Ethnobotanical study of medicinal flora used by muslim traditional healers in Baloi, Lanao Del Norte

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Research

Abstract

Background: Medicinal plants remain a vital component of primary healthcare among many rural and culturally distinct communities. In Baloi, Lanao del Norte, Muslim Maranao traditional healers continue to rely on indigenous plant-based remedies for disease treatment. However, this knowledge is largely undocumented and at risk of being lost. This study aimed to systematically document and quantitatively analyze the ethnomedicinal flora used in the community to support knowledge preservation and future pharmacological exploration.

Methods: A descriptive quantitative ethnobotanical approach was employed using purposive sampling of 25 key informants recognized as traditional healers. Data were collected through validated survey questionnaires, interviews conducted in the Maranao dialect, and guided field walks for plant identification. Quantitative indices, including Use Value (UV) and Informant Consensus Factor (FIC), were computed, and reported ailments were categorized using the ICD-10 classification system.

Results: Results documented 28 medicinal plant species belonging to 18 botanical families, with Asteraceae as the most represented. Several species such as *Annona muricata, Blumea balsamifera, Curcuma longa,* and *Cymbopogon citratus* exhibited moderate to high UVs, indicating strong cultural importance. High to complete FIC values (0.89-1.00) were observed for common ailments including fever, diabetes, hypertension, gastrointestinal disorders, and kidney-related conditions, reflecting strong consensus among informants.

Conclusions: These findings demonstrate a well-established and shared ethnomedicinal knowledge system within the community. It is recommended that conservation initiatives, community-based knowledge transmission programs, and pharmacological validation studies be undertaken to safeguard and further explore these culturally significant medicinal plants.

Keywords: Ethnomedicinal plants, Maranao ethnomedicine, Muslim Ethnomedicine, Traditional healers

Background

Plants have been an indispensable source of healing and wellness which forms the foundation of traditional medicine systems across the world. Medicinal flora encompasses a wide range of plant species with therapeutic properties that has been integral in treating illnesses long before the rise of modern pharmaceuticals. Ethnobotany, the scientific study of the relationship between people and plants, explores how communities utilize local flora for various purposes, including food, rituals, and medicine (Ahmad *et al.* 2022). In many developing and rural regions, traditional plant-based healing remains the primary source of healthcare due to its accessibility, affordability, and cultural acceptance (Khan *et al.* 2023). However, as modernization and globalization advance, traditional ethnobotanical knowledge is increasingly threatened by cultural erosion and habitat loss, necessitating the systematic documentation and quantitative assessment of this valuable heritage (Rahman *et al.* 2021).

Globally, ethnobotanical studies have gained prominence as researchers recognize their potential to preserve cultural knowledge and discover novel pharmacological compounds. Studies conducted in South Asia, Africa, and Latin America have recorded thousands of medicinal plant species and their ethnomedical applications (Bibi *et al.* 2020). For instance, quantitative ethnobotanical research in India, Nepal, and Pakistan has revealed how indigenous knowledge contributes to disease treatment and biodiversity conservation (Ganie *et al.* 2021). In Africa, communities rely heavily on herbal medicine to manage infectious and chronic diseases, while studies in Latin America highlight the integration of traditional medicine with local spirituality (Adebayo *et al.* 2022). These international efforts underscore the global relevance of documenting indigenous medicinal practices as part of cultural preservation and sustainable health development.

In the Philippines, a diverse country with over 10,000 plant species, ethnobotanical research has revealed extensive traditional medicinal knowledge across its archipelagic regions (Delos Reyes *et al.* 2022). Studies among the Ifugao, Aeta, and Tagbanua communities have identified plants used to treat fever, wounds, infections, and digestive disorders (Garcia & Balangcod, 2021). Recognizing the potential of traditional medicine, the Department of Health (DOH) institutionalized ten accredited medicinal plants such as *Lagundi (Vitex negundo)*, *Sambong (Blumea balsamifera)*, and *Niyog-niyogan (Quisqualis indica)* (Department of Health, 2023). Nevertheless, most ethnobotanical studies in the Philippines have been concentrated in Luzon and the Visayas, leaving many Mindanao regions underrepresented. Moreover, many works remain qualitative, focusing on descriptive documentation rather than employing quantitative indices that measure the cultural importance and consensus of plant use (Navarro *et al.* 2024).

The southernmost island of the Philippines, Mindanao, is not only rich in biodiversity but also in cultural diversity, a home to numerous indigenous and Muslim communities. Ethnobotanical studies in Mindanao have documented the medicinal practices of groups such as the Higaonon, Subanen, and Maranao, revealing the deep interconnection between nature, spirituality, and healing (Abdurahman *et al.* 2023). However, these studies are often limited to indigenous mountain populations, with minimal attention given to lowland Muslim communities whose healing practices are informed by both Islamic beliefs and traditional local knowledge. In Lanao del Norte, where Islam is a major cultural influence, plant-based remedies remain part of community health practices, yet little quantitative research has explored the extent and diversity of their medicinal flora.

Despite the existence of ethnobotanical literature in the Philippines, there remains a lack of quantitative studies focusing on Muslim populations in Northern Mindanao. Limited attention has been given to how acculturation and religious influences affect the transmission and practice of traditional healing within Muslim communities. There is a critical need for a quantitative ethnobotanical assessment that captures both the scientific and cultural dimensions of medicinal plant knowledge among Muslim inhabitants in Baloi, Lanao del Norte.

Therefore, medicinal plants are widely used all over the world to manage diseases and for health maintenance. This has played an important role in human's health for many centuries. Traditional medicinal knowledge, especially using medicinal plants in the developing countries has been in existence and use, and has been a part of therapeutic practices. The traditional use of medicinal plants is widely accepted in the Philippines. Plant species, cultures and practices on using the medicinal plants also vary in every island. Documentation of the traditional medicinal plants utilized by the Muslim Maranao residents of Barangay Baloi, Lanao del Norte must be made.

This study aims to quantitatively document and analyze the medicinal flora used by traditional Muslim healers in Baloi, Lanao del Norte. Specifically, it seeks to (1) identify the plant species used for medicinal purposes, (2) determine their quantitative ethnobotanical indices, (3) assess the level of consensus among informants regarding their uses, and (4) map and

characterize the distribution and occurrence of medicinal plants within the study area based on the guided field walk observations. By addressing these objectives, the study hopes to contribute to the preservation of traditional knowledge, provide baseline data for future pharmacological research, and strengthen cultural appreciation for the ethnobotanical wisdom embedded in Muslim communities.

Materials and Methods

Study area

The study area is Baloi, Lanao Del Norte. Baloi is a third-class municipality in the province of Lanao del Norte, Philippines with a total population of 68, 465 according to the 2020 census. Barangay East Poblacion in Baloi, has a recorded population of 6,595. This represented a significant growth from previous years, with an annualized growth rate of about 6.97% from 2015 to 2020. The area is predominantly inhabited by Muslim Maranaos.

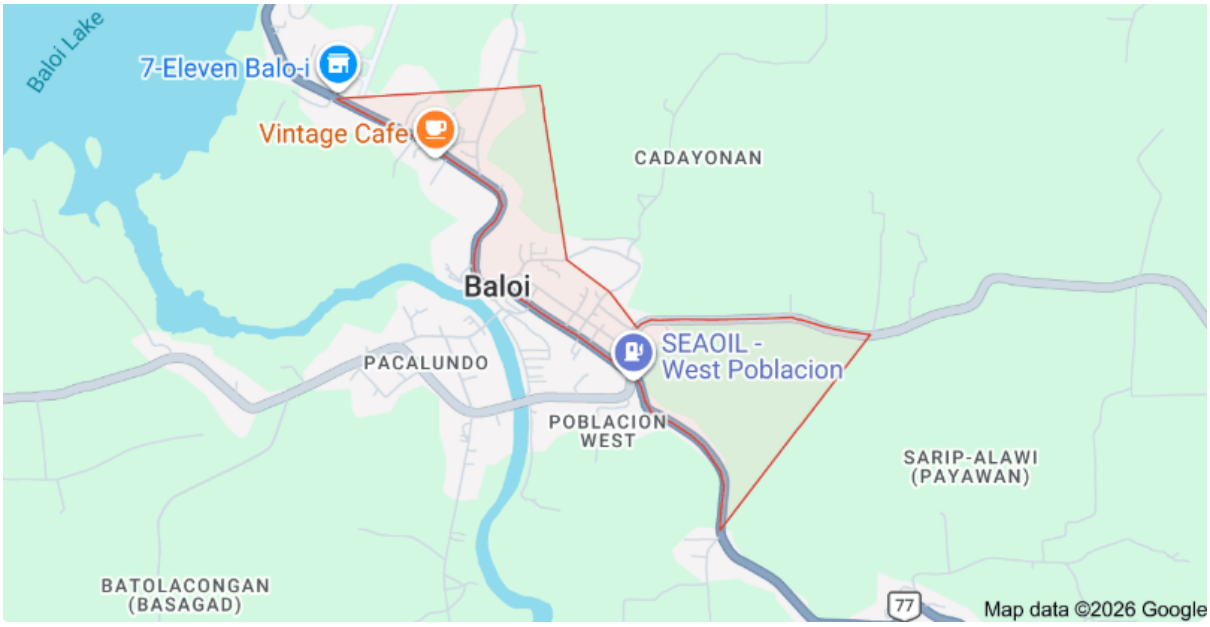

Figure 1. Map of Barangay East Poblacion in Baloi Lanao del Norte, Philippines, showing the study area

Informants Selection

The sampling method of this study involved a two-stage process. The first stage included purposive sampling for "informant-rich" participants and then the informants were asked to refer others that meet the criteria, using a snowball sampling to grow the sample. Only barangays East Poblacion, West Poblacion, Cadayonan, and Basagad were included to account for the East, West, North, and South regions of Baloi. Table 1 details the inclusion and exclusion criteria for the participants.

Table 1. Inclusion and exclusion criteria for the participants.

Category	Inclusion Criteria	Exclusion Criteria
Identity	Traditional Muslim Maranao healer with an established client base	Not considered by the community as a traditional healer and do not have an established client base
Residence	Resident of Barangay East Poblacion, West Poblacion, Cadayonan, or Basagad, Baloi	Residents outside the specified barangay
Length of Residency	>(5) years	<5 years

Data Collection

Proper protocol was followed before the conduct of the study. Permission from the municipal mayor and barangay chairmen were secured and consent forms were collected from the informants. The interview questions were translated to Maranao dialect. For this study, a Survey Questionnaire was used as the primary data collection instrument. A questionnaire by Nuneza et al. (2021), was adapted and modified to gather information about the traditional medicinal plants utilized by Muslim Maranao residents. This was expert validated, and was content and faced validity were tested.

The survey consists of multiple sections aimed at gathering both quantitative and qualitative data. The closed-ended questions are designed to assess the demographic profile, knowledge on ethnomedicinal plants along with the associated beliefs and practices, the M'ranao local name of the plant, ailment treated, plant part used, method of preparation, and method of application. while the open-ended questions allow participants to describe their personal experiences and insights.

A guided field walk was done alongside the interview schedule in order to describe the occurrence of medicinal plants and have insight on how they were sourced by the informants. Pictures were taken of the specimens and were identified by comparing them with the List of Medicinal Plants of the Philippines, referral to experts and other plant databases. Collected specimens were processed, properly labeled, and deposited in the repository of the Department of Science and Mathematics Education, Mindanao State University-Iligan Institute of Technology (MSU-IIT). Each specimen was assigned a unique voucher number for documentation and future reference.

Data Analysis

Initial identification was performed through morphological comparison using the List of Medicinal Plants of the Philippines and other authoritative botanical references. Specimens and photographic records were subsequently verified by experts in Philippines forestry and flora. In cases of discrepancy taxonomic keys and validated databases were consulted until species identity was confirmed.

Frequency counts and percentages were used to summarize the total number of medicinal plants and botanical families. Additionally, following indices were identified: Use Value and Informant Consensus Factor.

The Use Value (UV) represents the ratio of the total number of citations for a species (U) to the total number of informants (N), expressed as UV = U/N. A higher UV suggests that a plant is frequently cited, indicating its greater significance within the local community, whereas a lower UV reflects fewer reported uses.

The Informant Consensus Factor (FIC) is calculated using the formula FIC = (Nur - Nt) / (Nur - 1), where *Nur* denotes the number of use reports in a particular category and *Nt* represents the number of species used for that category by all informants. The FIC value ranges from 0 to 1, with a value of 1 signifying complete agreement among informants regarding the use of a specific species for a given ailment, and a value of 0 indicating no shared knowledge or consensus about plant use. Diseases mentioned were also categorized based on the International Classification of Diseases (ICD-10) by the World Health Organization (WHO).

Results

Socio-Demographic Profile of the Informants

The socio-demographic characteristics of the informants were determined through structured interviews conducted among Muslim Maranao inhabitants of Barangay East Poblacion, Barangay West Poblacion, Barangay Basagad, and Barangay Cadayonan, Balo-i, Lanao del Norte. A total of 25 informants participated in the study, comprising 21 females and 4 males. The predominance of female informants reflects the gendered nature of traditional medicinal knowledge within the community where women often play a central role in household health management and the preparation of herbal remedies.

In terms of barangay distribution, 4 informants were from Barangay East Poblacion, 8 informants from Barangay West Poblacion, 4 informants from Barangay Basagad, and 9 informants from Barangay Cadayonan. In terms of age distribution, the informants were categorized into three age groups: 31-45 years, 46-60 years, and 61 years and above. Of the total respondents, 7 informants belonged to the 31-45 age group, 10 informants were within the 46-60 age group, and 8 informants were 61 years old and above. The results indicate that the majority of knowledge holders were middle-aged to elderly individuals, suggesting that ethnobotanical knowledge is more concentrated among older members of the community.

With regard to educational attainment, most of the informants (21 out of 25) reported having no formal education, while 2 informants were elementary school graduates, and 2 informants had attained high school level education. The low level of formal education among the respondents underscores the oral and experiential transmission of ethnobotanical knowledge, which is traditionally passed down through generations rather than acquired through formal schooling.

Thus, the socio-demographic profile of the informants highlights the significant role of older women with limited formal education in preserving and practicing traditional medicinal knowledge in Barangay East Poblacion. This pattern reflects the strong reliance of the local Maranao community on indigenous knowledge systems for primary healthcare, particularly in areas where access to modern medical facilities may be limited.

Identification of Medicinal Plants used

The ethnomedicinal plants documented among the Meranao people represent a diverse range of botanical families, reflecting the depth and breadth of traditional healing knowledge in the community. Among the recorded species, the Asteraceae family is the most represented, including *Ageratum conyzoides*, *Blumea balsamifera*, and *Erigeron canadensis*. This dominance is consistent with global ethnobotanical trends, as Asteraceae species are widespread, grow easily in local environments, and possess well-known medicinal properties such as anti-inflammatory, antipyretic, and antimicrobial effects. The repeated appearance of these species in Meranao medicine indicates a reliance on plants that are both abundant and effective in addressing common illnesses such as fever, diarrhea, and infections. In contrast, many other plant families—such as Acoraceae, Annonaceae, Balsaminaceae, Poaceae, Euphorbiaceae, Fabaceae, Myrtaceae, Lauraceae, Sapotaceae, Verbenaceaa, and Zingiberaceae —are represented by only a single species each. Although less frequent, these unique species play important roles in treating specific ailments. For example, *Annona muricata* (Annonaceae) and *Cymbopogon citratus* (Poaceae) are used for managing diabetes and high blood pressure, and *Psidium guajava* (Myrtaceae) is used for ulcers. A detailed list of the documented ethnomedicinal plants of the Meranao people in Baloi is presented in Table 2.

The pattern suggests that while the Meranao people utilize a wide range of plant families, they depend most heavily on those that are abundant and multifunctional, such as Asteraceae. This pattern is also observed among the tribal communities of B'laan in Davao (Alinsug *et al.* 2022) and Manobo (Dapar *et al.* 2020), and the Sama tribe of the Simunul island in Tawi-tawi (Concepcion, 2023). At the same time, the presence of many single-species families highlights the community's ability to identify and preserve the use of plants with specialized therapeutic benefits (Buay *et al.* 2025).

The distribution of plant families also corresponds with the types of ailments most commonly treated, including fever, gastrointestinal discomfort, kidney disorders, metabolic conditions like diabetes, and respiratory issues. This demonstrates that Meranao ethnomedicine is both ecologically grounded—based on the availability of local flora—and culturally informed, drawing on generations of knowledge to address health conditions that are significant within the community.

The dataset in Table 3 shows species such as *Annona muricata* (UV = 1.0), *Blumea balsamifera* (UV = 0.84), *Curcuma longa* (UV =0.8), *Cymbopogon citratus* (UV = 0.68), *Cocos nucifera* (UV = 0.68), and *Euphorbia hirta* (UV = 0.76) exhibit relatively high use values. These findings suggest that these plants are widely recognized, frequently used, and culturally important within the community. This pattern aligns with multiple ethnobotanical studies in Southeast Asia, which consistently identify *Blumea balsamifera, Curcuma longa, Cocos nucifera, and Cymbopogon citratus* as highly valued medicinal species due to their accessibility, multipurpose use, and documented therapeutic properties (Khusna *et al.* 2022; Niamngon *et al.* 2024; Panjaitan, 2024). For example, previous research in the Philippines and neighboring countries notes *Blumea balsamifera* as among the most culturally significant herbal medicines, particularly for postpartum care, wound healing, and respiratory conditions (Cañet, 2025; Wang *et al.* 2023)—mirroring its observed "Moderate" remark and high citation count. Similarly, *Curcuma longa* (turmeric) is frequently cited in ethnomedicinal literature for its anti-inflammatory and antimicrobial uses, which supports its strong UV (Cruz *et al.* 2024; Tian *et al.* 2025). On the other end, numerous low-use species (UV = 0.03125-0.15625) reflect limited documentation or decreasing cultural reliance. This echoes the findings of studies that emphasize knowledge erosion, generational gaps, and reduced transmission of indigenous plant knowledge (Dean, 2024; Gallegos *et al.* 2024). Informants often cite unknown species when traditional names are remembered but scientific identifications are absent—an issue widely noted in ethnobotanical surveys in rural communities.

Table 2. List of identified ethnomedicinal plants of the Meranao informants in Baloi, Lanao del Norte.

Family	Scientific Name	Voucher number	Common English Name	Maranao Name	Ailment Used For	ICD-10 Classification
Acoraceae.	*Acorus calamus* L.	DSEM-MSU-IIT-2026-201	Sweet flag	Karumunga	Mariga (curse/ill fortune)	No ICD code - cultural illness
Annonaceae	*Annona muricata* L.	DSEM-MSU-IIT-2026-202	Guyabano / Soursop	Leaves of Guyabano	Diabetes / High blood pressure	E11 (Type 2 diabetes), I10 (Hypertension)
Asteraceae	*Ageratum conyzoides* L.	DSEM-MSU-IIT-2026-203	Billy goat weed	Mngiyak / Mingiyák	Diarrhea, Fever (babies/children)	A09 (Infectious gastroenteritis & diarrhea), R50.9 (Fever, unspecified)
Asteraceae	*Plumeria acuminata* W.T.Aiton	DSEM-MSU-IIT-2026-204	Calachuchi / Frangipani	Calachuchi	Stomach ache	R10.9 (Abdominal pain)
Asteraceae	*Blumea balsamifera* (L.) DC.	DSEM-MSU-IIT-2026-205	Sambong	Salimbawangan/ Tangila Lupa	Stomach ache, kidney stones, diuretic	R10.9, N20.0 N28.9 (Kidney disorder, unspecified)
Asteraceae	*Dracaena trifasciata (*Prain*)* Mabb.	DSEM-MSU-IIT-2026-206	Snake plant	Snake plant	General cleansing / spiritual illness	No ICD code (traditional healing)
Balsaminaceae	*Impatiens balsamina* L	DSEM-MSU-IIT-2026-207	Kamantigue	Suangga	Inflammation / Wound healing	R52, S31-S81
Caricaceae	*Carica papaya* L.	DSEM-MSU-IIT-2026-208	Papaya	Raon a Papaya	Antibiotic / Fever, Cough	R50.9, R05 (Cough)
Caricaceae	*Cocos nucifera* L.	DSEM-MSU-IIT-2026-209	Coconut	Kaniyinyog	Kidney stone / Gallstone	N20.0(Kidney stone), K80.2 (Gallstone)
Caricaceae	*Costus igneus* N.E.Br.	DSEM-MSU-IIT-2026-210	Insulin plant	Insulin Plant	Diabetes	E11
Poaceae	*Cymbopogon citratus* (DC.) Stapf	DSEM-MSU-IIT-2026-211	Lemongrass	Bawing	Diabetes / High blood pressure	E11, I10
Euphorbiaceae	*Euphorbia hirta* L.	DSEM-MSU-IIT-2026-212	Asthma plant / Tawa-tawa	Talawatawa	Fever / Bisa (“poison”)	R50, T63 (Toxic effects of venom)
Fabaceae	*Desmodium triflorum* (L.) DC.	DSEM-MSU-IIT-2026-213	Threeflower ticktrefoil	Tambda / Tambda	Heart disease	I51.9 (Heart disease, unspecified)
Lamiaceae	*Vitex arvensis L.*	DSEM-MSU-IIT-2026-214	Lagundi	Lagundi	Fever / Cough	R50, R05
Lamiaceae	*Coleus aromaticus* Benth	DSEM-MSU-IIT-2026-215	Oregano / Indian borage	Kapal	Fever / Cough	R50, R05

Lauraceae	*Cinnamomum tamala* (Buch.-Ham.) T.Ness & Eberm.	DSEM-MSU-IIT-2026-216	Laurel (Philippine bay leaf)	Kmi	Myoma	D25 (Leiomyoma of uterus)
Malvaceae	*Centella asiatica* (L.) Urb.	DSEM-MSU-IIT-2026-217	Gotu-Kola	goto-cola	Wound healing	S31-S81 (Open wounds)
Malvaceae	*Hibiscus rosa-sinensis* (L.)	DSEM-MSU-IIT-2026-218	Gumamela	Gumamela	Inflammation / Wound healing	R52, S31-S81
Myrtaceae	*Psidium guajava* (L.)	DSEM-MSU-IIT-2026-219	Guava	Leaves of Guava	Ulcer	K25-K27
Poaceae	*Eleucine indica* (L.) Gaertn.	DSEM-MSU-IIT-2026-220	Paragis	Rambiyawa	“Gopn minbawata” - postpartum strengthening	Z39.2 (Maternal postpartum care)
Sapotaceae	*Synsepalum dulcificum* (Schumach. & Thonn.) Daniell	DSEM-MSU-IIT-2026-221	Miracle fruit	“Miracle fruit”	Diabetes	E11
Verbenaceae	*Lantana camara* L.	DSEM-MSU-IIT-2026-222	Wild sage	Kabrek-brek	Fever (babies/children)	R50.9
Zingiberaceae	*Curcuma longa* L.	DSEM-MSU-IIT-2026-223	Turmeric	Kalawag	Fever / Heart Diabetes, High blood pressure, Ulcer	E11, I10, K25-K27 (Peptic ulcer) R50, I51

Table 3. Citation and Use Value of the ethnomedicinal plants of Meranao in Baloi, Lanao del Norte

Name	**Citations**	**Use Value**	**Lvl**	**Name**	**Citations**	**Use Value**	**Lvl**
Acorus calamus	1	0.04	Low	*Desmodium triflorum*	8	0.32	Low
Annona muricata	25	1.00	High	*Vitex arvensis*	12	0.48	Low
Ageratum conyzoides	12	0.48	Low	*Coleus aromaticus*	4	0.16	Low
Plumeria acuminata	7	0.28	Low	*Cinnamomum tamala*	1	0.04	Low
Blumea balsamifera	21	0.84	Moderate	*Centella asiatica*	8	0.32	Low
Sansevieria trifasciata	1	0.04	Low	*Hibiscus rosa-sinensis*	2	0.08	Low
Impatiens balsamina L	1	0.04	Low	*Psidium guajava*	12	0.48	Low
Carica papaya	12	0.48	Low	*Eleucine indica*	8	0.32	Low
Cocos nucifera	17	0.68	Moderate	*Synsepalum dulcificum*	1	0.04	Low
Costus igneus	5	0.20	Low	*Lantana camara L.*	5	0.20	Low
Cymbopogon citratus	17	0.68	Moderate	*Curcuma longa*	20	0.80	Moderate
Euphorbia hirta	19	0.76	Moderate				

UV Value	Interpretation
0	- The plant is not used or is unknown to informants.
Low (0.01-0.49)	- The plant has few reported uses; it is of minor cultural or medicinal importance.
Moderate (0.5-0.99)	- The plant has several reported uses; it is of moderate importance in the community.
High (≥1.0)	- The plant is widely used and considered highly important or versatile.

Table 3 reflects ethnobotanical usage patterns that are strongly supported by regional literature: high UV values concentrate around widely accessible, culturally embedded medicinal plants, while lower values highlight species with specialized or diminishing traditional roles. This distribution underscores the continued importance of documenting traditional knowledge, particularly for lesser-known species at risk of being forgotten.

Table 4, the Informant Consensus Factor (FIC) results show **g**enerally high to complete agreement among Meranao informants regarding the use of medicinal plants for various health conditions. Most ailments—such as fever, abdominal pain, diabetes, hypertension, gastric ulcer, cough, kidney stones, and gallbladder stones—record FIC values ranging from 0.91 to 1.00, indicating that informants consistently rely on a small set of highly trusted plant species for these conditions. This pattern reflects a strong, shared ethnomedicinal knowledge system within the community.

Ailments with complete agreement (FIC = 1.00), including infections, urinary disorders, kidney and gallbladder calculi, pain, and heart disease, suggest that these conditions are commonly experienced and have well-established traditional remedies. High uniformity in plant selection is typical when certain species have been culturally validated over time—an observation consistent with ethnobotanical studies across the Philippines; particularly in Panay, Ifugago, and across Mindanao (Andalan *et al.* 2024; Cordero *et al.* 2022; Meñiza *et al.* 2024). The only category showing no agreement (Z39.2, FIC = 0.00) relates to postpartum care. This low consensus may indicate that postpartum practices are more individualized, influenced by family traditions or religious customs, a trend noted in other Muslim communities in Mindanao and in Malay ethnomedicine where reproductive care varies widely (Jahan & Islam, 2024; Mohamad *et al.* 2022; Siregar *et al.* 2021).

Table 4. Informant Consensus Factor (FIC) of the ethnomedicinal plants of Meranao in Baloi, Lanao del Norte

Identified ICD-10 diseases	Nur	Nt	FIC values	Interpretation
R50.9 - Fever,	25	3	0.916667	High agreement
A09 - Infectious gastroenteritis and colitis, unspecified	5	1	1	Complete agreement
R10.9 - Abdominal pain,	28	2	0.962963	High agreement
E11 - Type 2 diabetes mellitus	68	5	0.940299	High agreement
I10 - Essential (primary) hypertension	62	3	0.967213	High agreement
K25-K27 - Gastric, duodenal, and peptic ulcer	32	2	0.967742	High agreement
N20.0 - Calculus of kidney	17	1	1	Complete agreement
K80.2 - Calculus of gallbladder without cholecystitis	17	1	1	Complete agreement
N28.9 - Disorder of kidney and ureter	24	1	1	Complete agreement
Z39.2 - Encounter for care and examination of mother immediately after delivery	1	1	0	No agreement
I51.9 - Heart disease,	8	1	1	Complete agreement
R50 - Fever	32	3	0.935484	High agreement
T63 - Toxic effect of contact with venomous animals	19	1	1	Complete agreement
R05 - Cough	12	1	1	Complete agreement
D25 - Leiomyoma of uterus	4	1	1	Complete agreement
S31-S81 - Injuries to various body regions	10	2	0.888889	High agreement
R52 - Pain	2	1	1	Complete agreement

Furthermore, it is important to note that these plants are actually present and cultivated in their backyards and home gardens, as observed through the guided field walk that was done. The observance of these plants are noted in Figure 2, below.

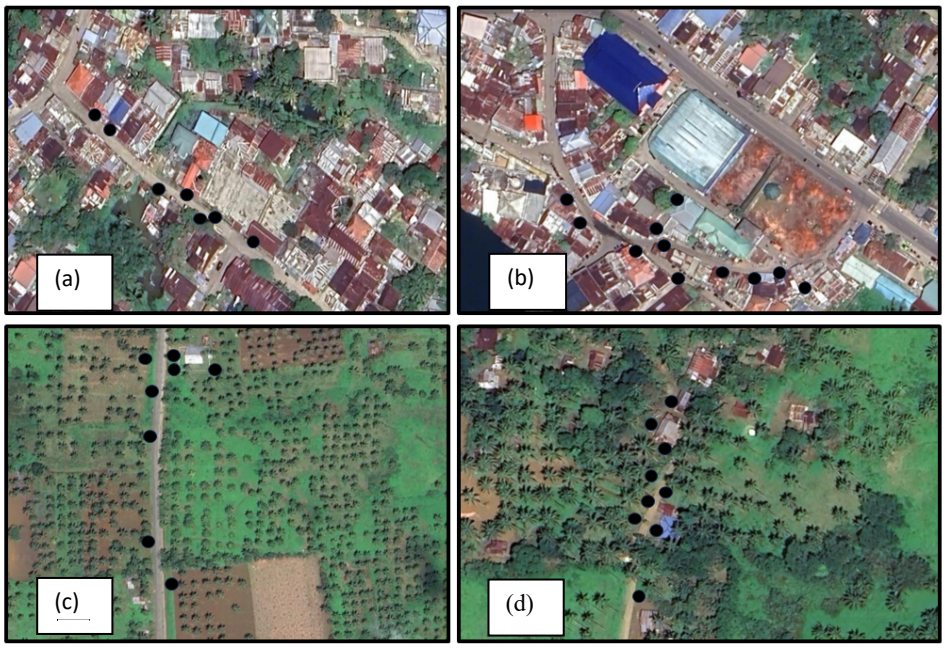

Figure 2. Guided field walk illustrating the spatial distribution of observed ethnomedicinal plants, marked by black dots. (a)East Poblacion; (b) West Poblacion; (c) Basagad; (d) Cadayonan

From an ecological perspective, this pattern aligns with the principles of resource availability and optimal foraging, wherein communities preferentially utilize plant species that are easily accessible, abundant, and require minimal energy to obtain (Awoke *et al.* 2025; Palchetti *et al.* 2023). Home gardens and roadside environments function as anthropogenic ecosystems that support a high diversity of ruderal and semi-domesticated plant species, many of which possess medicinal value (Ahoyo *et al.* 2023; González-Ball *et al.* 2022).

Similar patterns have been reported in ethnobotanical studies across the Philippines and Southeast Asia, where backyard gardens act as reservoirs of medicinal biodiversity and as primary sources of household healthcare (Buay *et al.* 2025; Meñiza *et al.* 2024). Ecologically, the prominence of roadside and garden species, which often are fast-growing, disturbance-tolerant taxa, demonstrates how human-modified habitats can enhance medicinal plant persistence through niche adaptation and ecological resilience. Culturally, this spatial distribution facilitates intergenerational knowledge transmission, as daily exposure to medicinal plants reinforces learning and practice within family settings. The localization of ethnomedicinal plants within domestic and semi-managed environments highlights the integration of ecological processes, cultural preference, and practical healthcare needs in shaping Meranao ethnomedicine.

Discussion

The present study documents a rich and actively practiced ethnomedicinal system among Muslim Maranao traditional healers in Baloi, Lanao del Norte. The identification of 28 medicinal plant species across 18 botanical families demonstrates that plant-based healing remains an essential component of primary healthcare within the community (Yessoufou *et al.* 2022; Tahir *et al.* 2023). The concentration of knowledge among older female informants highlights the gendered and intergenerational nature of ethnomedicinal knowledge transmission. This pattern mirrors findings from other Philippine and Southeast Asian ethnobotanical studies where women serve as key custodians of household health practices and traditional healing knowledge, reinforcing their critical role in sustaining ethnomedicinal traditions and community resource management (Yebirzaf *et al.* 2019; Ofosu-Bamfo *et al.* 2023).

The predominance of the Asteraceae family among the recorded species aligns with global ethnobotanical trends. Members of this family are widely distributed, ecologically adaptable, and known to contain diverse bioactive compounds with anti-inflammatory, antimicrobial, and antipyretic properties (Mukasa *et al.* 2023; Lombard *et al.* 2013). Species such as *Blumea balsamifera* and *Ageratum conyzoides*, frequently cited by informants, are also reported in other Southeast Asian ethnomedicinal surveys, reinforcing their recognized therapeutic value (Afrianto *et al.* 2021; Santos *et al.* 2022). The high Use Values recorded for *Annona muricata*, *Blumea balsamifera*, *Curcuma longa*, *Cymbopogon citratus*, and *Euphorbia hirta* indicate their strong cultural importance and repeated application across multiple health conditions. High Use Values typically characterize plants that are accessible, versatile, and trusted through generations of empirical validation, highlighting the importance of resource availability in shaping medicinal plant use in rural communities (Vrca, 2025; Aslam *et al.* 2017).

Leaves were identified as the most commonly utilized plant part, and decoction was the dominant preparation method. The preference for leaves may reflect ecological sustainability—since leaf harvesting is generally non-destructive—as well as the higher concentration of secondary metabolites often present in foliage (Ryan *et al.* 2024). Decoction, which involves boiling plant material in water, is a practical and culturally familiar technique that enhances the extraction of water-soluble bioactive compounds (Tan-Lim, 2024). These preparation practices illustrate how traditional healthcare systems balance effectiveness, safety, and resource availability while promoting the continued maintenance of medicinal plant diversity in home gardens and cultivated areas (Marpaung *et al.* 2024; Ofosu-Bamfo *et al.* 2023).

The Informant Consensus Factor values revealed high to complete agreement among healers for many common ailments, including fever, diabetes, hypertension, gastrointestinal disorders, and kidney-related conditions. High FIC values indicate a well-established and culturally validated knowledge system in which specific plants are consistently associated with particular illnesses (Antofie *et al.* 2023; Yebirzaf *et al.* 2019). Such strong agreement enhances the ethnopharmacological relevance of these species, as repeated and consistent use across informants often correlates with genuine therapeutic potential (Mukasa *et al.* 2023). In contrast, the low consensus observed in postpartum care may reflect individualized healing practices shaped by family traditions, spiritual beliefs, or religious customs rather than standardized plant-based treatments, illustrating the complexity of culturally embedded healthcare systems (Tontisirin *et al.* 2002; Lombard *et al.* 2013).

The ailments treated also provide insight into local health priorities. The prominence of remedies for metabolic diseases such as diabetes and hypertension may indicate increasing awareness of chronic lifestyle-related conditions within the community, reflecting shifts in public health concerns. Similarly, the frequent treatment of fever, cough, wounds, and digestive problems reflects the continued burden of infectious and inflammatory diseases in rural settings. These patterns suggest that medicinal plant selection is influenced by both epidemiological realities and long-standing cultural practices (Santos *et al.* 2022; Siswati *et al.* 2025).

Ecological observations from guided field walks revealed that many medicinal plants are cultivated or naturally occurring in home gardens and nearby environments. This supports the principle that resource availability strongly influences ethnobotanical use patterns and aligns with findings that highlight the vital role of home gardens as repositories of biodiversity and traditional knowledge (Yessoufou *et al.* 2022; Cattivelli, 2020). Backyard and roadside plants are more readily incorporated into traditional medicine due to their accessibility and minimal harvesting effort, facilitating intergenerational learning as younger family members observe plant use in everyday household contexts (Ofosu-Bamfo *et al.* 2023; Zeiner *et al.* 2024).

Despite the vitality of this knowledge system, the study highlights potential risks of cultural erosion. The concentration of ethnomedicinal knowledge among older individuals with limited formal education suggests that knowledge transmission is primarily oral and experiential (Afrianto *et al.* 2021; Castiñeiras *et al.* 2007). Modernization, lifestyle changes, and reduced reliance on traditional healing may disrupt this transmission process. Without systematic documentation and community-based preservation initiatives, valuable ethnobotanical knowledge may gradually decline (Santos *et al.* 2022; Mukasa *et al.* 2023).

This study contributes significantly to Philippine ethnobotanical literature by providing one of the few quantitative assessments of medicinal plant use among Muslim Maranao communities in Mindanao (Tahir *et al.* 2023). The integration of Use Value and Informant Consensus Factor analyses strengthens the scientific relevance of the findings and identifies culturally important species that may warrant further phytochemical and pharmacological investigation. Plants with high UV and FIC values represent promising candidates for future research into bioactive compounds and potential therapeutic applications (Aslam *et al.* 2017).

Several limitations should be acknowledged. The study involved a relatively small number of informants and was limited to selected barangays within Baloi, which may not fully represent the diversity of Maranao ethnomedicinal knowledge across the region (Ryan *et al.* 2024). Additionally, plant identification relied on field observations and available references, and laboratory verification of species and bioactive constituents was beyond the study's scope (Antofie *et al.* 2023). Future research could expand sampling areas, incorporate molecular plant identification, and conduct pharmacological validation of highly cited species (Afrianto *et al.* 2021; Mukasa *et al.* 2023).

Overall, the findings underscore the continued importance of traditional medicinal plants in community healthcare and highlight the urgent need for conservation, documentation, and scientific validation efforts. Preserving this ethnobotanical heritage not only safeguards cultural identity but also offers valuable leads for sustainable healthcare and drug discovery (Santos *et al.* 2022; Zeiner *et al.* 2024).

Conclusion

This quantitative ethnobotanical study highlights the rich and well-preserved traditional medicinal knowledge of the Muslim Maranao community in Baloi, Lanao del Norte. The documentation of diverse medicinal plant species, their uses, and associated quantitative indices confirms that ethnomedicine remains a vital component of local healthcare. High Use Values and strong Informant Consensus Factors for commonly treated ailments indicate a shared, culturally validated body of knowledge that has been sustained through generations, primarily among older women. The prevalence of backyard- and roadside-grown medicinal plants further reflects the integration of ecological availability and cultural practice in community health management.

Given the increasing risk of knowledge erosion due to modernization, it is recommended that systematic documentation of ethnomedicinal practices be continued across other Muslim and underrepresented communities in Mindanao. Educational initiatives involving younger generations, conservation of medicinal plant species through home gardens, and collaborative pharmacological studies are strongly encouraged to ensure the preservation, sustainable use, and scientific validation of this valuable ethnobotanical heritage.

Declarations

List of abbreviations: UV - Use Value; FIC - Informant Consensus Factor; ICD-10 - International Classification of Diseases 10th Revision; DOH - Department of Health; WHO - World Health Organization.

Ethics approval and consent to participate: The conduct of this study followed ethical and legal guidelines for research involving traditional knowledge and human participants. Permission to conduct the research was obtained from the Local Government Unit of Baloi, Lanao del Norte, and from the respective barangay officials of East Poblacion, West Poblacion, Cadayonan, and Basagad. All informants were informed of the objectives of the study, and participation was voluntary. Free Prior Informed Consent (FPIC) was obtained from each traditional healer before interviews and guided field walks were conducted. The study ensured respect for cultural practices, confidentiality of personal information, and recognition of indigenous knowledge holders.

Consent for publication: Not applicable

Availability of data and materials: All relevant data generated or analyzed during this study are included in this published article. Additional details may be made available from the corresponding author upon reasonable request, subject to ethical considerations concerning traditional knowledge.

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Author contributions: D.K.P.G. conducted the fieldwork, collected and analyzed the data, and prepared the initial manuscript. V. A. M. contributed to study conceptualization, methodology design, data interpretation, and manuscript revision. A. M. , J.A. C., and S.A.A. assisted in data collection and validation. O.A.A supported plant identification and botanical verification. M.A.S. supervised the study, contributed to data analysis, and finalized the manuscript. All authors read and approved the final version of the manuscript.

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