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Original Article

ETHNOMEDICINAL STUDY OF *UBAR KAMPUNG* FOR DIABETES MELLITUS: INDIGENOUS KNOWLEDGE, BELIEF, AND PRACTICE OF MEDICINAL, AROMATIC, AND COSMETIC (MAC) PLANTS IN SUNDA REGION, WEST JAVA, INDONESIA

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ABSTRACT

Objective: Over the past several decades, ethnobotany and ethnomedicine have been considered as a more appropriate interdisciplinary approach to drug discovery involving interdisciplinary collaboration. Several studies on ethnomedicine and ethnobotany worldwide have shown that diabetes mellitus has been recognised by the traditional healer as a pathological condition which can be treated with specific medicinal plants. The starting point in an ethno-directed search for anti-diabetic plants is the identification of plant species used by local healers for this purpose. This study aims to document medicinal plants used by local communities for the treatment of diabetes mellitus.

Methods: This ethnographical study highlights the *emic* point of the local people to documents knowledge, belief, and practice of *ubar kampung* in Sunda Region.

Results: The results of this study reveals 20 of most frequently used of medicinal, aromatic, and cosmetic plants by people in Sundanese community. The majority of plant species used for the treatment of diabetes mellitus belong to the families of *Asteraceae* (2 species), *Lauraceae* (2 species), and *Liliaceae* (2 species).

Conclusion: Most of the medicinal plants reported in the research area are already publicly acknowledged for their medicinal properties, indicating that their pharmacological activities have been studied in different areas. Medicinal plants such *Syzygium polyanthum, Moringa oleifera, Swietenia mahagoni, Allium sativum*, and *Cinnammomum burmanni* have been widely used in several regions by various ethnic groups. Leaves are the most frequently used plant part. In general, infusion and decoction are the most common plant preparation methods in the research area.

Keywords: Ethnomedicine, Diabetes mellitus, Medicinal plants

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INTRODUCTION

Diabetes mellitus poses a major threat to human health in the present century. Its prevalence is increasing rapidly, particularly in Asia, the Middle East, Africa, and developing countries around the world [1]. The burden of diabetes and its complications continue to rise worldwide, particularly in Low-and Middle-income Countries (LMIC)s. Studies on the global estimate of diabetes prevalence reveal that most diabetes patients are living in LMICs. It is predicted that there will be a 69% increase in the numbers of patients in developing countries between 2010 and 2030 [2]. The International Diabetes Federation Western Pacific (IDF WP) documented that 10.3 million of 159 million cases of diabetes mellitus in the Western Pacific region is recorded in Indonesia [3]. In line with the high prevalence of diabetes mellitus in Indonesia, the prevalence of diabetes mellitus is also gradually increasing in West Java, as one of the most developed and most populated provinces in Indonesia. Diabetes mellitus is the fourth cause of most deaths in West Java in 2017, with a 49.1% increase compared to 2007 [4, 5].

As diabetes is a multifactorial disease leading to several complications, this disease demands multiple therapeutic approaches. Various synthetic drugs have been developed as antidiabetics with different mechanism of actions, including acarbose, sulfonylureas, meglitinides, biguanides, and thiazolidinediones. However, their application is limited because of side effects such as severe hypoglycaemia, lactic acidosis, and digestive disturbance [6]. Furthermore, conventional medicines are not accessible by the underprivileged population in terms of availability and affordability [7, 8]. Consequently, medicinal plants are being looked up for the treatment of diabetes mellitus and its complications [9]. A vast number of plants have been evaluated for their anti-diabetic properties. To date over 800 medicinal plants have been reported to have anti-diabetic activity and are used as folk medicine, albeit in small numbers, which have a scientific and medical evaluation for their efficacy [8].

Apart from the burden which is experienced by the country, Indonesia is known as the country with the largest ethnic groups and cultures in the world. Having a large tropical forest area, Indonesia is one of the world's centers of biodiversity. Over the centuries, medicinal, aromatic, and cosmetic plants have been used by most Indonesian people, especially in rural areas [10]. About 40 million Indonesians have historically utilised around 6000 plant species for health enhancement and the treatment of diseases [11]. Yusro *et al.* (2014) report that 78 species of plants have been used by 34 ethnic groups in Indonesia for the treatment of malaria; 133 species are used by 30 ethnic groups for the treatment of common fever, and 110 species have been used by 30 ethnic groups for the treatment of gastrointestinal disorders [12]. This rich potential of biological resources in Indonesia, integrated with knowledge of plant utilisation by various ethnic groups in Indonesia, creates a knowledge system including traditional medical knowledge or ethnomedicine [12, 13].

Every community and ethnic group in a certain area has its local knowledge and wisdom in utilising biological resources to support their life. Different environments, traditions, manners and behaviours establish variation in the traditional medical knowledge among each ethnic group in Indonesia. One of the examples is the indigenous medical knowledge of Tetun ethnic, one of the indigenous ethnic groups on the island of Timor. When the people of Tetun ethnic experience malaria, they create a concept and ways to prevent and treat the disease. People of the Tetun ethnic perceive

that malaria is caused by naturalistic factors which affect the hot-cold balance in the body and use various local medicinal plants for the treatment of malaria. This knowledge can then be incorporated with the existing conventional malaria eradication programs to make them more culturally acceptable and effective [14].

The Sundanese, the second largest ethnic group in Indonesia, considered West Java as their homeland and called most of the part of West Java *Tatar Sunda*. The region is located in the western part of Java and has a mountainous geographic feature. Blessed with fertile volcanic soil and tropical climate, the Tatar Sunda region has heterogeneous vegetation. Therefore, medicinal plants become the major component of Sundanese traditional medical practice, namely ubar kampung. Ubar kampung has been used by Sundanese community in their livelihood to maintain well-being for many generations.

Given its theoretical and empirical significance, the importance of traditional medicine provides a sound basis for the study of local people's medical knowledge in the treatment of diabetes mellitus.

MATERIALS AND METHODS

This ethnographical study highlights the *emic* point of the local people to documents knowledge, belief, and practice of *ubar kampung* and collects the name of the MAC plants used by local communities for the treatment of diabetes mellitus. In the preparation phase, a literature study was conducted for the description of the geographical and administrative data of the research area, covering the geographical entity known as the *Tatar Sunda* Region. The *Tatar Sunda* or *Parahyangan* region refers to the cultural area of the province of West Java and Banten.

In addition to the geographical features, the selection of the research area has also considered the environmental characteristics such as rural/urban communities and local availability of health care services and facilities. Consequently, this study employs multistage cluster sampling, including stratification at each stage of the design, to refine the selected sample. The procedure involved stratifying the sub-districts into rural and urban areas. The villages were selected based on the type of environment and characteristics of the community. The type of environment plays an important role in the utilisation of MAC plants by the communities.

The data was initially collected on a semi-structured interview with selected knowledgeable elders in the Sunda region. Furthermore, this study also used structured questions with the list of MAC plants listed by the key informants to appraise the community knowledge and personal use of the most common MAC plants for the treatment of diabetes mellitus. Each plant growing *in situ* in the research area was collected and dried and further identified by a botanist from the Biology Department, Faculty of Mathematics and Science, Universitas Padjadjaran. The local names of the plants were then crosschecked with a literature search for their scientific names.

RESULTS

The present study was conducted in Kabupaten Bandung, the western part of Tatar Sunda in Java Island. Kabupaten Bandung has been endowed with a rich plant diversity base because of its heterogenous ecologies, fertile land conditions, and cool and humid climate. Most people in Kabupaten Bandung, especially in rural area, rely on traditional medicine or traditional healers for the treatment of common illnesses. In general, the characteristics of Kabupaten Bandung, in the context of bio-cultural diversity, provide a valuable resource for the study of people's behaviour and their interaction with the natural environment. Kabupaten Bandung is divided into 31 sub-districts. Among these 31 sub-districts, three sub-districts were selected, representing: the farthest and closest area from the district hospital, highland and lowland area, and urban and rural environments. The selected sub-districts are presented in fig. 1.

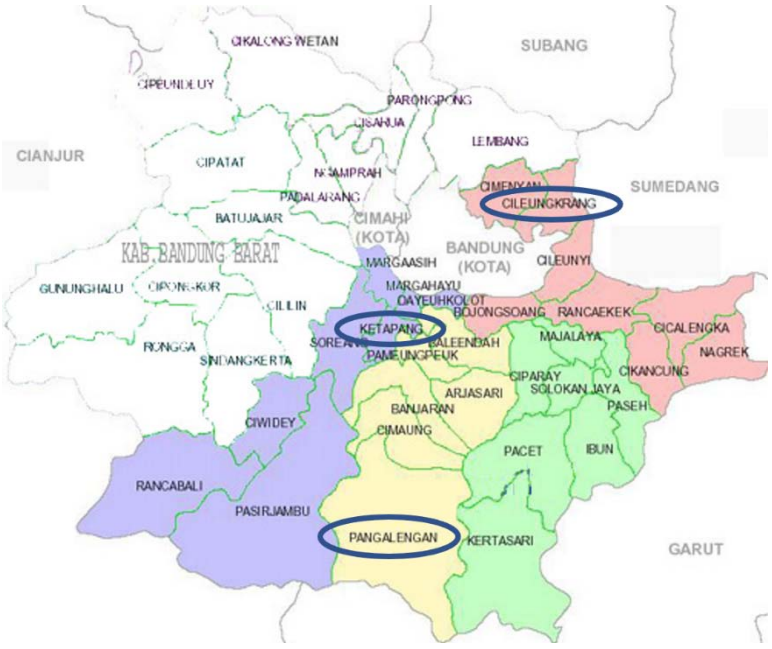

Fig. 1: Location of the three sample districts

Table 1: Knowledge on traditional medicine (N = 360)

Knowledge	Lamajang		Sukaluyu		Cipanjalu		Ciporeat		Katapang	
	N	%	N	%	N	%	N	%	N	%
No knowledge	0	0.0	0	0.0	0	0.0	1	2.9	2	2.0
A little knowledge	1	1.0	26	44.0	23	32.8	18	51.5	32	32.4
Average	16	16.5	24	40.7	17	24.3	10	28.6	17	17.2
Much knowledge	80	82.5	9	15.3	30	42.9	6	17.1	48	38.5
Total	97	100.0	59	100.0	70	100.0	35	100.0	99	100.0

Knowledge, beliefs, and practice on *ubar kampung*

In view of knowledge, beliefs, and practices of traditional medicine in West Java, the inhabitants in the five selected research area are commonly familiar with the medicinal plants and speak profoundly about their knowledge of traditional medicine. The majority of respondents hold an average level of knowledge of traditional medicine. Most of the respondents are able to name the component of traditional medicine, which includes the name, use of MAC plants and the recipe to make the *ubar kampung*.

Knowledge of traditional medicine is generally transferred orally, mainly from the parents to their children. Similarly, several studies reported that the transfer of local knowledge is hierarchically obtained from the family [15, 16]. However, a study in Morocco also reveals that knowledge of medicinal plants is in danger because of the influence of modernization, resulting in the mistrust of young generations to trust traditional medicine [17].

Furthermore, cultural norms and beliefs in natural healing processes are ascribed to the widespread use of traditional medicine [18]. Evidence for the association of spiritual and cultural beliefs with the use of traditional medicine has been shown in the study conducted in Jamaica [19]. Likewise, as traditional medicines are deeply rooted in cultural preferences, beliefs in traditional medicine become one of the reasons to use of traditional medicine among the Sundanese community. The distribution of beliefs on traditional medicine among community members in the research area is presented in table 2.

Table 2: Belief in traditional medicine (n = 360)

Belief	Lamajang		Sukaluyu		Cipanjalu		Ciporeat		Katapang	
	N	%	N	%	N	%	N	%	N	%
No belief	0	0.0	0	0.0	0	0.0	2	5.7	5	5.1
Little belief	12	12.4	17	28.8	13	18.5	9	25.8	27	27.3
Average	14	14.4	22	37.3	14	20.0	11	31.4	34	34.3
Much belief	71	73.2	20	33.9	43	61.5	13	37.2	23	33.4
Total	97	100.0	59	100.0	70	100.0	35	100.0	99	100.0

In a study on perceptions of the effectiveness of traditional medicine in Ghana, Gyasi *et al.* (2016) report that traditional medicine is perceived to be effective by patients for the treatment of broken bones, impotence, infertility, mental disorder and hypertension, while a lack of belief and negative opinions in the effectivity of traditional medicine is associated with insufficient scientific data regarding its safety [18]. These findings are in agreement with the study conducted in the Kilimanjaro region, where some of the respondents perceived traditional medicine to be unsafe and could damage organs [20]. Table 3 shows that respondents in the research villages commonly show positive opinions on traditional medicine. Positive opinions on traditional medicine are associated with being close to home, easy access, affordable, and lower side effects. Many respondents use traditional medicine because it is easy to obtain and cost-effective. Furthermore, Gyasi *et al.* (2016) suggest that respondents' positive attitudes are associated with the belief in natural remedies [18].

Table 3: Opinion on traditional medicine (n = 360)

Opinion	Lamajang		Sukaluyu		Cipanjalu		Ciporeat		Katapang	
	N	%	N	%	N	%	N	%	N	%
No opinion	0	0.0	1	1.7	0	0.0	0	0.0	3	3.0
Negative	2	2.1	0	0.0	2	2.9	1	2.9	6	6.0
Average	21	21.6	15	25.4	7	10.0	10	28.6	34	34.3
Positive	74	76.3	43	72.9	61	87.2	24	68.6	56	56.6
Total	97	100.0	59	00.0	70	100.0	35	100.0	99	100.0

Table 4: List of names of the 20 most frequently reported MAC plants for diabetes mellitus

No.	Local name	Sundanese*	Latin name**
1.	*Brotowali*	*Patrawali, brotowali*	*Tinospora cordifolia*
2.	*Daun salam*	*Daun salam*	*Syzygium polyanthum*
3.	*Kayu manis*	*Kayu manis*	*Cinnamomum burmanii*
4.	*Bawang putih*	*Bawang bodas*	*Allium sativum*
5.	*Kelor*	*Kelor*	*Moringa oleifera*
6.	*Ciplukan*	*Cecendet, cecenet*	*Physalis heterophylla*
7.	*Mahkota dewa*	*Mahkota dewa*	*Phaleria macrocarpa*
8.	*Sirsak*	*Sirsak, nangka walanda*	*Annona muricata*
9.	*Mahoni*	*Mahoni*	*Swietenia mahagoni*
10.	*Sirih merah*	*Seureuh beureum*	*Piper ornatum*
11.	*Kumis kucing*	*Kumis kucing*	*Orthosiphon aristatus*
12.	*Pegagan*	*Antanan*	*Centella asiatica*
13.	*Kersen*	*Kersen*	*Muntingia calabura*
14.	*Daun insulin*	*Daun insulin, daun yakon*	*Smallanthus sonchifolius*
15.	*Lidah buaya*	*Lidah buaya*	*Aloe vera*
16.	*Pare*	*Paria*	*Momordica charantia*
17.	*Lempuyang*	*Lampuyang*	*Zingiber zerumbet*
18.	*Teh hijau*	*Teh hejo*	*Camellia sinensis*
19.	*Kirinyuh pait*	*Kirinyuh pait*	*Eupatorium inulifolium*
20.	*Alpukat*	*Alpuket*	*Persea americana*

*Sundanese name of the plants are identified by the key informants in the research area, **Latin name of the plants is identified by a botanist from Universitas Padjadjaran

Plants used by the Sundanese community in the research area

The respondents acknowledge various medicinal plants and their medicinal properties such as *Piper betle* to reduce body odour and treat wounds, *Curcuma xanthorrhiza* to increase apetite in children and treat liver disease, *Alpinia galanga* to cure fungal skin infection, and *Aloe vera* to treat burns and skin cuts. Their interest in MAC plants is shown by the rows of pots and plastic polybags filled with MAC plants in their small gardens or on the terraces. MAC plants are used for the treatment of various conditions, including headache, common cold, cough, stomachache, diarrhoea, including external wounds such as skin infection. The majority of MAC plants are known for having multiple medical properties for treating several conditions in a single form or in a mixture. MAC plants are considered to have positive effects on overall human health. In this case, the infusion of herbs such as *daun sembung* (*Blumea balsamifera*), *antanan* (*Centella asiatica*), and *daun baluntas* (*Clerodendron buchananii*), are consumed regularly. Inhabitants in the research area sometimes combined several ways in preparing medicinal plants for health treatment.

Table 4 presents an overview of the 20 most commonly used plant species for the treatment of diabetes mellitus and its complications. The plants are listed based on the descending frequency of use by the informants and community members.

Most of the medicinal plants reported by key informants and used by the respondents in the research area are already publicly acknowledged for their medicinal properties and also reported in other research settings. A study conducted by Kasole *et al.* (2019) reports that medicinal plants such as moringa seeds and leaves (*Moringa oleifera*), soursop leaves (*Annona muricata*), avocado seeds (*Persea americana*), and lemongrass (*Cymbopogon citratus*) are widely used by diabetes patients and herbalists in the Kilimanjaro region [20]. An extensive review of medicinal plants used for diabetes in India listed *Aloe vera, Allium sativum*, *Moringa oleifera, Physalis heterophylla,* and *Tinospora cordifolia* as medicinal plants that are scientifically proven antidiabetics [7]. Additionally, those medicinal plants are not only used for diabetes but also for its co-morbidities such as hypertension, hypercholesterolemia, and coronary heart disease [8, 21, 22].

In Indonesia, medicinal plants such as *Syzygium polyanthum, Moringa oleifera, Swietenia mahagoni, Allium sativum,* and *Cinnammomum burmanni* have been widely used in several regions by various ethnic groups [12, 23]. Among the Sundanese in West Java, a study reveals that community members in Ranggawulung also use *Swietenia mahagoni* (seeds, raw form), *Arthocarpus heterophyllus* (leaves, decoction), and *Syzygium polyanthum* (leaves, decoction) for the treatment of diabetes melllitus [24]. The fact that some of the reported plants are having similar uses elsewhere indicates that the pharmacological activities have been studied in different areas [17].

Parts of the medicinal plants used

Leaves are the most common part used for remedies in metabolic disorders in the research area as well as other research settings. Ease of preparation, being readily available, and easy harvesting were the main reasons people use leaves [8, 17, 25], whereas the fruit cannot be taken all the time because plants do not produce it all the time, and not all plants bear fruit. Roots are rarely used unless plants are small. The least used was roots which is a good indicator because this practice helps to ensure plants continue growth, reducing the threat of extinction/destruction, and promoting sustainable harvesting [17, 25]. However, this finding is in contrast with a study conducted in South Africa which reports that the root is the most frequently used plant part for healing purposes because it is traditionally considered as a 'strong medicine' [26]. Furthermore, the study shows that the Sundanese use more herbs and rhizomes than trees. The use of herbaceous plants provides more advantages because they are easier to cultivate, have a faster harvesting time, and moreover, there are more herbaceous plants in nature compared to trees.

Table 5: Medicinal plants used for the treatment of diabetes mellitus, parts used and method of preparation

Latin name	Plants part used	Preparation	Family
Allium sativum	Bulbs	Fresh bulbs are taken orally	*Liliaceae*
Aloe vera	leaves	Fresh leaves, peeled off, the gel part was removed	*Liliaceae*
Annona muricata	Leaves	Leaves are dried, then the dried leaves are boiled as a decoction	*Annonaceae*
Camellia sinensis	Leaves	Soaked in hot water, drink as tea	*Theaceae*
Centella asiatica	Herbs	Fresh, as *lalab*	*Apiaceae*
Cinnamomum burmannii	Barks	Boiled in water as decoction, usually in combination with ginger	*Lauraceae*
Eupatorium inulifolium	Leaves	Soaked in a hot water	*Asteraceae*
Momordica charantia	Fruits and leaves	Fresh, as *lalab*	*Cucurbitaceae*
Moringa oleifera	Leaves	Boiled in water as a decoction	*Moringaceae*
Muntingia calabura	Fruits	Fresh	*Muntingiaceae*
Orthosiphon aristatus	Herbs	Leaves are dried, and boiled in water as a decoction	*Lamiaceae*
Persea americana	Seeds and leaves	Seeds and leaves are dried and boiled as a decoction	*Lauraceae/ Fabaceae*
Phaleria macrocarpa	Leaves, fruit (without seed), bark	Leaves and fruits are dried, then soaked into hot water, drink as tea	*Thymelaeceae*
Physalis heterophylla	Leaves and roots	Leaves and fruits are dried, then soaked into hot water, drink as tea	*Solanaceae*
Piper ornatum	Leaves	Leaves can be soaked in a cold or hot water	*Piperaceae*
Smallanthus sonchifolius	Leaves	Leaves are dried, then soaked into hot water, drink as tea	*Asteraceae*
Swietenia mahagoni	Seeds	Seeds can be consumed directly or seeds can be powdered and dissolve in water	*Meliaceae*
Syzygium polyanthum	Leaves	Leaves are dried, then boiled in water as a decoction	*Myrtaceae*
Tinospora cordifolia	Leaves	Infusion/Herb's tea	*Menispermaceae*
Zingiber zerumbet	Rhizome	Rhizomes are dried, then boiled in water as a decoction	*Zingiberaceae*

DISCUSSION

In the past decades, there has been growing interest in the consumption of medicinal plants because of their natural origin, ease of use, and lower cost [9, 27]. Since the 20th century, several precursors for therapeutic purposes have been synthesised from the secondary metabolites of medicinal plants. Despite advanced technology in the development of synthetic medicine, plants are still major sources of medicinal preparations. The role of medicinal plants in the development of new medicine has been documented since the isolation of quinine from the bark of the cinchona tree in 1820 [28]. To date, a vast number of pharmaceuticals which are derived from medicinal plants have been used in clinical care [29].

The prevalence of medicinal plants used among people living with diabetes ranges from 17% to 80% [30]. Several studies on

indigenous medicine for diabetes mellitus have been conducted worldwide, mostly in developing countries [31–34]. A vast number of plants have been evaluated for their anti-diabetic properties. Plants with multiple pharmacological activities may be potential candidates as alternatives or supplementary to available antidiabetic medications [22].

Over the past several decades, ethnobotany and ethnomedicine have been considered as a more appropriate interdisciplinary approach to drug discovery [35]. Research shows that 40 out of 70 plants (57%) which are ethnomedically used to treat diabetes in tropical countries exhibited antidiabetic activity in tested animals [36]. Likewise, Marles and Farnsworth (1995) document that 81% of plants used traditionally to treat diabetes give positive test results in anti-diabetes tests, while plants selected based on chemotaxonomy (not used traditionally) only give 47% positive results [37]. Earlier, Kesari *et al.* (2007) conducted the survey and listed more than 1200 plants used ethnopharmacologically as antidiabetics. They found that indigenous medicine and diet may not have activity in reducing blood sugar levels such as antidiabetic drugs or insulin, but those plants are still useful in disease treatment and complications [38]

Although diagnostic criteria and assumed causes might vary significantly, the pathophysiology of diabetes mellitus appears to be similar across cultures [35]. Several studies on ethnomedicine and ethnobotany worldwide have shown that diabetes mellitus has been recognised by the traditional healer as a pathological condition which can be treated with specific medicinal plants. The conditions and botanical remedies for diabetes mellitus are listed in several ancient medical texts. The *Ebers Papyrus,* as part of a collection of ancient Egyptian medical textbooks written about 1500 BC, described the pathology of a clinical condition similar to diabetes such as excessive thirst and high frequency of urination [33,39,40].

Furthermore, the *Sushruta Samhita,* an Ayurvedic textbook written between the fourth and fifth centuries B. C. in India, describes two types of diabetes. In this textbook, healers identified two causes of diabetes which are genetic disorder and imbalanced diets. The pharmacopoeia of ancient India listed specific treatments for diabetes, including dietary modifications, medicinal plant remedies, and minerals. Likewise, Chinese medical books written in 3000 B. C. gave explanations about diabetes mellitus and its therapies [41].

The Sundanese term for diabetes is "*panyakit gula*". This terminology appears not only common among the Sundanese community in West Java but also in Central Java, West Sumatera, and East Nusa Tenggara. Local people and patients also report that they observed that urine is absorbed more slowly into the soil and there is a white film on the surface where the urine dried [42, 43]. Some ethnicities use the same type of plant to treat the same symptoms. Once diagnosed, patients may be effectively treated by traditional healers for a variety of symptoms associated with diabetes mellitus.

Ubar kampung has been known for generations to the community in the Sunda Region. This local medical practice is still widely used among the Sundanese community, especially in rural areas. The Sundanese use *ubar kampung* in several ways, generally based on the severity of the illness. Medicinal plants become the major component in *ubar kampung*. Research conducted by Silalahi *et al.* (2018) regarding the use of traditional medicines in West Java reveals that various medicinal plants used among local people are in accordance with the scientific literature [44].

CONCLUSION

The ethnobotanical and ethnomedical information obtained from the study provides the potential to identify which plants are most likely to be useful for further study of antidiabetic treatment. Indigenous knowledge of plants provides a valuable indication of the use of plants, particularly for diabetes mellitus. With the help of local peoples who are still actively practising traditional medicine, the list of medicinal plants continues to grow. Documentation of the local knowledge on medicinal plants substantiates the focus of the present study on ethnomedicine for the treatment of diabetes mellitus. Data on MAC plants were collected through in-depth interviews with elders, traditional healers, and community leaders in a traditional community in the Sunda region. This study found that the majority of plant species used for the treatment of diabetes mellitus belong to the families of *Asteraceae* (2 species), *Lauraceae* (2 species), and *Liliaceae* (2 species). Most of the medicinal plants reported in the research area are already publicly acknowledged for their medicinal properties, indicating that their pharmacological activities have been studied in different areas. Medicinal plants such *Syzygium polyanthum, Moringa oleifera, Swietenia mahagoni, Allium sativum*, and *Cinnammomum burmanni* have been widely used in several regions by various ethnic groups. Leaves are the most frequently used plant part. Medicinal plants are either consumed as a single preparation or in a combination of several plants. In general, infusion and decoction are the most common plant preparation methods in the research area.

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AUTHORS CONTRIBUTIONS

All authors have contributed equally.

CONFLICTS OF INTERESTS

Declare none

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