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A Review of Ethnobotanical Knowledge on Antidiabetic Medicinal Plants in Minangkabau Communities

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Abstract
Diabetes mellitus is a chronic metabolic disorder with an increasing global prevalence. Ethnobotanical knowledge is essential for identifying natural antidiabetic agents. The Minangkabau people of West Sumatra possess extensive traditional knowledge of medicinal plants for diabetes management. This review documents these plants and analyzes species richness, plant-part utilization, and family distribution across regions. Data were collected through a systematic literature review using Google Scholar and Crossref. Relevant ethnobotanical studies from seven locations in West Sumatra were screened with predefined criteria and analyzed descriptively. A total of 53 medicinal plant species from 33 families were recorded. Most species were region-specific, with 32 species found in only one locality, indicating localized knowledge. Only ten species were shared among two or three regions. IV Koto Subdistrict exhibited the highest richness with 42 species, followed by Sungai Abu Solok and Nagari Sianok with eight each. Sijunjung recorded three species, while Sintuak, Talang, and Koto Baru Kambang each reported one species. Leaves were the most frequently used part (26 species), followed by rhizomes and fruits (seven each). Zingiberaceae dominated with six species, Asteraceae with four, while Lamiaceae and Poaceae each contributed three species. These findings reveal that traditional antidiabetic knowledge in West Sumatra is highly heterogeneous, shaped by ecological accessibility, cultural transmission, and local biodiversity. IV Koto represents a key center of ethnomedicinal knowledge and should be prioritized for future pharmacological and conservation studies.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disease whose prevalence continues to increase globally and has become a serious public health problem, including in Indonesia(Hossain et al., 2024). This disease is characterized by impaired glucose metabolism due to insulin deficiency or resistance, which in the long term can lead to various complications such as cardiovascular disease, kidney disorders, neuropathy, and retinal damage (Rosyidah & Cahyono, 2025).

Limited access to modern medicine, the side effects of synthetic drugs, and the relatively high cost of treatment encourage people to continue utilizing traditional medicine as an alternative or complement to medical therapy (Suryanti et al., 2025).

The Minangkabau people of West Sumatra possess rich traditional knowledge regarding the use of plants as medicine, which is passed down through generations and integrated into cultural systems and local wisdom (Ade et al., 2025). In the context of traditional medicine, diabetes is known locally as Penyakit gula, diabetes mellitus, or kencing manis and is treated using various plant-based concoctions. This ethnomedicinal knowledge not only reflects the close relationship between humans and the environment but also has the potential to serve as a source of initial information in the search for bioactive antidiabetic compounds.

Ethnobotanical studies play a crucial role in documenting and inventorying the use of medicinal plants by local communities before this knowledge is eroded by modernization and lifestyle changes (Bidiarti et al., 2023). Furthermore, the ethnobotanical approach also provides a scientific basis for the development of natural-based medicines, as plant selection is based on time-tested empirical experience. Numerous ethnopharmacological studies have shown that many traditionally used plants possess biological activities relevant to diabetes management, such as inhibition of carbohydrate-digesting enzymes, increased insulin sensitivity, and antioxidant activity.

However, information on antidiabetic medicinal plants used by various Minangkabau communities remains scattered and has not been comprehensively documented in a single, integrated study. Therefore, a systematic ethnobotanical review is needed to compile data on plant species, parts used, and how they are utilized as antidiabetic agents. This study is expected to serve as a basis for further research, including phytochemical and pharmacological approaches, as well as in silico approaches such as natural product analysis and molecular docking.

Based on this background, this article aims to review and summarize ethnobotanical knowledge related to antidiabetic medicinal plants used by several Minangkabau communities in West Sumatra and to highlight the potential for developing these plants as sources of candidate natural-based antidiabetic compounds.

METHOD

Research Design

The literature review was conducted utilizing systematic search methodologies through the Google Scholar and Crossref databases to identify pertinent studies on the ethnobotanical knowledge of antidiabetic medicinal plants in West Sumatra, Indonesia. The search strategy employed combinations of keywords in both Indonesian and English, including etnomedisin diabetes Sumatera Barat, etnobotani Sumatera Barat, etnofarmakologi Sumatera Barat, antidiabetic plants West Sumatra, ethnomedicine diabetes West Sumatra, ethnobotany West Sumatra, ethnopharmacology West Sumatra, tumbuhan antidiabetes Sumatera Barat, and related terms. The inclusion criteria were meticulously designed to ensure the relevance and quality of the selected references. Studies were included if they documented the traditional use of medicinal plants specifically for the treatment, prevention, or management of diabetes mellitus among communities in West Sumatra, encompassing various ethnic groups such as Minangkabau, Mentawai, and other local communities. Only studies conducted in clearly defined locations were considered to maintain geographical validity. Articles were required to provide clear identification of plant species, preferably using accepted scientific nomenclature, and to describe the plant parts utilized, such as leaves, is, bark, fruits, seeds, rhizomes, stems, flowers, or whole plants. Furthermore, the selected studies had to elucidate the therapeutic use or treatment context related to diabetes. Peer-reviewed journal articles, theses, dissertations, conference papers, and institutional reports containing original ethnobotanical or ethnopharmacological data were deemed eligible. Publications in both Indonesian and English were included. Exclusion criteria comprised duplicate records, review papers lacking primary data, studies conducted outside West Sumatra, articles lacking clear taxonomic identification, unclear study locations, or insufficient information regarding plant parts used and their role in diabetes treatment. The study selection process was documented using a PRISMA workflow to ensure transparency and reproducibility.

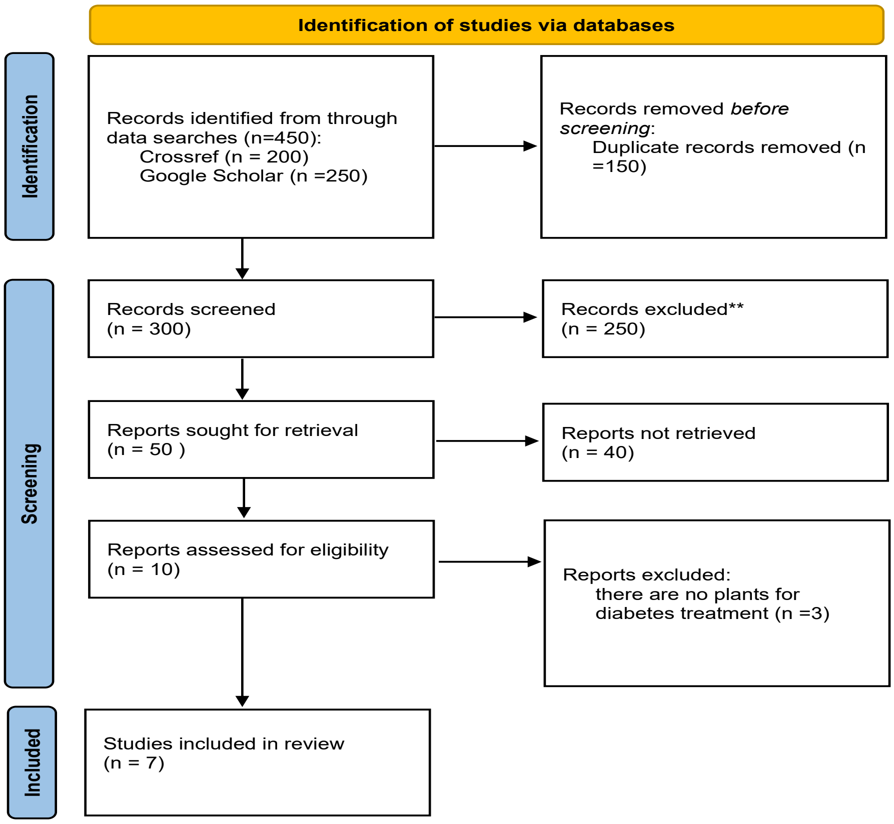

Figure 1. Prisma Workflow

Descriptive Analysis

The data were subjected to descriptive analysis with the objectives of determining the plant family most frequently employed as an antidiabetic agent, identifying the plant part most commonly utilized, and elucidating the patterns of medicinal plant use for diabetes management among the Minangkabau community. The findings are systematically presented in tabular formats and descriptive narratives to offer a comprehensive overview of the existing ethnobotanical knowledge. Subsequently, RStudio 2025.09.2 Build 418 was employed to visualize the results.

RESULT AND DISCUSSION

The results are summarized in Table 1, which compiles ethnobotanical data collected from seven different regions. Overall, it was found that the Minangkabau communities of West Sumatra utilize a total of 53 plant species representing 33 botanical families for the traditional treatment of diabetes. This high level of species and family diversity reflects the richness of local plant resources as well as the depth of traditional knowledge maintained by the community.

Among the documented taxa, the Zingiberaceae family emerged as the most prevalent, represented by six species. This prevalence underscores the significant role of ginger-related plants in Minangkabau traditional medicine, particularly for metabolic and health-related treatments. The second most frequently represented family was Asteraceae, with four species, followed by Lamiaceae and Poaceae, each contributing three species. The prominence of Zingiberaceae is also intricately linked to Minangkabau culinary culture, where rhizomatous spices such as ginger, turmeric, galangal, aromatic ginger, and related taxa are extensively utilized in daily food preparation. Traditional Minangkabau cuisine is renowned for its rich use of spices in dishes such as curries, rendang, gulai, and herbal beverages, fostering continuous household familiarity with these plants (Agesti et al., 2025). As these rhizomes are regularly cultivated, traded in local markets, stored in kitchens, and processed for cooking, knowledge regarding their identification, preparation, and perceived health benefits is widely disseminated within society. This frequent interaction likely facilitates the transmission of ethnomedicinal knowledge across generations, allowing culinary ingredients to function simultaneously as preventive and therapeutic remedies. Consequently, the dominance of Zingiberaceae in this review may reflect not only their pharmacological potential but also their strong cultural integration into everyday Minangkabau life.

Table 1. Antidiabetic medicinal plants used by several Minangkabau ethnic communities

No	Region	Family	Vern.name	Species	Parts used	Reference
1	1	Asteraceae	Siamih	*Ageratum conyzoides* L.	Whole Part	(Yanifa et al., 2021)
2	1	Amaryllidaceae	Bawang merah	*Allium cepa* L.	Bulb	(Yanifa et al., 2021)
3	2	Amaryllidaceae	Bawang Putih	*Allium sativum* L.	Bulb	(Purnama, 2008)
4	1	Asphodelaceae	Lidah buayo	*Aloe vera* L.	Leaf	(Yanifa et al., 2021)
5	1	Acanthaceae	Ampadu tanah	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	Leaf	(Yanifa et al., 2021)
6	1,3	Annonaceae	Sirsak	*Annona muricata* L	Leaf	(Hasibuan et al., 2023; Yanifa et al., 2021)
7	4	Basellaceae	Binahong	*Anredera cordifolia* (Tenore) Steen.	Leaf	(Andania et al., 2024)
8	1,4	Apiaceae	Seledri	*Apium graveolens* L.	Leaf	(Andania et al., 2024; Yanifa et al., 2021)
9	1	Fabaceae	Jariang	*Archidendron jiringa* (Jack) I.C.Nielsen	Rind	(Yanifa et al., 2021)
10	1	Moraceae	Sukun	*Artocarpus altilis* (Parkinson) Fosberg	Leaf	(Yanifa et al., 2021)
11	1	Oxalidaceae	Belimbing wuluh	*Averrhoa bilimbi* L.	Leaf	(Yanifa et al., 2021)
12	1	Asteraceae	Cepo	*Blumea balsamifera* L.	Leaf	(Yanifa et al., 2021)
13	1	Simaroubaceae	Melur	*Brucea javanica* L.	Fruit	(Yanifa et al., 2021)
14	1	Caricaceae	Batiak	*Carica papaya* L.	Leaf	(Yanifa et al., 2021)
15	1,2	Apocynaceae	Tapak dara	*Catharanthus roseus* (L.) G.Don	Leaf	(Purnama, 2008; Yanifa et al., 2021)
16	1	Poaceae	Rumput gajah	*Cenchrus purpureus* (Schumach.) Morrone	Stem	(Yanifa et al., 2021)
17	1	Apiaceae	Pugago	*Centella asiatica* (L.) Urb.	Leaf	(Yanifa et al., 2021)

18	5	Rutaceae	Limau puruik	*Citrus hystrix* DC.	Fruit	(Susanti, 2010)
19	5	Rutaceae	Asam kapeh	*Citrus × aurantiifolia* (Christm.) Swingle	Fruit	(Susanti, 2010)
20	5	Arecaceae	Karambia	*Cocos nucifera* L.	Fruit	(Susanti, 2010)
21	1	Lamiaceae	Piladang	*Coleus scutellarioides* (L.) Benth.	Leaf	(Yanifa et al., 2021)
22	5	Zingiberaceae	kunyik	*Curcuma longa* L.	Rhizome	(Susanti, 2010)
23	1,5	Zingiberaceae	Temulawak	*Curcuma zanthorrhiza* Roxb.	Rhizome	(Susanti, 2010; Yanifa et al., 2021)
24	1	Zingiberaceae	Kunyit putih	*Curcuma zedoaria* (Christm.) Roscoe	Rhizome	(Yanifa et al., 2021)
25	1	Poaceae	Sarai	*Cymbopogon citratus* (DC.) Stapf	Rhizome	(Yanifa et al., 2021)
26	1	Clusiaceae	Manggih	*Garcinia mangostana* L.	Rind	(Yanifa et al., 2021)
27	1	Asteraceae	Daun Afrika	*Gymnanthemum amygdalinum* (Delile) Sch.Bip.	Leaf	(Yanifa et al., 2021)
28	1	Cucurbitaceae	Pario	*Momordica charantia* L.	Fruit	(Yanifa et al., 2021)
29	1,5	Rubiaceae	Mengkudu	*Morinda citrifolia* L.	Fruit	(Susanti, 2010; Yanifa et al., 2021)
30	1	Moringaceae	Kelor	*Moringa oleifera* Lam.	Leaf	(Yanifa et al., 2021)
31	1	Moraceae	Murbei	*Morus alba L.*	Leaf	(Yanifa et al., 2021)
32	1	Muntingiaceae	Seri	*Muntingia calabura* L.	Leaf	(Yanifa et al., 2021)
33	5	Musaceae	Pisang	*Musa × paradisiaca* L .	Stem (Sucker)	(Susanti, 2010)
34	1	Lamiaceae	Kumis kucing	*Orthosiphon aristatus* (Blume) Miq.	Leaf	(Yanifa et al., 2021)
35	2	Lamiaceae	Kumis kucing	*Orthosiphon grandiflorus* A. Terracc.	Leaf	(Purnama, 2008)
36	1	Piperaceae	Sirih cina	*Peperomia pellucida* (L.) Kunth	Whole Part	(Yanifa et al., 2021)
37	1	Lauraceae	Alpukat	*Persea americana* Mill.	Leaf	(Yanifa et al., 2021)
38	1	Thymelaeaceae	Mahkota dewa	*Phaleria macrocarpa* (Scheff.) Boerl.	Fruit	(Yanifa et al., 2021)
39	1,2	Phyllanthaceae	Dukuang anak	*Phyllanthus niruri* L.	Whole Part	(Purnama, 2008; Yanifa et al., 2021)
40	1,2, 4	Solanaceae	Ciplukan	*Physalis angulata* L.	Leaf	(Andania et al., 2024; Purnama, 2008; Yanifa et al., 2021)
41	1,6	Piperaceae	Sirih merah	*Piper ornatum* N.E.Br.	Leaf	(Oktavia et al., 2024; Yanifa et al., 2021)
42	1	Myrtaceae	Jambu Biji	*Psidium guajava* L.	Leaf	(Yanifa et al., 2021)

43	2	Poaceae	Gelagah	*Saccharum spontaneum* L.	Stem, Leaf	(Purnama, 2008)
44	1	Acanthaceae	Kecebling	*Strobilanthes crispa* (L.) Blume	Leaf	(Yanifa et al., 2021)
45	1	Boraginaceae	Komprey	*Symphytum officinale* L.	Leaf	(Yanifa et al., 2021)
46	1,2	Myrtaceae	Daun salam	*Syzygium polyanthum* (Wight) Walp.	Leaf	(Purnama, 2008; Yanifa et al., 2021)
47	1	Malvaceae	Kakao	*Theobroma cacao* L.	Seed	(Yanifa et al., 2021)
48	1, 7	Menispermaceae	Brotowali	*Tinospora cordifolia* (Willd.) Hook.f. & Thomson	Stem, Root	(Purnama, 2008; Yanifa et al., 2021)
49	2	Menispermaceae	Brotowali	*Tinospora crispa* (L.) Hook.f. & Thomson	Stem	(Ade et al., 2025)
50	1	Asteraceae	Insulin	*Tithonia diversifolia* (Hemsl.) A.Gray	Leaf	(Yanifa et al., 2021)
51	5	Zingiberaceae	Bangle	*Zingiber cassumunar* Roxb.	Rhizome	(Susanti, 2010)
52	1	Zingiberaceae	Jahe merah	*Zingiber officinale* Roscoe	Rhizome	(Yanifa et al., 2021)
53	1	Zingiberaceae	Lempuyang	*Zingiber zerumbet* L.	Rhizome	(Yanifa et al., 2021)

The designated locations include: 1. District IV Koto, 2. Ngarai Sianok; 3. Koto Baru Kambang; 4. Nagari Sijunjung; 5. Sungai Abu; 6. Nagari Talang; 7. Sintuak

The analysis depicted in Figure 1, which integrates a geographical map with a corresponding bar chart, reveals a notable variation in the species richness of antidiabetic medicinal plants across the surveyed sites within the Minangkabau region. Specifically, this disparity is observed among five districts: Agam, Solok, Padang Pariaman, Pesisir Selatan, and Sijunjung. The IV Koto Subdistrict emerges as the location with the highest number of species, totaling 42. This elevated species richness can be attributed to several factors, including the broader geographical scope of the study area, the ecological diversity present within the district, and the intensity and comprehensiveness of the ethnobotanical documentation undertaken, and the large number of studies in this area are determining factors in the high number of species discovered. These findings suggest that IV Koto functions as a significant center of ethnomedicinal knowledge and should be prioritized for further research into antidiabetic medicinal plant resources. The larger spatial extent of the research area in IV Koto covering multiple villages such as Koto Tuo, Guguak Tabek Sarajo, Balingka, Koto Gadang, Sianok IV Suku, Koto Panjang, and Sungai Ladia compared to other study sites, which are limited to individual villages, likely contributes to the higher species count (Yanifa et al., 2021). Additionally, this region is part of Darek, the traditional homeland of the Minangkabau people, whose cultural connection to medicinal practices potentially enhances their ethnobotanical knowledge and botanical resource utilization (Ade et al., 2025).

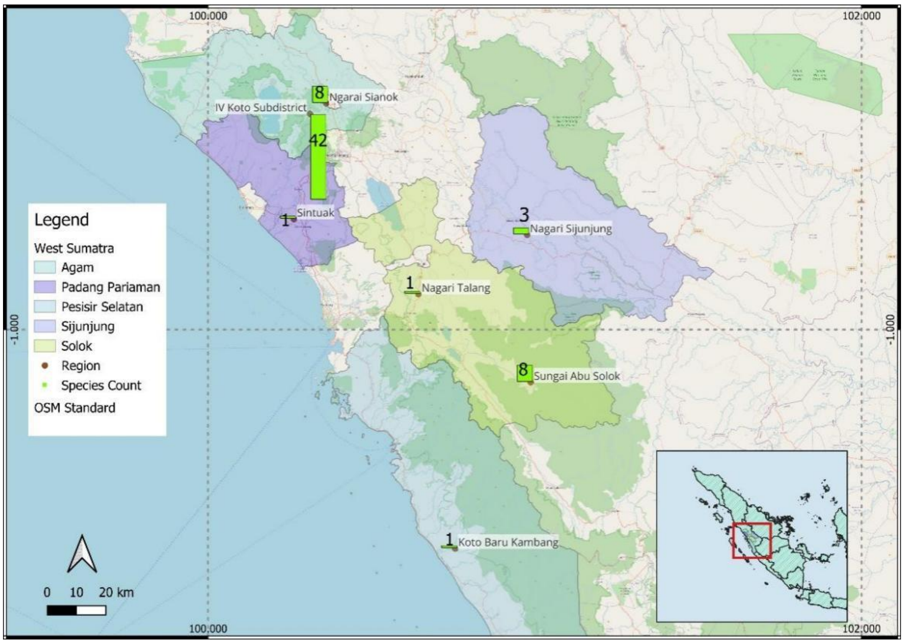

Figure 2. Map and Medical Plant Number of Species by Region

In contrast, Sungai Abu Solok and Nagari Sianok each recorded eight species, indicating a moderate level of diversity. This number indicates that while knowledge of medicinal plants still exists and is used by local communities, documentation may be more selective or limited to the most commonly used types. These regions remain important because they can represent local variation in species selection that may differ from areas with high species richness.

Sijunjung Village only reported three species, while Sintuak, Talang Village, and Koto Baru Kambang each reported only one species. The low number of species in these locations does not necessarily reflect a lack of traditional knowledge, but is more likely influenced by the narrow scope of the research, the focus of the study on specific plants, or the reduced transmission of traditional knowledge due to social and cultural changes (Misganaw et al., 2025; Wanjohi et al., 2020).

Moreover, the observed variation in species richness within this study appears to be significantly influenced by the phytogeographic characteristics of the research area (Rosmi et al., 2025). Specifically, the South Coastal Region, exemplified by Sintuak and Koto Baru Kambang, exhibited a lower diversity of antidiabetic medicinal plants in comparison to mountainous or highland regions such as IV Koto. This pattern suggests that ecological differences between coastal and mountainous environments impose natural constraints on the availability of botanical resources. From an ethnobotanical standpoint, ecological accessibility emerges as a critical factor, equally important as the pharmacological efficacy of plant species (Sandifer et al., 2015). Indigenous communities tend to prioritize the documentation and utilization of plant species that are readily accessible within their immediate environment, rather than seeking out potentially more potent pharmacological plants that are geographically challenging to obtain.

The limited overlap of only 10 shared species between the Darek (mountainous) and Coastal regions can therefore be interpreted as a consequence of contrasting ecological settings that shape both vegetation composition and patterns of traditional resource use. Highland areas are generally characterized by cooler temperatures, higher rainfall, fertile volcanic soils, and more heterogeneous forest habitats, conditions that support a broader range of wild and cultivated medicinal flora. In contrast, coastal zones are influenced by higher temperatures, saline winds, sandy or alluvial soils, and more intensive land conversion for settlements, fisheries, and agriculture, which may reduce the availability of certain medicinal species. As a result, communities in each region develop localized pharmacopeias based on the plants most abundant and reliable in their surrounding landscapes. Species overlap is therefore restricted largely to widely distributed, disturbance-tolerant, or commonly cultivated taxa such as household garden plants, fruit trees, and multipurpose medicinal herbs that can thrive across environmental gradients.

The disparity in species richness between mountainous and coastal zones observed in this study aligns with the findings of Ade et al. (2025), who demonstrated that ethnobotanical knowledge in West Sumatra is regionally structured according to the customary divisions of Darek, Rantau, and Pesisir. Their research indicated that the Darek (mountainous) region consistently exhibits a higher dependence on local biodiversity, as reflected by a greater density of informants and a richer diversity of plant species, particularly in highland areas. These findings reinforce the notion that the phytogeographic conditions of the Darek region provide a more extensive resource base, thereby supporting the development of indigenous healing practices, while the Coastal region maintains a more selective medicinal repertoire shaped by environmental limitation and stronger external socio-economic interactions.

Overall, this pattern demonstrates that ethnobotanical data are heavily shaped by local contextual factors and research methodologies, rather than solely reflecting the actual biodiversity present. The observed regional variations underscore the significance of adopting a comparative framework and promoting more equitable documentation efforts to attain a more comprehensive understanding of the Minangkabau Tribes' traditional knowledge regarding antidiabetic medicinal plants. These findings further emphasize the critical need to preserve indigenous knowledge as a foundational resource for subsequent phytochemical investigations and in silico analyses. The number of species documented in this study is notably high when compared to other ethnic groups, such as those in Pangung Rejo Village, Lampung (13 species) (Verantika et al., 2025), Java Island (15 species) (Anugrahini & Wahyuni, 2021), and East Kalimantan (10 species) (Ramadhan et al., 2019, 2022).

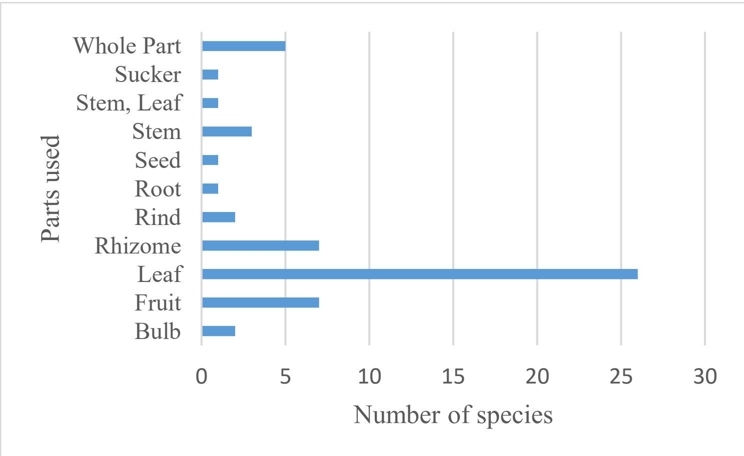

Figure 3. Medical Plants Parts Utilization

Figure 3 depicts the distribution of plant parts utilized in antidiabetic treatments by the Minangkabau people, emphasizing a distinct preference for certain plant organs. Leaves were identified as the most frequently used part, documented in 26 species, significantly surpassing all other categories. This pronounced predominance suggests that local communities tend to select plant parts that are easily accessible, readily harvested, simple to prepare, and commonly collected without inflicting permanent damage to the plant. Such practices indicate a relatively sustainable pattern of medicinal plant use.

The predominance of leaf utilization aligns with ethnobotanical patterns observed among other Sumatran ethnic groups, such as the Serawai tribe in Bengkulu (Fadila et al., 2020), Batak communities in North Sumatra (Basuki et al., 2023), and the Kerinci people in Jambi (Asra et al., 2025). Leaves are frequently favored due to their year-round availability, minimal dependence on seasonal reproductive cycles, and richness in bioactive secondary metabolites, including flavonoids, phenolics, tannins, alkaloids, and terpenoids, which are associated with antidiabetic properties. Additionally, their relatively soft texture facilitates preparation through methods such as boiling, infusion, crushing, or direct consumption.

Rhizomes and fruits were the second most frequently utilized categories, each represented by seven species. The significance of rhizomes underscores the prominent cultural role of rhizomatous plants, particularly those belonging to the Zingiberaceae family, in both Minangkabau cuisine and traditional medicine. Species such as ginger, turmeric, galangal, and temulawak are extensively cultivated, marketed in traditional markets, and maintained within households, leading to widespread community familiarity with their medicinal applications. Rhizomes are also recognized for containing essential oils, curcuminoids, gingerols, and other metabolites associated with glucose regulation and anti-inflammatory effects. Conversely, fruits may be preferred due to their direct consumability, nutritional benefits, and common association with preventive health functions.

The utilization of the entire plant was documented in five species, indicating that certain remedies depend on the complete plant material rather than isolated organs. This practice is particularly prevalent in herbaceous species, where leaves, stems, and roots are processed collectively, or where traditional beliefs attribute medicinal efficacy to the entire organism. The use of stems was recorded in three species, while bulbs and rinds were each represented by two species. More specialized categories, including sucker, combined stem-leaf use, seed, and root, were each documented in only one species. These lower-frequency categories suggest contextual and species-specific applications shaped by plant morphology, local availability, or inherited empirical knowledge.

The observed pattern suggests that the selection of plant parts in Minangkabau antidiabetic medicine is not arbitrary but is influenced by factors such as practicality, availability, sustainability, and perceived therapeutic efficacy. The predominance of leaves and rhizomes offers a significant direction for future pharmacological research, as these plant organs should be prioritized for phytochemical screening, bioactivity assays, and in silico studies aimed at identifying compounds with antidiabetic potential.

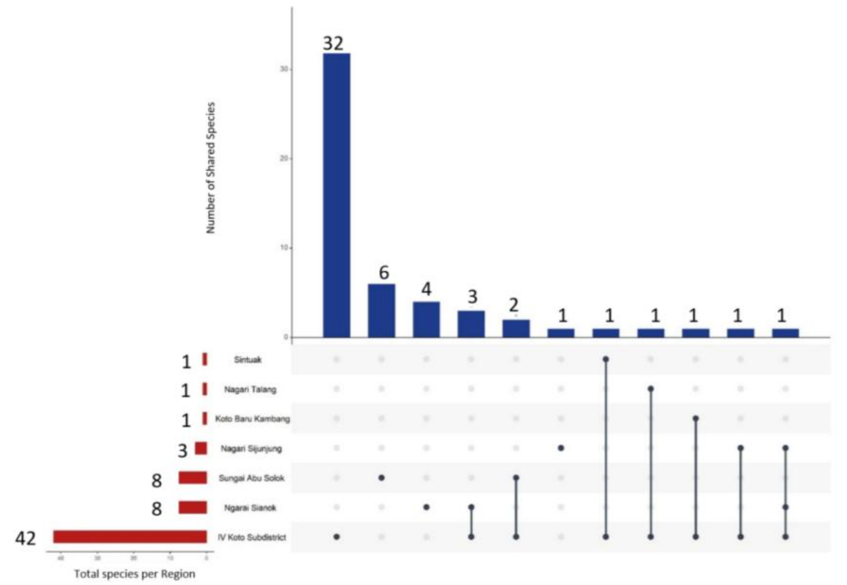

Figure 4. Upset plot Shared Knowledge by region

Figure 4 illustrates the interrelationship and overlap patterns of antidiabetic medicinal plant species across Minangkabau communities. The highest bar (32 species) represents taxa recorded only in a single region without overlap with other locations. This confirms that ethnobotanical knowledge of antidiabetic plants in Minangkabau is highly local and contextual, with plant selection strongly influenced by environmental availability, empirical experience, and independently developed medicinal traditions within each community. Such a high proportion of unique species also indicates that each locality contributes distinct medicinal resources that may not be captured through surveys conducted in only one area.

The number of species common to two or three regions is relatively limited, totaling only ten species. These shared taxa may be considered the core of regional ethnobotanical knowledge, representing medicinal plants that are more broadly recognized and likely perceived as effective across different communities. The presence of this core group suggests a degree of traditional consensus in antidiabetic plant selection, although it does not constitute the dominant portion of the dataset. In contrast, intersections involving a greater number of regions generally contained only one or two species, indicating that very few taxa are universally utilized across all communities. This pattern reflects the heterogeneity of Minangkabau traditional knowledge, which appears to function as a mosaic of complementary local practices rather than a homogeneous and standardized medical system.

The limited overlap of only ten shared species can also be explained by ecological contrasts between the customary zones of darek, rantau, and pasisia. Highland darek areas are characterized by cooler climates, fertile volcanic soils, higher rainfall, and more diverse semi-natural vegetation, conditions that favor the growth of a wider range of medicinal plants. In contrast, coastal pasisia regions experience higher temperatures, saline winds, sandy or alluvial soils, and more intensive land-use pressure, which may restrict the availability of certain taxa. Consequently, communities in each zone tend to develop localized pharmacopoeias based on species that are abundant, accessible, and culturally familiar in their immediate surroundings. Shared species are therefore likely dominated by widely cultivated, disturbance-tolerant, or commercially traded plants capable of thriving across environmental gradients.

The significance of IV Koto Subdistrict is underscored by its involvement in the majority of intersectional combinations, both as an individual site and in conjunction with other locations. This area recorded the highest species richness (42 species), far exceeding Nagari Sinaok and Sungai Abu Solok (8 species each), Nagari Sijunjung (3 species), and Sintuak, Nagari Talang, and Koto Baru Kambang (1 species each). These values highlight IV Koto as a major center of ethnobotanical diversity and documentation. Its high species richness substantially contributes to the variability and overlap of medicinal knowledge, particularly concerning species such as Brotowali (*T. cordifolia*), Daun salam (*S. polyanthum*), Sirih Merah (*P. ornatum*), Ciplukan (*P. angulata*), Dukuang Anak (*P. niruri*), Mengkudu (*M. citrifolia*), Temulawak (*C. zanthorrhiza*), Tapak dara (*C. roseus*), Seledri (*A. graveolens*), and Sirsak (*A. muricata*) (Table 1). The observed pattern of limited overlap yet significant regional variation suggests that the investigation of antidiabetic medicinal plants in Minangkabau cannot be confined to a singular study site. Rather, a multi-community approach is imperative to comprehensively capture the breadth of traditional knowledge. From a bioprospecting standpoint, species that are present across multiple locations should be prioritized as promising candidates for phytochemical screening and molecular docking studies. Conversely, the 32 unique species present valuable opportunities for the discovery of novel bioactive compounds derived from localized medicinal traditions.

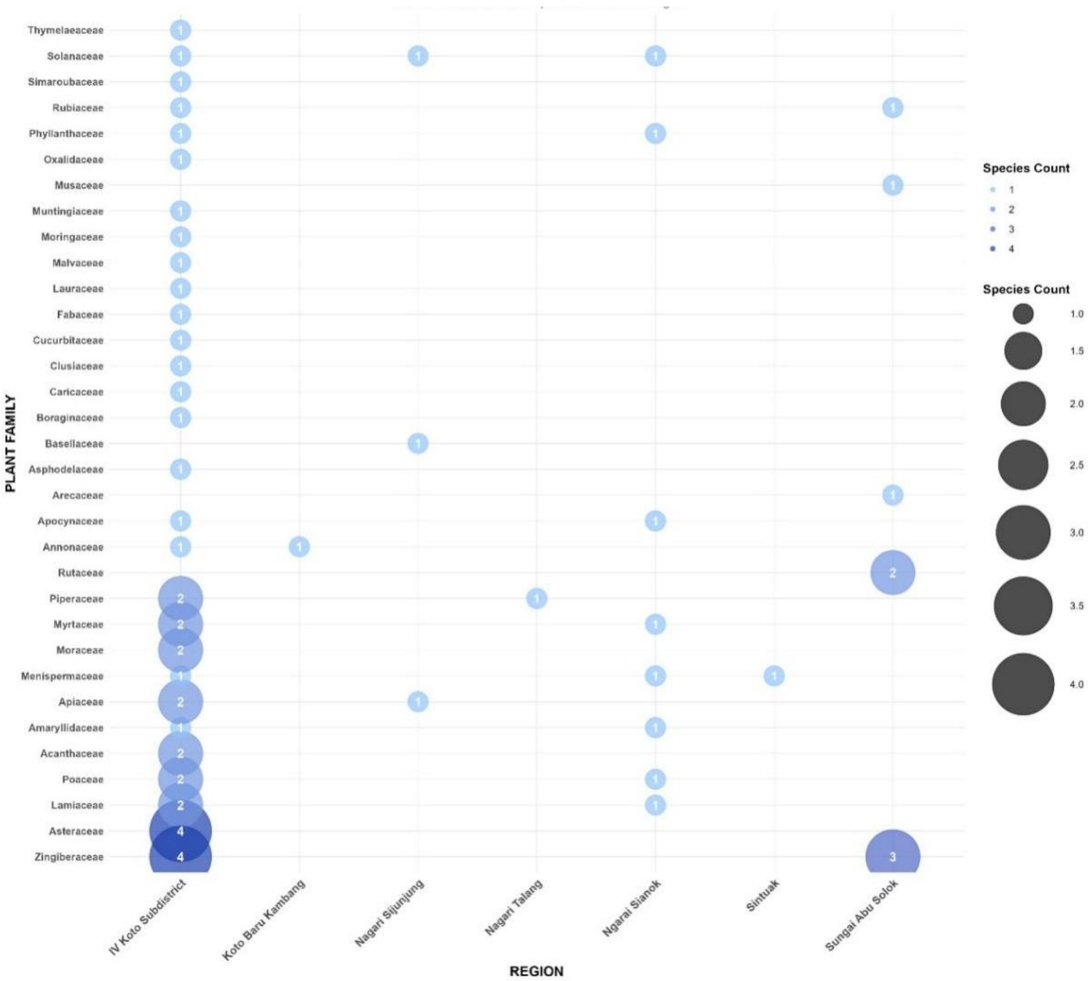

Figure 5. Family distribution Across regions

Figure 5 illustrates the distribution of antidiabetic medicinal plant families across the seven study regions, emphasizing both overlapping and site-specific taxonomic patterns. A notable concentration of family richness was identified in the IV Koto Subdistrict, which exhibited the highest number of represented families. Within this locality, the Zingiberaceae and Asteraceae families were predominant, each represented by four species, followed by the Apiaceae, Acanthaceae, Poaceae, Lamiaceae, Piperaceae, Myrtaceae, and Moraceae families, each with two species. Most of the remaining families in IV Koto were represented by a single species. This pattern suggests that the accumulation of medicinal knowledge is not uniformly distributed spatially but rather develops in accordance with the intensity of community interaction with local biodiversity and long-term reliance on surrounding plant resources.

In contrast, several other regions exhibited significantly lower family diversity. Sungai Abu Solok emerged as the second most diverse locality, with the Zingiberaceae family contributing three species and the Rutaceae family two species, while the Arecaceae, Musaceae, and Rubiaceae families were each represented by one species. Nagari Sinaok demonstrated a moderate pattern with multiple single-species families, including Zingiberaceae, Asteraceae, Lamiaceae, Poaceae, Acanthaceae, Myrtaceae, Menispermaceae, Amaryllidaceae, Phyllanthaceae, Solanaceae, and Apocynaceae. Meanwhile, Koto Baru Kambang, Nagari Talang, Nagari Sijunjung, and Sintuak each exhibited only one or a few recorded families, indicating narrower medicinal plant repertoires.

Certain families appeared to be confined to specific geographic areas, suggesting the presence of localized ethnobotanical knowledge that has not been widely disseminated across regions. For instance, Apocynaceae was recorded solely in Nagari Sinaok, whereas Arecaceae and Musaceae were documented exclusively in Sungai Abu Solok. Such restricted occurrence may reflect a prolonged process of empirical selection, wherein only species deemed effective and locally available are integrated into community healing systems. It may also indicate ecological specialization, as some families are associated with particular habitats, climates, or cultivation systems not uniformly present across West Sumatra.

Conversely, families present in multiple regions, even with relatively few species, may indicate either knowledge exchange among communities or the widespread availability of adaptable medicinal taxa. Zingiberaceae, for example, was distributed across several study sites and remained the most consistently represented family. This broad occurrence is likely related not only to its medicinal value but also to its significant role in Minangkabau cuisine and household cultivation, where rhizomatous plants such as ginger, turmeric, galangal, and temulawak are commonly maintained and frequently used. Thus, ecological accessibility and cultural familiarity may be as important as pharmacological efficacy in shaping medicinal plant use.

Differences in family richness may also reflect environmental transformation. Regions with lower family diversity may have experienced more pronounced habitat modification through settlement expansion, agriculture, or reduced forest access, thereby limiting the range of medicinal plants available to local communities. In this context, family-level diversity can serve as an indirect indicator of ecological pressure and changing resource landscapes.

From a bioprospecting perspective, families restricted to single regions but possessing documented ethnomedicinal value warrant priority for comparative phytochemical and pharmacological studies. Their unique spatial occurrence may harbor underexplored bioactive compounds relevant to diabetes treatment. Overall, the family distribution patterns depicted in Figure 4 not only represent variation in medicinal plant use but also reflect the complex interactions among ecology, cultural practice, plant availability, and the dynamics of traditional knowledge within the Minangkabau medicinal system.

Numerous plants traditionally utilized by Indonesians, including those from the Minangkabau community, serve as antidiabetic agents to facilitate the reduction of blood glucose levels (see Table 1). The therapeutic effects of these plants can be attributed to three distinct mechanisms. One important mechanism involves plants with astringent properties. These plants are able to precipitate proteins on the intestinal mucosal surface, forming a protective layer that limits glucose absorption in the digestive tract (Nugroho & Hartini, 2023). As a result, the entry of glucose into the bloodstream is reduced, helping to prevent sharp increases in blood sugar levels. Several plants commonly used for this purpose include avocado (*P. americana*), guava (*P. guajava*), and Daun Salam (*S. polyanthum*).

The avocado plant is an evergreen tree characterized by a dome-shaped canopy and can grow up to approximately 18 meters in height. In traditional practice, various parts of the plant, including the seeds, fruit, and leaves, are utilized for managing diabetes (Agunloye et al., 2025). Avocado rich with polyphenol and flavonoids such as Kaempferol, apigenin and isorhamentin glycosides (Elkader et al., 2022). Active compounds from seeds Avocado targeting via activation of PI3K/AKT pathway (Ojo et al., 2022)

Guava (*P. guajava*) is a well-known fruit plant widely recognized by the community. It is a shrub-type fruit tree, commonly referred to in English as lemon guava. Locally, guava is known by several names such as jambu klutuk, jambu siki, or jambu batu. Its characteristic taste and aroma are largely attributed to the presence of eugenol compounds (Kaur & Chaudhary, 2025). For diabetes management, the parts most commonly used by the community are the leaves and the fruit (Syah & Krishna, 2023).

The second antidiabetic mechanism involves enhancing the removal of glucose from the bloodstream (Singh Bhatti et al., 2022). This effect is achieved by improving blood circulation, which is closely associated with cardiac function, as well as by increasing renal filtration and excretion (Alicic et al., 2022). As kidney activity is stimulated, urine production rises, giving these plants a diuretic effect. The increased excretion of glucose through the kidneys ultimately contributes to a reduction in blood glucose levels (Mitrakou, 2011). Plants commonly associated with this mechanism include garlic (*A. sativum*), kecebeling (*S. crispa*), and kumis kucing (*O. aristatus*).

Garlic (*A. sativum*), a member of the Liliaceae family, is a plant species that is widely recognized and commonly used in daily life among the Minangkabau community as well as other ethnic groups in Indonesia. Beyond its role as a culinary spice that enhances the flavor of food, garlic has long been valued for its medicinal properties in traditional medicine (Liu et al., 2007). The Allyl S-Allyl-LCysteine (SAC), 5-Hydroxymethylfurfural, S-Methyl-L-Cysteine, Diallyl Disulfide, and S-Allylmercaptocysteine content are known to have the effect of inhibiting the DPP-4 (Dipeptidyl Peptidase-4) enzyme receptor which plays a role in the glucose homeostasis process and is a therapeutic target of gliptin in the treatment of type 2 diabetes (Rohmah, 2018; Sudirman et al., 2024).

Kumis kucing (*O. spicatus*) is an upright, herbaceous medicinal plant widely recognized for its therapeutic properties. It is believed to have originated in tropical Africa and subsequently disseminated to Asia and Australia. Phytochemical analyses reveal that the leaves, particularly during the early flowering stage, contain a variety of bioactive constituents, including minerals, flavonoid glycosides derived from caffeic acid, inositol, phytosterols, saponins, and essential oils. Additionally, Kumis Kucing possesses bioactive compounds such as rosmarinic acid, sinentin, eupatorin, and orthosipol A, which are associated with antidiabetic effects (Wang et al., 2022). The mechanisms underlying its pharmacological actions include upregulation of COL1A1 gene expression (Aisyah et al., 2025) and inhibition of enzymes such as alpha-glucosidase, contributing to its potential in managing diabetes mellitus (Maulana et al., 2022).

The third antidiabetic mechanism involves accelerating glucose utilization by enhancing metabolic activity or promoting its storage in the form of fat reserves (Gieroba et al., 2025). This process is closely linked to pancreatic function, particularly the production and action of insulin. Several medicinal plants that have been widely studied for this mechanism include lidah buaya (*A. vera*), Brotowali (*T. crispa*), Mengkudu (*M. charantia*), and Ampadu tanah (*A. paniculata*).

The medicinal use of *Aloe vera* has been documented since ancient times. Egyptian medical records, notably the Ebers Papyrus, describe its application as a healing and therapeutic agent. Likewise, traditional medical systems from various regions, including China, Greece, Spain, and Arabia, have long recognized the value of this plant (Kazeem et al., 2022). A. vera contains a wide range of bioactive compounds, such as barbaloin, isobarbaloin, aloe-emodin, and hydroxyaloin, aloenin, aloesin, acemannan, salicylic acid, saponins, sterols, and triterpenoids (Muñiz-Ramirez et al., 2020). The plant is known for its anti-inflammatory, antifungal, antibacterial, and cell-regenerative properties, and it has also been shown to help reduce blood glucose levels in individuals with diabetes (Hafizah & Meliahsari, 2025).

Pario or Pare (*M. charantia*), also known as balsam pear, is a well-known plant belonging to the Cucurbitaceae family. Although its precise origin remains uncertain, pario is widely distributed across tropical regions, both in the wild and under cultivation. Phytochemical analyses indicate that the leaves contain compounds such as momordicin, momordin, charantins, tricosanic acid, resins, saponins, and vitamins A and C, along with fatty oils composed of oleic, linoleic, and stearic acids (Virdausy et al., 2025). The seeds are known to contain momordicines. In traditional and experimental use, the fruit and seeds are the plant parts most commonly employed in diabetes treatment.

Ampadu tanah or sambiloto, is a wild plant commonly found in gardens. The active phytochemical constituents present include andrographolide, 14-deoxy-11-oxoandrographolide, 14-deoxy-11,12-didehydroandrographolide, and neoandrographolide (Najib, 2019). Empirical research has demonstrated that extracts this plant containing andrographolide has been shown to enhance insulin sensitivity by promoting glucose uptake, activating the insulin signaling pathway, and inhibiting the activation of nuclear factor kappa-B (NF-κB) signaling pathways, which are typically stimulated by tumor necrosis factor-alpha (TNF-α) in 3T3-L1 adipocyte cells. The bioactive compounds found in Ampadu tanah demonstrate potential as antidiabetic agents through multiple mechanisms of action, indicating their promise as therapeutic candidates for the management of diabetes mellitus (Alverina et al., 2024).

The 53 medicinal plant species examined in this review exhibit a range of pharmacological mechanisms pertinent to diabetes management. Several species function by inhibiting carbohydrate-digesting enzymes, such as α-glucosidase and α-amylase, while others facilitate glucose uptake, enhance insulin sensitivity, protect pancreatic β-cells, or promote glucose excretion through diuretic effects. Many of these plants are also abundant in flavonoids, phenolics, alkaloids, terpenoids, and saponins, compounds extensively documented for their antihyperglycemic and antioxidant properties. These findings strongly indicate that traditional ethnomedicinal practices in West Sumatra are corroborated by contemporary scientific evidence and constitute a valuable resource for future antidiabetic drug discovery.

A limitation of this review is the limited availability of ethnobotanical information in indexed scientific databases, as a significant portion of traditional medicinal knowledge in West Sumatra may remain undocumented or only accessible in grey literature, such as local reports, theses, community records, and unpublished manuscripts. Consequently, some pertinent plant use records may not have been captured in the present study. Additionally, the traditional knowledge reported across the reviewed sources often lacked standardized information regarding dosage, preparation methods, frequency of administration, treatment duration, and patient response, complicating direct comparisons between studies. Variations in vernacular plant names, incomplete taxonomic identification, and differences in study methodology may also have influenced data consistency. Another important concern is the gradual erosion of indigenous and local knowledge due to cultural change, modernization, and decreasing intergenerational knowledge transfer, which may threaten the continuity of valuable ethnomedicinal practices. Therefore, documentation, preservation, and protection of traditional knowledge are essential to safeguard this cultural heritage. While this review provides a comprehensive overview of antidiabetic medicinal plants used in West Sumatra, further field-based ethnobotanical surveys and pharmacological validation studies are needed to strengthen and standardize the available evidence.

CONCLUSION

The limited overlap in species among communities suggests the existence of ethnobotanical knowledge that remains insufficiently documented and may be at risk of erosion without targeted conservation and inventory efforts. These findings highlight the critical importance of ethnobotanical documentation for preserving traditional knowledge and serve as a foundation for future scientific research. Plants consistently reported or unique to particular regions hold significant potential for phytochemical, natural product, and molecular investigations aimed at discovering novel antidiabetic agents derived from indigenous biological resources.

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