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Ethnobotany of medicinal plants by the community in Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

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Abstract. *Albar H, Juhriah, Santosa S. 2025. Ethnobotany of medicinal plants by the community in Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia. Biodiversitas 26: 315-325.* The use of plants as traditional medicine has been a long-standing practice among the people of Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia. This study aims to determine the diversity of medicinal plant species, plant parts used, processing methods, and how to use plants as traditional medicine. This study uses a qualitative and quantitative descriptive approach. Data collection using a semi-structured questionnaire was distributed to 45 respondents who are traditional healers and community users of medicinal plants. Questionnaire data with respondents were analyzed using quantitative ethnobotany index calculations consisting of Use Value (UV), Fidelity Level (FL), and Informant Consensus Factor (ICF). Based on the results of the study, the community uses 50 species of medicinal plants classified into 44 genera and 29 families as traditional medicine to treat 37 different types of diseases. The largest families come from the Fabaceae, Moraceae, and Zingiberaceae families (8% each). The most widely used part of the plant is the leaves (44%). The most common processing method is boiling (52%), at the same time, the most common way of use is drinking (76%). The highest UV values were found in the plant species *Carica papaya*, *Strychnos nux-vomica*, *Swietenia mahagoni*, *Psidium guajava*, and *Curcuma longa*, with values of 1 each. The highest FL value was found in the *P. guajava* plant with a value of (100%), which is the type of plant with the largest number of user respondents. The highest ICF values were found in the categories of dermatological diseases and reproductive system disorders, with values of 0.96 each. Medical plants play a very important role in providing health services in the study area. This study needs to be carried out scientifically related to its utilization and safety through various biological activity tests and toxicological properties.

Keywords: Bima, diversity, ethnobotany, Langgudu, medicinal plants

Abbreviations: FL: Fidelity Level, ICF: Informant Consensus Factor, UV: Use Value

INTRODUCTION

Indonesia is known as one of the countries rich in biodiversity, especially plants. Indonesia has around 30,000 plant species, most of which have the potential to be used as medicine, and 90% of them are found in Asia (Rambey et al. 2024). North American botanist John Harshberger introduced the term "ethnobotany" in 1895, defining it as a scientific discipline that explores the uses of plants in society (Darmastuti et al. 2024). Ethnobotany is an interdisciplinary field of science that covers all interactions between humans and plants (Awan et al. 2021). As time goes by, interactions between humans and plants are becoming more intense, resulting in the accumulation of human knowledge and expertise in the field of herbal medicine (Mela et al. 2022). Local knowledge about medicinal plants in the surrounding environment has helped communities survive and progress (Xiong et al. 2020). The primary goal of ethnobotany is to comprehend how humans use, manage, and benefit from plants (Nahdi and Kurniawan 2019). One scientific field that represents the community's understanding of environmental resources that can be utilized to safeguard cultural values is ethnobotany (Sutraningsih et al. 2020).

Medicinal plants are an alternative treatment method for curing various health problems (Adam et al. 2020). People have long used plants for health, passing this tradition down from generation to generation (Rastogi et al. 2022; Tambaru et al. 2023). Around the world, primary health care widely uses medicinal plants due to their affordability, safety, and effectiveness in maintaining health (Cordero et al. 2023). Among the people, medicinal plants have become the foundation of the health care system. Approximately 85% of drugs used for primary health care worldwide come from plants (Jhariya and Pawar 2024). Medicinal plants play a very important role in treating and preventing diseases, especially for people living in remote areas far from access to health services (Pikulthong et al. 2022). Some modern medical research is usually based on ethnobotanical studies and traditional knowledge, and most of the medical drugs we use today come from plants. Plants provide 25% of the drugs prescribed worldwide, with 121 compounds still in use (Abadi et al. 2023).

Bima District, West Nusa Tenggara, Indonesia has a lot of natural resources, especially plants. Communities in every sub-district in Bima District utilize the potential of plants as natural products that are beneficial for their health. Local knowledge and policies passed down as

traditions and customary law, typically underpin the traditional use of plants (Arasti 2021). Traditional community knowledge regarding the use of medicinal plants is currently decreasing due to competition with modern medicines. This shift is due to modernization in people's lives (Husaini et al. 2022). Research that examines the use of plants with medicinal properties is necessary, given the various pressures and threats, as well as the lack of information and scientific publications related to these plants (Azmin et al. 2019).

While previous studies, including research conducted by Arasti (2021) in Ambalawi, Parado, and Woha Sub-districts, have shed light on the use of medicinal plants in Bima District, there is a significant gap in our understanding of the use of medicinal plants in Langgudu Sub-district, Bima District. Therefore, to prevent the extinction of traditional knowledge, it is necessary to explore the knowledge or local wisdom of the Langgudu Sub-district community in the use of natural resources, especially medicinal plants, and this research aims to do just that.

This research focuses on the diversity of medicinal plants, the parts of plants used, processing methods, and how to use plants as traditional medicine in three villages: Karumbu, Kalodu, and Pusu Villages, Langgudu Sub-district, Bima District. This research has the potential to become a valuable resource for future ethnobotanical research. By documenting and sharing this knowledge, we hope to provide a comprehensive understanding of the use of medicinal plants and inspire further research in this field.

MATERIALS AND METHODS

Study area

The research was conducted in 3 villages, namely Karumbu Village, Kalodu Village, and Pusu Village, Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia (Figure 1). A bay separates the land that constitutes Langgudu Sub-district. Langgudu Sub-district covers 322.94 km^2, divided into 15 villages, with a population of 32,377 people in 2022. Karumbu Village, which is the center of government in Langgudu Sub-district, is 36.6 km from Bima District's capital. Pusu Village and Kalodu Village are two remote villages in Langgudu Sub-district, with areas far from city access (Akbar et al. 2022).

Procedures

This research is from July to August 2023. The sample determination was carried out based on purposive sampling and snowball sampling techniques. Determination of samples based on purposive sampling techniques was used to select individuals or figures who were considered to be most knowledgeable about the community in Karumbu Village, Kalodu Village, and Pusu Village, Langgudu Sub-district. The chosen figure for the interview was the village head, who served as the key informant. The snowball sampling technique was employed to choose respondents based on recommendations of key informants.

Ethnobotanical interviews were used as the basis for data collection, using semi-structured questionnaire methods and open interviews. Some questions asked during the interview process with respondents include: (i) Since when have you used medicinal plants? (ii) Where did you get your knowledge about medicinal plants? (iii) What types of plants do you usually use as medicine? (iv) What types of diseases can they cure? (v) What parts of medicinal plants do you use as medicine? (vi) How do you process medicinal plants so that they can be used to treat the disease? (vii) How do you use medicinal plants to treat the disease? (viii) How do you get the medicinal plants?

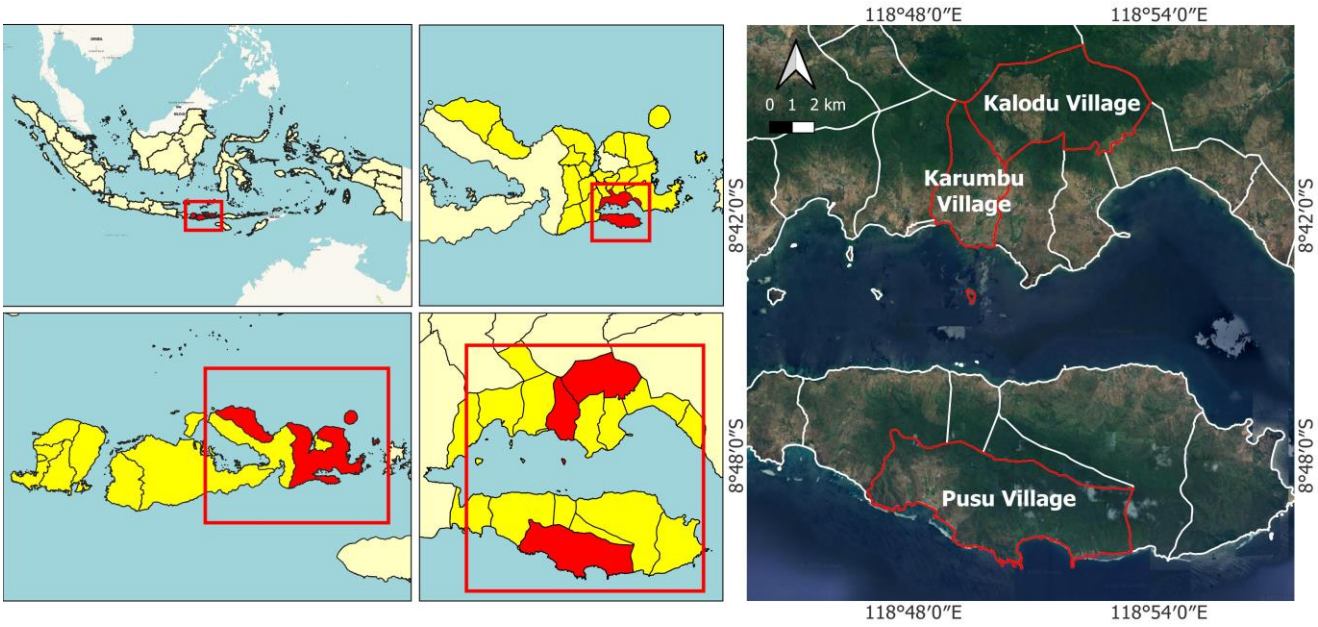

Figure 1. Map of the study area of Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia, i.e. Karumbu Village, Kalodu Village, and Pusu Village

A total of 45 respondents were interviewed: 15 respondents from Karumbu Village, Kalodu Village, and Pusu Village, consisting of traditional healers and medicinal plant users aged 40-80 years. The number of female respondents was 26 people, and the number of male respondents was 19 people. The ethnobotanical data collected include the diversity of medicinal plant species (regional names of plants), types of diseases treated, plant parts used, processing methods, and how to use them. Identification of medicinal plants was carried out using the plant website https://identify.plantnet.org. The plant identification process begins with all parts of the plant being photographed using a camera. The percentage that appears after the identification process and compared with the original image of the plant reveals the accuracy of the identification results.

According to Jadid et al. (2020) diseases that commonly occur in Indonesia are grouped into seven categories, namely: (i) gastrointestinal disorders (ulcer, diarrhea, constipation, cholera, facilitates digestion, nausea, and worms); (ii) dermatological diseases (boil, wound, burns, tinea versicolor, and itch); (iii) reproductive system disorders (urinary tract infections); (iv) musculoskeletal disorders (gout and bone pain); (v) internal medical diseases (diabetes, jaundice, malaria, cholesterol, tumors, hypertension, cancer, fever, appendicitis and blood purifier); (vi) respiratory, nose, oral, throat problems (cough, sprue, toothache and shortness of breath); and (vii) others (insomnia, immune booster, body odor, cigarette addiction remover, increases appetite, antidote, dizziness and chest pain).

Data analysis

The questionnaire data with respondents were analyzed using quantitative ethnobotany index calculations consisting of Use Value (UV), Fidelity Level (FL), and Informant Consensus Factor (ICF). Here is a more detailed description of these three indices:

Use Value (UV)

UV is an ethnobotanical index that indicates the relative importance of locally known plant species based on the number of uses recorded for each species. UV uses the following formula:

$$UV = \sum \frac{Ui}{N}$$

Where:

Ui: Number of respondents who use certain medicinal plant species

N: Total number of respondents (Nguyen et al. 2019)

Fidelity Level (FL)

FL is used to determine the percentage of respondents who use certain plant species to treat certain diseases. This reflects people's preferences for certain plant species in certain treatments. FL uses the following formula:

$$FL = \frac{Np}{N} \times 100$$

Where:

Np : Number of respondents who use certain plant species to treat certain diseases

N : Total number of respondents who use certain plant species to treat various diseases (Jadid et al. 2020)

Informant Consensus Factor (ICF)

The ICF is used to determine medicinal plant species that are considered culturally important and potentially effective. ICF uses the following formula:

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

Where:

Nur : Number of useful reports in each disease category

Nt : Number of plant species used (Cordero and Alejandro 2021)

RESULTS AND DISCUSSION

Diversity of medicinal plant species in Langgudu Sub-district

The research reveals that the community uses 50 species of medicinal plants from 44 genera and 29 families as medicines. The largest number of species are found in the Karumbu Village, with 48 species, followed by the Kalodu Village, with 46 species, and the Pusu Village, with 44 species. The families with the highest percentage values were reported to come from the Fabaceae, Moraceae, and Zingiberaceae families with percentage values (8% each), followed by Asteraceae, Euphorbiaceae, Lamiaceae, and Piperaceae (6% each), Annonaceae, Arecaceae, Myrtaceae, and Rutaceae (4% each). The rest (2% each) were used to treat 37 types of diseases. There are 9 parts of plants used as ingredients for making traditional medicine, including but not limited to digestive disorders, skin diseases, and respiratory ailments. Based on the processing method, there are 6 ways of processing medicinal plants and 5 ways of using medicinal plants carried out by the community in 3 villages in Langgudu Sub-district (Table 1).

Plant parts used, method of processing, and method of use

The most widely used part of the plant is its leaves (44%), followed by fruit (16%), bark and rhizome (each 8%), leaves, stem, and root (4%), flower (4%), root (4%), leaves, stem (2%), seed (2%), stem (2%), leaves, root (2%), fruit, stem (2%) and bulb (2%) (Figure 2.A). The most common processing method is boiled (52%), followed by pounded (16%), grated, squeezed (10%), without processing (6%), chewed (4%), pounded, squeezed (4%), squeezed (4%), without processing, boiled (2%), and boiled, squeezed (2%) (Figure 2.B). While the most common way of use is drunk (76%), followed by pasted (14%), drunk, gargled (2%), drunk, pasted (2%), drunk, smeared (2%), eaten (2%), and smeared (2%) (Figure 2.C).

Table 1. Medicinal plants used to treat various diseases in three villages of Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

Family	Scientific name	Local name	PU	MoP	MoU	Disease treated	Number of users in 3 villages		
							Villages		
							Karumbu	Kalodu	Pusu
Amaryllidaceae	*Allium cepa* L.	Bawa	Bu	Po	Pa	Chest pain, fever	11	5	7
Anacardiaceae	*Lannea grandis* (Dennst.) Engl.	Kanondo	Ba	Bo	Dr	Diarrhea, nausea	5	7	3
Annonaceae	*Annona muricata* L.	Garoso belanda	Le	Bo	Dr	Hypertension	9	5	4
	Annona squamosa L.	Garoso mpoa	Le	Po	Pa	Bone pain	2	2	6
Apiaceae	*Apium graveolens* L.	Ro'o sop	Le	Po	Pa	Chest pain	6	4	5
Arecaceae	*Areca catechu* L.	U'a	Fr	Ch	Dr	Constipation, worms, toothache	4	10	5
	Cocos nucifera L.	Ni'u	Fr	Wp	Dr	Antidote	8	9	7
Asteraceae	*Ageratum conyzoides* L.	Bandotan	Le, Ro	Bo	Dr	Cancer, malaria	5	8	3
	Chromolaena odorata (L.) King & H.E. Robins	Golka	Le, St	Bo, Sq	Dr, Sm	Ulcer, gout, diabetes, wound	12	15	11
	Elephantopus scaber L.	Lera sahe	Le	Bo	Dr	Diabetes	3	1	1
Caricaceae	*Carica papaya* L.	Kapaja	Le	Po, Sq	Dr	Malaria, worms, increases appetite	15	15	15
Cucurbitaceae	*Momordica balsamina* L.	Paria	Le	Po, Sq	Dr	Cough, cigarette addiction remover	12	11	10
Euphorbiaceae	*Acalypha australis* L.	Kantobo	Le	Bo	Dr	Tumor, cancer	3	5	2
	Euphorbia hirta L.	Kna'a	Le	Po	Pa	Burns	2	3	9
	Jatropha curcas L.	Katanga	Le	Bo	Dr	Fever	6	8	4
Fabaceae	*Clitoria ternatea* L.	Wunta eri	Fl	Bo	Dr	Dizziness	8	0	0
	Mimosa pudica L.	Putri malu	Le	Bo	Dr	Diabetes	2	3	4
	Senna alata (L.) Roxb.	Kakapi	Le	Po	Sm	Tinea versicolor	10	8	9
	Tamarindus indica L.	Mangge	Fr	Sq	Dr	Blood purifier	10	8	8
Lamiaceae	*Coleus amboinicus* Lour.	Mbumbujo	Le	Bo	Dr	Hypertension	7	5	6
	Ocimum tenuiflorum L.	Pataha doro	Ro	Bo	Dr	Shortness of breath	4	6	2
	Orthosiphon aristatus (Blume) Miq.	Kumis kucing	Le	Bo	Dr	Urinary tract infection	3	3	4
Loganiaceae	*Strychnos nux-vomica* L.	Songga	Fr, St	Wp, Bo	Dr	Diabetes, cholera, diarrhea, malaria, hypertension	15	15	15
Malvaceae	*Ceiba pentandra* (L.) Gaertn.	Ringi	Le	Po	Pa	Boil	7	9	12
Meliaceae	*Swietenia mahagoni* (L.) Jacq.	Mahuni	Se	Wp	Dr	Diarrhea, malaria, diabetes	15	15	15
Menispermaceae	*Tinospora cordifolia* (Willd.) Hook.f. & Thomson	Tamba mpu'u	St	Bo	Dr	Cancer	8	5	6
Moraceae	*Artocarpus altilis* (Parkinson) Fosberg	Karara	Fr	Bo	Dr	Jaundice	3	0	0
	Artocarpus elasticus Reinw. ex Blume	Tere	Le	Bo	Dr	Jaundice	0	10	0
	Ficus septica Burm.F.	Mposu	Le	Po	Pa	Ulcers, toothache	4	2	8
	Streblus asper Lour.	Feli	Le	Po	Pa	Wounds, fever	4	0	0
Moringaceae	*Moringa oleifera* Lam.	Parongge	Ba	Bo	Dr	Cholesterol	5	6	3
Myrtaceae	*Psidium guajava* L.	Jambu doro	Le	Ch	Dr	Diarrhea	15	15	15
	Syzygium cumini (L.) Skeels	Duwe	Ba	Bo	Dr	Cancer	4	5	3
Oxalidaceae	*Averrhoa bilimbi* L.	Limbi	Fl	Bo	Dr	Itch	6	7	5
Phyllanthaceae	*Phyllanthus niruri* L.	Maramancu	Le, St, Ro	Bo	Dr	Appendicitis, cough, diabetes	5	3	10
Piperaceae	*Piper betle* L.	Nahi	Le	Bo	Dr, Ga	Cholesterol, body odor, toothache	8	15	7
	Piper crocatum Ruiz & Pav.	Nahi keta	Le	Bo	Dr	Cholesterol, gout, diabetes	8	7	4
	Piper retrofractum Vahl	Sabia	Fr	Bo	Dr	Shortness of breath	5	7	11
Poaceae	*Imperata cylindrica* (L.) Raeusch.	Ati	Ro	Bo	Dr	Sprue	2	1	5
Portulacaceae	*Portulaca oleracea* L.	Soka	Le, St, Ro	Bo	Dr	Urinary tract infection	6	5	6
Rhamnaceae	*Ziziphus mauritiana* Lam.	Rangga	Le	Bo	Dr	Facilitates digestion	11	10	10
Rubiaceae	*Morinda citrifolia* L.	Nonu	Fr	Gr, Sq	Dr	Ulcer, cough	4	9	5

Rutaceae	*Citrus aurantiifolia* (Christm.) Swingle	Dungga nipi	Fr	Sq	Dr	Cough	7	8	8
	Limonia acidissima L.	Kinca	Fr	Wp	Ea	Diarrhea	6	0	0
Sapindaceae	*Schleichera oleosa* (Lour.) Oken	Sambi	Ba	Bo	Dr	Cancer	8	2	8
Verbenaceae	*Stachytarpheta jamaicensis* (L.) Vahl	Pecut kuda	Le	Bo	Dr	Cough	0	6	0
Zingiberaceae	*Curcuma heyneana* Val. & V	Tawoa	Rh	Gr, Sq	Dr	Worms, diarrhea	9	13	9
	Curcuma longa L.	Huni	Rh	Gr, Sq	Dr, Pa	Ulcer, diarrhea, immune booster, wound	15	15	15
	Curcuma zanthorrhiza Roxb.	Tamulawa	Rh	Gr, Sq	Dr	Immune booster	7	11	6
	Zingiber zerumbet (L.) Roscoe ex Sm.	Kampuja	Rh	Gr, Sq	Dr	Insomnia increases appetite	10	13	13

Note: Ba: Bark; Bu: Bulb; Fl: Flower; Fr: Fruit; Le: Leaf; Rh: Rhizoma; Ro: Root; Se: Seed; St: Stem; Bo: Boiled; Ch: Chewed; Gr: Grated; Wp: Without processing; Po: Pounded; Sq: Squeezed; Dr: Drunk; Ea: Eaten Ga: Gargled; Pa: Pasted; Sm: Smeared; PU: Part Used; MoP: Method of Processing; MoU: Method of Use

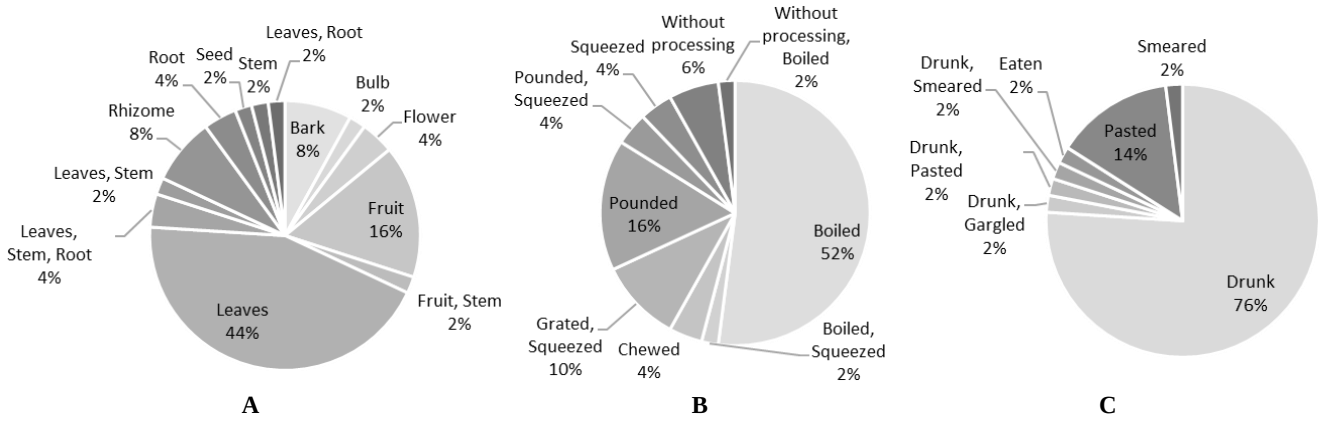

Figure 2. A. Percentage of plant parts; B. Method of processing; and C. Method of use in Karumbu Village, Kalodu Village, and Pusu Village, Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

Various diseases treated using several species of medicinal plants can be seen in Figure 3. Diabetes and diarrhea are the diseases most commonly treated using 7 species of plants, followed by cancer and cough with 5 species of plants, malaria with 4 species of plants, and 7 types of diseases consisting of cholesterol, fever, hypertension, toothache, ulcers, wounds, and worms with 3 species of plants each. In comparison, the rest are treated using 2 or 1 species of plants.

Use Value (UV)

The analysis of the relative importance of medicinal plant use is based on the total number of respondents who specifically use certain plant species. In each village, medicinal plants have a UV value ranging from 0.00 to 1.00. The UV values of the sub-districts range from 0.07 to 1.00. Based on the number of plant species obtained with a UV value of 1.00 in each village, there were 7 plant species with a UV value of 1.00 found in Kalodu Village. While in Karumbu Village and Pusu Village, 5 plant species were found, each with a UV value of 1.00 (Table 2).

The results of this study revealed that the highest UV values in Langgudu Sub-district were found in the plant species *Carica papaya*, *Strychnos nux-vomica*, *Swietenia mahagoni*, *Psidium guajava*, and *Curcuma longa* with values (each 1), followed by *Chromolaena odorata* (0.84), *Zingiber zerumbet* (0.80), *Momordica balsamina* (0.73), *Curcuma heyneana*, and *Ziziphus mauritiana* (each 0.67). In contrast, the other 40 species had values of 0.07 to 0.67 (Figure 4).

Fidelity level (FL)

FL is used to determine the specific uses of each plant species and its preference over other species. The FL value in each village ranges from 0.0% to 100%. Meanwhile, the FL value at the sub-district level ranges from 43.2% to 100% (Table 3). In this study, 31 plant species were obtained with an FL value of 100%, where the 31 species are the same species used by the community in each village and are only used in a single disease category. Meanwhile, the other 19 species have FL values between 43.2% and 80.5%. The following are the plant species with the highest number of user respondents and FL values in Langgudu

Sub-district (Figure 5). *Psidium guajava* has the highest value based on the number of user respondents, 45 out of a total of 45 respondents.

Informant Consensus Factor (ICF)

There are 37 uses for medicinal plants, which are divided into seven disease categories (Table 4, Figure 6). The ICF is used to determine medicinal plant species that are considered culturally important and potentially effective. The ICF value in each village ranges between 0.60 to 0.90. The highest ICF value in Karumbu Village is in the category of reproductive system disorders, with a value of 0.88. In Kalodu Village, the highest ICF value was in the category of gastrointestinal disorders and dermatological diseases, with a value of 0.88. Meanwhile, in Pusu Village, the highest ICF value is in the dermatological diseases category, with a value of 0.90. The results of this study indicate that the ICF values obtained in Langgudu Sub-district ranged from 0.92 to 0.96, with the highest values found in the categories of dermatological diseases and reproductive system disorders at 0.96 each. In the category of dermatological diseases, the diseases treated are boils, wounds, burns, tinea versicolor, and itching using 8 species of medicinal plants. In the category of reproductive system disorders, the disease being treated is urinary tract infection using two types of medicinal plants. The lowest ICF value is in the musculoskeletal disorders category, with a value of 0.92. The diseases treated are gout and bone pain, using three types of medicinal plants.

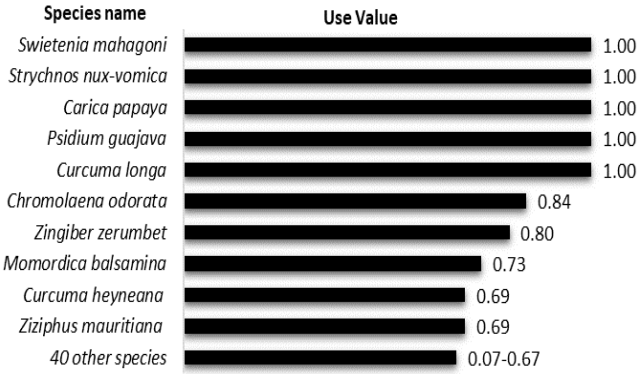

Figure 4. Plant species with the highest Use Value (UV) in Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

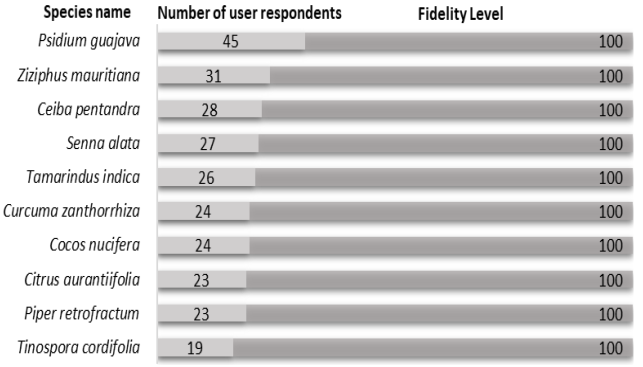

Figure 5. Plant species with the highest number of users and Fidelity Level (FL) in Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

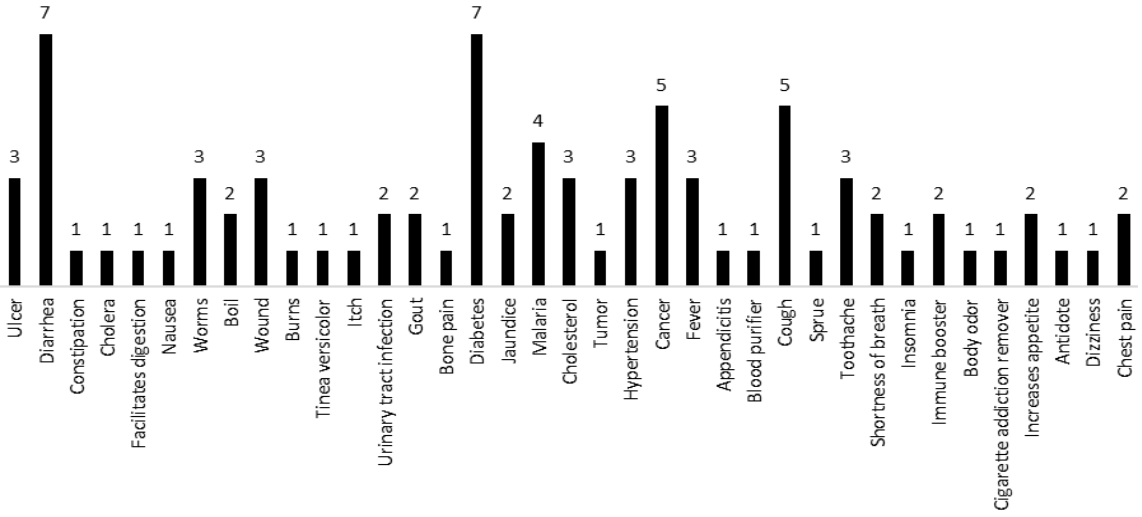

Figure 3. Various diseases were treated using several species of medicinal plants in Karumbu Village, Kalodu Village, and Pusu Village of Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

Table 2. Use Value (UV) of medicinal plants in Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

Plant species	UV each Village N = 15			UV District N = 45
	Village			
	Karumbu	Kalodu	Pusu	
	UV	UV	UV	
Allium cepa L.	0.73	0.33	0.47	0.51
Lannea grandis (Dennst.) Engl.	0.33	0.47	0.20	0.33
Annona Muricata L.	0.60	0.33	0.27	0.40
Annona squamosa L.	0.13	0.13	0.40	0.22
Apium graveolens L.	0.40	0.27	0.33	0.33
Areca catechu L.	0.27	0.67	0.33	0.42
Cocos nucifera L.	0.53	0.60	0.47	0.53
Ageratum conyzoides L.	0.33	0.53	0.20	0.36
Chromolaena odorata (L.) King & H.E. Robins	0.80	1.00	0.73	0.84
Elephantopus scaber L.	0.20	0.07	0.07	0.11
Carica papaya L.	1.00	1.00	1.00	1.00
Momordica balsamina L.	0.80	0.73	0.67	0.73
Acalypha australis L.	0.20	0.33	0.13	0.22
Euphorbia hirta L.	0.13	0.20	0.60	0.31
Jatropha curcas L.	0.40	0.53	0.27	0.40
Clitoria ternatea L.	0.53	0.00	0.00	0.18
Mimosa pudica L.	0.13	0.20	0.27	0.20
Senna alata (L.) Roxb.	0.67	0.53	0.60	0.60
Tamarindus indica L.	0.67	0.53	0.53	0.58
Coleus amboinicus Lour.	0.47	0.33	0.40	0.40
Ocimum tenuiflorum L.	0.27	0.40	0.13	0.27
Orthosiphon aristatus (Blume) Miq.	0.20	0.20	0.27	0.22
Strychnos nux-vomica L.	1.00	1.00	1.00	1.00
Ceiba pentandra (L.) Gaertn.	0.47	0.60	0.80	0.62
Swietenia mahagoni (L.) Jacq.	1.00	1.00	1.00	1.00
Tinospora cordifolia (Willd.) Hook.f. & Thomson	0.53	0.33	0.40	0.42
Artocarpus altilis (Parkinson) Fosberg	0.20	0.00	0.00	0.07
Artocarpus elasticus Reinw. ex Blume	0.00	0.67	0.00	0.22
Ficus septica Burm.F.	0.27	0.13	0.53	0.31
Streblus asper Lour.	0.27	0.00	0.00	0.09
Moringa oleifera Lam.	0.33	0.40	0.20	0.31
Psidium guajava L.	1.00	1.00	1.00	1.00
Syzygium cumini (L.) Skeels	0.27	0.33	0.20	0.27
Averrhoa bilimbi L.	0.40	0.47	0.33	0.40
Phyllanthus niruri L.	0.33	0.20	0.67	0.40
Piper betle L.	0.53	1.00	0.47	0.67
Piper crocatum Ruiz & Pav.	0.53	0.47	0.27	0.42
Piper retrofractum Vahl	0.33	0.47	0.73	0.51
Imperata cylindrica (L.) Raeusch.	0.13	0.07	0.33	0.18
Portulaca oleracea L.	0.40	0.33	0.40	0.38
Ziziphus mauritiana Lam.	0.73	0.67	0.67	0.69
Morinda citrifolia L.	0.27	0.60	0.33	0.40
Citrus aurantiifolia (Christm.) Swingle	0.47	0.53	0.53	0.51
Limonia acidissima L.	0.40	0.00	0.00	0.13
Schleichera oleosa (Lour.) Oken	0.53	0.13	0.53	0.40
Stachytarpheta jamaicensis (L.) Vahl	0.00	0.40	0.00	0.13
Curcuma heyneana Val. & V	0.60	0.87	0.60	0.69
Curcuma longa L.	1.00	1.00	1.00	1.00
Curcuma zanthorrhiza Roxb.	0.47	0.73	0.40	0.53
Zingiber zerumbet (L.) Roscoe ex Sm.	0.67	0.87	0.87	0.80

Note: (UV: Use Value; N=15: number of respondents in each village; N=45: total number of respondents)

Table 3. Fidelity Level (FL) values of medicinal plants in Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

Plant species	FL each Village N = 15			FL District N = 45
	Village			
	Karumbu	Kalodu	Pusu	
	FL	FL	FL	
Allium cepa L.	68.8	71.4	70.0	69.7
Lannea grandis (Dennst.) Engl.	62.5	58.3	60.0	60.0
Annona Muricata L.	100	100	100	100
Annona squamosa L.	100	100	100	100
Apium graveolens L.	100	100	100	100
Areca catechu L.	44.4	41.7	45.5	43.2
Cocos nucifera L.	100	100	100	100
Ageratum conyzoides L.	71.4	66.7	75.0	69.6
Chromolaena odorata (L.) King & H.E. Robins	50.0	50.0	50.0	50.0
Elephantopus scaber L.	100	100	100	100
Carica papaya L.	50.0	60.0	55.6	54.9
Momordica balsamina L.	75.0	84.6	83.3	80.5
Acalypha australis L.	50.0	50.0	50.0	50.0
Euphorbia hirta L.	100	100	100	100
Jatropha curcas L.	100	100	100	100
Clitoria ternatea L.	100	100	100	100
Mimosa pudica L.	100	100	100	100
Senna alata (L.) Roxb.	100	100	100	100
Tamarindus indica L.	100	100	100	100
Coleus amboinicus Lour.	100	100	100	100
Ocimum tenuiflorum L.	100	100	100	100
Orthosiphon aristatus (Blume) Miq.	100	100	100	100
Strychnos nux-vomica L.	46.9	60.0	50.0	51.7
Ceiba pentandra (L.) Gaertn.	100	100	100	100
Swietenia mahagoni (L.) Jacq.	55.6	68.2	75.0	65.2
Tinospora cordifolia (Willd.) Hook.f. & Thomson	100	100	100	100
Artocarpus altilis (Parkinson) Fosberg	100	100	100	100
Artocarpus elasticus Reinw. ex Blume	100	100	100	100
Ficus septica Burm.F.	80.0	50.0	61.5	63.6
Streblus asper Lour.	57.1	0.0	0.0	57.1
Moringa oleifera Lam.	100	100	100	100
Psidium guajava L.	100	100	100	100
Syzygium cumini (L.) Skeels	100	100	100	100
Averrhoa bilimbi L.	100	100	100	100
Phyllanthus niruri L.	62.5	50.0	62.5	60.0
Piper betle L.	50.0	62.5	46.7	54.5
Piper crocatum Ruiz & Pav.	57.1	63.6	57.1	59.4
Piper retrofractum Vahl	100	100	100	100
Imperata cylindrica (L.) Raeusch.	100	100	100	100
Portulaca oleracea L.	100	100	100	100
Ziziphus mauritiana Lam.	100	100	100	100
Morinda citrifolia L.	66.7	75.0	71.4	72.0
Citrus aurantiifolia (Christm.) Swingle	100	100	100	100
Limonia acidissima L.	100	100	100	100
Schleichera oleosa (Lour.) Oken	100	100	100	100
Stachytarpheta jamaicensis (L.) Vahl	100	100	100	100
Curcuma heyneana Val. & V	69.2	72.2	75.0	72.1
Curcuma longa L.	51.7	53.6	48.4	51.1
Curcuma zanthorrhiza Roxb.	100	100	100	100
Zingiber zerumbet (L.) Roscoe ex Sm.	62.5	65.0	61.9	63.2

Note: FL: Fidelity Level; N=15: number of respondents in each village; N=45: total number of respondents)

Table 4. Informant Consensus Factor (ICF) values based on disease categories in Karumbu Village, Kalodu Village, and Pusu Village, Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia

Disease category	ICF each Village N = 15									ICF District N = 45		
	Village											
	Karumbu			Kalodu			Pusu					
	Nt	Nur	ICF	Nt	Nur	ICF	Nt	Nur	ICF	Nt	Nur	ICF
Gastrointestinal disorders	17	112	0.86	16	122	0.88	16	97	0.84	17	331	0.95
Dermatological diseases	8	50	0.86	7	49	0.88	7	59	0.90	8	158	0.96
Reproductive system disorders	2	9	0.88	2	8	0.86	2	10	0.89	2	27	0.96
Musculoskeletal disorders	3	6	0.60	3	7	0.67	3	12	0.82	3	25	0.92
Internal medical diseases	29	169	0.83	28	149	0.82	27	131	0.80	30	449	0.94
Respiratory, nose, oral, and throat problems	10	48	0.81	11	75	0.86	10	61	0.85	11	184	0.95
Others	11	75	0.86	10	65	0.86	10	64	0.86	11	204	0.95

Note: Nur: Number of use reports; Nt: Number of species; ICF: Informant Consensus Factor; N = 15: Number of respondents in each village; N = 45: Total number of respondents

Figure 6. Some medicinal plants from Langgudu Sub-district, Bima District, West Nusa Tenggara, Indonesia: A. *Carica papaya* L.; B. *Strychnos nux-vomica* L.; C. *Swietenia mahagoni* (L.) Jacq.; D. *Psidium guajava* L.; E. *Curcuma longa* L.

Discussion

The community reported that there were 50 species of medicinal plants belonging to 44 genera and 29 families that were used as medicine by the community in Karumbu Village, Kalodu Village, and Pusu Village, Langgudu Sub-district (Table 1). Karumbu Village had the highest number of species, with 48, followed by Kalodu Village with 46, and Pusu Village with 44. The difference in the number of medicinal plant species used in each village is due to the fact that several species do not grow in the area. Additionally, the lack of community knowledge regarding the use of plants is also a contributing factor. This study yielded a higher number of species than Arasti's (2021) study in the Ambalawi, Parado, and Woha Districts, Bima District, which only identified 39 species of medicinal plants. The community uses this high number of species to treat diseases that are common and often occur in everyday life. This indicates that the Langgudu Sub-district research yielded a greater variety of medicinal plant species compared to earlier investigations. Local knowledge and policies passed down from generation to generation in the form of customs and customary laws typically guide the Langgudu Sub-district community's use of plants as medicine. Most of the plants utilized by the community are wild plants that grow around their residential environment, but some people cultivate them (Tambaru et al. 2023).

The largest families reported came from the Fabaceae, Moraceae, and Zingiberaceae families (Table 1). The results of this study are almost similar to the results of a study conducted by Husaini et al. (2022) in Bantimurung-Bulusaraung National Park, South Sulawesi, where most people use medicinal plants from the Fabaceae, Moraceae, and Zingiberaceae families. In the Fabaceae family, *Senna alata* is the type of plant with the most users used to treat tinea versicolor. In the Moraceae family, *Ficus septica* is the type of plant with the most users used to treat boils. In the Zingiberaceae family, *C. longa* is the type of plant with the most users used to treat ulcers. The high utilization of plant species from these families is due to their very wide distribution and very easy availability (Hassan et al. 2020).

Some parts of plants used as ingredients for making traditional medicine by the people of Langgudu Sub-district include roots, rhizomes, tubers, stems, bark, leaves, flowers, fruits, and seeds (Figure 2.A). Leaves are the most widely used part of the plant. Traditional medicine has long utilized leaves as an ingredient due to their easy accessibility, both in terms of ingredients and preparation methods. In addition, leaves being a place for photosynthesis, have a high metabolite content (Nisa et al. 2021), which is a fascinating aspect of their use. In terms of medicinal plant survival, taking leaves within reasonable limits can preserve the plant compared to taking stems, roots, and all parts of the plant, which can endanger the plant's life (Zahoor et al. 2017; Jadid et al. 2020). Seeds and bulbs are the least used parts of the plant. People use the seeds of the *S. mahagoni* plant to treat diarrhea, malaria, and diabetes, while they use the bulbs of the *Allium cepa* plant to treat fever and chest pain.

There are several ways of processing plants before being used as medicine by the people in Langgudu Sub-district, including boiling, pounding, squeezing, grating, chewing, and without processing (Figure 2.B). The most widely used processing method is boiling, where the boiled water is drunk as medicine. Boiling is very common in rural areas, where the absorption and effectiveness of drinking boiled water are much higher compared to other traditional processing methods. Usually, people use it to treat more serious diseases and severe conditions (Cordero and Alejandro 2021). In this study, the *P. guajava* and *Areca catechu* plants used a unique processing method, namely chewing. The leaves of the *P. guajava* plant are chewed until smooth, and then the water from the chewing is drunk while the pulp is thrown away; it is believed to be very effective in treating diarrhea. *Areca catechu* plant uses the same processing method as *P. guajava* used to treat constipation, worms, and toothache.

The method of drug use varies depending on the type of disease and the ingredients used (Chaachouay et al. 2019; Husaini et al. 2022). There are several ways of using traditional medicine by the people in Langgudu Sub-district, namely by drinking, pasting, smearing, gargling, and eating (Figure 2.C). The most common method of use in research is by drinking. The high incidence of internal diseases in the region has led to the dominance of this method, and it is considered the most appropriate method by patients (Chaachouay et al. 2019).

In this study, 37 diseases were recorded (Figure 3); diabetes and diarrhea have the largest number of plant species used as medicine. The results of this study are almost identical to the research conducted by (Chaachouay et al. 2019; Husaini et al. 2022), where diabetes is the disease with the largest number of species found. Some of the plant species used to treat diabetes are *C. odorata*, *Elephantopus scaber*, *Mimosa pudica*, *S. nux-vomica*, *S. mahagoni*, *Phyllanthus niruri*, and *Piper crocatum*. *Strychnos nux-vomica* is a plant species with the largest number of users to treat diabetes. *Strychnos nux-vomica* has also shown various actions, one of which is as an antidiabetic (Shruti and Dolas 2023). Meanwhile, the medicinal plant species used to treat diarrhea include *Lannea grandis*, *S. nux-vomica*, *S. mahagoni*, *P. guajava*, *Limonia acidissima*, *C. heyneana*, and *C. longa*. *Psidium guajava* is a plant species with the largest number of users to treat diarrhea. People around the world have long used *P. guajava* as a traditional medicine to treat diarrhea. The leaves of this plant have potential antidiarrheal activity in diarrhea caused by chemicals. They are also reported to be effective against the antibacterial activity of pathogens that are susceptible to diarrheal infections (Hirudkar et al. 2020). The community in Langgudu Sub-district believes that medicinal plants with a bitter taste can cure diabetes and diarrhea.

Table 2 shows the UV values of medicinal plants used in each village. Based on the number of plant species obtained with a UV value of 1.00 in each village, Kalodu Village is the village with the largest number of plant species, namely 7 plant species (*C. odorata*, *C. papaya*, *S. nux-vomica*, *S. mahagoni*, *P. guajava*, *Piper betle*, and *C. longa*). Meanwhile, in Karumbu Village and Pusu Village, there are 5 species of plants (*C. papaya*, *S. nux-vomica*, *S. mahagoni*, *P. guajava*, and *C. longa*), where these 5 types of plants are types of plants with a UV value of 1.00 in both villages. The difference in the number of plant species with a UV value of 1.00 in each village is due to the fact that some people do not yet know the uses of these plant species.

The results of this study revealed that several species of medicinal plants have a UV value of 1.00 in Langgudu Sub-district, including *C. papaya*, *S. nux-vomica*, *S. mahagoni*, *P. guajava*, and *C. longa* (Figure 4). The large number of respondents who use these plants contributes to their high UV values. Additionally, the high UV values of these plants can be attributed to their abundance and ease of finding. The people of Langgudu Sub-district use the *C. papaya* plant as a medicine to treat malaria and worms and increase appetite. The extract of the *C. papaya* plant leaves has been scientifically proven to function as an antibacterial, antifungal, anticancer/tumor, and antiplasmodial (Okpe et al. 2016). *Strychnos nux-vomica* is used as medicine for diabetes, malaria, cholera, diarrhea, and hypertension. *Strychnos nux-vomica* has also shown various therapeutic actions, including anti-inflammatory, analgesic, antidiabetic, antitumor, and immunomodulatory activities (Shruti and Dolas 2023). *Swietenia mahagoni* is used as medicine for diarrhea, diabetes, and malaria. The pharmacological activities of *S. mahagoni* are antimicrobial, anti-inflammatory, hepatoprotective, antidiarrheal, antiulcer, depressant, anticonvulsant and neuropharmacological, antidiabetic, anti-HIV, immunomodulatory, mosquito repellent and larvicide, antifungal, antioxidant, analgesic, platelet aggregation inhibitor, antimutagenic, and anticancer (Sukardiman and Ervina 2020). *Psidium guajava* is used as medicine for diarrhea. The leaves of this plant have potential antidiarrheal activity in diarrhea caused by chemicals. They are also reported to be effective against the antibacterial activity of pathogens susceptible to diarrheal infections (Hirudkar et al. 2020). *Curcuma longa* is used as medicine for ulcers, diarrhea, immune boosters, and wounds. *Curcuma longa* has been widely used in medicine because it has various biological and pharmaceutical characteristics, namely: anti-inflammatory, antioxidant, anti-diabetic, anti-carcinogenic, anti-coagulant, antibacterial, anti-ulcer, antifungal, anti-fibrotic, hypotensive, and antiviral (Vo et al. 2021).

FL is used to evaluate how important medicinal plants are for treating certain diseases or health problems. In this study, 31 plant species were obtained with an FL value of 100%, where the 31 species were the same species used by the community in each village (Table 3). *Psidium guajava* is a plant species with the highest FL value in Langgudu Sub-district based on the number of user respondents, namely 45 respondents out of a total of 45 respondents (Figure 5). A high FL value for a particular plant indicates that all reports of use mention the use of the same plant to treat a particular disease and are recommended by many respondents (Chaachouay et al. 2019; Nguyen et al. 2019; Cordero and Alejandro 2021; Husaini et al. 2022). This indicates that medicinal plant species with an FL value of

100% in Langgudu Sub-district tend to be used to treat one type of disease rather than several diseases.

The ICF value is based on the number of reports of use and the number of types of medicinal plants used in each category. The results range from 0 to 1 (Cordero and Alejandro 2021). Table 4 shows the ICF values based on disease categories in Karumbu Village, Kalodu Village, and Pusu Village, Langgudu Sub-district. The highest ICF value in Karumbu Village is in the category of reproductive system disorders, with a value of 0.88. In Kalodu Village, the highest ICF value was in the category of gastrointestinal disorders and dermatological diseases, with a value of 0.88. Meanwhile, in Pusu Village, the highest ICF value was in the category of dermatological diseases, with a value of 0.90. The results of the study showed that the highest ICF values in Langgudu Sub-district were in the categories of dermatological diseases and reproductive system disorders, with values of 0.96 each. The results of this study are very different from the results obtained by Husaini et al. (2022) in Bantimurung-Bulusaraung National Park, South Sulawesi, Indonesia, where the highest ICF value was found in the musculoskeletal disorders category. A high ICF value indicates that respondents use certain plant species to treat certain diseases, while a low value indicates low agreement with the use of plants for certain diseases.

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