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ETHNOPHARMACOLOGY STUDY OF MEDICINAL PLANTS UTILIZED FOR HYPERCHOLESTEROLEMIA TREATMENT IN KALIMANTAN, INDONESIA

Studi Etnofarmakologi Tumbuhan Obat untuk Pengobatan Hiperkolesterolemia di Kalimantan, Indonesia

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ABSTRACT

The use of medicinal plants for various health purposes has been widely reported. This study aimed to inventory knowledge related to the use of medicinal plants, in particular, to treat hypercholesterolemia in the community by traditional healers in Kalimantan, Indonesia. The data collection was based on purposive random sampling using a structured questionnaire among selected traditional healers. The study results exhibited that Syzygium polyanthum was recognized as the most cited plant (UV=0.22) by traditional healers in the treatment of hypercholesterolemia, mostly for internal administration route (93.33%) either in a single compound (66.67%) or in combination (33.33%) with other medicinal plants. Leaves were determined as the most explored and utilized plant part (66.67%) compared to other organs. Most medicinal plants were collected from the home yard (60.00%). However, only 37.5% were cultivated. In conclusion, this study revealed the important roles of medicinal plants as well as traditional healers in maintaining community health, especially for the treatment of hypercholesterolemia in Kalimantan.

Keywords**:** *hypercholesterolemia, Syzygium polyanthum, traditional healers, indigenous knowledge*

ABSTRAK

Pemanfaatan tumbuhan obat untuk tujuan kesehatan telah banyak dilaporkan. Penelitian ini bertujuan untuk menginventarisasi pengetahuan pemanfaatan tanaman obat khususnya untuk pengobatan hiperkolesterolemia di masyarakat oleh pengobat tradisional di Kalimantan, Indonesia. Pengumpulan data menggunakan kuesioner terstruktur berdasarkan *purposive random sampling* pada pengobat tradisional (battra) terpilih yang memenuhi berbagai kriteria inklusi yang ditetapkan. Hasil penelitian menunjukkan bahwa *Syzygium polyanthum* (UV=0,22) merupakan tanaman obat yang paling banyak digunakan oleh battra untuk pengobatan hiperkolesterolemia, dimana administrasi internal (93,33%) merupakan rute yang paling banyak digunakan baik dalam bentuk tunggal (66,67%) maupun kombinasi (33,33%) dengan tanaman obat lainnya. Dibandingkan bagian tanaman lainnya, daun (66,67%) dilaporkan sebagai bagian tanaman yang paling banyak dieksplorasi dan dimanfaatkan. Sebagian besar tanaman obat dikumpulkan dari pekarangan rumah (60,00%), sedangkan yang dibudidayakan hanya 37,50%. Kesimpulan yang dapat diambil dari studi ini adalah bahwa baik tanaman obat maupun battra memiliki peran yang sangat penting dalam menjaga kesehatan masyarakat, khususnya untuk pengobatan hiperkolesterolemia di Kalimantan.

Kata kunci: hiperkolesterolemia, *Syzygium polyanthum*, pengobat tradisional, pengetahuan lokal

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BACKGROUND

The use of medicinal plants in Indonesia for health purposes has been known and practiced by ancestors and passed down from generation to generation (Herman et al., 2013; Mitra et al., 2010; Sholikhah, 2016). The trend of back to nature that is increasingly developing today has triggered an increase in the use of various medicinal plants in terms of quantity and types of medicinal plants themselves (Triratnawati, 2016). As many as 30,000 medicinal plants, which cover 90% of medicinal plants in the Asian region, grow and develop in Indonesia (Syamsiah et al., 2016). The use of traditional medicine is increasing along with the increase in population, healthy lifestyles, and cases of degenerative diseases (Triratnawati, 2016). As much as 21.4% of Indonesia's population was reported to be using traditional medicine for the independent handling of health problems (Siregar et al., 2020). Herbal remedies and massage are the most common treatments provided by traditional healers in Indonesia (Peltzer & Pengpid, 2019). Traditional medicines consumption increased by 5.4% annually in Indonesia (Riptanti et al., 2018). The efficacy, lower price, easy access, and dissatisfaction with conventional treatments are some of the reasons for choosing treatment with traditional medicine (Birhan et al., 2011; Triratnawati, 2016).

Kalimantan, commonly called Borneo, is one of the big islands in Indonesia which is rich in plant diversity and has been widely used not only for trading commodities but also for health purposes (Kustiawan, 2007). One of the health problems that become a challenge in Kalimantan, Indonesia is hypercholesterolemia (Anonim, 2017). High cholesterol is a condition in which the total cholesterol level reaches 200 mg/dL or more and is established as a risk factor for cardiovascular diseases (Zhang et al., 2018; Stapleton et al., 2010). The percentage of high cholesterol recorded at the Integrated Development Post and Community Health Centre which has used the surveillance information system on Kalimantan is 43.28%, higher than the national percentage (42%) in 2016 (Anonim, 2017).

One of the medicinal plants reported to have anti-hypercholesterolemic activity both empirically and scientifically is Syzygium polyanthum. Other biological activities of S. polyanthum have been reported. The 10% water extract of S. polyanthum leaves has a preservative activity through a mechanism of inhibiting bacterial growth (Hartanti et al., 2019). Significant antioxidant activity (90%) compared to the standard ascorbic acid was shown by the ethanol extract of ripe S. polyanthum fruit which contains flavonoids, saponins, steroids, triterpenoids, and tannins (Kusuma et al., 2011). S. polyanthum is one of the many types of woody plants used by the Karo ethnic for the treatment of diabetes (Situmorang et al., 2015) and is determined to have an antihypertension effect (Ismail et al., 2013).

The utilization of medicinal plants in the community cannot be separated from the knowledge possessed by both traditional healers and the community itself in terms of treatment using medicinal plants. Several studies reported that most of the traditional healers are in the elderly group and they do not have documentation regarding their knowledge and practice of medicine (Peltzer & Pengpid, 2019; Mustofa et al., 2020). This is one of the threats to the disappearance and loss of knowledge and various matters related to the medicinal abilities possessed by the community. Therefore, good documentation of knowledge and medical practices carried out by the community, especially traditional healers need to be conducted to provide a database that can be passed down to the next generation. This study was conducted to find out the medicinal plant species used by traditional healers, the plant part used, the preparation method and the administration route, sources of species, and the cultivation status of each species,

in particular, to treat hypercholesterolemia in the community and related practices by traditional healers in Kalimantan, Indonesia.

METHODS

Study area

The study was carried out among 19 ethnic groups distributed in five provinces (West Kalimantan, North Kalimantan, East Kalimantan, South Kalimantan and Central Kalimantan Province) of Borneo Island (Figure 1) during 2015 and 2017. Galik, Lau, Melahoy, Sanggau, and Suaid ethnic groups were located in West Kalimantan; Dusun Deyah, Harakit, and Pagatan ethnic groups in South Kalimantan; Dayak Sampit and Dayak Tomum in Central Kalimantan while Bajau, Dayak Apokayan, Dayak Bahau, Dayak Segai, and Kutai ethnic groups were located in East Kalimantan; Bulongan, Dayak Punan and Uma' Bakung ethnic groups were distributed in North Kalimantan.

Figure 1. The study area of Kalimantan, Indonesia, consists of 19 ethnic groups distributed in West Kalimantan, North Kalimantan, East Kalimantan, South Kalimantan, and Central Kalimantan Province

Data Collection

Data was collected by direct interview using a systematically structured questionnaire, followed by observation and medicinal plants sample collection as informed and shown by the selected interviewed healers in each ethnic group. This study involved five widely known traditional healers for each ethnic group in Kalimantan who possessed knowledge and expertise in healing and treating diseases by using medicinal plants. Healers were selected based on the purposive sampling method and met several predefined inclusion criteria. The inclusion criteria namely healers must be an indigenous ethnic group or acculturated, the most well-known and recognized traditional healers by the community, have expertise in treating diseases, and carry out medical practices using medicinal plants. The data on vernacular plant names, plant parts used, plant sources, the dosage used, way of preparation, and administration route were provided in the questionnaire. The species was identified for its scientific name by the expertise. The plant voucher specimens collected from this study were deposited at Herbarium Tawangmanguensis of Medicinal Plant and Traditional Medicine Research and Development Center, Tawangmangu, Central Java. Ethical approval of this study was obtained from the Health Research Ethics Committee of the National Institute of Health Research and Development, Ministry of Health, Indonesia.

Data analysis

The relative importance of data analysis of each species was calculated and represented by the Use Value (UV) level with the following formula calculation:

$$UV=\sum U/n \text{ (Ayyanar \& Ignacimuthu, 2011)}$$

UV is defined as the use-value of a species, U is described as the use reports number cited by each selected traditional healer for each medicinal plant species, while n is the informant total number interviewed for a given plant. In this study, UV is indispensable in identifying and determining the types of medicinal plants that are most often used by traditional healers to treat hypercholesterolemia.

RESULTS AND DISCUSSION

This section begins by discussing the number of plant species used or efficacious for hypercholesterolemia in each ethnic group. Furthermore, the preference index is discussed and then the use-value (UV) is calculated.

This ethnopharmacology study was carried out to provide a good documentation on medicinal plant utilization for treating hypercholesterolemia specifically in Kalimantan, Indonesia. The study showed that each traditional healer had local knowledge and skill about the use of medicinal plants for medication purposes, whereas most of the healers acquired the knowledge and skills from their parents or previous generations. Clear and good documentation is urgently needed to preserve local indigenous knowledge before it is completely lost (Mustofa *et al*., 2020). The availability of databases and documentation of knowledge and medical practices organized by the community, especially traditional healers, is very important to minimize the potential loss of this knowledge to the next generation. The study demonstrated the existence as well as the use of 26 medicinal plant species classified into 21 families and 30 herbal formulas for anti-hypercholesterolemia among 27 healers distributed in 19 ethnic groups in Kalimantan, Indonesia.

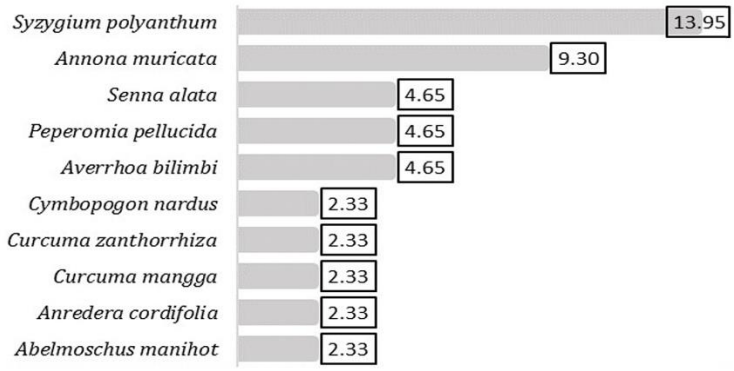

Figure 2. Ten leading medicinal plant species used by healers (%)

Figure 2 exhibited *S. polyanthum* as the most cited plant by healers for the treatment of hypercholesterolemia in Kalimantan, Indonesia, followed by *A. muricata, S. alata, P. pellucida, A. bilimbi, C. nardus, C. zanthorrhiza, C. mangga, A. cordifolia, A. manihot* and sixteen other species.

Prianwari (2019) reported whether clinical trial studies of S. *polyanthum* leaf extract administration of 2 x @200 mg for 30 consecutive days significantly reduced lipoprotein levels in dyslipidemia patients (Prianwari *et al*., 2019). Leaf water extract concentrations of 5, 10, and 20% induced a decrease in total cholesterol levels of propyl thiouracil-induced dyslipidemia rats and did not differ significantly from the simvastatin administration effect (Prahastuti *et al*., 2011). While normal and treated rats daily provision by *S. polyanthum* extract dose of 1 g/kg BW for two weeks showed liver toxicity symptoms marked by hepatocyte damage and kidney toxic changes showed by glomerulosclerosis and interstitial bleeding (Al-Nuaimi, 2018). The ethanol extract of *S. polyanthum* stems at doses of 0.72 and 1.44 g/200 g BW reduced cholesterol, triglyceride, and LDL levels and significantly increased HDL levels compared to simvastatin 0.2 mg/200 g BW in male hypercholesterolemic mice (Sutrisna *et al*., 2018). These cholesterol levels reduce the activity of *S. polyanthum* through the inhibition mechanism of HMG-CoA reductase, which was influenced by the phenol content of the extract (Hartanti *et al*., 2019). Another study suggested that the flavonoids contained in *S. polyanthum* leaf play a role in the reducing cholesterol synthesis effect mediated by the inhibitory mechanism of HMG-CoA reductase (Prianwari & Syafril, 2020).

Table 1. Medicinal plants utilized by traditional healers for treating hypercholesterolemia in Kalimantan, Indonesia

Species	Family	Plant part used	Use percentage (%)	Species cited number	Use Value (UV)	Way of preparation	Toxicity data
Lannea coromandelica (Houtt.) Merr.	*Anacardiaceae*	stem bark	2.33	1	0.04	Take the 3x12 cm stem bark, boil with water until brownish like tea, and drink a little at a time until the pain disappears.	Not yet available
Annona muricata L.	*Annonaceae*	Leaf	9.30	4	0.15	Take a handful of leaves, wash thoroughly, boil in 4 cups of water and the remaining 3 cups, drink regularly for 6 days, and check cholesterol on day 7; another way by taking 3 leaves, wash clean, boil in 3 cups of water until the remaining 1 cup or boil with 1 cup of water until the remaining 1/2 cup, then drink the water	Commercial noni juice showed no chronic toxicity (West, 2017).
Pinanga crassipes Becc.	*Arecaceae*	leaf	2.33	1	0.04	Take the leaves, wash until clean, boil with 3 cups of water, take the water and drink 2x1 a day until it heals.	Not yet available
Vernonia amygda lina Delile	*Asteraceae*	leaf	2.33	1	0.04	Take 7 pieces of leaves, boil with 1 glass of water, and drink three times a day or more for more than 2 months.	Methanol extract up to a dose of 1.2 g/kg exhibited no adverse effects on rat's liver and kidneys (Akowuah *et al*., 2015)
Anredera cordifolia (Ten.) Steenis	*Basellaceae*	leaf	2.33	1	0.04	Take 3 fresh leaves, wash them clean, boil in 3 cups of water and the remaining half, drink 2 times a day until cholesterol levels decreased	Leaf extract up to a dose of 90 mg had no toxicity effect on the guinea pig's liver (Wijayanti *et al*., 2019)

Species	Family	Plant part used	Use percentage (%)	Species cited number	Use Value (UV)	Way of preparation	Toxicity data
Garcinia mangostana L.	*Clusiaceae*	leaf, fruit	2.33	1	0.04	Not stated	Rind and pericarp extract showed a broad safety index among experimental animals (Candra & Irwani, 2016)
Terminalia catappa L.	*Combretaceae*	leaf	2.33	1	0.04	A total of 3 pieces of leaves are boiled with 2 cups of water until the remaining 1 cup, drink until they run out, and repeat until healed.	High dose extract caused rats cell swelling damage and liver necrosis (Rudy *et al*., 2020)
Mimosa pudica L.	*Fabaceae*	herbaceous part	2.33	1	0.04	Take 5 grams of herbs, wash, boil in 2 cups of water until boiling, and the remaining half, filter and drink twice a day.	Crude extract showed anti-inflammation activity (Rahman *et al*., 2016)
Senna alata (L.) Roxb.	*Fabaceae*	leaf	4.65	2	0.07	Take 7 old leaves, boil in 3 cups of water until the remaining 1 cup, and drink enough until healed. Excessive use can cause diarrhea; Take 5 leaves, boil with 3 cups of water until the remaining 2 cups, and drink 2x1 a day until recovered.	Aqueous extract revealed no pathological changes in Wistar rats and mice (Eziuche *et al.*, 2016)
Abelmoschus manihot (L.) Medik.	*Malvaceae*	leaf	2.33	1	0.04	Take a few leaves, dry them, mash them into a powder, pour water, and drink or mix them with vegetables	Ethanol extract of 3.2 g/kg 14 days caused necrosis of rabbit liver cells but not in mice and rats (Luan *et al*., 2020)
Sida rhombifolia L.	*Malvaceae*	root	2.33	1	0.04	Take the root, wash and boil until it boils, drink the water after it cools.	Not yet available
Syzygium polyanthum (Wight) Walp.	*Myrtaceae*	Leaf	13.95	6	0.22	Take fresh leaves, dry, boil together with *C. nardus* stalks, boil in 3 cups of water to a boil and the remaining 1 cup, drink when cold; or take 7 leaves, wash clean, soak in hot water then drink the water; or take 3 leaves, wash it with lukewarm water, then drink it; another way, boil the leaves with 5 cups of water until the remaining 2 cups and drink the water 2x1 a day.	Ethanol extract of dose 400 mg/kg did not show toxicity effects against Wistar rats (Sumiwi *et al*., 2019)
Scorodocarpus borneensis (Baill.) Becc.	*Olacaceae*	leaf	2.33	1	0.04	Take the top of the leaves, roast then eat	Ethyl acetate extract was more toxic than n-hexane against *Coptotermes curvignathus* (Sudrajat *et al.*, 2018)
Averrhoa bilimbi L.	*Oxalidaceae*	leaf, fruit	4.65	2	0.07	Take the leaves and fruit, boil separately with 5 cups	Fruit extract showed no toxic

Species	Family	Plant part used	Use percentage (%)	Species cited number	Use Value (UV)	Way of preparation	Toxicity data
						of water until the remaining 2 cups are then drunk	effects (Leliqia & Safitri, 2021)
Pandanus amaryllifolius Roxb.	*Pandanaceae*	leaf	2.33	1	0.04	Take the leaves, cut them into small pieces, boil in 5 cups of water until the remaining 2 cups, and drink three times a day.	Leaf extract induced larvae mortality and fecundity of diamondback moth (Imtithal *et al*., 2018)
Phyllanthus urinaria L.	*Phyllanthaceae*	leaf	2.33	1	0.04	Wash the leaves, boil in 3 cups of water to a boil, and the remaining 1 cup, strain, and drink the water.	High dose extract may have a toxic effect and increases urea levels in mice (Singh *et al*., 2016)
Peperomia pellucida (L.) Kunth	*Piperaceae*	leaf	4.65	2	0.07	Take the leaves, clean, put them in the container, add hot water, cover the container for 10 minutes, drink the water three times a day for one week or take the herbs, boil in 5 glasses of water until the remaining 2 cups, drink the concoction twice a day morning and evening.	Methanol extract of dose 4 g/kg did not cause mice mortality and liver damage (Waty *et al*., 2017)
Piper crocatum R uiz & Pav.	*Piperaceae*	leaf	2.33	1	0.04	Take and wash the leaves, boil in 2 cups of water until it boils, strain then drink the water.	The aqueous extract caused no toxic effect, changes of blood chemistry and organ histopathology (Ichwana *et al*., 2021)
Cymbopogon nardus (L.) Rendle	*Poaceae*	stem	2.33	1	0.04	Take the stem, dry it, boil with the *S. polyanthum* leaves, boil it in 3 cups of water to a boil, and the remaining 1 cup, drink when it is cold.	Essential oil of dose 1 g/kg increases creatinine and AST levels of rats (Ouedraogo *et al*., 2020)
Morinda citrifolia L.	*Rubiaceae*	fruit	2.33	1	0.04	Take 2 pieces of fruit, clean, cut into small pieces, boil with water in a saucepan until boiling, remove from heat and let drain then drink.	Methanol extract of 400 mg/kg was safe again mice (Nagarjuna *et al.*, 2015)
Nephelium sp.	*Sapindacaeae*	leaf	2.33	1	0.04	Take 1 rambutan leaf, boil it with enough water, take the shoot, then stick it on the crown of the head.	Extract of dose 8 g/kg was practically non-toxic against albino mice (Kusuma *et al*., 2013)
Phaleria macrocarpa (Scheff.) Boerl.	*Thymelaeaceae*	fruit	2.33	1	0.04	Take a handful of dried fruit, boil it in 3 cups of water until the remaining 1 cup, drink the water 3 times a day until it heals, usually before 1 month it is healed.	Long-term use of ethanolic extract was toxic to the liver (Armenia *et al*., 2006)
Curcuma mangga Valeton & Zijp	*Zingiberaceae*	rhizome	2.33	1	0.04	Take the rhizome of *C. mangga* and *C. zanthorrhiza*, thinly sliced 1-2 mm, dry in indirect sunlight for 2 days, oven 1	Ethanol extract up to a dose of 5 g/kg BW caused no sign of toxicity (Arifin *et al*., 2020)

Species	Family	Plant part used	Use percentage (%)	Species cited number	Use Value (UV)	Way of preparation	Toxicity data
						hour, blender and pack in 500 mg capsules, drink	
Curcuma zanthorrhiza Roxb.	*Zingiberaceae*	rhizome	2.33	1	0.04	Take the rhizomes of *C. zanthorrhiza* and *C. mangga*, thinly sliced 1-2 mm, dry them in indirect sunlight for 2 days, oven 1 hour, blender and pack in 500 mg capsules, drink	Rhizome extract was reported to have a variety of pharmacological activities (Musdja, 2021)
Zingiber montanum (J.Koenig) Link ex A.Dietr.	*Zingiberaceae*	rhizome	2.33	1	0.04	Finely crush the rhizome of *Z. montanum* and *Zingiber sp*, heat for a while, and apply to the tingling part.	Ethanol extract caused no changes in rat liver histopathology (Handani *et al.*, 2018)
Zingiber sp.	*Zingiberaceae*	rhizome	2.33	1	0.04	Mash the rhizomes of *Zingiber sp* and Z. *montanum*, heat briefly and apply to the tingling part.	White ginger extract was not toxic to BHK-21 fibroblast cells (Robiansyah *et al.*, 2020)

Table 1 revealed the identity of each medicinal plant species used as anti-hypercholesterolemic therapy starting from the species name, family, part used, species cited number, herb preparation, and use methods as well as supporting data related to species safety. Each species had its way of preparation and the most common way was by boiling the herbs. It can be shown that the five highest relative importance of the species represented by Use Value (UV) level were S. polyanthum, A. muricata, P. pellucida, A. bilimbi, and S. alata. With a use-value of 0.22, S. polyanthum was the species that had the highest UV level among other plants. It showed that the species had many use reports, interpreting its importance in the community. On the contrary, the UV approach to zero when there are few reports related to its use (Jaradat et al., 2016; Musa et al., 2011). S. polyanthum had the highest relative importance in treating hypercholesterolemia in Kalimantan since it is probably well grown on the island. The broad distribution of certain species contributes to their high relative importance locally. Furthermore, the consciousness of local healers to cite the species for health treatment, influences the high score of UV, as well (Ullah et al., 2014).

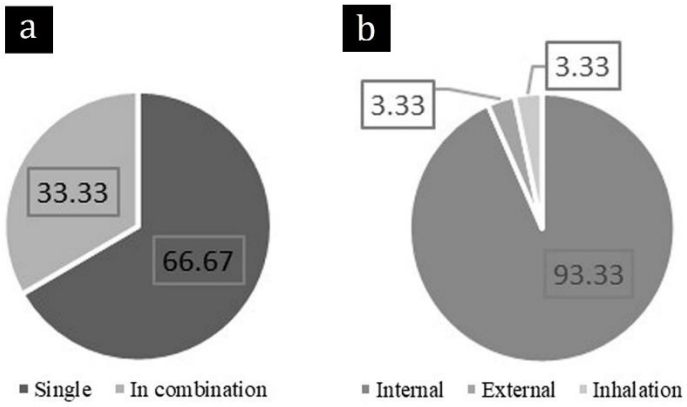

Figure 3. Medicinal plant's way of use (%) (a) and administration route of anti-hypercholesterolemia concoction (%) (b)

The results showed that a single form administration route of concoction was more frequent than in a combination for as of 66.67% (Figure 3.a). However, from this study, it could be presumed that the use of a single form of S. polyanthum was less frequent than in combination with other plants, namely A. muricata, C. mangga, C. zanthorrhiza, C. nardus, G. mangostana, and M. citrifolia. Internal use was identified as the most prominent administration route of the concoction, followed by the external and inhalation routes (Figure 3.b). The finding that the more frequent of the concoction was administered in a single form rather than in a combination seemed in contrast with recent theory whereas a multi-item herb of medicinal plants can have an antagonistic or synergistic effect, the presence of one herb can alter the effects of another when given together (Che et al., 2013). Moreover, the combined use of several plant extracts to treat infectious diseases is an alternative approach to help treat infections caused by multi-resistant pathogens (Bakarnga-Via et al., 2016). Each medicinal plant has its own chemical content complexity and a variety of bioactivities which resulted in various pharmacological effects (Ghosh, 2018). The study exhibited the most administration route was internal use rather than external or inhalation way. This is following the finding that the water concoction of the medicinal plant is the commonest traditional herbal dosage form for oral consumption which is generally intended for immediate use (Kumadoh & Ofori-Kwakye, 2017).

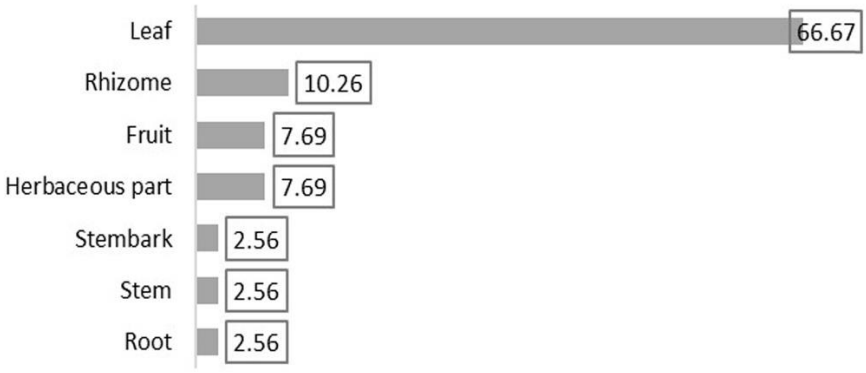

Figure 4. Plant parts utilized by healers (%)

Seven kinds of plant parts were identified to be utilized by traditional healers to cure hypercholesterolemia in Kalimantan, Indonesia. The leaf was claimed as the most frequently plant part used followed by rhizome, fruit, herbaceous part, stembark, stem, and root (Figure 4). This finding was following the study conducted by Syamsiah (2016) in which leaves were recognized as the most common plant part used in Mamuju ethnic. Leaves are usually available in abundant amounts and regenerate easily on plants. Furthermore, the leaves are part of the plant that is harvested easily and processed as well as consumed conveniently to treat various ailments. Chemical contents that possessed medicinal properties are usually accumulated on leaves (Mustofa *et al*., 2020; Amri & Kisangau, 2012; Fiscal, 2017; Giday *et al*., 2010). Harvesting leaves are relatively safer to either stem or root, because it does not kill the plant. Conversely, harvesting the main stem and roots of the plant can damage the plant and even cause it to die. Thus, the use of leaves is appropriate for conservation purposes (Mustofa *et al*., 2020).

Most traditional healers collected the raw material of medicinal plants from the home yard. While some others healers prefer to gain the herbs from wild sources such as forests and savanna. Other healers tend to look for and take ingredients from gardens and beach areas (Figure 5).

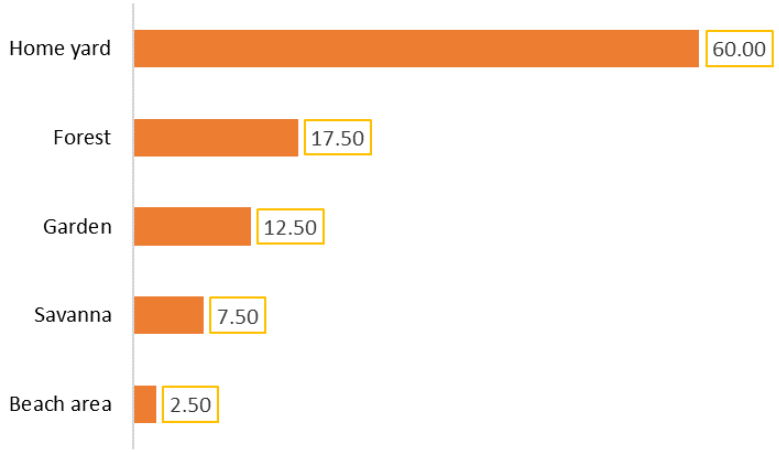

Figure 5. Sources of medicinal plants collected and used by healers (%)

The fact that most of the healers collected the plants from their own home yard indicated that they have awareness of conserving medicinal plant species. However, only 37.5% of a total of 26 species were cultivated by healers in Kalimantan, Indonesia. Utilizing the home garden as a place for cultivating medicinal plants contributes to both environmental and cultural conservation. Moreover, in cultivation in the home yard, the traditional healers acquire economic benefits, save more time and get fresh ingredients (Husain *et al*., 2019). A former study reported that herbal practitioners suggested effective ways to practice medicine for the diabetic treatment depending on home yard source (Chowdhury, 2019). The forest became the second place that was frequently visited by the healers in collecting medicinal plants. Wild plants are a free resource without investment, pesticide-free, and used to be more effective in treating ailments. However, overharvesting of medicinal plants leads to the extinction of ecotypes and species, resource depletion, and environmental damage (Chen *et al*., 2016).

CONCLUSION

In conclusion, the result exerted the pivotal role of traditional healers in maintaining community health utilized medicinal plants, especially for the treatment of hypercholesterolemia in Kalimantan, Indonesia. The study revealed the utilization of twenty-six plant species distributed in 21 families whereas *Syzygium polyanthum* Wight (Walp.) was identified as the highest use value species, while leaves and Zingiberaceae were determined as the most prominent plant part and family as well. The most administration route was internal use rather than external or inhalation way. Healers prefer to collect species from the home yard, even though the healer's cultivation effort is still below fifty percent. Efforts to cultivate medicinal plants need to be continuously developed to prevent species loss and further research on the safety and efficacy of each species needs to be conducted for providing a comprehensive and evidenced database on developing alternative hypercholesterolemia therapies.

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