	Cultivated
Ananas comosus (L.) Merr.	*Nanas*	0.03	Bromeliaceae	0.03	Immunity	Fruit	Raw	Consumed	Cultivated
Kalanchoe blossfeldiana Poelln.	*Dingin-dingin*	0.13	Crassulaceae	0.13	Fever	Leaves	Soaked, drained	Pasted	Cultivated
Aleurites moluccanus (L.) Willd.	*Kemiri*	0.13	Euphorbiaceae	0.08	Bowel disorder, skin disease	Seeds	Cooked. Baked, mashed	Consumed	Cultivated
Jatropha curcas L.	*Jarak*	0.04	Euphorbiaceae		Digestive disorder	Leaves	Boiled	Drink	Cultivated
Sesbania grandiflora (L.) Poir.	*Turi*	0.39	Fabaceae	0.39	Oral disease, hyperglycemia	Roots, leaves	Boiled	Drink	Cultivated
Orthosiphon aristatus (Blume) Miq.	*Kumis Kucing*	0.23	Lamiaceae	0.09	Dental problem	Roots, leaves	Boiled	Drink, gargled	Cultivated
Coleus amboinicus Lour.	*Bangun-bangun*	0.11	Lamiaceae		Skin disease	Leaves	Shredded, drained	Pasted	Cultivated
Lavandula angustifolia Mill.	*Lavender*	0.07	Lamiaceae		Aromatherapy	Flowers	Raw	Inhaled	Cultivated
Ocimum basilicum L.	*Kemangi*	0.06	Lamiaceae		Hyperglycemia	Leaves	Raw (fresh)	Consumed	
Coleus scutellarioides (L.) Benth.	*Jawer Kotok*	0.04	Lamiaceae		Hyperglycemia	Leaves	Boiled	Drink	Cultivated
Ocimum americanum L.	*Simartampua*	0.03	Lamiaceae		Hyperglycemia	Leaves	Raw (fresh)	Consumed	Cultivated
Cinnamomum burmanni (Nees & T.Nees) Blume	*Kayu Manis*	0.25	Lauraceae	0.25	Hyperglycemia, menstrual cramp, immunity	Skin	Boiled	Drink	Cultivated
Lawsonia inermis L.	*Pacar Kuku*	0.07	Lythraceae	0.06	Bowel disorder	Leaves	Boiled	Drink	Cultivated
Punica granatum L.	*Delima*	0.06	Lythraceae		Immunity	Fruits	Raw	Consumed	Wild
Angiopteris evecta (G.Forst.) Hoffm.	*Paku Gajah*	0.01	Marattiaceae	0.01	Bowel disorder	Leaves	Boiled	Drink	Wild
Melastoma malabathricum L.	*Senduduk*	0.14	Melastomataceae	0.14	Wound healing	Leaves	Munched	Pasted	Cultivated

Moringa oleifera Lam.	*Kelor*	0.25	Moringaceae	0.25	Hyperglycemia, fever	Leaves	Boiled	Drink	Cultivated
Myristica fragrans Houtt.	*Pala*	0.10	Myristicaceae	0.10	Antibiotics	Seeds	Cooked	Consumed	Cultivated
Syzygium aromaticum (L.) Merr. & L.M.Perry	*Cengkeh*	0.14	Myrtaceae	0.08	Hyperglycemia	Fruits	Cooked, boiled	Consumed, gargled	Cultivated
Psidium guajava L.	*Jambu Biji*	0.10	Myrtaceae		Bowel disorder	Leaves	Boiled	Drink	Cultivated
Syzygium polyanthum Miq.	*Salam*	0.01	Myrtaceae		Bowel disorder	Leaves	Boiled	Drink	Cultivated
Breynia androgyna (L.) Chakrab. & N.P.Balakr.	*Katuk*	0.11	Phyllanthaceae	0.11	Lactation improvement, detoxification	Leaves	Boiled	Drink	Cultivated
Piper betle L.	*Sirih*	0.13	Piperaceae	0.11	Cough	Leaves	Boiled	Drink	Wild
Peperomia pellucida (L.) Kunth.	*Sirih Cina*	0.13	Piperaceae		Skin disease	Leaves	Mashed	Pasted	Cultivated
Piper crocatum Ruiz & Pav.	*Sirih Merah*	0.08	Piperaceae		Cough	Leaves	Boiled	Drink	Cultivated
Cymbopogon nardus (L.) Rendle	*Serai Wangi*	0.25	Poaceae	0.25	Fever, respiratory disease, Bowel disorder	Leaves	Dipped	Pasted	Cultivated
Ziziphus mauritiana Lam.	*Bidara*	0.08	Rhamnaceae	0.08	Bowel disorder, wound healing	Leaves	Boiled	Drink, pasted	Cultivated
Gardenia jasminoides J.Ellis	*Kacapiring*	0.11	Rubiaceae	0.09	Oral disease	Leaves	Mashed, soaked	Drink, pasted	Cultivated
Myrmecodia pendens Merr. & L.M.Perry	*Sarang Semut*	0.10	Rubiaceae		Bowel disorder	Shoots	Boiled	Drink	Wild
Uncaria gambir (W.Hunter) Roxb.	*Gambir*	0.07	Rubiaceae		Respiratory disease, oral disease	Leaves	Boiled	Gargled	Cultivated
Eurycoma longifolia Jack	*Pasak Bumi*	0.01	Simaroubaceae	0.01	Malaria	Roots	Boiled	Drink	Wild
Physalis angulata L.	*Ciplukan*	0.11	Solanaceae	0.06	Bowel disorder	Fruits	Raw	Consumed	Wild
Datura metel L.	*Kecubung*	0.06	Solanaceae		Skin disease	Leaves	Mashed	Pasted	Cultivated
Capsicum frutescens L.	*Cabai Rawit*	0.04	Solanaceae		Bowel disorder	Fruits	Cooked	Consumed	Cultivated
Solanum lycopersicum L.	*Tomat*	0.03	Solanaceae		Hypertension	Fruits	Raw (fresh)	Consumed	Cultivated
Styrax benzoin Dryand.	*Kemenyan*	0.10	Styraceae	0.10	Aromatherapy	Saps	Extraction	Smeared	Wild
Phaleria macrocarpa (Scheff.) Boerl.	*Mahkota Dewa*	0.34	Thymelaeaceae	0.34	Respiratory disease, cardioprotective, malaria	Fruits	Dried, boiled	Drink	Cultivated
Aloe vera (L.) Burm.f.	*Lidah Buaya*	0.07	Asphodelaceae	0.07	Dental problem, hyperglycemia	Leaves	Juiced	Consumed	Cultivated
Zingiber officinale Roscoe	*Jahe*	0.68	Zingiberaceae	0.21	Bowel disorder, hyper-glycemia, menstrual cramp	Rhizomes	Shredded, boiled	Drink	Cultivated
Curcuma zanthorrhiza Roxb.	*Temulawak*	0.30	Zingiberaceae		Bowel disorder, cough	Rhizomes	Boiled	Drink	Cultivated
Curcuma longa L.	*Kunyit Kuning*	0.23	Zingiberaceae		Aromatherapy, bowel disorder, stamina boost	Rhizomes	Mashed, boiled	Drink, sprayed	Cultivated
Etlingera elatior (Jack) R.M.Sm.	*Kecombrang*	0.20	Zingiberaceae		Lactation improvement, dental problem	Rhizomes	Cooked	Consumed	Cultivated
Kaempferia galanga L.	*Kencur*	0.17	Zingiberaceae		Bowel disorder, cough	Roots, rhizomes	Mashed, boiled, squeezed, shredded	Drink, consumed	Cultivated
Alpinia galanga (L.) Willd.	*Lengkuas*	0.15	Zingiberaceae		Wound healing	Rhizomes	Mashed, oiled, sauteed	Pasted	Cultivated
Curcuma zedoaria (Christm.) Roscoe	*Kunyit Putih*	0.14	Zingiberaceae		Bowel disorder	Rhizome	Dried, mashed	Drink	Cultivated
Curcuma caesia Roxb.	*Kunyit Hitam*	0.10	Zingiberaceae		Bowel disorder	Rhizome	Boiled	Drink	Cultivated
Zingiber zerumbet (L.) Roscoe ex Sm.	*Lempuyang*	0.07	Zingiberaceae		Hyperglycemia	Rhizome	Boiled	Drink	Cultivated
Zingiber purpureum Roscoe	*Bangle*	0.06	Zingiberaceae		Bowel disorder, fever	Rhizome	Shredded, mashed	Consumed	Cultivated

Table 3. Preparation of medicinal plants by Aek Guo Village community, North Sumatra Province, Indonesia

Usage	Respondents	
	Number	Percentage (%)
Inhaled	1	1.52
Tied and Drink	1	1.52
Consumed	18	27.27
Consumed and inhaled	1	1.52
Consumed and gargled	1	1.52
Gargled	1	1.52
Washed	1	1.52
Drink	24	36.36
Drink and consumed	1	1.52
Drink and gargled	1	1.52
Drink and sprayed	1	1.52
Drink and pasted	1	1.52
Smeared	3	4.55
Pasted	10	15.15
Pasted and drink	1	1.52

Table 4. Plant part used for medicines by Aek Guo Village community, North Sumatra Province, Indonesia

Plant Part	Respondents	
	Number	Percentage (%)
Leaf	37	56.06
Tuber	2	3.03
Fruit	8	12.12
Seed	2	3.03
Flower	1	1.51
Bark	1	1.51
Root	1	1.51
Sap	1	1.51
Rhizome	9	13.63
Root & Rhizome mixture	1	1.51
Root & Leaf mixture	2	3.03
Leaf & Tuber mixture	1	1.51

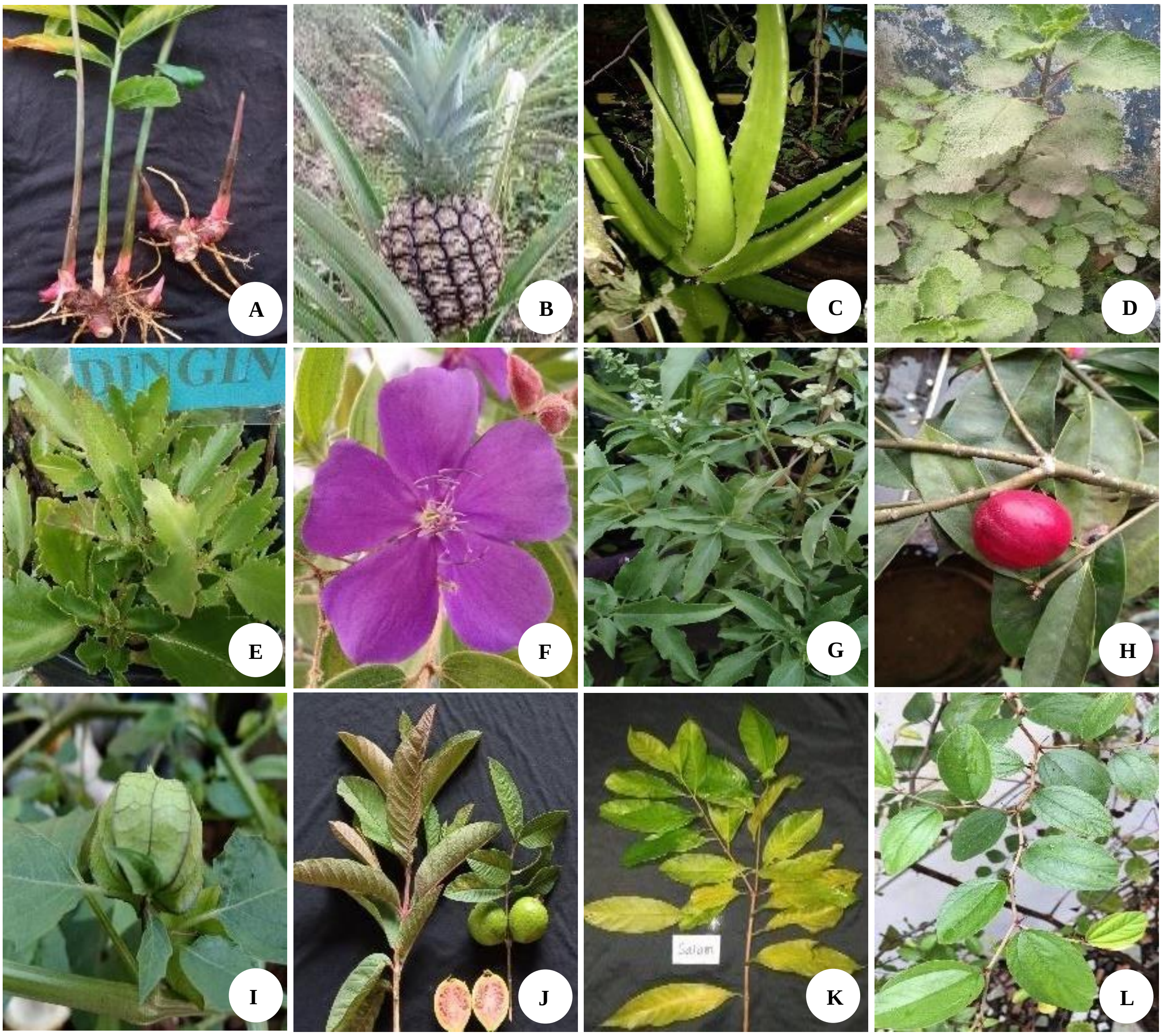

Figure 2. Field documentation of some medicinal plants utilized by Aek Guo Community, Indonesia. A. *Alpinia galanga*, B. *Ananas comosus*, C. *Aloe vera*, D. *Coleus amboinicus*, E. *Kalanchoe blossfeldiana*, F. *Melastoma malabathricum*, G. *Ocimum basilicum*, H. *Phaleria macrocarpa*, I. *Physalis angulata*, J. *Psidium guajava*, K. *Syzygium polyanthum*, L. *Ziziphus mauritiana*

Processing and usage of medicinal plants

The processing methods and utilization patterns of medicinal plants within the Aek Guo Village community are presented in Table 3. The predominant processing method is boiling. This finding aligns with the research conducted by Hastiana et al. (2023), which documented boiling as the most widely used method due to its simplicity compared to alternative processing techniques. The simplicity, cost-effectiveness, and ease of implementation make boiling a preferred choice among communities (El-Amri et al. 2015). The boiling process is instrumental in dissolving the active compounds present in medicinal plants into water, facilitating their extraction (Nugroho et al. 2021). Table 3 summarized the various ways medicinal plants are utilized, with the predominant method being ingestion through drinking, constituting 36.36% of the reported cases. This aligns with findings from the study by Julung et al. (2023) among the Dayak people, where drinking emerged as the most common method of utilization. This preference is attributed to the belief that drinking yields a faster therapeutic response compared to alternative modes of administration. Particularly, drinking is favored for addressing internal diseases and is associated with positive healing outcomes (Supiandi et al. 2021).

The residents of Aek Guo Village employ *Z. officinale* to address digestive issues, regulate blood sugar, and alleviate menstrual pain. The rhizome is the utilized plant part, processed by grating it into a smooth consistency and subsequently boiling it with water. The resulting decoction is consumed orally. Akash et al. (2015) confirmed the antidiabetic therapeutic effects of *Z. officinale*, citing increased insulin sensitivity, protection of pancreatic islet cells, reduced fat accumulation, oxidative stress mitigation, and enhanced glucose absorption by tissues. The rhizome of *Z. officinale* is rich in essential oils, phenolic compounds, flavonoids, carbohydrates, proteins, alkaloids, glycosides, saponins, steroids, terpenoids, and tannins (Dhanik et al. 2017). *Sesbanea grandiflora* was used to treat fever, regulate blood sugar, address canker sores, alleviate bone pain, and as a natural antibiotic. Both roots and leaves are utilized, boiled with water, and the resulting infusion is consumed orally. The antibacterial properties of *S. grandiflora* leaves against drug-resistant human pathogens have been demonstrated. *Polyathia macrocarpa* fruits were consumed for various ailments, including shortness of breath, heart attacks, malaria, stomach aches, flatulence, coughs, diabetes, and cardiovascular health. The processing involves drying the fruit and subsequent boiling with water for oral consumption. The fruits are rich in tannins, saponins, alkaloids, flavonoids, and glycosides, exhibiting antioxidant properties by inhibiting oxidation reactions and reducing various radicals (Husori et al. 2022).

***Plant Part Value* (PPV) of medicinal plants**

Table 4 presents the plant parts utilized by the Aek Guo Village community. Various plant parts, including roots, seeds, heads, fruit, flowers, leaves, sap, skin, rhizomes, and tubers, are used for medicinal purposes. Medicinal plants are seldom used in their entirety; at least one of the parts, such as leaves, stems, or roots, is utilized for therapeutic purposes (Naeem et al. 2021). Notably, leaves (56.06%) emerge as the most frequently utilized plant part, followed by rhizomes (13.63%), fruits (12.12%), and the least of other utilized plant parts (<10%). Leaves are a preferred choice due to their consistent availability throughout the year, unlike fruits and flowers, which are seasonal in nature. The preference for leaves in drug formulations is rooted in their ease of acquisition, processing, and the sustainable nature of their use. Harvesting leaves does not harm the overall plant, as they regenerate, allowing for continuous utilization (Supiandi et al. 2019). The use of leaf parts is regarded as a conservation effort that does not negatively impact the survival of medicinal plants (Az-Zahra 2021).

Comparative studies by Nahdi et al. (2016) on Turgo Hamlet residents, Yogyakarta, Indonesia, highlighted leaves as the most commonly used medicinal part (51%), followed by fruits (15%), rhizomes (11%), stems (5%), roots (4%), saps (3%), flowers (3%), all parts (3%), tubers (3%), and endosperms (2%). Eni et al. (2019) conducted a study in Jagaraga Village, West Nusa Tenggara, Indonesia, indicating that leaves were the most utilized plant part. Kandari et al. (2012) reported that roots and rhizomes held the highest utilization rate (42%), followed by leaves (26%), seeds (10%), seeds and leaves (8%), bark and the whole plant (6%), and flowers (1%). Supiandi et al. (2021) provided insights into the rationale behind selecting specific plant organs for traditional disease treatment. Roots were valued for their efficacy, especially when accompanied by specific incantations. Stems, regarded as food reservoirs, contain beneficial substances for the body. Leaves contain secondary metabolite compounds with medicinal properties. Flowers are rich in steroid, terpenoid, and phenolic compounds, contributing to anti-inflammatory, anti-bacterial, and anti-microbial activities. Fruits serve as vital sources of vitamins and minerals, while seeds encompass secondary metabolite compounds like alkaloids, flavonoids, terpenoids, polyphenols, phenolic hydroquinone, and saponins. The active compounds in medicinal plants used by the Aek Guo community play a pivotal role in traditional medicine.

Fidelity Level (FL) of medicinal plants

Table 5 presents Fidelity Level (FL) values for each species used in treating specific diseases by the Aek Guo community. FL values signify the importance of a species for a particular disease, representing the percentage of respondents who utilize a plant species for the same primary purpose. Notably, *O. aristatus* (22.82%) and *Z. officinale* (22.54%) exhibit the highest FL values, signifying their extensive use within the Aek Guo Community. Conversely, *P. granatum*, *E. longifolia*, *S. polyanthum*, and *A. evecta* demonstrate the lowest FL values (1.41%), indicating lesser utilization by the community. *Orthosiphon aristatus* is predominantly used by the Aek Guo community to alleviate toothaches, utilizing both roots and leaves. Processing involves boiling these parts with water, and the resulting infusion can be ingested or used as a mouthwash.

Table 5. Fidelity level (FL) of medicinal plant for a specific treatment purpose

Local name	Botanical name	Treatment(s)	Np	FL (%)
Pala	*Myristica fragrans*	Antibiotic	7	9.86
Bawang Merah	*Allium ascalonicum*	Aromatherapy	5	7.04
Lavender	*Lavandula angustifolia*	Aromatherapy	3	4.23
Bawang Merah	*Allium ascalonicum*	Blood pressure	2	2.82
Seledri	*Apium graveolens*	Blood pressure	3	4.23
Tomat	*Solanum lycopersicum*	Blood pressure	10	14.08
Lidah Buaya	*Aloe vera*	Blood sugar	5	7.04
Kayu Manis	*Cinnamomum burmanii*	Blood sugar	10	14.08
Jawer Kotok	*Coleus atropurpureus*	Blood sugar	6	8.45
Kelor	*Moringa oleifera*	Blood sugar	8	11.27
Simartampua	*Ocimum americanum*	Blood sugar	14	19.72
Kemangi	*Ocimum basilicum*	Blood sugar	4	5.63
Turi	*Sesbania grandiflora*	Blood sugar	2	2.82
Kecibeling	*Strobilanthes crispus*	Blood sugar	9	12.68
Cengkeh	*Syzygium aromaticum*	Blood sugar	3	4.23
Jahe	*Zingiber officinale*	Blood sugar	6	8.45
Lempuyang	*Zingiber zerumbet*	Blood sugar	3	4.23
Sirsak	*Annona muricata*	Bone	5	7.04
Kecombrang	*Etlingera elatior*	Breast milk	4	5.63
Mangkokan	*Polyscias scutellaria*	Breast milk	9	12.68
Katuk	*Sauropus androgynus*	Breast milk	7	9.86
Bawang Daun	*Allium fistulosum*	Cholesterol	3	4.23
Bawang Putih	*Allium sativum*	Cholesterol	9	12.68
Caisin	*Brassica chinensis*	Cholesterol	5	7.04
Jerangau	*Acorus calamus*	Cough	6	8.45
Hanjuang	*Cordyline fruticosa*	Cough	9	12.68
Temulawak	*Curcuma zanthorrhiza*	Cough	3	4.23
Kencur	*Kaempferia galanga*	Cough	10	14.08
Sirih	*Piper betle*	Cough	5	7.04
Sirih Merah	*Piper crocatum*	Cough	11	15.49
Kelapa	*Cocos nucifera*	Dehydration	2	2.82
Lidah Buaya	*Aloe vera*	Dental	10	14.08
Kecombrang	*Etlingera elatior*	Dental	7	9.86
Kumis Kucing	*Orthosiphon aristatus*	Dental	17	22.82
Katuk	*Sauropus androgynus*	Detoxification	4	5.63
Bawang Merah	*Allium ascalonicum*	Diabetes	10	14.08
Kemiri	*Aleurites moluccanus*	Digestion	4	5.63
Bawang Daun	*Allium fistulosum*	Digestion	6	8.45
Lokio	*Allium schoenoprasum*	Digestion	2	2.82
Paku Gajah	*Angiopteris evecta*	Digestion	1	1.41
Cabai Rawit	*Capsicum frutescens*	Digestion	3	4.23
Kunyit Hitam	*Curcuma caesia*	Digestion	7	9.86
Kunyit Kuning	*Curcuma longa*	Digestion	8	11.27
Temulawak	*Curcuma zanthorrhiza*	Digestion	7	9.86
Kunyit Putih	*Curcuma zedoaria*	Digestion	5	7.04
Serai Wangi	*Cymbopogon nardus*	Digestion	9	12.68
Jarak	*Jatropha curcas*	Digestion	3	4.23
Kencur	*Kaempferia galanga*	Digestion	6	8.45
Pacar kuku	*Lawsonia inermis*	Digestion	10	14.08
Sarang semut	*Myrmecodia pendans*	Digestion	11	15.49
Ciplukan	*Physalis angulata*	Digestion	2	2.82
Jambu Biji	*Psidium guajava*	Digestion	7	9.86
Salam	*Syzygium polyanthum*	Digestion	1	1.41
Bangle	*Zingiber cassumunar*	Digestion	7	9.86
Jahe	*Zingiber officinale*	Digestion	5	7.04
Bidara	*Ziziphus mauritiana*	Digestion	4	5.63
Kayu Manis	*Cinnamomum burmanii*	Dysmenorrhea	16	22.54
Jahe	*Zingiber officinale*	Dysmenorrhea	6	8.45
Caisin	*Brassica chinensis*	Eye	3	4.23
Selada	*Lactuca sativa*	Eye	3	4.23
Serai Wangi	*Cymbopogon nardus*	Fever	2	2.82
Dingin-dingin	*Kalanchoe blossfeldiana*	Fever	9	12.68
Kelor	*Moringa oleifera*	Fever	9	12.68

Bangle	*Zingiber cassumunar*	Fever	6	8.45
Kemenyan	*Styrax benzoin*	Gum	7	9.86
Mahkota Dewa	*Phaleria macrocarpa*	Heart	8	11.27
Jerangau	*Acorus calamus*	Immunity	4	5.63
Nanas	*Ananas comosus*	Immunity	6	8.45
Kayu Manis	*Cinnamomum burmanii*	Immunity	2	2.82
Delima	*Punica granatum*	Immunity	1	1.41
Sembung	*Blumea balsamifera*	Malaria	8	11.27
Pasak Bumi	*Eurycoma longifolia*	Malaria	1	1.41
Mahkota Dewa	*Phaleria macrocarpa*	Malaria	8	11.27
Kacapiring	*Gardenia augusta*	Mouth	2	2.82
Turi	*Sesbania grandiflora*	Mouth	14	19.72
Gambir	*Uncaria gambir*	Mouth	8	11.27
Kunyit Kuning	*Curcuma longa*	Psychology	2	2.82
Serai Wangi	*Cymbopogon nardus*	Respiratory	2	2.82
Mahkota Dewa	*Phaleria macrocarpa*	Respiratory	8	11.27
Gambir	*Uncaria gambir*	Respiratory	6	8.45
Kemiri	*Aleurites moluccanus*	Skin	9	12.68
Bangun-bangun	*Coleus aromaticus*	Skin	6	8.45
Kecubung	*Datura metel*	Skin	6	8.45
Wungu	*Graptophyllum pictum*	Skin	4	5.63
Pacar air	*Impatiens balsamina*	Skin	8	11.27
Sirih Cina	*Peperomia pellucida*	Skin	5	7.04
Kelapa	*Cocos nucifera*	Stamina	12	16.90
Kunyit Kuning	*Curcuma longa*	Stamina	2	2.82
Angur-angur	*Ageratum conyzoides*	Wound	2	2.82
Lengkuas	*Alpinia galanga*	Wound	10	14.08
Sarap	*Hemigraphis alternata*	Wound	3	4.23
Senduduk	*Melastoma malabathricum*	Wound	11	15.49
Bidara	*Ziziphus mauritiana*	Wound	5	7.04

Note: Np : Number of respondents

Kusmala et al. (2023) highlighted the potential of *O. aristatus* as an antioxidant, anti-inflammatory, anti-hypertensive, anti-diabetic, and anti-microbial agent with diuretic effects. The leaves of *O. aristatus* contain flavonoid compounds, including major secondary metabolites such as rosmarinic acid, eupatorin, and sinensetin, with rosmarinic acid belonging to the phenolic group and sinensetin and eupatorin categorized as flavonoids (Faramayuda et al. 2022). The *Z. officinale* is also extensively utilized by the Aek Guo community for treating digestive problems, regulating blood sugar, and relieving menstrual pain. The rhizome is the utilized part, processed by grating and boiling it with water, and the resulting infusion is consumed orally. Mahluji et al. (2013) demonstrated in their study that *Z. officinale* can reduce insulin levels in patients with type 2 diabetes. Additionally, *Z. officinale* supplementation shows supportive effects in the treatment of inflammatory disorders and metabolic syndrome (Gumbarewicz et al. 2022).

In conclusion, this study documented the local knowledge within the Aek Guo village community, revealing a commitment to sustainable practices through the utilization and preservation of surrounding plants for medicinal purposes. A significant aspect of their communal practices involves the utilization of medicinal plants as an alternative treatment, rooted in ethnobotanical knowledge transmitted across generations. The study identified 66 plant species belonging to 36 families, employed by the Aek Guo community for 26 different types of medications. The inventory of plant species in Aek Guo Village not only contributes valuable data to the understanding of medicinal plants in Indonesia but also serves as an active conservation effort for the preservation of these resources within the region. The communal reliance on traditional practices implies the importance of ongoing ethnobotanical knowledge transfer, fostering a symbiotic relationship between the community and its natural surroundings.

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