Indigenous Knowledge and Herbal Medicine: Exploring the Ethnobotany of the Karo Tiganderket Tribe in Indonesia

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Abstract

This ethnobotanical study investigates the traditional use of medicinal plants in Tiganderket Village, Karo Regency, Indonesia, to document local plants' diversity, uses, and preparation methods for medicinal purposes. Utilizing a quantitative descriptive approach, data were gathered from 30 informants, including traditional healers and residents. The study identified 92 plant species from 44 families, with the Zingiberaceae family being the most dominant. Frequently used plants, such as *Piper betle* (belo) and *Zingiber officinale* (ginger), were primarily employed to treat common ailments like fever, boils, and joint pain. Boiling (74%) was the most common method of plant preparation, and leaves (50%) were the most frequently used plant parts. The Relative Frequency of Citation (RFC) revealed *Acorus calamus* and *Curcuma longa* as the most cited species. At the same time, 40 of 66 recorded diseases showed high Informant Consensus Factor (ICF) values, reflecting shared knowledge of plant use. This study highlights the rich preservation of traditional medicinal plant knowledge in Tiganderket Village, which continues to play a crucial role in local healthcare practices.

1. Introduction

Traditional medicine has long been used to maintain public health [1, 2]. It has become a part of global health, aiding communities in preventing, diagnosing, recovering, or treating various physical and mental diseases [3]. Medicinal plants are believed to possess healing properties, and their use has spanned centuries [4–6]. In pursuing modern drug development, traditional medicinal plants have become the focus of research rooted in ethnobotany and traditional medical practices handed down through generations [7–11]. Knowledge of traditional medicine, particularly medicinal plants in developing countries, has long played a significant role in therapeutic health practices [12]. Therefore, the study of medicinal plants and their uses, especially for therapeutic purposes, remains one of humanity's most fundamental concerns and continues to be practiced extensively across the globe [13–17].

Traditional knowledge plays a vital role in ethnobotanical studies [18]. Traditional knowledge in ethnobotanical studies refers to the cultural understanding and practices passed down through generations regarding using plants for food, medicine, and rituals in a specific region, highlighting the reciprocal relationship between plants and humans [18]. This knowledge is important for biodiversity conservation and contributes to the well-being and health of local communities. However, preserving traditional knowledge currently faces significant challenges, including rapid modernization, displacement of indigenous peoples, and biodiversity loss [19]. Furthermore, the lack of systematic documentation and integration of this knowledge into
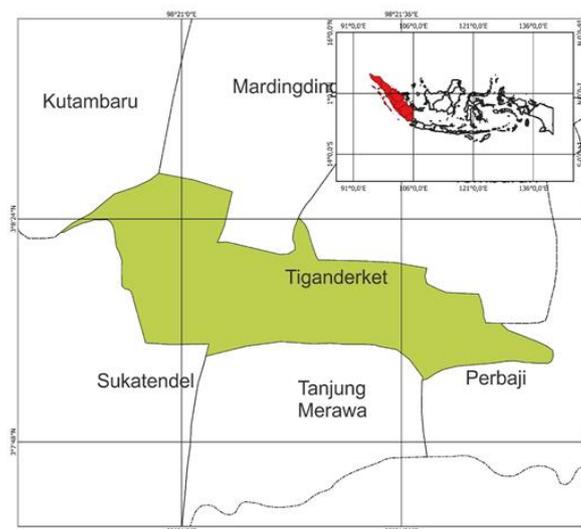
Figure 1. Research location map. It highlights the research site on the island of Sumatra, with a focus on Tiganderket Village, located in Tiganderket District, Karo Regency, North Sumatra, Indonesia.

formal education systems exacerbate the risk of this knowledge being forgotten. Therefore, it is important to implement a comprehensive strategy to preserve and pass on traditional knowledge through ethnobotany research that involves the community searching for observational data to become documented knowledge and a valuable resource for future generations [20].

The knowledge of plant use for medicinal purposes is a cultural heritage passed down through generations, with the primary goal of maintaining health [21, 22]. One of the ethnic groups in Indonesia with a rich tradition of plant-based medicine is the Karo people. The Karo are one of the subgroups of the Batak ethnic group, which is divided into six subgroups: Karo, Simalungun, Pakpak, Toba, Angkola, and Mandailing [8]. Among these, the Karo are one of the largest. The Karo people are spread across six regions in North Sumatra: Karo Regency, Deli Serdang Regency, Langkat Regency, Dairi Regency, Binjai City, and Medan City, encompassing 1,228 villages. One such village in Karo Regency is Tiganderket Village.

Ethnobotanical studies of the Karo people have revealed a rich cultural heritage and ancestral knowledge that reflects a deep connection with their environment. Several ethnobotanical investigations have demonstrated the Karo community's understanding of plant use, particularly in the production of Karo Oil, which involves the use of 84 medicinal plants from 39 families, with the Zingiberaceae family being the most dominant in Berastagi District [8]. Specifically, 30 plant species produce Karo Oil [23]. Furthermore, ethnobotanical knowledge of the Karo people in Kuala District, Langkat Regency, identified 49 species of medicinal plants [24]. In contrast, in the Merdeka District, 85 species from 43 families and 73 genera are used for food, medicine, and

other purposes [25]. In Karo District, 60 medicinal plant species have been documented, with parts of the plants, such as leaves, fruits, and dragon fruit, being the most commonly utilized [26]. Additionally, 53 food plants from 27 families have been recorded, with 30% of the collected species being wild plants used as food sources [27]. These studies highlight the profound ethnobotanical knowledge of the Karo people and underscore its critical role in preserving their cultural identity.

There is currently limited information available about the Karo community's knowledge of medicinal plants in Tiganderket Village. Several factors influence their use of plants for traditional medicine, including generational knowledge, the affordability of traditional remedies, and the easy availability of medicinal plants. Previous research has not thoroughly explored the Karo Tiganderket community's use of these plants. This study, therefore, aims to investigate and document their practices. This study will explore the Karo community's ethnobotanical knowledge, highlighting the significance of medicinal plants in preserving their cultural identity and heritage.

2. Materials and Methods

2.1. Time and Location of Research

The study was conducted from March to April 2024 in Tiganderket Village, Tiganderket District, Karo Regency, North Sumatra, Indonesia (Figure 1). Tiganderket Village is part of Karo Regency, which covers an area of 2,127.25 km² and has a total population of 420,799, with 14,292 residents in Tiganderket District. The district experiences a humid tropical climate, with average monthly temperatures ranging from 22 to 30 °C. Most residents of

Tiganderket are engaged in vegetable and fruit farming, while others are involved in trade, and a small proportion are employed as government civil servants [28].

2.2. Research Methods

This study employed a survey method with semi-structured interviews. Prior consent was obtained for each interview, and we adhered to an international code of ethics throughout the process [29]. A total of 30 local respondents participated, including ten key informants, such as village elders, traditional healers, massage practitioners, Karo oil producers, and herbal medicine makers. The remaining 20 informants were housewives from the Karo community.

Key informants were selected for their deep, inherited knowledge of medicinal plants and their practical experience in utilizing these plants. Village elders provided historical and cultural context, while massage practitioners, Karo oil producers, and herbal medicine makers contributed practical insights into plant usage, crucial in preserving Karo's cultural heritage. Housewives were chosen to offer perspectives on the everyday use of medicinal plants in household settings.

The interviews followed a discussion format based on a pre-prepared list of questions. Information gathered included local plant names, diseases treated, plant parts used, preparation methods, and administration routes. Field observations were conducted to document the presence of plants in the area, and plant specimens were collected from home gardens and local farms. These specimens were identified and confirmed using scientific literature and relevant botanical websites (http://www.plantsoftheworldonline.org/). The collected plant specimens were not stored as part of a herbarium collection.

2.3. Data Analysis

The data analysis in this study employs a quantitative approach to assess plant usage within the community, utilizing several indices: Use Value, Relative Frequency of Citation (RFC), Informant Consensus Factor (ICF), and Fidelity Level (FL).

The use value reflects the relative importance of plant species based on the number of documented uses [30]. A high use value (close to 1) indicates frequent medicinal use by respondents, whereas a low use value (close to 0) suggests limited use [31]. It is calculated using the Equation 1 [32]:

$$Use\ Value = \frac{U}{N} \qquad (1)$$

where U is the number of informants who know or use the plant species and N is the total number of informants.

The RFC measures local knowledge of plant-based medicine, ranging from 0 (no informants reported the plant as useful) to 1 (all informants reported the plant as useful) [30]. The RFC is determined using Equation 2 [33]:

$$RFC = \frac{FC}{N} \qquad (2)$$

where FC represents the number of respondents who mentioned the plant's use, and N is the total number of respondents surveyed.

The ICF assesses the consistency of traditional knowledge among informants. It is computed with Equation 3 [34]:

$$ICF = \frac{N_{ur} - N_t}{N_{ur} - 1} \qquad (3)$$

where N_{ur} is the number of informants who know the medicinal plant species, and N_t is the number of species used for one type of disease. ICF values range from 0 to 1, with 0 indicating no knowledge among informants and 1 indicating complete agreement on medicinal plant use [34].

The FL measures how consistently a plant species is reported for a specific purpose. A high FL value indicates that nearly all reports refer to the same use, while a lower FL indicates multiple uses. It is calculated using Equation 4 [35]:

$$FL\ \% = \frac{N_p}{N} \times 100 \qquad (4)$$

where N_p is the number of respondents who reported the plant's use for a particular disease and N is the total number of respondents who named the plant for any disease.

3. Results and Discussion

3.1. Use Value

The Karo Tiganderket people have traditionally utilized a variety of local plant species for medicinal purposes. Table 1 lists the species used as traditional medicine. This study identified 92 species from 44 plant families, documenting their therapeutic applications among the Karo people. A use value nearing one indicates frequent use of a plant species.

The most commonly used plants for medicinal purposes come from the Zingiberaceae family, with 11 species,

Table 1. Local plants used as medicinal plants by the Karo tribe in Tiganderket village.

No.	Family	Botanical Name	Local Name	Part Used	How to Use	Benefit	Use Value
1	Acanthaceae	*Graptophyllum pictum*	Daun Ungu	Leaf	Purple leaves are boiled, and the water is consumed	Hemorrhoid	0.23
		Avicennia germinans	Jambar Api	Leaf	Jambar fire leaves are boiled, and the water is consumed	Chickenpox	0.36
		Andrographis paniculata	Sambiloto	Leaf	The bitter leaf is boiled, and water is drank	Hypertension	0.13
		Justicia gendarussa	Gandarusa	Leaf	Grind the willow leaves and then apply them to the affected area	Sprain	0.23
		Strobilanthes crispa	Kejibeling	Leaf	The kejibeling leaves are boiled, then the water is strained and consumed.	Kidney stone	0.26
2	Acoraceae	*Acoras calamus*	Jeringo	Leaf	Jeringo leaves are boiled, and the water is consumed	Anemia, asthma, and fever	0.7
3	Amaranthaceae	*Amaranthus spinosus L*	Bayam Duri	Leaf	Spinach leaves are boiled, and the water is consumed	Indigestion	0.33
		Achyranthes aspera	Jarong	All parts	All parts of the Jarong plant are boiled, and the water is consumed	Malaria	0.16
4	Amaryllidaceae	*Allium sativum*	Bawang Putih	Fruit	Garlic is boiled, and the water is consumed	Cholesterol and hypertension	0.43
		Allium cepa L	Bawang Merah	Tuber	Grated red onion is mixed with coconut oil and a small amount of acid and applied to the baby's back and stomach	Fever in babies	1
5	Annonaceae	*Annona muricata L*	Nangka Belanda	Leaf	Soursop leaves are boiled, and the water drank	Uric acid and cholesterol	0.63
6	Apiaceae	*Coriandrum sativum*	Ketumbar	Leaf	Grind the coriander leaves with a little water, then strain and take the water. drip the water into the nose	Nosebleed	0.2
		Centella asiatica	Pegagan	Leaf	Gotu Kola leaves are boiled, and the water is consumed	Insomnia	0.16
		Apium graveolens L	Seledri	Leaf	Celery leaves are boiled, and the water is consumed	Gout and hypertension	0.36
7	Araliaceae	*Panax*	Ginseng	Root	Ginseng roots are boiled, and the water is consumed	Anti-cancer	0.3
8	Arecaceae	*Areca catechu L*	Pinang	Seed	Young areca nut seeds are cooked and consumed straight	Menstrual pain	0.16
		Cocos viridis nucifera	Mumbang	Fruit	Coconuts can be consumed straight	Fever	0.33
		Arenga pinnata	Enau	Root	Palm oil roots are boiled, and the water is consumed	Kidney Stone	0.33
9	Asparagaceae	*Cordyline fruticosa*	Andong merah	Leaf	Boiling andong merah leaves and drinking the resulting water	Dysentery	
10	Asteraceae	*Vitis gracilis BL*	Gagatan harimau	Leaf	Wash gagatan harimau leaves and eat them right away	Vomiting diarrhea	0.36
		Chromolaena odorata	Kapal terbang	Leaf	Putting kapal terbang leaves directly on the skin or boiling them	Wounds on the skin	0.26
		Gynura procumbens	Sambung Nyawa	Leaf	Sambung nyawa leaves are boiled and the water is consumed	Breast cancer	0.4

No.	Family	Botanical Name	Local Name	Part Used	How to Use	Benefit	Use Value
		Elephantopusn scaber	Tapak liman	Root	Tapak Liman roots are boiled, and the water is consumed	Hepatitis	0.2
		Gynura pseudochina	Tapak dewa	Leaf	Tapak dewa leaves are boiled, and the water is consumed	Diabetes	0.23
		Ageratum conyzoides	Bandotan	Leaf	Bandotan leaves are boiled, and the water is consumed	Bloated	0.16
11.	Asphodeloideae	*Aloe vera*	Lidah Buaya	Root	Aloe vera roots are dried, then cooked, and the resulting water is consumed	Worms	0.36
12.	Campanulaceae	*Hippobroma longifera L*	Katarak	Flower	Soak the cataract flower stems in clean water and apply drops to the sore eyes	Irritation in the eyes	0.36
13.	Caricaceae	*Carica papaya*	Mbertik	Leaf	Papaya leaves are boiled, and the water is consumed	Cholesterol	0.23
14.	Cruciferae	*Raphanus sativus*	Lobak	Tuber	Consumed immediately and cooked	Diabetes	0.2
15.	Cucurbitaceae	*Sechium edule*	Ropah	Fruit	Ropah is cooked and consumed directly.	Pain in the feet	0.23
		Momordica charantia L	Pare	Leaf	Boiling bitter melon leaves and drinking the resulting water	Cough	0.23
		Cucumis sativus	Cimen	Fruit	Cucumber is consumed immediately	Hypertension	0.26
16.	Commelinaceae	*Trades spanthaceae*	Adam hawa	Leaf	Adam hawa leaves are boiled, and the water is consumed	Bleeding cough	0.2
17.	Cyperaceae	*Cyperus rotundus L*	Rumput teki	Root	Boil the roots of rumput teki and drink the water	Ulcer	0.16
18.	Euphorbiaceae	*Ricinus communis*	Jarak	Leaf	Jarak leaves are boiled, and the water is consumed	Stomach ache and toothache	0.26
		Manihot esculenta	Ubi Kayu	Skin	Ubi kayu is boiled, and the water is consumed	Worms	0.23
		Euphorbia hirta L	Patikan kebo	Leaf	Patikan kebo leaves are boiled, and the water is consumed	Strokes	0.3
		Aleurites moluccanus	Kemiri	Fruit	Candlenuts are boiled, and the water is consumed	Heart	
		Acalypha australis	Padung-padung	Leaf	Padung-padung leaves are boiled, and the water is consumed	Itchy rash	0.2
19.	Fabaceae	*Mimosa pudica*	Putri Malu	Leaf	Mimosa leaves are boiled, and the water is consumed	Insomnia	0.13
		Leucaena leucocephala	Petai cina	Seed	Petai cina seeds are roasted, pounded, brewed with hot water, and consumed	Worms	0.2
		Abrus precatorius	Saga	Leaf	Saga leaves are boiled, and the water is consumed	Throat	0.3
20.	Labiatae	*Pogestemon cablin benth*	Nilam	Root	Squeeze the nilam root and apply it to the sore spot. Leave it until it dries, then rinse with warm water	Rheumatism	0.26
		Colenus aromaticus	Terbangun	Leaf	Terbangun leaves are boiled, and the water is consumed	Anti stinging and postpartum	0.53
21.	Lamiaceae	*Mentha piperata L*	Mint	Leaf	Mint leaves are boiled, and the water is consumed	Indigestion	0.26
		Orthosiphon aristatus	Kumis kucing	Leaf	Kumis kucing leaves are boiled, and the water is consumed	Cough, kidney, and itching	0.76
22.	Lauraceae	*Persea americana*	Pokat	Fruit	Avocados are consumed directly	Heart	0.2
		Cinnamomum verum	Kayu Manis	Skin	The cinnamon is boiled, and the water is consumed	Cholesterol	0.23

No.	Family	Botanical Name	Local Name	Part Used	How to Use	Benefit	Use Value
23.	Loranthaceae	*Loranthus*	Benalu	Leaf	Benalu leaves are boiled, and the water is consumed	Colds and headaches	0.36
24.	Meliaceae	*Aglaia odorata*	Pacar cina	Leaf	Squeeze the water from the pacar cina leaves and place them in a glass. Drink the juice	Stomach acid	0.23
25.	Menispermaceae	*Tinospora cordifolia*	Brotowali	Stem	Brotowali stems are boiled, and the water is consumed	Diabetes	0.13
		Arcangelisia flava L	Kayu kuning	Root	Kayu kuning roots are boiled and the water consumed	Antidote	0.26
26.	Moringaceae	*Moringa oleifera*	Kelor	Leaf	Moringa leaves are boiled, and the water is consumed	Cholesterol	0.33
27.	Myristicaceae	*Myristica fragrans*	Pala	Seed	Ground nutmeg seeds are placed on the stomach	Bloated	0.36
28.	Mimosaceae	*Archidenron pauciflorum*	Jengkol	Fruit	Jengkol is cooked or consumed directly	Coral reef	0.23
29.	Myrtaceae	*Syzygium aromaticum*	Cengkeh	Seed	Clove seeds are cooked, and water is drank	Nauseous	0.36
		Psidium guajava	Galiman	Leaf	Guava leaves are consumed immediately or cooked, and the water is consumed	Diarrhea and cholesterol	0.53
		Syzygium polyantum	Salam	Leaf	Salam leaves are boiled, and the water is consumed	Kidney and stomach ache	0.23
30.	Oleaceae	*Jasminum*	Melati	Flower	Boil jasmine flowers and drink the water	Cholesterol	0.26
31.	Oxalidaceae	*Averrhoa carambola*	Belimbing	Leaf	Star fruit leaves are boiled, and the water is consumed	Hypertension	0.3
		Averrhoa bilimbi	Belimbing Wuluh	Fruit	Starfruit is boiled and consumed	Cough, hypertension, and mouth ulcers	0.4
32.	Pandanceae	*Pandanus amaryllifolis*	Pandan	Leaf	Pandan leaves are boiled, and the water is consumed	Fever and diarrhea	0.36
33.	Piperaceae	*Piper betle*	Belo	Leaf	Betel leaves are boiled, and water is drank	Cough, hypertension, and toothache	1
		Peperomia pellucida	Belo Cina	Leaf	Chinese betel leaves are boiled, and the water is consumed	Boil	1
		Piper nigrum	Lada Hitam	Seed	Grind black pepper seeds and add some honey or crushed black pepper seeds put into warm soup	Cough, Flu	0.43
34.	Phyllanthaceae	*Sauropus androgynus*	Katu	Leaf	Katuk leaves are prepared as vegetables and consumed	Facilitates breast milk	0.33
		Phyllanthus urinaria	Meniran	Leaf	Meniran leaves are boiled, and the water is consumed	Menstrual pain	0.33
35.	Poaceae	*Imperata cylindrica*	Alang-alang	Root	Mash the reed roots until they are bruised and runny, then press until only water remains, then drink the water from the reed roots on a regular basis	Nosebleed	0.4
		Eleusine indica	Padang Teguh	Root	The field roots are boiled, and the water is consumed	Bleeding wounds	0.26
		Bambusa sp	Bambu	Shoot	Bamboo shoots are crushed and then placed on the injured part	Fracture	0.3
		Cymbopogon citrus	Sere	Stem	Lemongrass stems are boiled, and the water is consumed	Cholesterol and stomach ache	0.43
36.	Rubiaceae	*Uncaria gambir*	Gambir	Leaf	Gambier leaves are crushed, applied over the wound, and let to dry	Burns	0.4
		Morinda citrofolia	Mengkudu	Fruit	Noni is boiled, and the water is consumed	Cholesterol	0.33
37.	Rutaceae	*Citrus aurantifolia*	Rimo Nipis	Fruit	Lime juice Mix lime juice into warm tea, then add a little honey and soy sauce	Fever and Flu	0.63

| No.	Family	Botanical Name	Local Name	Part Used	How to Use	Benefit	Use Value
		Citrus hystrix	Rimo Mungkur	Fruit	Kaffir Lime Juice Mix kaffir lime juice in warm water	Flu	0.2
38.	Rosaceae	*Prunus cerasus L*	Seri	Leaf	Cherry leaves are boiled, and the water is consumed	Gout	0.23
39.	Simaroubaceae	*Eurycoma longifolia*	Pasak bumi	Root	The pasak bumi roots are boiled, and the water is consumed	Diabetes	0.26
40.	Solanaceae	*Solanum mauritianum*	Lancing	Leaf	Lancing leaves are pulverized and affixed to the waist	Back pain	0.53
41.	Thymelaeaceae	*Phaleria macrocarpa*	Mahkota Dewa	Fruit	Dry the slices of the crown of god fruit then, boil the slices of fruit, then drink the boiled water	Anti-allergic	0.33
42.	Urticaceae	*Urticadional*	Jelatang	Leaf	Dried nettle leaves are brewed with tea	Back pain	0.4
43.	Verbenaceae	*Lantana camara*	Bunga tai ayam	Leaf	Bunga tai ayam leaves are crushed and then applied to the injured area	Swelling	0.26
				Root	Bunga tai ayam roots are dried and boiled, and the water is consumed	Headache	0.26
44	Zingiberaceae	*Zingiber officinale*	Alia	Rhizome	Ginger is boiled, and the water is consumed	Heart, cholesterol, and body stamina	1
		Curcuma longa	Kuning Gersing	Rhizome	Turmeric is applied to the affected region	Anti sting	0.63
		Curcuma zanthorrhiza	Kuning Las	Rhizome	Temulawak is boiled the water is drank	Diabetes, diarrhea and kidney	0.46
		Kaempferia galanga	Kaciwer	Rhizome	Kencur is boiled and the water is consumed	Cough and body stamina	1
		Zingiber zerumbet	Mburle	Rhizome	Boil lempuyang with brown sugar and consume the water	Joint pain	1
		Alpinia galanga	Kelawas	Rhizome	Galangal is boiled, and the water is consumed	Anemia, diabetes and cholesterol	0.46
		Curcuma heyneana	Kuning Gajah	Rhizome	Temugiring is hammered and massaged into the forehead	Fever	0.56
		Amomum cardamomum	Kapulaga	Seed	Crush the cardamom and place it in the tea. Brew it with boiling water and let it rest until the aroma emerges. Then, it is consumed	Female fertility	0.36
		Zingiber cassumunar	Panglai	Rhizome	Boil grated panglai with lime juice and a little honey, then drink the mixture; alternatively, mash panglai and massage it into the afflicted joint, or cook it and combine with lime juice, consuming the resulting water	Jaundice, Rheumatism, cough with phlegm	0.53
		Boesenbergia rotunda	Temu Kunci	Leaf	Ginger is boiled and the water is consumed	Ulcumer	0.4
		Zingiber officinale var rubrum	Bahing	Rhizome	Red ginger is boiled and water is consumed	Muscle ache	0.76
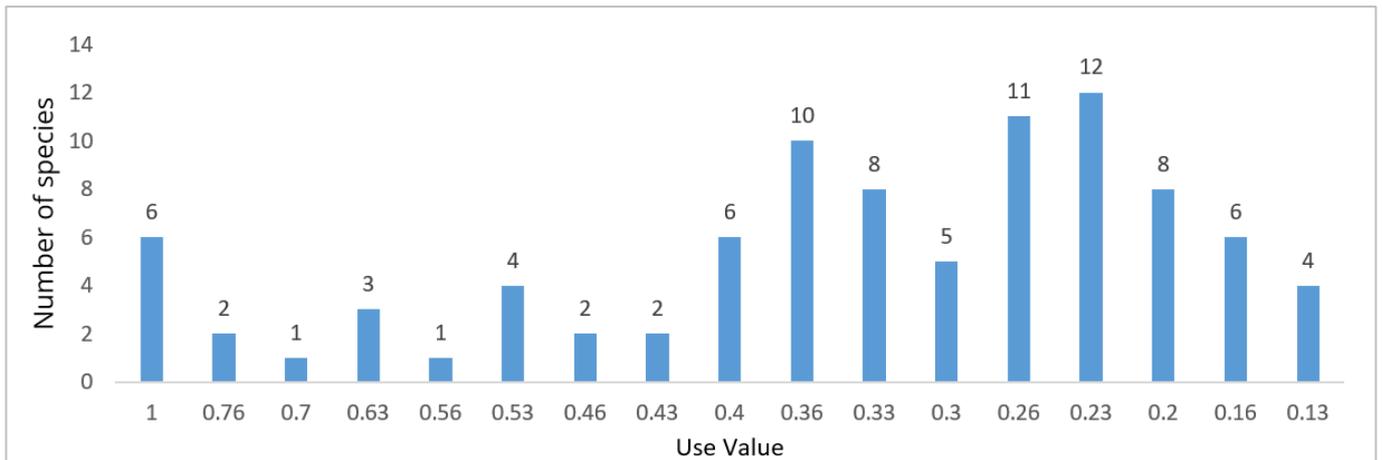
Figure 2. Ranking of the most important medicinal plant species based on their use value.

followed by the Asteraceae family (6 species), and the Acanthaceae and Euphorbiaceae families (5 species each). The Zingiberaceae family plays a prominent role in the healing practices of the Karo Tiganderket community, reflecting its importance in their traditional knowledge. Zingiberaceae is one of the most widely utilized plant families in traditional medicine across various ethnic groups in Indonesia [8, 25, 36–38]. In addition to having a significant number of species (approximately 1,400), the effects of using plants from this family have been proven through generations [39]. These plants are highly valued for their medicinal properties, attributed to their bioactive compounds, such as essential oils, flavonoids, and phenolics, which have anti-inflammatory, antioxidant, and antimicrobial effects [39]. The widespread use of *Zingiberaceae* species in traditional medicine, particularly in Asia [40], highlights their efficacy and cultural significance, especially among the Karo people. These plants are also readily available in tropical regions like Sumatra, where the Karo Tiganderket community resides. Their ease of cultivation and harvesting ensures a steady supply, and their dual use as spices in cooking further enhances their value in everyday life.

Based on the use value, the six most frequently used species, each with a use value of 1, are *Allium cepa* L., *Piper betle*, *Peperomia pellucida*, *Kaempferia galanga*, *Zingiber officinale*, and *Zingiber zerumbet*. Specifically, *Allium cepa* L. is used to treat infant fever, *Piper betle* for cough and hypertension, *Peperomia pellucida* for boils, *Kaempferia galanga* for cough and stamina enhancement, *Zingiber officinale* for heart disease, cholesterol, and body stamina, and *Zingiber zerumbet* for joint pain. The findings indicate that these plants are widely used by the Karo Tiganderket community and local healers to treat various ailments. The indigenous Karo people's knowledge of the medicinal properties of these plants makes them the primary choice in traditional medicine.

Plants with high use values commonly treat various diseases across communities, including the Karo Tiganderket, who rely on ancestral knowledge for healing practices. Species with the highest use value offer numerous benefits and are well-known to informants, while species with the lowest Use Value have fewer or lesser-known uses [9]. The six species with the highest use value commonly treat ailments such as toothache, hypertension, cough, heart disease, cholesterol, infant fever, boils, stamina, and muscle pain.

Meanwhile, *Mimosa pudica* (Fabaceae) has the lowest use value, followed by *Aleurites moluccanus* (Euphorbiaceae), *Tinospora cordifolia* (Menispermaceae), and *Andrographis paniculata* (Acanthaceae), all with a use value of 0.13. These four species treat conditions such as diabetes, insomnia, heart disease, and hypertension.

The use value metric helps determine the utility of plant species, allowing researchers to identify which species are considered most important by the community. Medicinal plants with the highest use values, such as *Piper betle* (belo), *Peperomia pellucida* (belo cina), *Allium cepa* L. (bawang merah), *Zingiber officinale* (alia), *Kaempferia galanga* (kaciwer), and *Zingiber officinale var rubrum* (bahing), are highly regarded by informants for their medicinal benefits.

In contrast, plants with lower use values have less known or fewer perceived benefits. *Mimosa pudica* (Putri Malu) of the Fabaceae family has the lowest use value, followed by *Aleurites moluccanus* (Kemiri) of the Euphorbiaceae family, *Tinospora cordifolia* (Brotowali) of the Menispermaceae family, and *Andrographis paniculata* (Sambiloto) of the Acanthaceae family, all with use values
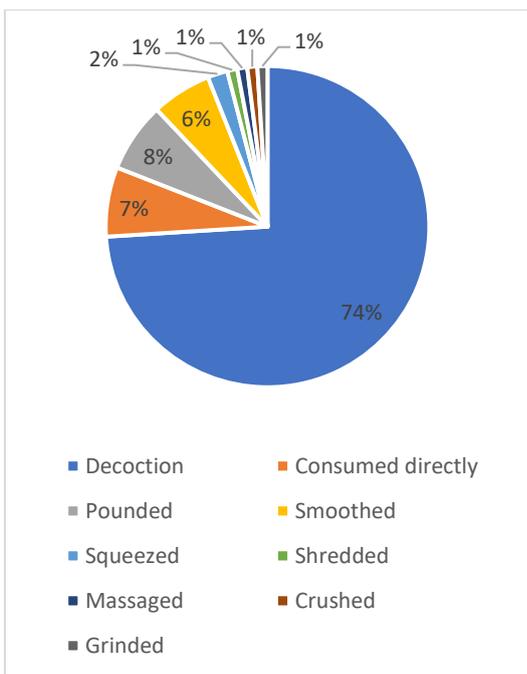
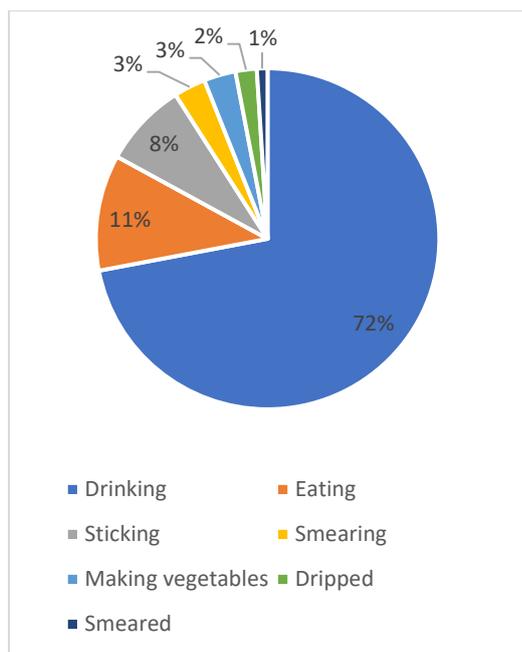**Figure 3.** The process of processing local plants in traditional medicine.

Figure 4. The methods of using local plants in traditional medicine.

of 0.13. These species are known for treating ailments such as diabetes, sleeplessness, heart disease, and hypertension. The use values are presented in Figure 2.

3.2. Utilization of Plants Based on Method of Use

In traditional medicine, medicinal plants must undergo processing before being used. Several methods are employed to prepare these plants. In this research, the most commonly used processing methods by the people of Tiganderket Village are boiling (74%), consuming

directly (7%), pounding (7%), mashing (6%), squeezing (2%), grating (1%), kneading (1%), crushing (1%), and grinding (1%), as illustrated in Figure 3.

Boiling (68 species, 74%) was the most frequently used method among the Karo Tiganderket Village community. This method is favored for its simplicity, natural approach, and ease of use. Boiling is also considered an effective and economical technique, as it preserves the medicinal properties of the plants. The efficacy of these plants remains largely intact, even after repeated boiling.

The Karo Tiganderket community, through knowledge passed down over generations, has long recognized boiling as a reliable method for preparing medicinal remedies. From a scientific perspective, boiling is one of the most efficient ways to extract active compounds from plants, such as alkaloids, flavonoids, and polyphenols, which are water-soluble. The heat generated during the process helps break down the cell structures of the plants, allowing the bioactive compounds to dissolve more easily and be released into the water. Boiling requires no specialized equipment and can be done using common kitchen tools, making it practical and economical [41]. This has made boiling the preferred method for preparing medicinal plants in various traditional healing practices, including among the Karo Tiganderket people.

In terms of medicinal plant usage, the Karo Tiganderket community employs a variety of methods: consuming as a drink (72%), eating (11%), applying as a poultice (8%), applying topically (3%), using as raw vegetables (3%), administering as drops (2%), and inhaling (1%). These different methods of usage are depicted in Figure 4.

Drinking medicinal concoctions from 66 species (72%) is the most prevalent method. This approach is simple to prepare and deeply rooted in the cultural practices of the Karo people in Tiganderket Village. For generations, consuming herbal preparations in liquid form has been considered the most effective way to absorb the medicinal properties of plants, allowing the body to benefit from their healing compounds fully. Furthermore, drinking herbal remedies is closely tied to the traditional knowledge passed down through the community, making it a trusted and preferred treatment method.

3.3. Utilization of Plant Parts in Traditional Medicine

The Karo Tiganderket community utilizes various parts of plants for medicinal purposes, including roots, stems, fruit, leaves, seeds, flowers, rhizomes, tubers, and more, as shown in Figure 5. Field research shows that different parts of plants are used to make traditional medicines,
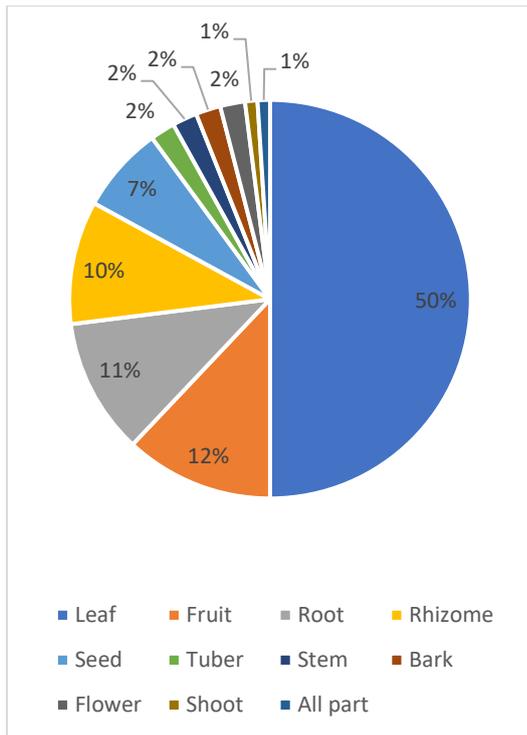
Figure 5. The parts of the plant used in traditional medicine,

including leaves, fruit, roots, rhizomes, seeds, tubers, stems, bark, flowers, shoots, and entire plants. The results indicate that the most commonly used plant part for medicinal purposes is the leaves (50%), followed by fruit (12%), roots (11%), rhizomes (10%), seeds (7%), tubers (2%), stems (2%), bark (2%), flowers (2%), shoots (1%), and the entire plant (1%) (Figure 5).

Leaves are the most frequently used plant part (50%) in the Karo Tiganderket community's traditional medicine practices. This preference is largely due to the accessibility and availability of leaves year-round, making them the primary choice for medicinal preparation. Leaves can be harvested without causing significant harm to the plant, ensuring a more sustainable approach to their use. Furthermore, leaves are relatively easy to process into medicinal forms by boiling, drying, or consuming them directly, making them more practical than other plant parts like roots or bark [42].

The predominant use of leaves reflects the efficiency and practicality embedded in Karo traditional medicine. Local knowledge recognizes the versatility and sustainability of leaves, making them an essential part of the community's healthcare practices.

3.4. Relative Frequency of Citation (RFC)

The utility of a plant can be determined by how frequently it is mentioned by informants, which is measured using the RFC. The RFC values of plants used by the Karo Tiganderket community are presented in Figure 6, ranging from 0.13 to 0.03. Two plants, *Acorus calamus* (Jeringau) and *Curcuma longa* (Turmeric), have the highest RFC value of 0.13, indicating that they were mentioned four times by the 30 informants. In contrast, 67 plants have an RFC of 0.03, meaning they were only mentioned once by an informant.

The high RFC values of the *Acorus calamus* and *Curcuma longa* suggest their significant role in the traditional medicine of the Karo Tiganderket community. These two species are commonly used to treat ailments such as fever, colds, asthma, insect stings, indigestion, menstrual pain, and to enhance body stamina. Their frequent mention by informants highlights their importance in local healthcare practices.

3.5. Informant Consensus Factor (ICF)

The ICF assesses the consistency of traditional knowledge among informants regarding the medicinal use of plants (Figure 7). A higher ICF value indicates greater agreement among informants about using a plant for treating a specific disease. A lower ICF value suggests that a plant is used for various ailments, leading to less consensus [43].

In this study, the ICF values for disease treatment using local plants by the Tiganderket community ranged from 0.65 to 1. Of the 66 identified diseases, 40 had high information homogeneity (ICF = 1). These diseases include boils, joint pain, infant fever, muscle pain, back pain, breast cancer, burns, nausea, eye irritation, female fertility issues, vomiting, diarrhea, chickenpox, anti-allergy treatments, lactation facilitation, stroke, bone fractures, sore throat, anti-cancer treatments, poison antidote, bleeding wounds, skin injuries, rheumatism, postpartum recovery, hemorrhoids, jaundice, kidney stones, diabetes, sprains, leg pain, acid reflux, ulcers, bloody cough, hepatitis, swelling, dry cough, dysentery, phlegm cough, and asthma.

The high ICF values for these ailments indicate that informants shared a consistent understanding of how to treat these diseases using the same types of plants. High consensus suggests that traditional knowledge is well-established and widely accepted in the community. In contrast, lower consensus may reflect variations or local adaptations in traditional healing practices [44].

3.6. Fidelity Level (FL)

The FL determines the percentage of respondents who mention the benefits of a specific plant for a particular treatment. In this study, the fidelity level
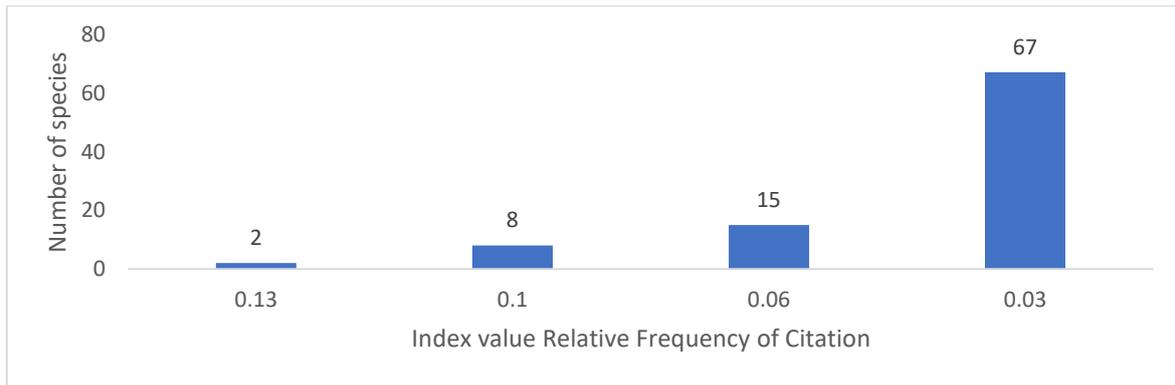
Figure 6. Ranking of the most important medicinal plant species based on Relative Frequency of Citation.
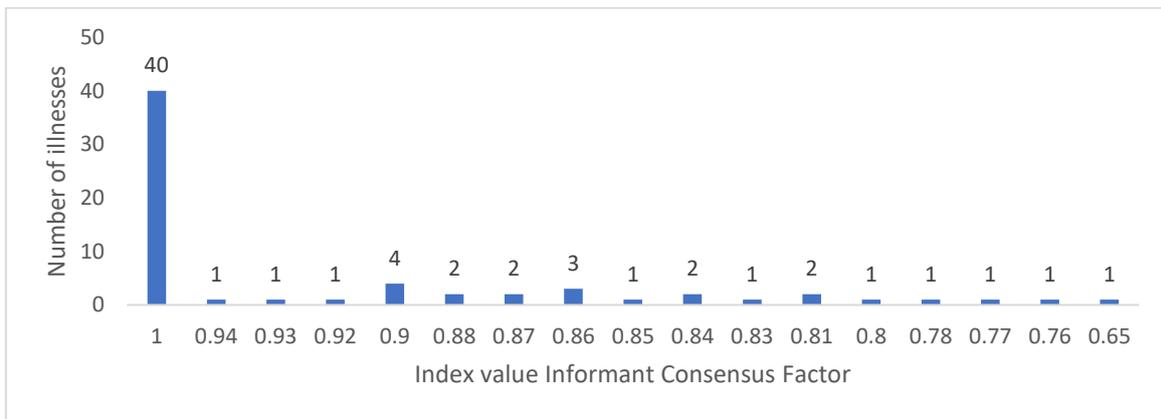

Figure 7. Ranking of the most important medicinal plant species according to Informant Consensus Factor.
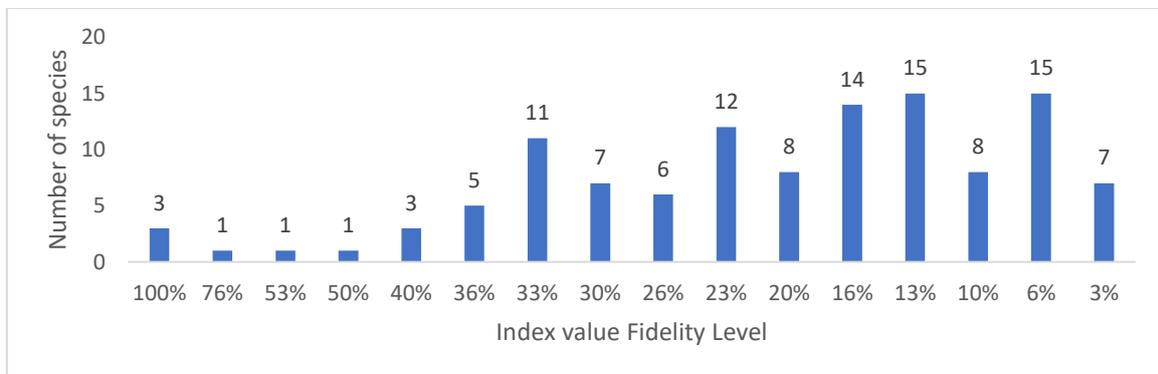

Figure 8. Ranking of the most important medicinal plant species according to Fidelity Level.

of plants ranged from 3% to 100%. The Fidelity Level values are presented in Figure 8.

Among the 92 plant species used by the Karo Tiganderket community, three plants have a Fidelity Level of 100%. All informants identified *Peperomia pellucida* for treating boils, *Zingiber zerumbet* for joint pain, and *Allium cepa* L. for treating fever in babies. Additionally, 76% of informants indicated that *Zingiber officinale var. rubrum* is used for muscle pain, while 53% mentioned *Solanum mauritianum* for back pain. Other plants with a Fidelity Level of 40% include *Gynura procumbens* for breast cancer, *Uncaria gambir* for burns, and *Syzygium aromaticum* for nausea.

The high-fidelity levels for these plants reflect their strong association with specific ailments within the community, highlighting their importance in traditional healing practices.

4. Conclusions

This ethnobotanical study in Tiganderket Village, Karo Regency, identified 92 medicinal plant species from 44 families used to treat various ailments. Plants with the highest use value of 1, such as *Piper betle* (belo), *Peperomia pellucida* (belo cina), *Allium cepa* L. (red onion), *Zingiber officinale* (ginger), *Kaempferia galanga* (kaciwer), and *Zingiber officinale var. rubrum* (red ginger),

are frequently used to treat conditions like fever, boils, and heart disease. *Acorus calamus* (Jeringo) and *Curcuma longa* (turmeric) had the highest RFC at 0.13, indicating their recognized health benefits among informants.

Of the 66 diseases recorded, 40 had high ICF values of 1, showing a strong agreement in the community's knowledge regarding treating ailments such as boils, joint pain, and infant fever. Medicinal plants are primarily processed through boiling (74%), with leaves being the most commonly used plant part (50%). The highest FL of 100% was observed for *Peperomia pellucida* (for boils), *Zingiber zerumbet* (for joint pain), and *Allium cepa* L. (for infant fever).

Overall, the study underscores the rich and well-preserved traditional knowledge of medicinal plants in the Tiganderket community, which has been passed down through generations and plays a vital role in local healthcare practices.

Ethical Clearance: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: All data generated or analyzed during this study are included in this published article.

Conflicts of Interest: All the authors declare no conflicts of interest.

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