RESEARCH ARTICLE

Ethnomedicinal plants by the Subanen of Barangay Lake Duminagat, Mindanao Island, Philippines

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ABSTRACT

Background: In this modern age of technological advancements, traditional herbal medicine still takes an integral part in an array of medical and scientific studies that deal with drug discoveries and drug development. In the Philippines, ethnomedicinal studies involving different cultural communities have already been conducted. However, these studies focused mostly on well-known tribes whereas knowledge of the many less-known indigenous groups is still untapped. The Subanen is one of this group who resides in Barangay Lake Duminagat situated on Mindanao Island. The Subanen is considered as one of the most prominent of the Lumad or non-Muslim indigenous cultural communities. Prior studies about the medicinal ethnobotany of the Subanen were already recorded but most of these were from Ozamis City, Zamboanga del Norte, and Zamboanga del Sur. Traditional knowledge from this tribe was passed on from generation to generation through oral communication but the lack of proper documentation poses a threat to this valuable information.

Objective: This study was conducted to document the herbal remedies used by the Subanen and identify the plants according to their common name, scientific name, family, habit of growth, plant parts used, modes of preparation, mode of application, and ailments treated.

Methodology: Ethnomedicinal information was gathered from 35 respondents through key informant interviews and focused group discussions conducted in Barangay Lake Duminagat, Mt. Malindang, Philippines.

Results: Thirty-two plants distributed to 21 families were documented as medicinal plants used by the Subanen respondents to treat various ailments in their community. Asteraceae was the most represented followed by Lamiaceae with seven and three species each, respectively. As to the plant habit, out of the 32 species, 20 plant species are herbs, thus, constituting the highest portion, followed by four tree species, four species of shrub, three species of grass, and one fern species. Leaves were the most frequently utilized (60.7%), followed by roots (19.6%), and whole plant (10.7%). Plants prepared as herbal medicines are utilized in different ways such as decoction, infusion, poultice, heated, chewed, or as extract but the highest mentioned was decoction. As to the mode of utilization, orally administered decoction (27.3%) through drinking ranked the highest. For the Relative Frequency of Citation (RFC), the highest was calculated for *Pletcranthus sculletarioides* (1.49), followed by *Psidium guajava* (0.83), and *Kalanchoe pinnata* (0.80). Lastly, for the Use Value (UV), the result varied from 0.03 to 0.25 with an average UV value of 0.06. The highest UV was calculated for *Pletcranthus sculletarioides* (UV=0.23).

Conclusion: Compared to previously conducted studies between the years 2014 to 2019, fewer ethnomedicinal plants were recorded in this particular area. This might imply that the ethnomedicinal knowledge of this specific Subanen community is slowly eroding.

Keywords: *ethnomedicinal, healthcare, herbal, traditional knowledge*

Introduction

Ethnomedicinal plants serve as an important element in various indigenous health systems in different parts of the world [1] and have been extensively used to treat various human ailments since ancient times [2]. At present, these medicinal plants still serve as immediate options to provide relief to simple to complex health issues among various communities due to their availability and accessibility. The role of ethnomedicinal studies has become vital to the discovery of new drugs. Due to the revival of this traditional knowledge on customary health practices, the interest of the scientific community towards ethnomedicine has increased [3]. Many of today's drugs have been derived from plant resources and serve as primary materials for the manufacture of synthetic drugs due to their promising bioactive components [4-7]. Moreover, recent research on herbal plants showed great developments in terms of pharmacological evaluation [8].

The long history of plants being utilized for various purposes can be traced back to prehistoric human societies. Over the years, indigenous knowledge was built from using plants with healing characteristics and enable early civilizations to utilize natural resources as remedies [9]. These medicinal plants are considered part of the oldest sciences in countries such as China, Greece, Egypt, and India [10]. This wealth of knowledge across cultures worldwide is facing the threat of getting forgotten by future generations in the years to come. The lack of written documentation poses a threat to this valuable ethnobotanical information of indigenous communities which has been passed on from one generation to the next in a form of oral communication [11,12].

In the Philippines, there are about 170 ethnolinguistic groups and 110 indigenous groups that make up 14–17 million of the total population. Majority of these groups can be found in Mindanao with 61% while the remaining 33% and 6% are located in Luzon and few areas of the Visayas, respectively [13-15]. Since ancient times, these people practice herbal medicine as a magical or religious healing art [16]. Through the years, they are able to uphold their traditions as reflected in their music, dances, rituals, folklore, wood carving, agriculture, and forestry practices [14]. These cultural communities have their own set of medicinal plants used in their traditional ways and practices of healing the sick. A study reported that the Ayta communities of Dinalupihan in Bataan utilize a total of 118 plant species as herbal medicines in which plants from Fabaceae and Poaceae showed the highest species representation [17]. The study conducted in Barangay San Jose, Sta. Cruz, Davao del Sur has documented 47 medicinal plants used by the Tagabawa tribe wherein a high usage of tree species in the area was observed [18]. The Maranaos in Pualas, Lanao del Sur utilize 68 medicinal plants to treat a variety of health problems from simple wounds to serious diseases such as cancer [19].

Meanwhile, the Subanen tribe, residing on the mountainous part of Zamboanga del Sur and Misamis Occidental, is considered one of the most prominent of the Lumads or non-Muslim indigenous cultural communities in Mindanao[20]. The most recent study on the ethnomedicinal knowledge of Subanen conducted in two villages occupied by the Subanen tribe in Ozamis City, Philippines documented a total of 113 plant species gathered from 83 respondents [20]. Another study documented 89 medicinal plants gathered from seven selected healers in Lapuyan, Zamboanga del Sur [21]. On the other hand, a study listed 75 medicinal plants from the five barangays inhabited by the Subanen tribe in Sindangan, Zamboanga del Sur [22]. In a study by Morilla et al. in three barangays situated in Dumingag, Zambonga del Sur, 60 medicinal plants obtained from nine respondents were recorded [16].

Although previous studies on the medicinal plants used by the Subanen tribe were already conducted across different Subanen-inhabited areas in Mindanao, most of these studies are focused on the Subanen residing in Ozamis City, Zamboanga del Norte, and Zamboanga del Sur. Furthermore, published materials documenting the medicinal plants and traditional medicine of the Subanen tribe across different areas within Misamis Occidental are still few. This ethnomedicinal study on the Subanen tribe of Barangay Lake Duminagat, Mt. Malindang will serve as baseline information. Hence, this study aimed to document the local names of the medicinal plants used by the Subanen and identify the plants according to common name and scientific name, record the plant habit and plant parts utilized as medicine, and document the ailments treated, mode of application, and different modes of herbal preparations by the Subanen tribe of Barangay Lake Duminagat, Mt. Malindang, Philippines.

Methodology

Site of the Study

As shown in Figure 1, the study was conducted at Barangay Lake Duminagat, Don Victoriano which is located within the Malindang mountain range in Mindanao, a protected area, straddling the provinces of Misamis Occidental, Zamboanga del Norte, and Zamboanga del Sur.

According to the Mt. Malindang profile, Barangay Lake Duminagat is a crater valley with a plain area of 0.478 square kilometers (sq. km) or 47.8 hectares (ha), the home of the Subanen people. Barangay Lake Duminagat lies within the coordinates 08°17'54.1" N to 8°18'20.1''N and 123°37'0.6''E to 123°36'51.3''E with an elevation that ranges from 1451 to 1590 meters above sea level. Information on the ethnobotanical knowledge and medicinal plant utilization of the Subanen was gathered and documented from 35 individuals following the key informant interviews and focused group discussions.

The Subanen of Barangay Lake Duminagat

The Subanen is a non-Muslim indigenous community that originates from the island of Mindanao, particularly within Zamboanga Peninsula, and is said to be among the first land dwellers of this region [23]. This ethnic group is spread across the provinces of Zamboanga del Sur, Zamboanga Sibugay, and even up to the mountainous portions of Misamis Occidental [24]. The name "Subanen" comes from the Bisayan language "suba" which means "river dweller" [25]. This tribe contributed a rich cultural past to Mindanao's own history throughout time. Traditionally, the Subanen people call the medicinal plants and herbs "bulung" which they believe are like humans. Plants have spirits that must be respected and valued [21]. They believe that knowledge on the use of plants as medicines is bestowed through a dream and its effect depends on the plant's characteristics which they relate to the disease [26].

As reported, the Subanen may be scattered into five groups based on differences in terms of language and traditions [25]. The five groups include the Sindangan Subanon (residing in Sindangan), Western Subanon (located in Siocon-Sibuco-Gutalac), Eastern Subanon (found in Sibuguey/Sibugay Bay),

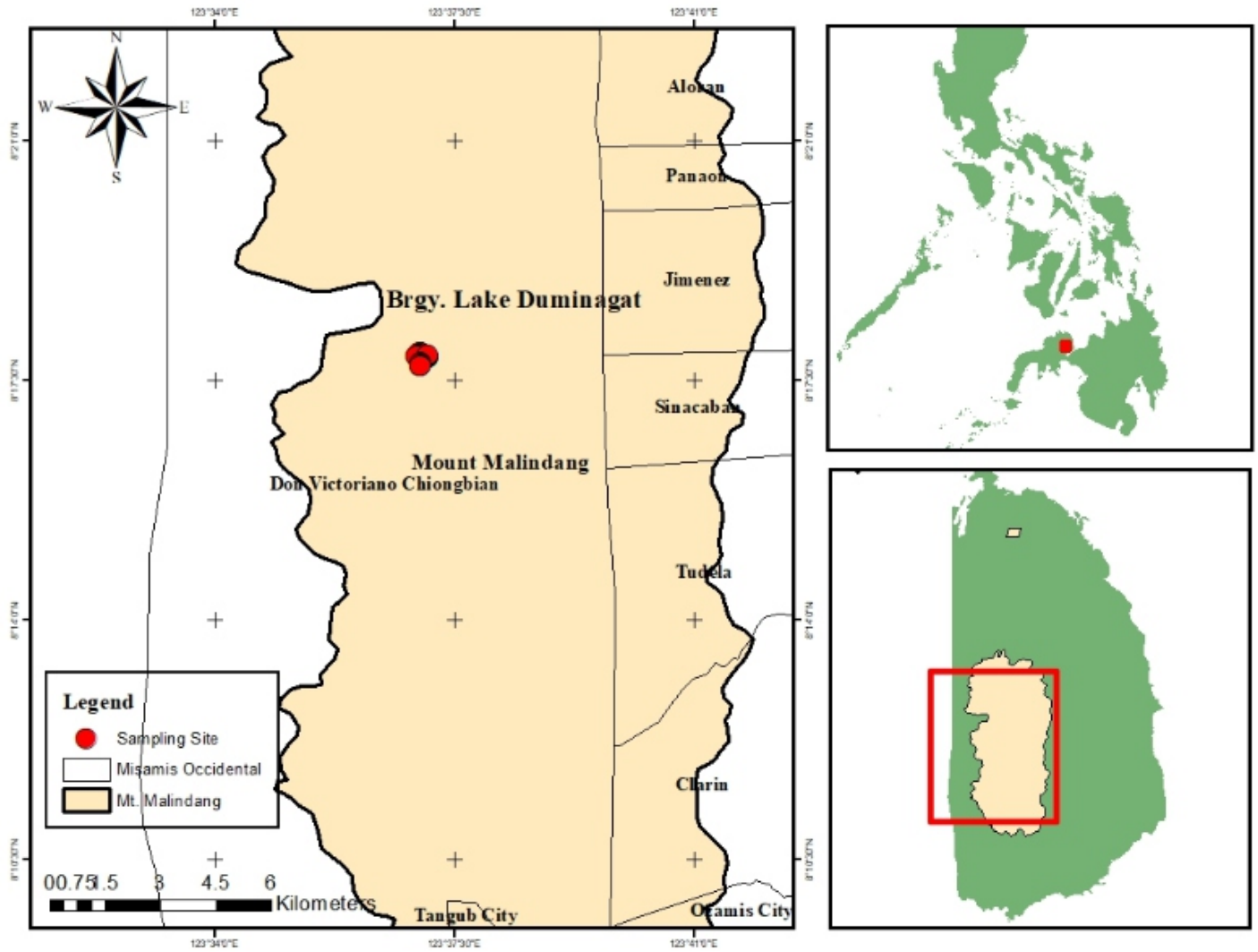

Figure 1. *Map of Barangay Lake Duminagat, Don Victoriano, Mt. Malindang, Misamis Occidental, Philippines (Map Created on ArcGIS)*

Southern Subanon (settled in Lapuyan), and Salugnon Subanon (residing in Malindang area). This means that the Subanen that settled in Barangay Lake Duminagat is categorized as the Salugnon Subanon.

The Subanen living in Barangay Lake Duminagat has a smaller population as compared to other Subanen found in other areas. According to a study conducted by Cali *et al.*, there are 58 households of Subanen living in the area with a total population of 391 [27]. However, the number of households decreased to 51 and the total population reduced from 391 to 264 as recorded in the 2010 census conducted by the National Statistics Office (NSO) [28]. The latest census conducted by the Philippine Statistics Authority in 2015 recorded a total population of 231 [29]. This indicates that the number of households, as well as the population of the Subanen, continues to decrease throughout time. In terms of source of living, most of the Subanen people are engaged in farming and most of their products are sold in the lowland area of Mansawan.

Free, Prior, and Informed Consent (FPIC)

A prior informed consent was secured by adhering to the guidelines of the National Commission on Indigenous Peoples (NCIP) on Free, Prior, and Informed Consent (FPIC). The procedures were drafted to help promote and protect the rights of the indigenous peoples as stipulated in the implementing rules and regulations of the Republic Act No. 8371 or the IPRA Law (Indigenous Peoples' Right Act). The permit was issued by the Subanen Indigenous Political Structure (IPS) with the assistance of the FPIC team from the NCIP.

A series of activities and meetings were conducted before the project was allowed to carry out the survey and the collection of plant samples in the study area. First, the research team submitted the project proposal to NCIP Region 10 who has jurisdiction over the proposed study area. Detailed information on the sampling procedures, scope and extent of the study, costs and benefits of the project, and perceived disadvantages of the project to the community were included in the proposal. After the review of the submitted proposal, the NCIP Regional Director identified the Field-Based Investigation (FBI) or the FPIC Team which is mainly composed of the Provincial Officer as the team leader and its corresponding members. The FBI team was tasked to perform the field-based investigation, notify and invite the Subanen leaders to participate in the Pre-FPIC Conference, facilitate the finalization of the Work and Financial Plan (WFP), assist in the conduct of the signing of the Memorandum of Agreement (MOA), and other activities related to the FPIC process. After the FPIC team was identified, the Pre-FPIC Conference organized by the FPIC team was held with the main purpose of presenting the proposed study and finalizing the work and financial plan. The Pre-FPIC was attended by the FPIC Team, proponent, and tribal leaders. On separate dates after the Pre-FPIC conference, the conduct of the ritual was done and facilitated by the Subanen followed by the signing of the Memorandum of Agreement (MOA). All the conditions agreed during the Pre-FPIC conference were included in the draft Memorandum of Agreement prepared and finalized by the FPIC Team.

Gratuitous Permit

A Wildlife Gratuitous Permit was secured from the Department of Environment and Natural Resources (DENR) Region 10 Office. The permit was required as compliance with Republic Act No. 9147 (Wildlife Resources Conservation and Protection) and Republic Act No. 9304 (Malindang Range Natural Park Act of 2004) pursuant to Republic Act No. 7586 (National Integrated Protected Areas System of 1992). Since the study area of the project was located in a protected area, a series of undertakings spearheaded by the Protected Area Management Board (PAMB) Executive Committee was attended by the research team before the permit was obtained. The initial step was the submission of the proposal to PAMB-DENR wherein information on the sampling procedures as well as the sampling duration was emphasized. After the review of the proposal, the PAMB-DENR Sub-Committee for Research called for a Sub-Committee Meeting where the research team presented in detail the overall aspect of the research. As a result of the meeting, the PAMB-Sub Committee for Research endorsed the project for approval by the PAMB Executive Committee Board. The final step was the conduct of the PAMB Executive Committee Meeting where the project was given permission (Gratuitous Permit no. R10 2020-14) to begin in the area.

Ethnobotanical Survey (Interview) and Field Sampling

A semi-structured questionnaire translated into Cebuano dialect was used to gather information from the respondents. Although the key informants speak the Subanen language, they can understand well the Cebuano dialect, thus, there was no need to translate the questionnaire to the Subanen dialect. To minimize the element of pressure and encourage spontaneous answers from the respondents, the interviews were delivered as informal conversations. Demographic information such as age, gender, and ethnobotanical knowledge was gathered. Data such as the medicinal plants

used by the Subanen, the plant parts used, the mode of local preparation, the mode of utilization, medicinal uses, and ailments treated were also recorded. Before starting the interview, the research team introduced themselves properly and explained the purpose of the said activity. The purpose of this study was explained well by the research team to the Subanen community at Barangay Lake Duminagat, Mt. Malindang during their initial meeting as one of the requirements for the processing of the FPIC and Gratuitous permit. The research team openly answered questions and clarifications by the respondents regarding the benefits and advantages of documenting their ethnomedicinal knowledge and folkloric uses of their medicinal plants. Respondents were asked to participate voluntarily. Any respondent who declined to be interviewed was not forced by the research team to join in any discussion. The respondents were free to disclose only the information they want to share with the team. As part of this study, the results would have been presented to the community during a validation meeting but due to the COVID-19 pandemic, the validation meeting was postponed.

Identification and Preservation of Plant Specimens

The plant species were identified using the books entitled: "A Pictorial Cyclopedia of Philippine Ornamental Plants Second Edition" [30] and "A Dictionary of Philippine Plant Names Volume I" [31]. Legitimate internet sources were also used such as www.philippineplants.org / Co's Digital Flora [32], www.phytoimages.siu.edu [33], and www.stuartxchange.com [34]. On authenticating plant species, the method of Umair [35] was followed using the international plant name index (http://www.ipni.org) [36] whereas the names of families follow the A.P.G. system [37]. Moreover, Dr. William Gruezo (former professor at the University of the Philippines Los Baños), an expert on plant taxonomy and Prof. Jaime Guihawan, a botany professor at the Mindanao State University-Iligan Institute of Technology, were consulted to identify the medicinal plants reported by the Subanen of Barangay Lake Duminagat, Mt. Malindang. Samples, photographs, and other necessary information such as the "Subanen names" of the medicinal plants were submitted to both consultants for the identification process. Any initial identification done by the research team was also referred to Dr. Gruezo and Prof. Guihawan for validation. The collection of the medicinal plants for herbarium specimen was done after all the respondents were interviewed. The reported medicinal plants by the respondents were found within the vicinity of the community within close proximity to the Subanen houses. Some respondents assisted the research team by providing the location of the medicinal plants. The samples gathered were treated with denatured alcohol to eliminate the possibility of fungal growth on the specimen and then placed securely in between newspapers and pressed using a wooden plant press. Herbarium collection is deposited at the Natural Science Museum of the Mindanao State University-Iligan Institute of Technology.

Relative Frequency of Citation (RFC)

The Relative Frequency of Citation values was derived by dividing the number of informants mentioning a useful species (FC or frequency of citation) to the total number of informants in the survey (N) [35]. The RFC value varies from 0 (when nobody refers to a plant as a useful one) to 1 (when all the informants mentioning it as useful). The RFC index was calculated using the following formula: FC=FC/N (0<RFC<1).

Use Value

The use-value (UV) demonstrates the relative importance of plants known locally. The UV was calculated using the following formula: UVi=ΣUi /N where Ui is the number of uses mentioned by each informant for a given species and N is the total number of informants [35].

Results and Discussion

Demographic Characteristics

Through the actual interviews, data on demographic characteristics were gathered and recorded. As presented in Table 1, a total of 35 respondents representing 35 households composed of male and female local informants, both knowledgeable young and old were interviewed. In the census conducted by the National Statistics Office (NSO) in 2010 [28], there are 51 households of Subanen living in the area with a total population of 391 that was eventually reduced to a total population of 231 as recorded in the census conducted by Philippine Statistics Authority in 2015 [29]. This shows that the number of Subanen living in the area is reduced through time. According to some of the locals interviewed, some of the Subanen households decided to live in the lowland area of Barangay Mansawan and other areas upon getting married, some are studying in high school and college, whereas few are already employed in the nearby areas. During the conduct of the survey, there were only less than 40 households present in the area with an approximate population of less than 100 individuals. Out of the estimated population, only 35 respondents were interviewed because some are kids and

Table 1. *Demographic Profile of the Respondents from Barangay Lake Duminagat*

Demographic Characteristics	Brgy. Lake Duminagat		Total	Percentage (%)
Sex	**Number of male and female informants**			
Male	17		17	49%
Female	18		18	51%
Total	35		35	100%
Sex	**Number of male and female herbalist**			
Male	0		0	0
Female	0		0	0
Total	0		0	0
Age Range	**Number of respondents by age group**			
	Male	Female		
≤ 20	1	2	3	9%
21-30 years	1	3	4	11%
31-40 years	1	3	4	11%
41-50 years	7	6	13	37%
51-60 years	6	2	8	23%
≥61 years	1	2	3	9%
Total	**17**	**18**	**35**	**100%**

some refused to participate because of lack of knowledge on medicinal plants. Aside from this, there were Subanen families who were not present in the area during the conduct of the survey as few of the houses were closed.

The 35 respondents comprised 18 (51%) females and 17 (49%) males. Meanwhile, in terms of age, there were more respondents with age between 41-50 years old, followed by respondents around 51-60 years old, 21-30 years old, 31-40, less than 20 years old, and greater than 61 years old. The oldest respondent interviewed was 87 years old and the youngest was 17 years old. There was only a small number of Subanen respondents since the place is within a protected area so the number of households is limited. However, to gather and secure a valuable and competent source of data, reliable informants were tapped by the research team.

The usage of medicinal plants as an alternative healthcare method is an old practice common among ethnolinguistic groups in the Philippines which was passed on by their respective ancestors through verbal communication to a series of generations [38]. In line with this, the Subanen people also possess their own knowledge of medicinal plants. Although the Subanen of Lake Duminagat freely shared their ethnomedicinal knowledge for this research, it was observed through the interviews that knowledge on the use of various kinds of plants for medicinal purposes is slowly eroding and now rarely practiced by this particular subset of Subanen compared to other Subanen tribal communities found in other places within Mindanao. To emphasize, one respondent mentioned that it has become a common habit among the members of the community to ignore or let simple illnesses pass by and heal without administering any medicine whereas some depend on over-the-counter drugs purchased at the nearest sari-sari stores or rely on donated medicines given through the initiatives of the local government in the form of medical missions.

Medicinal Plants Recorded

This ethnomedicinal survey conducted in the Subanen cultural community situated in Lake Duminagat, Mt. Malindang, Misamis Occidental, Philippines has recorded a total of 32 medicinal plants (with 1 fern species) belonging to 21 families and under 29 genera. Table 2 shows the local or Subanen names, families, scientific names and common names, habit of growth, plant part(s) used, modes of preparation, utilization, and medicinal applications of the recorded ethnomedicinal plants, respectively. The documented medicinal plants in the area are relatively few as compared to prior studies published among the different Subanen-inhabited areas in Mindanao. The most recent study conducted [20] mentioned a total of 113 plant species gathered from 83 respondents among the Subanen in two villages of Ozamis City, whereas 89 medicinal

Table 2. *Medicinal Plants used by the Subanen Tribe of Barangay Lake Duminagat, Mt. Malindang, Philippines*

FAMILY/ SCIENTIFIC NAME	COMMON NAME (CN) AND SUBANEN NAME (SN)	HABIT OF GROWTH	PLANT PARTS USED	PREPARATION AND MODE OF UTILIZATION	MEDICINAL APPLICATION	FREQUENCY	USE VALUE
ACANTHACEAE (1 species)							
Justicia gendarussa Burm.f.	**CN:** willow-leaved Justicia **SN:** handulusa/salimbangon	herb	leaves	heat over fire and directly apply on affected area	fever, stomach disorder	0.34	0.06
ADOXACEAE (1 species)							
Viburnum odoratissimum Ker Gawl.	**CN:** sweet viburnum **SN:** makataynok	tree	bark	pound the bark until soft and apply topically on affected area to serve as poultice	wound healing	0.03	0.03
AMARYLLIDACEAE (2 species)							
Allium cepa L.	**CN:** onion **SN:** sibuyas	herb	whole plant	heat over fire and directly apply on affected area	fever	0.09	0.03
Allium tuberosum Rottler ex. Spreng	**CN:** chives **SN:** ganda	herb	leaves	squeeze leaves and obtain extract to drink	stomachache, eye problem	0.17	0.06
ASTERACEAE (Compositae) (7 species)							
Acmella grandiflora (Turcz) R.K. Jansen	**CN:** toothache plant **SN:** --- no given local name	herb	flower	fresh flower applied to affected tooth	toothache	0.03	0.03
Artemisia vulgaris L.	**CN:** mugwort **SN:** marija/hilbas	herb	whole plant leaves	put in a glass of water and drink heat over fire and directly apply on affected area	toothache stomach disorder	0.11	0.06
Artemisia capillaries Thunb.	**CN:** wormwood **SN:** bino-bino	herb	roots	boil in water and drink decoction	stomach disorder, urinary tract infection	0.23	0.06
Bidens pilosa L.	**CN:** beggar's ticks/ blackjack **SN:** tulay-tulay	herb	roots	boil in water and drink decoction	headache, fever, stomachache	0.29	0.09
Blumea balsamifera (L.) DC.	**CN:** ngai camphor (sambong) **SN:** handilib-on/gabon-**gabon**	herb	leaves	squeeze leaves and obtain extract pound the leaves and apply topically on affected area to serve as poultice put in a glass of water and drink	cough headache stomachache	0.49	0.09
Chrysanthemum sp.	**CN:** chrysanthemum **SN:** chrysanthemum	herb	leaves	pound the leaves and apply topically on affected area to serve as poultice	swelling or inflammation, anti-tetanus	0.37	0.09
Elephantopus scaber L.	**CN:** elephant's foot **SN:** "kukugbanog"	herb	leaves	pound the leaves and apply	fever	0.26	0.03
BORAGINACEAE (1 species)							
Symphytum officinale L.	**CN:** common comfrey **SN:** kompre	herb	leaves	heat over fire and directly apply on affected area	stomachache	0.29	0.03
CARICACEAE (1 species)							
Carica papaya L.	**CN:** papaya (male) **SN:** kapayas na laki	shrub	leaves	squeeze leaves and obtain extract to drink	measles	0.14	0.03

Table 2. *Medicinal Plants used by the Subanen Tribe of Barangay Lake Duminagat, Mt. Malindang, Philippines*

FAMILY/ SCIENTIFIC NAME	COMMON NAME (CN) AND SUBANEN NAME (SN)	HABIT OF GROWTH	PLANT PARTS USED	PREPARATION AND MODE OF UTILIZATION	MEDICINAL APPLICATION	FREQUENCY	USE VALUE
CYPERACEAE (1 species)							
Cyperus kyllingia Endl.	**CN:** whitehead spikehedge **SN:** busikad	grass	roots whole plant	put in a glass of water and drink put in a glass of water and drink	cough, headache, fever, toothache	0.31	0.13
CRASSULACEAE (1 species)							
Kalanchoe pinnata (Lam.) Pers.	**CN:** miracle leaf **SN:** hanlilika/katakataka	herb	leaves	pound the leaves and apply topically on affected area to serve as poultice	mumps headache, toothache	0.80	0.09
EUPHORBIACEAE (1 species)							
Euphorbia hirta L.	**CN:** asthma weed **SN:** salingkapan (tawa-tawa)	herb	whole plant	boil in water and drink decoction	fever, dengue	0.23	0.06
FABACEAE (1 species)							
Mimosa pudica L.	**CN:** sensitive plant **SN:** hibi-hibi/makahiya	herb	roots	boil in water and drink decoction	body energizers, urinary tract infections	0.26	0.06
LAMIACEAE (3 species)							
Mentha arvensis L.	**CN:** peppermint/ wild mint (herba buena) **SN:** hambo- Buena	herb	leaves	heat and squeeze the leaves to obtain extract then mix with water and drink	stomachache	0.03	0.03
Plectranthus amboinicus (Lour.) Spreng.	**CN:** oregano **SN:** kalabo	herb	leaves	squeeze leaves and obtain extract to drink	cough	0.17	0.03
Pletcranthus sculletarioides (L.) R.Br.	**CN:** coleus **SN:** mayana	herb	leaves	squeeze leaves and obtain extract to drink pound the leaves and apply topically on affected area to serve as poultice squeeze to obtain sap and use as drops juice extracted, directly apply to affected area	stomachache, diarrhea, fever, cough, toothache, headache mouth ulcer swelling or inflammation, toothache	1.49	0.25
LAURACEAE (1 species)							
Persea Americana Mill.	**CN:** avocado **SN:** abokado	tree	leaves	boil in water and drink decoction	diarrhea, stomachache, ulcer	0.14	0.06
MALVACEAE (1 species)							
Sida acuta Burm.f.	**CN:** broom weed **SN:** iskoba	herbs	leaves	pound the leaves and apply topically on affected area to serve as poultice	headache	0.06	0.03
MELASTOMATACEAE (1 species)							
Melastoma malabathricum L.	**CN:** malatungaw **SN:** hantutuknaw	shrub	roots	boil in water and drink decoction	body energizers	0.17	0.03
MUSACEAE (1 species)							
Musa textilis Née	**CN:** abaca (manila hemp) **SN:** abaka	herb	roots	boil in water and drink decoction	mouth ulcer, body energizer	0.31	0.06

Table 2. *Medicinal Plants used by the Subanen Tribe of Barangay Lake Duminagat, Mt. Malindang, Philippines*

FAMILY/ SCIENTIFIC NAME	COMMON NAME (CN) AND SUBANEN NAME (SN)	HABIT OF GROWTH	PLANT PARTS USED	PREPARATION AND MODE OF UTILIZATION	MEDICINAL APPLICATION	FREQUENCY	USE VALUE
MYRTACEAE (1 species)							
Psidium guajava L.	**CN:** guava **SN:** bayabas	tree	young leaves leaves	pound the young leaves and apply topically on affected area to serve as poultice boil in water and drink decoction pound the leaves and apply topically on affected area to serve as poultice	stomachache diarrhea swelling or inflammation	0.83	0.09
POACEAE (Graminae) (2 species)							
Imperata cylindrica (L.) Raeusch.	**CN:** cogon grass **SN:** kogon	grass	whole plant	boil in water and drink decoction	toothache	0.29	0.03
Zea mays L.	**CN:** corn **SN:** mais	grass	Kernel	fry the kernel and mix with water then add water and drink	stomachache	0.03	0.03
SOLANACEAE (1 species)							
Solanum nigrum L.	**CN:** black nightshade **SN:** muti-muti	herb	leaves	pound the leaves and apply topically on affected area to serve as poultice	swelling or inflammation	0.03	0.03
VERBENACEAE (2 species)							
Stachytarpheta jamaicensis (L.) Vahl.	**CN:** bastard vervain **SN:** kanding-kanding	herb	leaves	pound the leaves and apply topically on affected area to serve as poultice	skin disease	0.23	0.06
Vitex negundo L.	**CN:** five-leaved chaste tree **SN:** lagundi	tree	leaves	boil in water and drink decoction	cough, headache	0.34	0.06
ZINGIBERACEAE (1 species)							
Zingiber officinale Roscoe	**CN:** ginger **SN:** luy-a	herb	rhizome	pound until soft, wrap in banana leaves and apply or massage to the affected area	stomachache, headache	0.06	0.06
PTERIDOPHYTES (ferns and fern-allies)							
ATHYRIACEAE (1 species)							
Diplazium esculentum (Retz.) Sw.	**CN:** vegetable fern **SN:** paku	terrestrial fern	Rosots	boil in water and drink decoction	body energizers	0.49	0.03

plants were documented in Lapuyan, Zamboanga del Sur [21]. On the other hand, five barangays occupied by the Subanen tribe in Sindangan, Zamboanga del Sur, [22] have 75 medicinal plants, whereas, 60 medicinal plants were listed [16] in three barangays situated in Dumingag, Zambonga del Sur. A study identified that one of the problems faced by the Subanen is the loss of ethnobotanical knowledge because only a few people with knowledge of medicinal plants remain among the Subanen communities. As a consequence, knowledge becomes limited generation after generation [22].

For this study, the research team opted to interview young and old members of the Subanen community of Barangay Lake Duminagat, Mt. Malindang. The team interviewed the "oldest" member of the community who lives near Lake Duminagat. During the interview proper, it was observed that the "oldest" respondent had a hard time recalling these so-called medicinal plants and was even assisted by some family members trying to remember any Subanen medicinal plants they could recall. The same situations were also observed with other elderly respondents who were interviewed for this study. The limited

number of plants they can recall and the struggle to remember the said medicinal plants were concretely observed during the face-to-face interview. Meanwhile, younger members of the community who were approached by the research team were hesitant and would attempt to decline in participating in the interview because of their belief that they do not have enough knowledge on their ethnomedicinal plants and their folkloric uses. Despite being in a secluded location which is Mt. Malindang, accessibility of medicines sold in nearby communities is made possible through motorcycles that serve as the primary mode of transportation. According to the locals, some medical missions have been able to reach the said community as well. It was also observed during the interviews that respondents including elderly informants, would state that they have already forgotten most of their medicinal plants and traditional practices due to their growing patronage of modern types of medicines during sickness and discomfort. Some Subanen members in the community refused to participate in the said interviews due to their perceived inability to impart any knowledge at all.

Distribution of Plant Species Across Different Families

As shown in Table 2, in terms of distribution of medicinal plants under different plant families, Asteraceae is the dominant family with the highest number of representative species, comprising seven species of medicinal plants, followed by Amaryllidaceae and Poaceae represented by two species each while the rest of the plant families have only one representative species. A study conducted in the Subanen community in Gala and Guimad villages in Ozamis City, Misamis Occidental, Philippines recorded *Asteraceae* (Compositae) as the plant family with the highest number of representative species along with *Euphorbiaceae* with a total of 8 species each [20]. A work on the Manobo community of Prosperidad, Agusan del Sur also recorded *Asteraceae* as the dominantly represented family in terms of species [39]. Meanwhile, *Lamiaceae* had the most species representation in a study on the Ati Negrito indigenous group of Guimaras Islands, Iloilo, with 13 medicinal plants under the said family [40].

Moreover, ethnobotanical studies in the community inhabited by the indigenous group called 'Bandarban' located in the southeastern portion of Bangladesh in Rourkela [41], an area in India called as “Steel City”[42], in the highlands of Alvand Mountain in Hamedan and Tuyserkan in Iran [43], and in Djebel Zdimm in the northeastern portion of Algeria [44] have also documented *Asteraceae* as the plant family with the highest contribution in terms of representative species of medicinal plants ranging between 12-19 recorded species. The dominant representation of medicinal plants belonging to *Asteraceae* (Compositae) in several studies can be traced back to the fact that this family comprised the largest number of species among angiosperms [45]. Furthermore, plants under *Asteraceae* possess an array of medicinal potential and have become subjects of interest by several scientific studies encompassing ethnobotanical, phytochemical, and pharmacological studies. A study featured a number of species belonging to *Asteraceae* that are used in treating dermatological problems or skin diseases which are commonly administered by the villagers in Mundgod, India as a treatment for leprosy, eczema, pimples, skin cuts and wounds, boils, sores, and ulcers [46]. Meanwhile, the anti-parasitic activities of medicinal plants under *Asteraceae* [47] as well as the wound-healing activities of some species belonging to *Asteraceae* [48] were studied. A study determining the probable medicinal value of the family *Asteraceae* as an antioxidant was also carried out [49]. Undeniably, the wealth of *Asteraceae* in terms of medicinal value is evident.

Relative Frequency of Citation (RFC) and Use Value (UV)

The relative frequency of citation (RFC) of the reported species ranged from 0.03 to 1.49 (Table 2). However, the average RFC was 0.31. The highest RFC was calculated for *Pletcranthus sculletarioides* (1.49), followed by *Psidium guajava* (0.83), and *Kalanchoe pinnata* (0.80). These species have high RFC values because they are the most frequently used plant species and were reported by the majority of the respondents to treat any disease. *Pletcranthus sculletarioides* was noted to effectively treat common ailments such as cough, diarrhea, fever, headache, mouth ulcer, stomachache, swelling and inflammation, and toothache. *Psidium guajava* is used as a remedy for diarrhea, stomachache, swelling, and inflammation. *Kalanchoe pinnata*, on the other hand, is used as a treatment for toothache, headache, and mumps. These species are usually planted in the backyard or found at a nearby farm.

For use value (UV), the result varied from 0.03 to 0.25 with an average UV value of 0.06 (Table 2). The highest UV was also calculated for *Pletcranthus sculletarioides* (UV=0.23). This finding signifies that this species was used extensively by the local respondents as herbal medicine to treat various ailments. Also, among the plant species recorded, *Pletcranthus sculletarioides* had the highest use reports. The lowest UV values of some plant species such as *Imperata cylindrica*, *Symphytum officinale*, *Mentha arvensis*, *Melastoma malabathricum*, *Sida acuta*, *Plectranthus amboinicus*, *Carica papaya*, *Elephantopus scaber*, *Zea mays*, *Viburnum odoratissimum*, *Solanum nigrum*, *Diplazium esculentum*, *Allium cepa*, and *Acmella grandiflora* (UV=0.03, for each) may be attributed to minimum ethnobotanical uses.

Plant Habit

As to plant habit, out of 32 species, 20 plant species were herbs thus constituting the highest portion, followed by four tree species, four species of shrub, three species of grass, and one fern species. Figure 2 shows that the highest percentage of representation according to life forms is exhibited by the herbs constituting 69% of all the recorded medicinal plants in this study. Similar findings were also observed in the studies conducted by various researchers [50-53]. During this research, it was observed in the area that medicinal herbs such as *Artemisia capillaris*, *Acmella grandiflora*, *Bidens pilosa*, *Euphorbia hirta*, *Elephantopus scaber*, and *Sida acuta* were common weeds that cover a wide vegetation range in some portions of the sampling area except for *Mentha arvensis* which was rarely observed and was found almost near to where the lake is located, resting at a portion with higher altitude compared to where the other wild herbaceous medicinal plants were located. Meanwhile, the rest of the medicinal herbs were cultivated in gardens either for personal consumption or for an economic purpose as a source of income.

Plant Parts Utilized as Medicine

Plant parts that are used for herbal preparations include the leaves, roots, whole plant, rhizome, kernel, flower, and bark. The most frequently used plant parts are the leaves (60.7%), followed by roots (19.6%), and whole plant (10.7%) whereas the remaining plant parts constituted only 3% to 1.8% (Figure 3). The finding that leaves are the frequently used plant part for herbal preparation corresponds with the findings of various studies. Leaves are reported as the most commonly used plant part by the Subanen tribe from five barangays of Sindangan, Zamboanga del Norte, Philippines [22]. Another study among the Subanen tribe of Gala and Guimad in Ozamiz City also cited leaves as the most commonly used plant part including the newly sprouted, young, and even dried leaves [20]. Leaves are also the most frequently used plant part prepared through decoction and taken orally in Lapuyan, Zamboanga Del Sur [21]. Leaves are responsible for the manufacture and storage of various chemical compounds such as alkaloids, tannins, flavonoids, coumarins, essential oil, and inulin which are active components for herbal preparations [54]. Various leaf extracts ensure better preparation of active ingredients when used as medication [55].

Methods of Preparation

Plants prepared as herbal medicine are utilized in different ways such as decoction, infusion, poultice, heated, chewed, or as extract. In this study and as depicted in Figure 4, decoction (27.3%) ranked the highest as method of

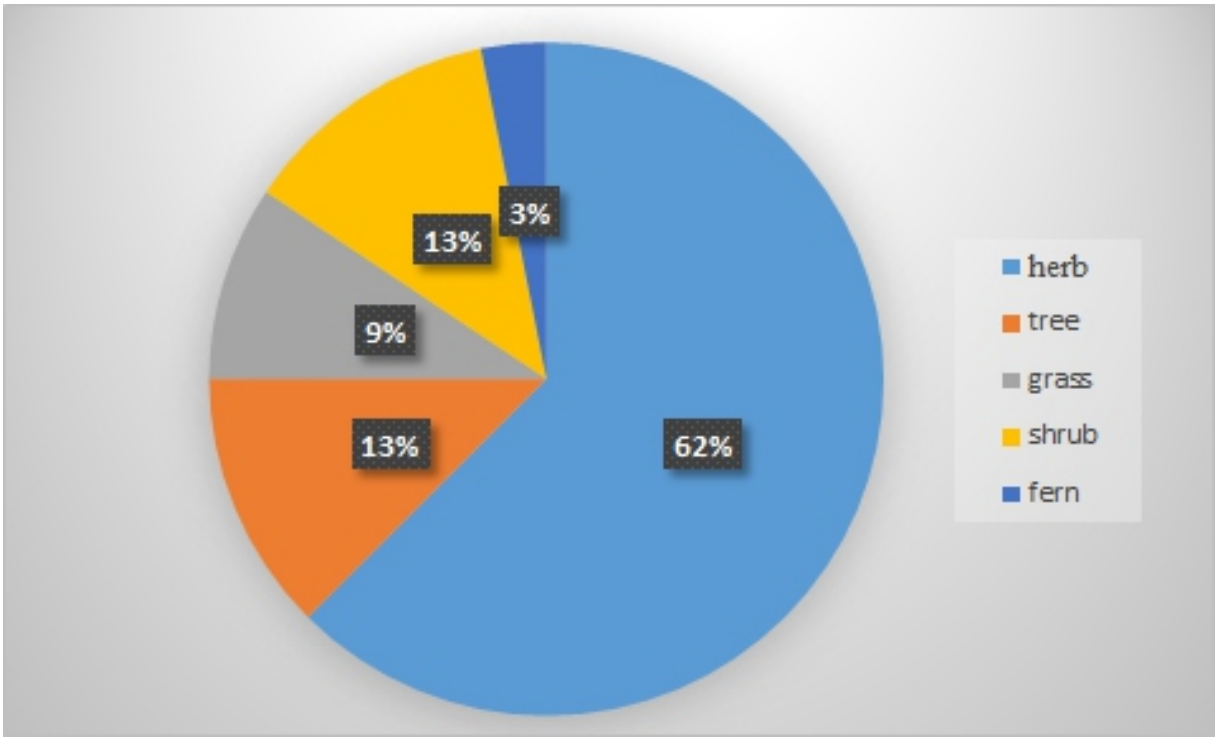

Figure 2. *Medicinal plants used by the Subanen of Barangay Lake Duminagat, Don Victoriano. according to its plant habit*

preparation followed by poultice (25.5%), extract (23.6%), infusion (10.9%), heated (9.1%), and fresh (3.6%). Roots are mostly prepared as herbal medicine through decoction followed by leaves and the whole plant. Decoction includes boiling of the usually harder woody plant part such as roots and bark for a particular time in order to release the medicinal constituents. Various studies both from local and international sources also claimed decoction as the frequently used mode of herbal preparation as reported also by the study among the Maranaos in Pualas, Lanao Del Sur, Philippines [19]. One technique that was also applied by the Subanen was the mixture of different species during herbal preparations to increase effectivity.

Mode of Application

Figure 5 shows that on mode of application, three types were used by the Subanen in the study area such as: oral administration constituting 58.9%, direct application to the affected area (39.3%), and drops constituting 1.8%. Plants that are prepared as herbal medicines and are given orally are mostly treatment for digestive system disorders such as stomachache, diarrhea, and flatulence, or as body energizers. On the other hand, plants that are prepared as a poultice and directly applied to the affected area are mostly treatments for wounds, swelling and inflammation, skin diseases, mumps, and headaches. In Prosperidad, Agusan Del Sur, Philippines, a similar outcome was mentioned where both oral and external methods of medicinal application were recorded [56].

Conclusion

This study recorded a total of 32 plants utilized for medicinal purposes. In terms of the plant part used, leaves were the most frequently used by the Subanen respondents. As to the mode of utilization, orally administered decoction (33%) through drinking ranked the highest in which the plant parts frequently prepared as decoction were the leaves, roots, and the whole plant as well mostly to cure stomach pain, diarrhea, flatulence, and as body energizers. Compared to previously conducted research studies, between the years 2014 to 2019, fewer ethnomedicinal plants were recorded in this particular area. The low number of listed herbal plants in this study area might imply that the ethnomedicinal knowledge of this specific Subanen community is slowly eroding due to factors such as the absence of traditional

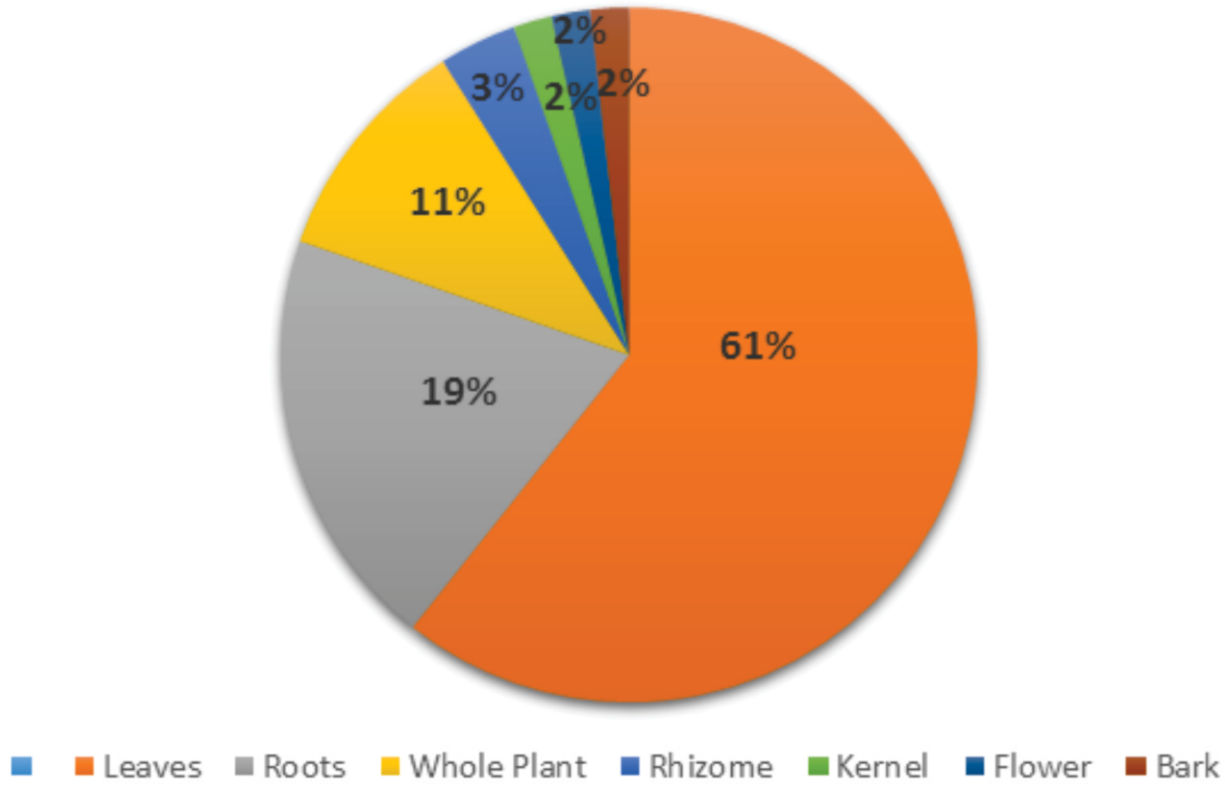

Figure 3. *Plant parts used in herbal preparations by the Subanen in Barangay Lake Duminagat, Mt. Malindang.*

healers or any knowledgeable elderly member within their community who could teach or guide the younger Subanen to help preserve the rich traditional healing practices and continuously pass on the valuable tradition to the future generations. Moreover, the growing patronage of modern medicine particularly in this specific group of Subanen can possibly push others to forget their traditional methods of healing the sick. The hesitation of the younger members of the Subanen community to participate in the interviews due to lack of knowledge on ethnomedicinal plants and traditional healing practices is an indication of their gradually diminishing ethnomedicinal knowledge. The documentation of such medicinal plants may be helpful in stimulating the recall of forgotten information on their medicinal plants.

Acknowledgment

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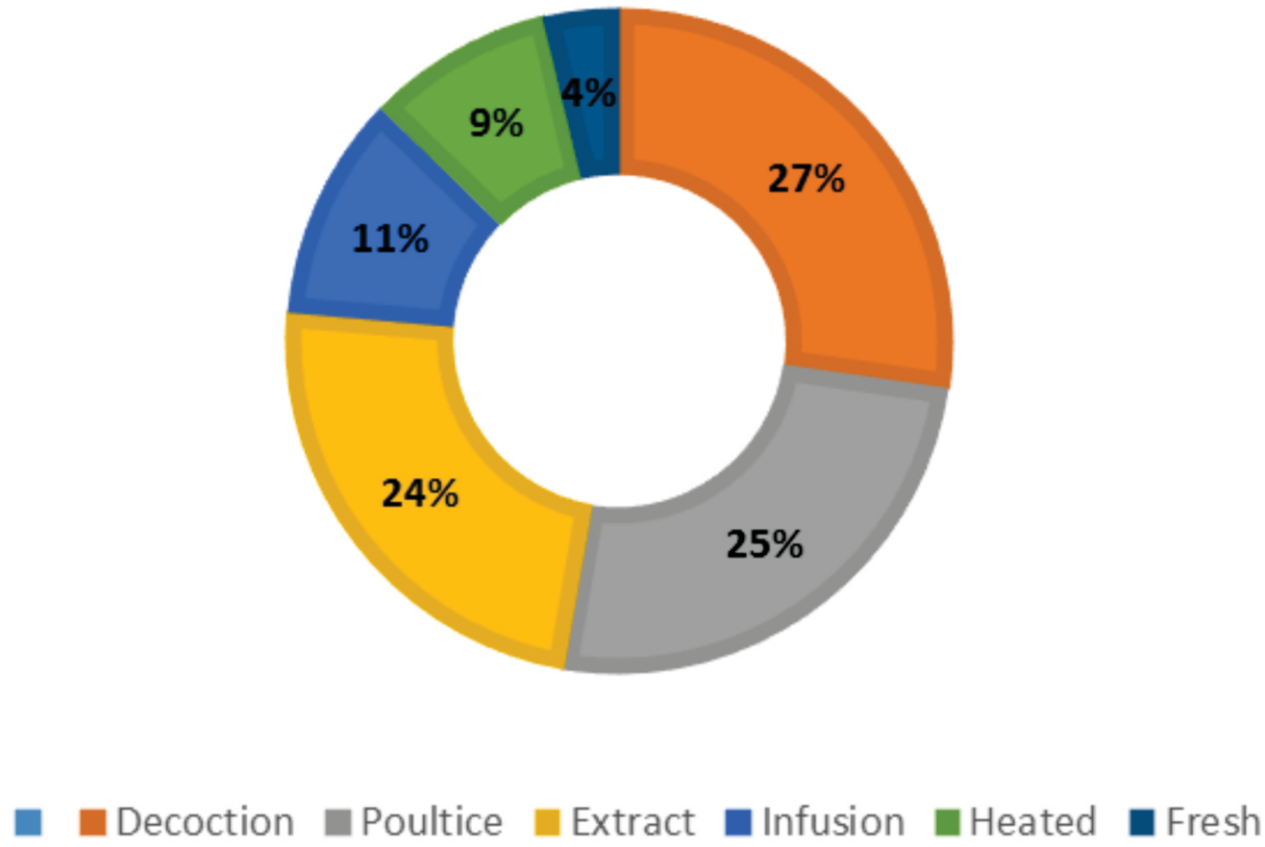

Figure 4. *Frequency of plant species according to method of preparation used by Subanen of Barangay Lake Duminagat, Mt. Malindang, Philippines.*

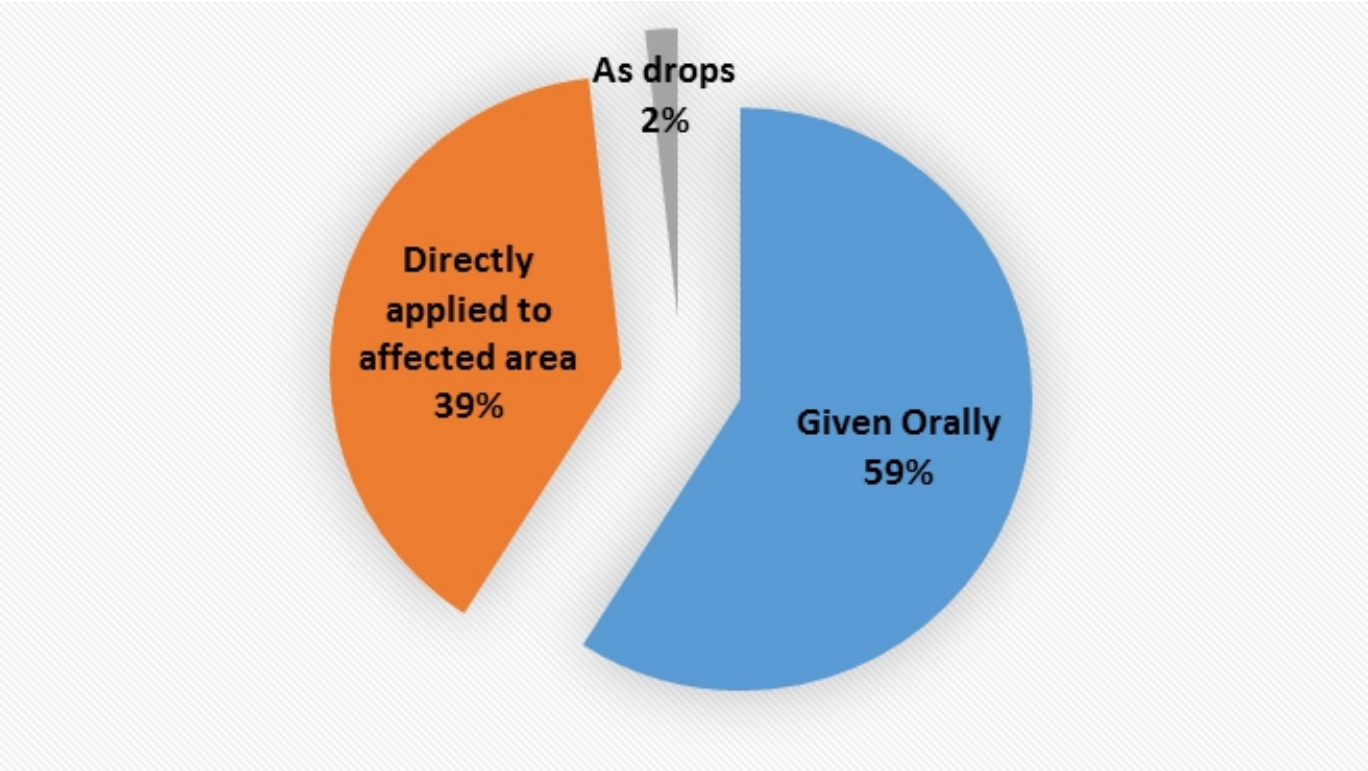

Figure 5. *Frequency of plant species by mode of application used by Subanen of Barangay Lake Duminagat, Mt. Malindang*

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APPENDIX

Appendix A. List of herbarium specimens

Collection Number	Accepted Name	Place Collected	Date Collected	Photo
NSM-4265	*Acmella grandiflora* (Turcz) R.K. Jansen	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4263	*Allium cepa* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4264	*Allium tuberosum* Rottler ex. Spreng	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4267	*Artemisia capillaries* Thunb.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4266	*Artemisia vulgaris* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	

Appendix A. List of herbarium specimens

Collection Number	Accepted Name	Place Collected	Date Collected	Photo
NSM-4268	*Bidens pilosa* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4269	*Blumea balsamifera* (L.) DC	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4273	*Carica papaya* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4270	*Chrysanthemum* sp.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4274	*Cyperus kyllingia* Endl.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	

Appendix A. List of herbarium specimens

Collection Number	Accepted Name	Place Collected	Date Collected	Photo
NSM-4292	*Diplazium esculentum* (Retz.) Sw.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4271	*Elephantopus scaber* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4276	*Euphorbia hirta* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4286	*Imperata cylindrica* (L.) Raeusch.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4261	*Justicia gendarussa* Burm.f.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	

Appendix A. List of herbarium specimens

Collection Number	Accepted Name	Place Collected	Date Collected	Photo
NSM-4275	*Kalanchoe pinnata* (Lam.) Pers.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4283	*Melastroma malabathricum* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4278	*Mentha arvensis* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4277	*Mimosa pudica* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4284	Musa textilis Née	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	

Appendix A. List of herbarium specimens

Collection Number	Accepted Name	Place Collected	Date Collected	Photo
NSM-4281	*Persea americana* Mill.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4279	*Plectranthus amboinicus* (Lour.) Spreng.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4280	*Pletcranthus sculletarioides* (L.) R.Br.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4285	*Psidium guajava* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4282	*Sida acuta* Burm.f.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	

Appendix A. List of herbarium specimens

Collection Number	Accepted Name	Place Collected	Date Collected	Photo
NSM-4288	*Solanum nigrum* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4289	*Stachytarpheta jamaicensis* (L.) Vahl.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4272	*Symphytum officinale* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4262	*Viburnum odoratissimum Ker Gawl.*	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4290Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	*Vitex negundo* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	

Appendix A. List of herbarium specimens

Collection Number	Accepted Name	Place Collected	Date Collected	Photo
NSM-4287	*Zea mays* L.	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019	
NSM-4291	*Zingiber officinale* Roscoe	Brgy. Lake Duminagat, Mt. Malindang, Don Victoriano, Misamis Occidental, Philippines	December 2019