

Indigenous Knowledge of Traditional Medicinal Plant Use among Malaysia-Indonesia Border Communities on Sebatik Island Sabah

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Abstract

The National Policy on Traditional and Complementary Medicine (T&CM) was developed in 2001 and revised in 2007. This policy plays a crucial role in the development framework of T&CM in Malaysia and serves as a guide to achieve the desired goals, ensuring that the practice of traditional and complementary medicine is safe and of high quality for the well-being of all citizens. The aim of this study is to discuss the use of traditional plants among the Malaysia-Indonesia border communities, better known as Sebatik Island. Sebatik Island, located in Sabah, is a newly developing area in terms of infrastructure and facilities, which has led to a low level of access for the local population in terms of healthcare, education, and other social services. As a result, traditional planting and farming activities have become the primary livelihood for the population, ensuring food security and serving as an alternative form of medical treatment. This study is conducted as a case study, using methods of observation and in-depth interviews. The findings indicate that the use of traditional plants

is influenced by three main factors: social, economic, and ecological factors. We hope that this review will provide comprehensive knowledge about the factors influencing the use of plants in traditional practices and help identify the plants used among the community in Kampung Aji Kuning, Sebatik Island, Sabah.

Keywords: Traditional Plants, Medicinal Plants, Traditional Medicine, Indigenous Knowledge, Consumption Factor

Introduction

In the past 50 years, natural resources on Earth have produced approximately 15 trillion pounds of natural products (Achiso, 2020). Medicinal plants have become an important source for both curative and preventive medical treatments for humans and have also been used for the extraction of important bioactive compounds (Mbuni et al., 2020). The use of these plants has gradually been refined through generations and has come to be known in many contexts as traditional medicine (Salmeron-Manzano et al., 2020). The official definition of traditional medicine can be considered as "the sum total of knowledge, skills, and practices based on theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health, as well as in the prevention, diagnosis, improvement, or treatment of physical and mental illnesses" (Salmeron-Manzano et al., 2020). While many plants do not have side effects, like aromatic plants used in infusions such as chamomile, rosemary, mint, or thyme, there are also other plants that may contain potentially harmful active principles. Similar to the study by Abdullmutalib et al. (2022) on Libyan Olive Oil and Its Advantages in Biomedical Applications, this study provides a detailed discussion about olive oil and its importance. Agha et al. (2022), in their study, note that the leaves of *Thaumatococcus daniellii* are used in traditional medicine to treat various health issues. Both of these studies touch on the use of plants. However, the study on medicinal plant use in the community on Sebatik Island focuses more on identifying the plants they use and their applications in the traditional practices of the residents.

This study is the first to be conducted in Kampung Aji Kuning, Sebatik Island, Sabah, as there have been no previous studies on the use of medicinal plants in traditional practices in this location. The level of awareness and understanding among the residents regarding the effectiveness of plants in traditional medicine on Sebatik Island is relatively high. Furthermore, the good interaction and relationship between the people of Malaysia and Indonesia facilitates the exchange of knowledge and the continued practice of using these medicinal plants. As an overview, Sebatik Island is divided into two regions: the southern area belongs to Indonesia, while the northern area belongs to Malaysia (Jangkung et al., 2018). Various policies have been developed by the government to advance the agricultural sector at the Malaysia-Indonesia border (Hidayah et al., 2023). Slow growth, declining trade terms, low productivity, and eco-unfriendly practices have often been major issues hindering agricultural development, particularly in achieving the prosperity of farm households (Jangkung et al., 2018). Therefore, this study was conducted to identify the use of traditional plants in traditional practices among the residents of Kampung Aji Kuning, Sebatik Island, Sabah, located at the Malaysia-Indonesia border. The location of this area is depicted in Figure 1.

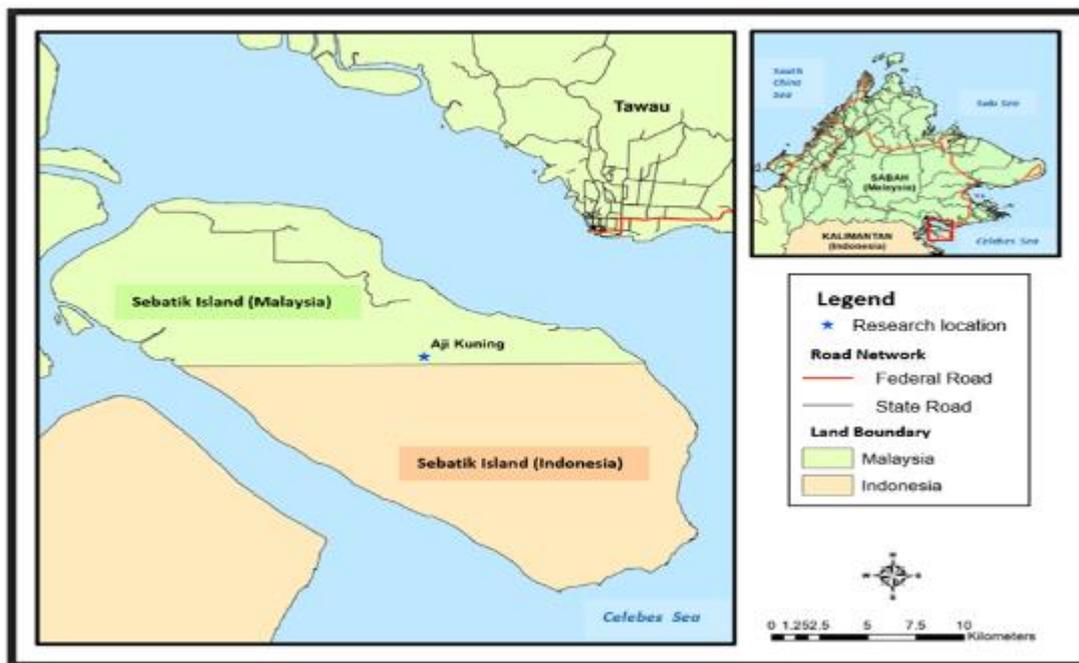


Fig. 1. Aji Kuning Village Sebatik Island, Sabah Malaysia

Source: Modified from google maps (2024)Materials and methods

The research methodology employed in this study utilizes observations and interviews. Both methods were chosen due to its particularistic focus on a specific situation, event, program, or phenomenon. These approaches aim to provide a rich, abundant, and robust description of the studied phenomenon, thereby heuristically explaining and aiding the reader's understanding of the research topic.

The data collection utilized qualitative methods, specifically through observations and interviews with selected informants, enhancing the depth and accuracy of information gathered to address the research questions effectively. As echoed by Ciesielska et al., (2018), observation is one of the most important research methods employed, suitable for descriptive studies like this one. Observation was carried out at the location of the type of traditional plants used by residents of Sebatik Island.

Furthermore, this study also utilizes interview as part of data collection technique. As posited by Knott et al. (2022), in-depth interview is a qualitative research method widely used in social sciences. It enables participants to describe their personal perspectives and interpretations of their experiences. Despite seeming like a simple conversation, these interviews provide deep insights into how individuals perceive and make sense of their world. The data from interview questions was collected from 10 informants or residents of Sebatik Island. Purposive sampling was employed to determine the informants of the interview.

Prior to the main research phase, a pilot study was conducted at the research location involving several respondents over multiple days. The findings from the pilot study determined that the area was suitable for further in-depth research related to the identified issues and research objectives. Several preliminary observations were also conducted at the research site to refine the sampling strategy. Aji Kuning village on Sebatik Island was

ultimately selected as the research location due to its suitability and the presence of traditional medicinal plant practices deeply integrated into the social and familial systems of the community.

Traditional Plants as Medical Treatment

Recent studies highlight the intricate nutrient interactions in plants, particularly involving nitrogen (N), phosphorus (P), sulphur (S), zinc (Zn), and iron (Fe), which play crucial roles in optimizing growth and productivity by influencing uptake, utilization, and broader metabolic pathways. Master regulators such as PHR1 and light-responsive transcription factors govern nutrient homeostasis across these elements, as revealed through integrative approaches combining "Omics" technologies and genetics. These insights are pivotal for enhancing crop nutrient efficiency and resilience under varying climatic conditions, thereby guiding sustainable agriculture practices to improve global crop yields (Kumar et al., 2021).

Concurrently, an ethnobotanical review on medicinal plants used in traditional Saudi Arabian medicine underscores the cultural significance and therapeutic roles of 96 plant species across 47 families. Documented from various sources, including journals and databases, the study highlights the diverse applications of these plants, predominantly herbs and subshrubs, utilized through decoction and infusion methods to treat a wide array of human ailments. Despite their historical use, further research is needed to explore their pharmacological activities and safety profiles, offering potential for developing novel therapeutic agents Riaz et al. (2023). Additionally, a study on home gardens in Kampung Masjid Ijok, Perak, Malaysia, underscores the biodiversity conservation role of larger gardens (>1,500m²), which host a greater variety of food, medicinal, and ornamental plants compared to smaller plots. With 207 plant species documented across 78 families, these gardens play a crucial role in preserving plant diversity, including endangered species, highlighting their importance in local ecosystems and sustainable food production (Ramli et al., 2021b).

Past studies highlight diverse aspects of food acquisition, traditional food plants (TFPs), and traditional farming practices in indigenous communities. Research on the Jahai subtribe of Orang Asli in Malaysia reveals their food acquisition methods, combining traditional practices like gathering and hunting with modern strategies such as purchasing and food aid receipt. Challenges include low purchasing power, diminishing local food sources, and wildlife threats, emphasizing the need for targeted interventions to enhance food security (Tay et al., 2023). The significance of TFPs globally is underscored for their nutritional value, health benefits, and resilience during crises, supported by modern technologies like omics and gene editing to enhance their nutritional content and stress tolerance. Meanwhile, traditional farming practices in India are reviewed for their environmental benefits, contrasting with the negative impacts of the Green Revolution. Practices like mixed cropping and agroforestry are highlighted for their resilience to climate change and enhancement of nutritional quality, advocating for their integration with modern agriculture to achieve sustainable food production and conserve traditional knowledge (Patel et al., 2020).

By reviewing the global status of edible plants and emphasizing neglected and underutilized species (NUS), the article aims to unlock new food resources. It highlights that while there are over 7,000 edible plant species, mainstream agriculture predominantly relies on a few hundred crops, limiting diversity. Many of these edible plants serve multiple purposes beyond

food, including medicinal and environmental uses. Conservation efforts are crucial, with significant numbers of edible plants already assessed for conservation status, though challenges remain in preserving genetic diversity. The article advocates for enhancing research to understand the biology and ecological roles of NUS, especially in the face of climate change, and stresses the importance of integrating traditional knowledge for sustainable agricultural practices. Overall, biodiversity offers untapped potential to improve not only food security and promote sustainable agriculture but also includes medical treatment which aligns with global goals such as the UN Sustainable Development Goal 2 (Ulian et al., 2020).

The importance of wild food plants is diverse. In Kitui County, Kenya, a comprehensive botanical survey identified 199 wild plant species, predominantly trees, shrubs, and herbs from families like *Leguminosae* and *Malvaceae*, crucial for food security in dryland areas. Conservation efforts are deemed essential due to threats such as overgrazing and habitat fragmentation, underscoring the need for community involvement and sustainable practices (Mutie et al., 2020). Meanwhile, in North Sebatik district, Nunukan regency, border communities are empowered through initiatives focusing on human, natural, and social capital to enhance food security and community resilience. This approach emphasizes utilizing local resources effectively to bolster agricultural activities and household income (Laude & Foo, 2021). Similarly, the study in Berek natural forest, Oromia special zone, highlights 34 wild and semi-wild edible plant species significant for nutrition and income among rural communities. The community's local knowledge of useful plants that are so widely used in daily life, making the community also take care and preserve its existence in the surrounding environment (Adelisa et al., 2023).

The erosion of traditional medicinal plant knowledge among rural and indigenous communities is increasingly evident due to modernization, including advancements in public healthcare, economic development, and formal education (Saynes-Vasquez et al., 2013). Research by Weckmuller et al. (2019) show that this decline is marked by a generational gap and is exacerbated by inadequate documentation, economic pressures, and environmental degradation. Despite these challenges, traditional medicinal knowledge remains vital for drug discovery, as demonstrated by **catharanthus roseus** (commonly known as bright eyes, Cape periwinkle, graveyard plant, Madagascar periwinkle, old maid, pink periwinkle, rose periwinkle) role in providing key anticancer agents (Pham et al., 2020).

In Malaysia, there is limited documentation of the Orang Asli's traditional medicinal practices. This study focuses on the Temuan tribe in Kampung Orang Asli Donglai Baru, which uses 39 medicinal plant species, fewer than in other Temuan villages but still significant. Identified plant families include *Zingiberaceae*, *Marantaceae*, and *Leguminosae*, with common preparations involving decoctions of leaves, roots, and flowers. The study underscores the urgent need to preserve this knowledge amidst environmental and generational shifts (Ramli et al., 2021b).

Malaysia's tropical forests are a rich source of medicinal plants, with about 15,000 flowering species identified, 20% of which are used traditionally by local communities, including the Orang Asli. Despite this, traditional knowledge and plant species face threats from habitat loss, modernization, and overharvesting. Studies show varying numbers of medicinal plants

used by different Orang Asli communities, with some villages recording up to 56 species. Home gardens in Kampung Masjid Ijok were found to be particularly rich in medicinal plant diversity, documenting 68 species from 40 home gardens, surpassing other local studies. Key families include *Zingiberaceae* and *Asteraceae*, with herbs being the most common life-form. Home gardens play a crucial role in conserving medicinal plants, especially as they become rare in the wild. This study highlights the importance of documenting and preserving these traditional practices and plant species for future generations (Ramli et al., 2021a).

The Melanau community of Sarawak, possibly the oldest inhabitants of the region, has a rich history intertwined with the Malays and ancient civilizations, as suggested by archaeological findings in Niah Cave. Traditionally, the Melanau people's belief system, rooted in animism, influences their understanding of illness and healing, with diseases often attributed to supernatural forces. Traditional medicine, which relies heavily on plant-based remedies, plays a crucial role in their health practices. This reliance on plant-derived medicines is driven by beliefs in their natural efficacy, safety, and the rising costs of modern pharmaceuticals, making traditional remedies increasingly popular among the Melanau (Omar & Latip, 2022). Sabah, Malaysia, renowned for its rich biodiversity and cultural diversity, is home to numerous ethnic groups and a wealth of medicinal plants. The state's varied landscapes and ethnicities, including the Kadazan, Dusun, and Muruts, contribute to a rich tapestry of traditional and complementary medicine (T&CAM) practices. Despite the growing interest and potential in T&CAM, many traditional practices are poorly documented and not yet fully regulated. The Sabah Biodiversity Centre and the Traditional and Complementary Medicine Act (2016) represent steps towards recognizing and formalizing these practices. The medicinal plants used by local communities address a range of ailments and hold significant potential for healthcare development. Future efforts should focus on comprehensive product development, scientific research, and integrating traditional knowledge with modern technology, while ensuring cultural preservation and community involvement (Haris et al., 2023).

Results and Discussion

Ten (10) informants were interviewed for this research as depicted in Table 1 below. They were asked the main reason for using traditional plants for the purpose of food consumption in their daily lives is their easy availability and the presence of fertile lands suitable for cultivating various types of plants. These factors fall under the category of ecology. The information obtained from the interviews highlights the significant role of ecological factors in the use of medicinal plants.

Table 1
Informant Information (Not Real Names)

No.	Name	Age	Occupation	Bugis Language Job	Ethnic Category	Monthly Income (RM)
1.	Mrs. Chida	38	Trader	<i>Pa'dangkang</i>	Sidrap	3,000
2.	Mrs. Marak	55	Trader	<i>Pa'dangkang</i>	Bone, Sinjai	3,000
3.	Mrs. Hajah Sukma	48	Trader	<i>Pa'dangkang</i>	Bone	3,500
4.	Mrs. Hajah Niti	55	Trader	<i>Pa'dangkang</i>	Sidrap	5,000
5.	Mrs. Hajah Cembak	63	Trader	<i>Pa'dangkang</i>	Sidrap	3,000
6.	Mrs. Nanna	30	Trader	<i>Pa'dangkang</i>	Bone, Sinjai	3,000
7.	Mrs. Hajah Alang	53	Trader, Farmer	<i>Pa'dangkang, Pa'darek</i>	Bone	12,000
8.	Mrs. Hajah Barik	59	Farmer	<i>Pekebun</i>	Sidrap	5,000
9.	Mrs. Manting	85	Retired	<i>Bersara</i>	Sidrap, Sinjai	-
10.	Mr. Suharto	53	Factory Worker, Shaman	<i>Pakkilang, Sandro</i>	Sidrap	2,000 4,000

The Use of Traditional Plants for Traditional Medical Treatment

Table 2 below depicts the findings of the study which illustrates the traditional plant names that are found in Sebatik Island. These traditional plants, along with their Bugis names, botanical names, and plant family classifications, are recognized as important ingredients in complementary medicine.

Table 2
Traditional Plants Analysis

No	Plant Names	Bugis Names	Botanical Names	Family
1.	Shallot	Lasuna cellak	<i>Allium cepa</i>	<i>Alliaceae</i>
2.	Garlic	Lasuna puteh	<i>Allium sativum</i>	<i>Alliaceae</i>
3.	Coconut	Kaluku	<i>Cocos nucifera</i>	<i>Arecaceae</i>
4.	Noni fruit	Baja'	<i>Morinda citrifolia</i>	<i>Rubiaceae</i>
5.	Galingale leaves	Daung galingkan	<i>Senna alata</i>	<i>Fabaceae</i>
6.	Gemunggal leaves	Daung kelorok	<i>Moringa oleifera</i>	<i>Moringaceae</i>
7.	Guava leaves	Daung jampu	<i>Psidium guava</i>	<i>Myrtaceae</i>
8.	Papaya leaves	Daung keniki	<i>Carica papaya</i>	<i>Solonaceae</i>
9.	Banana leaf	Daung loka	<i>Musa paradisiaca</i>	<i>Musaceae</i>
10.	Celery leaves	Daung sop	<i>Apium graveolens</i>	<i>Umbelliferae</i>
11.	Castor bean	Daung pellek keniki	<i>Jatropha curcas</i>	<i>Euphorbiaceae</i>
12.	Tapioca leaf	Daung lamey	<i>Manihot esculenta</i>	<i>Euphorbiaceae</i>
13.	Java wood	Aju Jawa	<i>Lannea coromandelica</i>	<i>Sapindalaceae</i>
14.	Turmeric	Onyik	<i>Curcuma domestica</i>	<i>Zingiberaceae</i>
15.	Pumpkin	Lawo	<i>Sechium edule</i>	<i>Cucurbitaceae</i>
16.	Aloe vera	Lilla buaja	<i>Aloe vera</i>	<i>Liliaceae</i>
17.	Mistletoe fig	Mas cotek	<i>Ficus deltoide</i>	<i>Moraceae</i>
18.	Pearl grass	Daung canggadori	<i>Sida rhombifolia</i>	<i>Malvaceae</i>

Allium cepa / Alliaceae (Shallot)

Based on information from informants or medical practitioners in Sebatik Island, “*shallots (Allium cepa) work to reduce and eliminate acne, fever, cure ulcers, smallpox, external wounds, beautify problematic skin, reduce skin itching, reduce mumps, and cancer problems*”. The way to prepare it is to wash or crush the onion by hand (crush) and mix it with young coconut water (highly recommended). After that, the material should be regularly applied to problem areas. Among the informants who used shallots as a traditional medicine practice were Mrs. Chida, Mrs. Marak, Mrs. Hajah Sukma, Mrs. Hajah Niti, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, Mrs. Manting and Mr Suharto.

Allium sativum / Liliaceae (Garlic)

Based on informants' feedback, “*garlic (Allium sativum) works to treat fever*”. While the preparation method is to mix the garlic with natural coconut oil and apply it to all limbs in a relaxed massage. Among the informants who used garlic as a traditional medicine practice were Mrs. Chida, Mrs. Marak, Mrs. Hajah Sukma, Mrs. Hajah Niti, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, Mrs. Manting and Mr. Suharto.

Cocos nucifera / Arecaceae (Coconut)

Based on information from Mr. Suharto, medical practitioner of Pulau Sebatik, “*the coconut tree (Cocos nucifera) functions to remove toxins in the body, treat mumps, headaches, reduce itching in the body, for beauty purposes, cure ringworm, cancer, acne, fever and cure smallpox*”. For skin problems such as itching, wrinkles, grooming, smallpox and mumps, the way of preparation is the coconut water is combined with shallots that have been soaked. The substance is then applied to the problem area of the skin as often as possible. This means that when the skin starts to dry, the coconut water and shallots are reapplied to the skin to keep the skin moisturized. For poisoning problems, treating headaches, beautifying the skin from the inside and out, it is recommended to drink young coconut water every day. Meanwhile, for appendicitis and vomiting blood, 7 lemongrass stalks (grated or coarsely ground) are needed, take salt at the end of a spoon or 2 pinch salt, half a cup of water, 1 old coconut (take the spatula). All the ingredients are heated instantly and filtered. After warmth, it should be drunk. Other informants who practice the use of coconut water in the field of traditional medicine are Mrs. Chida, Mrs. Marak, Mrs. Hajah Sukma, Mrs. Hajah Niti, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, and Mrs. Manting.

Morinda citrifolia / Rubiaceae (Noni fruit)

Mr. Suharto, one of the informants of this study explained that “*the noni tree (Morinda citrifolia) works to help blacken grey hair and treat hair loss problems*”. The method is the noni tree leaves need to be boiled, and the boiled water is drunk after resting. In addition, the leaf decoction can also be used during bathing and needs to be wiped from the ends of the hair to the toes for comprehensive use. Quite a number of informants practice the use of this plant as a source of medicine, namely Mrs. Hajah Sukma, Mrs. Hajah Niti, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, and Mrs. Manting.

Senna alata / Leguminosae (Galingale leaves)

Based on the results of an interview, Mr. Suharto stated that “*Gelenggang (Senna alata) according to Bugis belief, it can remove acne and smooth and beautify the skin of the body*”. This can be done through boiling the leaves. While the leaves are still warm, they are applied

to the skin areas depending on the individual's resistance to the temperature of the freshly boiled leaves. Among the informants who also used Gelenggang leaves as a source of medicine were Mrs. Chida, Mrs. Marak, Mrs. Hajah Sukma, Mrs. Hajah Niti, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, and Mrs. Manting.

Moringa oleifera / Moringaceae (Gemunggal leaves)

Being a shaman, Mr. Suharto, confirmed that the Gemunggal tree or better known as the moringa tree (*Moringa oleifera*) “functions for the purpose of beautifying women's skin as well as curing appendicitis or unhealthy digestive system problems, through the use of cooked or sautéed leaves”. Among the other informants who practise and use Gemunggal leaves as a source of medicine are Mrs. Chida, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, and Mrs. Manting.

Psidium guava / Myrtaceae (Guava leaves)

Based on information from informant, Mrs. Niti stated that as a medical practitioner in Sebatik Island, the guava tree (*Psidium guava*) “can cure and reduce diarrheal problems by using Guava leaves by boiling the leaves”. Once the water has boiled and has been rested (warm), it can be drink and eaten with the leaves (1 time for a day until cured). Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, and Mrs. Manting also use Guava leaves as their daily source of medicine.

Carica papaya / Solonaceae (Papaya leaves)

The results of this study found that the papaya leaves (*Carica papaya*) are useful for reducing gout and diabetes. One of the informants, Mr Suharto explained that “for gout disease, young papaya fruits with their skin are needed to be boiled with water”. Once the water boils, wait until it is cool or suitable for drinking and also drink with young coconut water (preferably if you have one). For diabetes, young (small) papaya leaves need as many as seven leaves, 3 tablespoons of honey and 1 duck egg yolk. The ingredients all need to be ground until well combined and drink. Mrs. Chida, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, and Mrs. Manting also stated that these papaya leaves are very good for health, and they usually use Mr. Suharto as the main reference in their traditional medicine.

Musa paradisiaca / Musaceae (Banana leaf)

Based on the results of an interview, Mr. Suharto posits that “the use of banana leaf is practiced regularly for the beauty of facial skin, while for fever and sore throat it is drink when the symptoms of the disease arise”. According to traditional medicine practitioners, about a handful of banana leaves need to be boiled, filtered and drink after they boil and rest (warm). Mrs. Chida, Mrs. Marak, Mrs. Hajah Sukma, Mrs. Hajah Niti, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik and Mrs. Manting also practice the use of this banana leaf, similar to the method explained by Mr. Suharto.

Apium graveolens / Umbelliferae (Celery leaves)

Meanwhile, the celery leaves (*Apium graveolens*) is able to reduce the problem of gout which is called a rheumatic disease by residents of Sebatik island. Mr. Suharto explained that “celery leaves can also be made as a vegetable dish”.

Jatropha curcas / Euphorbiaceae (Castor bean)

Based on the findings of this study, “*castor bean is a plant used to cure haemorrhoids. The method used to cure haemorrhoids is to apply castor bean in the affected area to reduce the effect of haemorrhoids after heating them in a pan*”. Meanwhile, to reduce seizures and amputations, a few castors bean were mixed with termite nests, seven grains of rice and one clove of garlic and onion. All the mixtures are heated in a frying pan for about five minutes. Then the mixture is placed on the forehead, chest and neck. Apart from Mr. Suharto, Mrs. Hajah Alang, Mrs. Hajah Barik and Mrs. Manting are villagers that know and use this plant in the practice of traditional medicine.

Manihot esculenta / Euphorbiaceae (Tapioca leaf)

The results of this study found that the tapioca leaf (*Manihot esculenta*) functions as a blood booster for women who suffer from anemia (especially for pregnant women). The tapioca leaf (*Manihot esculenta*) or *cassava tree* in the *Euphorbiaceae* family is a type of vegetable that is filled in the soil, has various types and nutrients. Cassava trees can reach a height of 4 m, and the entire section contains white latex, the stems grow upright and unbranched. While the leaves are used to reduce headaches. As a result of interviews with all the informants through FGD, they unanimously agreed that this tapioca leaf has the nutrients as stated and is very good for health.

Lannea coromandelica / Sapindalaceae (Java bark)

In addition, based on information from informants or female Bugis medical practitioners in Sebatik Island, the Javanese tree (*Lannea coromandelica*) is said to be able to heal external wounds on the skin such as ulcers. The trunk of the Javanese tree is used to heal external wounds on the skin. Both informants namely Mrs. Manting and Mr. Suharto argue that “*the preparation method is to take the fruit in a scraped stem, placed on the wound in a rounded manner without covering the eye of the wound to allow the pus to come out*”. Sukma also agrees by stating that “*this Javanese wood is very potent for purulent external wounds*”.

Curcuma domestica / Balsaminaceae (Turmeric)

Based on the study, it was found that “*turmeric is used to cure smallpox, treat skin problems and for various beauty purposes. It is also useful for reducing fever, flu attacks and coughing up phlegm*”. The way it is used is by oral ingestion, which is chewed. The way to prepare it is that after the live turmeric is cleaned, half a cm of the part is chewed together with a white pepper. This practice should be done continuously for seven consecutive days.

Sechium edule / Cucurbitaceae (Pumpkin)

Pumpkin (*Sechium edule*) works to reduce and relieve asthma. “*The part of the pumpkin used is the leaves of the young pumpkin that need to be crushed until they are fleshy*”. The water from the leaves is filtered for drinking and the approximate quantity of intake is about 1 tablespoon and taken only when necessary. Among the informants who used pumpkin leaves as a traditional medicine practice were Mrs. Chida, Mrs. Marak, Mrs. Hajah Sukma, Mrs. Hajah Niti, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, Mrs. Manting and Mr. Suharto.

Aloe vera / Liliaceae (Aloe vera)

Aloe vera (Aloe vera) based on the findings of this study can reduce the problem of acne and treat the scalp and face problems as well as heal external wounds. By taking the aloe vera mucus and rubbing it on problem parts of the skin. All the informants also use aloe vera in skin care and beauty. According to one of informants, Mrs. Chida “*this aloe vera tree is very popular among the Sebatik Island residents generally because it is said to be the latest and easily identifiable plant*”.

Sida rhombifolia / Malvaceae (Pearl grass)

In this study, pearl grass was used “*for the purpose of draining bowel movements, curing fever, reducing body aches and is important for eye health and skin beautification for women*”. The way to prepare it is by boiling the leaves of the plant. After boiling, the water needs to be rested and drunk after it is lukewarm (suitable for drinking and not too hot). Only a few informants know about the function of this pearl grass in health, namely, Mr. Suharto, Mrs. Chida and Mrs. Marak.

Ficus deltoidea / Moraceae (Mistletoe fig)

“*Mistletoe fig reduces itchy skin problems*”. The leaves are taken as many as a handful and then boiled with a large bottle of water. The boiled water is drunk and should be consumed within seven days. Every time you want to drink the water, you need to reheat it, let it warm first and then drink it. Among the informants who used mistletoe fig as a traditional medicine practice were Mrs. Chida, Mrs. Marak, Mrs. Hajah Sukma, Mrs. Hajah Niti, Mrs. Hajah Cembak, Mrs. Nanna, Mrs. Hajah Alang, Mrs. Hajah Barik, Mrs. Manting and Mr. Suharto.

Table 3

Species Classification According To The Part Used

Plants Parts / Species	Stem	Leaf	Fruit	Mucus	Water	Total
1. <i>Sida rhombifolia</i>		+				1
2. <i>Curcuma domestica</i>			+			1
3. <i>Senna alata</i>		+				1
4. <i>Aloe vera</i>				+		1
5. <i>Allium cepa</i>			+			1
6. <i>Allium sativum</i>			+			1
7. <i>Cocos nucifera</i>					+	1
8. <i>Sechium edule</i>		+				1
9. <i>Morinda citrifolia</i>		+	+			2
10. <i>Manihot esculenta</i>		+				1
11. <i>Musa paradisiaca</i>		+				1
12. <i>Apium graveolens</i>		+				1
13. <i>Moringga oleifera</i>		+				1
14. <i>Psidium guava</i>		+				1
15. <i>Lannea coromandelica</i>	+					1
16. <i>Ficus deltoide</i>		+				1
17. <i>Carica papaya</i>		+	+			2
18. <i>Jatropha curcas</i>		+				1
Number of species	1	12	5	1	1	20
Species frequency (%)	5	60	25	5	5	100

18 plants were identified as being commonly used among the residents of Kampung Aji Kuning, Sebatik, for traditional medicinal purposes. However, the most popular plants in traditional medicine use are onions, garlic, papaya leaves, noni fruit and the galingale leaf, particularly in treating common ailments experienced by the local population, such as fever and skin problems (itching and acne). Based on Table 3, the plant species part most commonly used is the leaf, with 12 species (60%), followed by the fruit, with 5 species (25%), while the stem, plant mucus, and plant water each account for 1 species (5%) used in the traditional medicine on Sebatik Island.

Factors of Plant Usage for Traditional Medical Treatment

Several previous research studies (Foo & Jaafar, 2017; Hasbullah & Hassan, 2017; Ahmad et al., 2023; Mustapha, 2022; Daud, 2011; Duguma, 2020; Che Amat et al., 2023; Lee & Ong, 2022) have pointed out the key factors related to the use of medicinal plants in their study. The results of this study are classified into more specific factors of the use of medicinal plants as shown in Figure 2 and narrowed down to three main factors including social factors, economic factors and ecological factors. Based on the interview data, this study has identified several top reasons for traditional plants used for medical treatment by the Sebatik Island residents as discussed below.

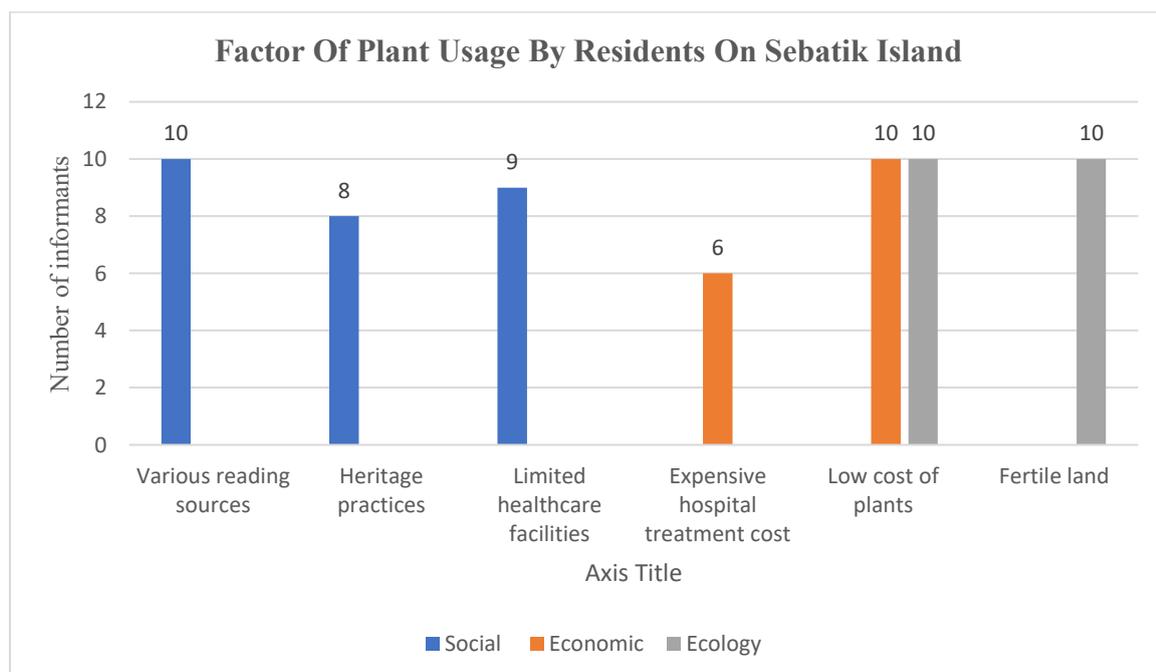


Fig. 2. Factor of Traditional Plants Usage by Residents of Sebatik Island

Various Reading Resources

The material referenced in this study encompasses a diverse collection available both within and outside library holdings, comprising various forms that serve as essential sources of specific information (Foo & Jaafar, 2017). According to the findings, all 10 informants noted that their use of medicinal plants in traditional medicine is heavily influenced by their reading practices related to plant medicine resources. These reading practices extend beyond traditional books to include mass media such as television, smartphones, and computers. The informants emphasized that their knowledge acquisition from these sources serves as a guide

in practicing traditional medicine among the residents of Sebatik Island. This underscores the enduring culture of reading in Kampung Aji Kuning, Pulau Sebatik, where there is a strong interest in utilizing plants for treating and curing diseases through traditional methods.

Heritage Practices

As noted by 8 informants, the use of medicinal plants is deeply rooted in familial heritage, passed down from parents to their children and beyond. This heritage includes practical teachings on remedies as well as spiritual practices such as readings, prayers, and mantras, which are integral to healing rituals. While customs and taboos may vary, adherence to these traditions is considered essential for their continuity and efficacy. Similarly, recent research by Mustapha (2022) underscores the enduring significance of hereditary practices in Malay society, particularly in locales like Kampung Aji Kuning. Here, herbal medicine continues to play a vital role, deeply integrated into community and cultural practices. Local residents esteem practitioners such as "Sandro and shaman," renowned for their blend of traditional wisdom and modern medical knowledge, reflecting a longstanding cultural tradition and community habit.

Limited Healthcare Facilities

This study found that limited healthcare facilities is among the top reasons why the villages opted for traditional plants as an alternative for medical treatment. As acknowledged by 9 informants, the remote and secluded geographical location of Sebatik Island that is a bit far away from modern healthcare facilities provided by the government has prompted the villages to seek for an alternative medical treatment using the traditional plants around them. Daud (2011) and Duguma (2020) highlight that remote areas continue to face significant challenges due to their distance from urban centers and the ongoing disparities in development. These areas often suffer from inadequate infrastructure including healthcare facilities, electricity supply, transportation networks, economic opportunities, and residential infrastructure. In the case of Sebatik Island, this lack of development is particularly evident in its healthcare sector, as noted by nine informants who reported insufficient healthcare facilities on the island. Consequently, residents of Sebatik sometimes have to cross the border to Tawau to seek medical treatment at Tawau Hospital. This situation underscores the persistent disparities in infrastructure and services between remote areas like Sebatik Island and more developed urban areas, impacting the accessibility and quality of essential services for local residents.

Expensive Hospital Treatment Costs

The findings of this research underscore a sense of pride among participants, as 6 informants highlight cost as a significant factor influencing their preference for traditional herbal medicine over hospital treatments, which they find prohibitively expensive. This preference extends beyond the direct costs of treatment to include expenses associated with transportation, travel time, and waiting times at hospitals. The informants express strong confidence in the efficacy of herbal remedies like coconut water, red onions, and white onions, which are considered indispensable and widely utilized. Despite reporting a monthly household income of RM3,000 or more per informant, financial considerations are not the primary obstacle preventing regular access to modern healthcare. Rather, the logistical challenges associated with accessing hospital services, such as mobility limitations and

bureaucratic procedures, deter them from seeking conventional treatment and reinforce their reliance on herbal medicine as a pragmatic alternative (Che Amat et al., 2023).

Low Cost of Plants

Based on the interviews conducted, all 10 informants unanimously agree that a primary reason for the widespread use of medicinal plants in traditional practices is their affordability. They emphasize that these plants are easily accessible, whether found in the wild or cultivated, making them a cost-effective source of medication. This accessibility ensures that medicinal plants are not only abundant but also inexpensive to obtain and utilize. As a result, the economic factor plays a crucial role in promoting the continued reliance on herbal medicine within the community, where the affordability and availability of these plants meet the practical healthcare needs of the population (Lee & Ong, 2022).

Easy Availability of Plants

All 10 informants unanimously emphasize that medicinal plants are readily abundant on Sebatik Island, covering approximately 80% of its area with forests, cultivated areas, and agricultural lands. This rich natural environment facilitates easy access to raw materials necessary for traditional herbal medicine. Similarly, recent research by Ahmad et al. (2023) underscores the significant reliance of local communities in Malaysia on medicinal plants due to their easy accessibility and economic viability. These findings highlight the local population's preference for herbal medicine as a practical and accessible healthcare solution, bolstered by the abundant natural resources available in their environment.

Fertile Land

All 10 informants identified themselves as traditional medicine practitioners, often referred to as "Pakdarek," who possess advanced gardening skills and extensive experience in assessing plant fertility. According to recent research, land fertility is evaluated based on the consistent yield and productivity of cultivated plants over multiple seasons. Informants determine land fertility by observing abundant and productive crops (Hasbullah & Hassan, 2017). Conversely, they stress the importance of regular soil fertilization and maintaining optimal irrigation conditions if yields are poor or inconsistent. This expertise underscores the practical agricultural knowledge and skills of "Pakdarek" practitioners, highlighting their pivotal role in cultivating medicinal plants and ensuring their efficacy in traditional medicine practices.

Conclusion

This study concludes with several key findings, namely: (i) economic and cultural significance, which emphasizes the economic viability and cultural importance of traditional medicinal plants for the communities residing on Sebatik Island, a region divided between Malaysia and Indonesia. Local inhabitants rely heavily on these plants for their medicinal properties, given their accessibility and low cost; (ii) the role of traditional knowledge, in which the continued use of medicinal plants is deeply embedded in the familial heritage of the communities, signifying a strong cultural attachment to traditional medicine. This knowledge is often passed down through generations, highlighting its integral role in maintaining health and well-being; (iii) biodiversity and ecosystem, where Sebatik Island's unique ecological landscape, characterized by a mix of forests and agricultural lands, plays a pivotal role in sustaining a diverse range of medicinal plants. The rich biodiversity of the area supports a

variety of species used in traditional medical practices; (iv) community involvement and practices, where all informants participating in the study identified themselves as traditional medicine practitioners. Their roles involve cultivating medicinal plants and ensuring the efficacy of traditional medicine practices through advanced gardening skills and expertise in assessing plant fertility. The study highlights the importance of traditional medicinal plants in the socio-cultural and economic fabric of communities on Sebatik Island. By documenting and analyzing these practices, the research provides a foundation for further studies that could contribute to the preservation of cultural heritage, promotion of biodiversity conservation, and improvement of community health and well-being.

Theoretical and Contextual Contribution

This study contributes theoretically by enriching the ethnobotanical literature, particularly in the context of understudied border communities like those on Sebatik Island. It offers empirical insights into how traditional medicinal plant knowledge is shaped by intertwined socio-cultural, economic, and ecological factors, thereby reinforcing the theoretical framework of indigenous knowledge systems in health and well-being. Contextually, the study is significant as it documents and validates the practices of a geographically and politically unique community situated between Malaysia and Indonesia, a region with limited formal healthcare access. By doing so, it highlights the adaptive strategies and resilience of local populations in maintaining traditional health practices despite modernizing influences. The research underscores the role of traditional knowledge not only as a cultural artifact but also as a practical healthcare alternative, thus offering critical implications for public health policy, biodiversity conservation, and cultural heritage preservation within borderland contexts.

Recommendations

The researchers suggest that future studies can explore more areas of Sebatik Island and involve various ethnicities. Further research has the potential to unearth more traditional sciences that could contribute to the field of botany and biogeography. Sebatik Island, which is unique in that it is inhabited by two countries, Malaysia and Indonesia, offers an opportunity for comparison between the traditional practices of the communities between the two countries.

In addition, future researchers are expected to conduct studies in other areas of Malaysia such as the East Coast of the Peninsula and the capital city which faces various issues including natural disasters and extinction of natural resources. This study can increase public awareness about the importance of botany and the preservation of natural resources. By appreciating nature's rewards such as the climate and suitable soil for medicinal plants, Malaysia is able to develop a competitive herbal industry. Traditional knowledge needs to be preserved and used as the basis for the development of science and technology, making it the basis of the country's progress. The data from this study can also be used as a reference to create a better botanical study model for future researchers in Sebatik Island.

Furthermore, future research could further explore the ecological and cultural dimensions of traditional medicinal plant usage among communities like those on Sebatik Island. Specifically, studies could investigate the biodiversity impact of harvesting medicinal plants, considering sustainable practices and conservation strategies. Understanding how local

knowledge influences plant selection, cultivation practices, and medicinal efficacy could inform conservation efforts and promote sustainable use.

Additionally, investigating the economic implications of traditional medicine in terms of income generation, market potential, and integration with modern healthcare systems would provide insights into its broader socio-economic impact.

Moreover, conducting longitudinal studies to monitor changes in plant availability, biodiversity, and community health outcomes over time would offer valuable data for assessing the sustainability and resilience of traditional medicinal practices amidst environmental and socio-economic changes.

These interdisciplinary approaches could enhance policy and management strategies aimed at preserving cultural heritage, promoting biodiversity conservation, and improving community health and well-being. Interdisciplinary approaches that combine cultural heritage preservation with biodiversity conservation and community health improvement are recommended. These strategies could inform policy and management efforts aimed at sustaining traditional medicinal practices while promoting ecological and cultural preservation.

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