

Ethnobotanical Survey on Medicinal Plants used by the Manobo Tribe of Don Marcelino, Davao Occidental, Philippines

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ABSTRACT

Ethnobotanical knowledge has been instrumental in the identification of new potent sources of novel bioactive compounds. Hence, ethnobotanical study is highly essential as a precursor for drug discovery. The study aimed to document the medicinal plants used by the Manobo tribe of Don Marcelino, Davao Occidental Philippines. In this study, the ethnobotanical practices of the Manobo tribe were explored and surveyed from the three (3) Barangay of Don Marcelino, Davao Occidental Philippines. The study employed observational-descriptive surveys in data gathering. Structured interviews using questionnaires were also utilized in the study. A total of 30 respondents were interviewed with ages between 21-46 years old and above. Based on the results, there were forty-one (41) medicinal plants identified by the Manobo tribe belonging to the twenty-eight (28) taxonomic families. *Psidium guajava* is the most cited while *Moringa oleifera* has the highest used value. Leaves are the most utilized parts and are prepared by decoction to extract the curative compounds of the medicinal plants. Furthermore, studies on the screening of novel compounds are highly desirable to additionally substantiate the medicinal properties of each identified plant.

Keywords: Ethnobotany, Manobo, Traditional, Medical, Knowledge.

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INTRODUCTION

The therapeutic values of plants have significantly benefited since the dawn of human civilization. The World Health Organization (WHO) documented approximately 80% of the world's population depended on alternative medicine for their immediate healthcare needs. Consequently, plants are being studied as potential sources of effective bioactive compounds.^[1] Alternative medicines are important health resources with a wide range of preventive applications and managing lifestyle-related chronic diseases, and in curving the medical wellness needs of aging populations.^[2]

Ethnobotanical studies are recognized as the simplest method of identifying new medicinal plants.^[3] Medicinal plants are considered an upscale ingredient in drug development and play a vital role as a health aid.^[4]

In the Philippines, important Indigenous knowledge of medicinal plants are highly preserved by the Indigenous people. The application of medicinal plants by many tribes lies in the knowledge, skills, and practices supported by their beliefs and experiences that are used to maintain and improve health as well as to prevent diseases.^[5] Moreover, one of the advantages of medicinal plants is that it is cheaper than conventional medicine and it is easier to get compared to prescribed medicine. One of the reasons why people resort to medicinal plants due to the costly nature of over-the-counter medicine compared to medicinal plants that are easily accessible in the locality.^[6]

In Mindanao, the province of Davao Occidental is known to be culturally rich where distinct ethnic tribes have preserved their own cultural identities in selected

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areas in the province. Manobo is one of the dominant ethnic tribes in the province. The tribes of Manobo preferred the lowlands of Malita and upland areas of Don Marcelino and Jose Abad Santos.^[7] There have been reports on the utilization of medicinal plants by the Manobo tribes from selected municipalities in Agusan Del Norte,^[8] Prosperidad, Agusan Del Sur,^[9] Sibagat, Agusan Del Sur,^[10] Bayugan City^[11] and Surigao Del Sur Philippines.^[12]

Currently, there had been no reported study on the medicinal plant knowledge among the Manobo Tribe of Don Marcelino, Davao Occidental. Hence, this study was conducted. This study documented the pharmacological applications of the various medicinal plants used by the Manobo tribe. Moreover, this study identified the curative practices of medicinal plants and identified the various species with medicinal properties on the selected Barangay, namely: Kinanga, Lawa and Lanao, Don Marcelino Davao Occidental, Philippines.

The findings of the study will be utilized to preserve the peculiar practices and rich medical knowledge of the Manobo Tribes. Moreover, the findings of the study would be very helpful in disseminating the unique cultural richness of indigenous communities. This study aimed to document the medicinal value of available plants used by the Manobo tribe of Don Marcelino Davao Occidental.

Specifically, it aims to;

1. Determine the demographic profile of the respondents;
2. Identify medicinal plants in the selected barangays;
3. Determine the utilization indices such as; Relative Frequency of Citation (RFC), and Used Value (UV);
4. Identify medicinal plants; parts used by the Manobo Tribe;
5. Characterized the preparation and application of the recorded medicinal plants; and
6. List the common diseases treated by identified medicinal plants;

MATERIALS AND METHODS

Study sites

The study was conducted in three (3) Barangay in Don Marcelino, Davao Occidental. There are three (3) selected Barangay namely Kinanga (6° 11'49" North, 125° 41'34" East), Lawa (6° 10'58" North, 125° 41'43" East) and Lanao (6° 05'12" North, 125° 42'12" East) Don Marcelino's land classification has a total land area of 40,640 hectares which is divided into two categories Alienable and Disposable land (A and D)



Figure 1: Map of the selected three (3) Barangay of Don Marcelino, Davao Occidental (From: Google earth the Philippines)

Forest Land. Barangay Kinanga has a total land area of 615.83 hectares. The Barangay of Lawa has 1,103.62 hectares, and Barangay Lanao has 514.26 hectares. The three (3) barangays are located along the coastal area of the municipality. Based on the latest census report by the Philippines Statistics Authority (PSA).^[13] Don Marcelino has a total population of 47,904. Kinanga has a total population of 3,860. The Barangay of Lawa has a total population of 3,269, while Brgy. Lanao has a total population of 1,044. The majority of constituents in Don Marcelino belong to minority or Indigenous Peoples (IPs) groups. There are 18,452 is the total population of the Manobo tribe in Don Marcelino, Davao Occidental.^[14]

Research Design

This study utilized an observational, descriptive survey type of research method in data gathering. The researcher provided a questionnaire to the respondents; the responses of the respondents were processed and interpreted. Comprehensive Focus group discussions (FGD) were made with the participants regarding the medicinal plants in the study area.

Data gathering procedure

Before the conduct of the study, required documents such as Free Prior Informed Consent (FPIC) were requested and secured from the National Commission on Indigenous Peoples (NCIP). A request was also sent and approved by the Tribal chieftain and from the office of the Barangay Indigenous People. A courtesy visit to the three Barangay captains of the Barangay of Don Marcelino, namely; Kinanga, Lawa, and Lanao. The respondents of the study were taken purposely from the three different selected barangays in Don Marcelino, Davao Occidental.

The study employs purposive sampling since there are specifically selected respondents who meet the criteria for a certain purpose. The identified practicing Manobo healers by the IPMR were the chosen respondents.

Research questionnaires cover the demographic profile of the respondent, such as the utilized medicinal plants, specific used parts, and preparation upon application which are subsequently examined in detail. The purposive sampling method was used to determine the respondents; it said that the purposive sampling is an informant selection tool widely used in ethnobotany studies.^[15] A total of 30 participants were selected purposively from the three selected barangays.

The 30 participants were selected purposely based on the recommendations of the knowledgeable elders of the tribe. Traditional healers comprise key participants, being traditional experts who are also the guardians of indigenous knowledge on medicinal plants. The researchers used self-made questionnaires. The sets of questionnaires were used in gathering data from the respondents. The employed questionnaires covered the (1) demographic profile of the respondents; (2) medicinal plants utilized; (3) location of medicinal plants, (4) the plant parts used of the Manobo elders, (5) diseases/illnesses that can be cured, (6) mode of preparation, (7) and mode of application.

Data Analysis

The Ethnobotanical survey of medicinal plants was conducted in the selected three (3) Barangay namely Kinanga, Lawa and Lanao shown in Figure 1 based on the recommendation of the Indigenous Person Mandatory Representative (IPMR) known to be dominated by the Manobo tribe. The collected data was analyzed using the utilization indices namely Relative Frequency of Citation (RFC), and Use Value (UV). RFC determines the local importance of medicinal plant species^[32] as computed using the formula: $RFC = FC/N$, where FC is the number of respondents who cited the plants species while N is the total number of respondents. The RFC rating ranges from 0 to 1 where a rating of 1 constitutes a high significance. The UV was computed to identify the relative importance of the medicinal plant species using the following formula: $UVs = U_i/N$, where U_i is the number of use reports by each informant for a specific species and N is the total number of informants.^[33] A use report was generated each time; a respondent mentioned a plant used to treat for a specific illness. The use-value index was used to identify the relative importance of the medicinal plants: high values signify a higher use value report, while relative frequency citation identified the general usefulness of the plant.

Ethical Consideration

The researcher ensures that the conduct of the study is in accordance with the ethical standard of Southern

Philippines Agri-Business and Marine and Aquatic School of Technology (SPAMAST) (RA 10173 or the Data Privacy Act of 2012. Before the conduct of the study, informed consent was secured. Anonymity was maintained by not collecting identifying information on individual subjects. Moreover, confidentiality was ensured by not revealing the identity of the respondents.

RESULTS

A total of thirty (30) selected respondents participated in the study. Table 1 shows the selected participants that were recommended by knowledgeable elders. They are composed of local healers in their respective barangays. 86.07 percent (%) of respondents were aged 46 years old and above, whereas the remaining 13.03 percent (%) were below 45 years old. Most of the respondents were high school graduates (53.03%) while others were high school graduates (23.03%) and elementary graduates (23.03%). Most of the selected respondents were married (76.07%) while 20% were separated and 3.03% were widowed.

Figure 1 shows the selected study sites as recommended by the IPMR Chairman, namely Barangay Lawa, Lanao, and Kinanga. The selected sites are known to be dominated by the Manobo tribe. The selected barangays are situated in the Upland areas of Don Marcelino, Davao Occidental.

Table 1: Demographic profile of the Manobo Tribe Respondents.

Age Classes	Frequency	Percentage (%)
46 above	26	86.07
41-45	4	13.03
Gender		
Male	4	20
Female	26	80
Educational Background		
Level	Frequency	Percentage (%)
Elementary Graduate	7	23.03
High School Level	7	23.03
High School Graduate	16	53.03
College Graduate	0	0
Civil Status		
Status	Frequency	Percentage (%)
Married	23	76.07
Widowed	1	3.03
Separated	6	20
Single	0	0

Table 2: Family of Medicinal plant species.

Family Name	Number. of Species
Myrtaceae	2
Bignoniaceae	1
Asphodelaceae	1
Arecaceae	2
Moraceae	3
Meliaceae	1
Poaceae	2
Basselaceae	1
Crassulaceae	1
Solanaceae	1
Caricaceae	1
Rutaceae	1
Lamiaceae	2
Zingiberaceae	3
Euphorbiaceae	2
Fabaceae	4
Bixaceae	1
Moringaceae	1
Musaceae	1
Lauraceae	1
Lytharaceae	1
Combretaceae	1
Annonaceae	1
Oxalidaceae	2
Convolvulaceae	1
Piperaceae	1
Menispermaceae	1
Malvaceae	1

The Manobo Tribe identified forty-one (41) plant species from twenty-eight (28) families shown in Table 2. Each family is represented by each species with Fabaceae as the most represented with four (4) species, followed by Moraceae and Zingiberaceae with three (3) species, while two species were identified from the family of Myrtaceae, Arecaceae, Poaceae, Lamiaceae, Euphorbiaceae and Oxalidaceae. Furthermore, there were only single representative species for Bignoniaceae, Asphodelaceae, Combretaceae, Meliaceae, Basselaceae, Crassulaceae, Solanaceae, Caricaceae, Rutaceae, Bixaceae, Moringaceae, Musaceae, Lauraceae, Lytharaceae, Annonaceae, Convolvulaceae, Piperaceae, Menispermaceae, and Malvaceae.

Table 3 shows the medicinal importance of each species in terms of the relative frequency of citation (RFC) represented by a numerical rating from 0.00 to 1.00 which indicates the preferred medicinal plants

as mentioned by the respondents. A higher numerical rating, the greater number of citations of each medicinal plant. The species of *Psidium guajava* (1.00), *Alpinia purpurata* (Vieill.) K. Schum. (1.00) are the most cited medicinal plants by the Manobo Tribe followed by *Kalanchoe pinnata*(0.97), *Citrus × microcarpa*(0.97), *Vitex negundo* (0.97), *Tinospora rumphii*(0.97), *Origanum vulgare*(0.93), *Euphorbia hirta*(0.93), *Moringa oleifera*(0.93) *Annona muricata*(0.93), *Cymbopogon citratus*(0.90), *Carica papaya*(0.87), *Hibiscus rosa-sinensis*(0.83), *Capsicum frutescens*(0.80), *Zingiber officinale*(0.80), *Curcuma longa* L.(0.73), *Musa paradisiaca*(0.70), *Artocarpus heterophyllus* Lam. (0.67), *Persea americana*(0.63), *Basella alba* Linn. (0.67), *Ipomea batatas*(0.67), *Cocos nucifera*(0.60), *Averrhoa bilimbi*(0.57), and *Piper betle*(0.53). Moreover, relative frequency of citation of *Mimosa pudica* (0.43), *Manibot esculenta* (0.33), *Terminalia catappa* (0.30), *Tamarindus indica* (0.27), *Persea americana* (0.27), *Bixa orellana* (0.23), *Bambusa vulgaris* (0.23), *Azadirachta indica* (0.17), *Ficus elastica* (0.17), *Artocarpus communis* (0.13), *Arachis hypogaea* (0.10), *Syzygium aqueum* (0.10) were documented. Furthermore, the following medicinal plants namely *Allamanda cathartica* Linnaeus *Aloe barbadensis* Mill., *Areca catechu*, *Acacia confusa*, *Punica granatum* and *Averrhoa carambola* have an RFC value of less than 0.10.

In terms of Use Value, which describes the number of uses mentioned by each informant for a given species, the plant species with the highest Use Value are *Moringa oleifera* (3.58), *Kalanchoe pinnata* (3.52), and *Psidium guajava* Linn. (3.32), *Euphorbia hirta* (3.13) followed by *Alpinia purpurata* (Vieill.) K. Schum. (2.79), *Curcuma longa* L. (2.63), *Origanum vulgare* (2.56), *Tinospora rumphii* (2.03), *Averrhoa bilimbi* (2.02), *Annona muricata* (2.00), *Carica papaya* (1.83), *Citrus × microcarpa* (1.63), *Zingiber officinale* (1.50), *Piper betle* (1.43), *Artocarpus heterophyllus* Lam. (1.33), *Musa paradisiaca* (1.27), *Cymbopogon citratus* (1.17), *Vitex negundo* (1.03) and *Basella alba* Linn. (1.00). Moreover, the following species namely *Capsicum frutescens*, *Areca catechu*, *Hibiscus rosa-sinensis*, *Ipomea batatas*, *Mimosa pudica*, *Manibot esculenta*, *Aloe barbadensis* Mill., *Cocos nucifera*, *Persea americana*, *Tamarindus indica*, *Artocarpus communis*, *Azadirachta indica*, *Bambusa vulgaris*, *Bixa orellana*, *Punica granatum*, *Terminalia catappa*, *Averrhoa carambola*, *Syzygium aqueum*, *Allamanda cathartica* Linn., *Ficus elastica*, *Acacia confusa* and *Arachis hypogaea* with a use value index range of 0.06 to 0.96. The greater the numerical value indicates the greater utilization of recorded medicinal plants.

Figure 2 shows the parts of the plant parts with identified medicinal attributes. The thirty (30) respondents identified the specific plant parts in each species that were used in treating specific illnesses. 40(%) percent of the respondents identified the leaves. 21(%) Percent

Table 3: Recorded Medicinal Plants of Manobo Tribe from Don Marcelino, Davao Occidental.

Family name	Manobo name	Scientific name	Plant parts used	Mode of preparation	Rfc (%)	Use value
Myrtaceae	Bayabas	<i>Psidium guajava</i> Linn.	Leaves	Decoction, Infusion, Poultice, Pounded	1.00	3.32
Myrtaceae	Tambis	<i>Syzygium aqueum</i>	Leaves, Barks	Decoction	0.10	0.13
Bignoniaceae	Yellow Bell	<i>Allamanda cathartica</i> Linn.	Leaves	Infusion, Poultice	0.07	0.10
Asphodelaceae	Aloe Vera	<i>Aloe barbadensis</i> Mill.	Leaves	Extraction	0.06	0.63
Arecaceae	Niyog-Niyogan	<i>Areca catechu</i>	Seeds	Decoction, Paste, Consumptions of fruits	0.03	0.93
Arecaceae	Lubi	<i>Cocos nucifera</i>	Fruit, Roots, Barks	Infusion, Poultice, Powdered, Consumptions of fruits, Extraction	0.60	0.63
Moraceae	Nangka	<i>Artocarpus heterophyllus</i> Lam.	Leaves, Roots, Barks	Decoction, Infusion	0.67	1.33
Moraceae	Kulo	<i>Artocarpus communis</i>	Leaves, Fruits	Decoction, Consumption of fruits	0.13	0.40
Meliaceae	Neem Tree	<i>Azadirachta indica</i>	Leaves, Barks	Decoction, Paste	0.17	0.40
Poaceae	Kawayan	<i>Bambusa vulgaris</i>	Roots, Barks	Decoction	0.23	0.26
Poaceae	Tanglad	<i>Cymbopogon citratus</i>	Stem	Decoction	0.90	1.17
Basselaceae	Alugbati	<i>Basella alba</i> Linn.	Leaves	Pounded, Paste, Consumptions of leaves,	0.67	1.00
Crassulaceae	Hanlilika	<i>Kalanchoe pinnata</i>	Leaves	Pounded	0.97	3.52
Solanaceae	Sili	<i>Capsicum frutescens</i> .	Leaves, Fruit	Decoction, Infusion, Poultice, Pounded, Paste, Powdered	0.80	0.96
Caricaceae	Kapayas	<i>Carica papaya</i>	Leaves, Fruit	Pounded, Consumption of fruits	0.87	1.83
Rutaceae	Lemonsito	<i>Citrus × microcarpa</i>	Fruit	Extraction	0.97	1.63
Lamiaceae	Kalabo	<i>Origanum vulgare</i>	Leaves	Pounded, Extraction	0.93	2.56
Lamiaceae	Lagundi	<i>Vitex negundo</i>	Leaves	Decoction, Infusion, Poultice	0.97	1.03
Zingiberaceae	Luy-ang Dilaw	<i>Curcuma longa</i> L.	Fruit	Infusion, Poultice, Paste, Powdered, Extraction	0.73	2.63
Zingiberaceae	Luy-ang Tapul	<i>Alpinia purpurata</i> (Vieill.) K. Schum.	Fruit	Infusion, Poultice, Paste, Powdered	1.00	2.79
Zingiberaceae	Luy-a	<i>Zingiber officinale</i>	Fruit	Infusion, Poultice, Paste	0.80	1.50
Euphorbiaceae	Tawa-Tawa	<i>Euphorbia hirta</i>	Whole Plants	Decoction, Paste, Squeezing	0.93	3.13
Euphorbiaceae	Balanghoy	<i>Manihot esculenta</i>	Roots, Barks	Decoction, Paste	0.33	0.67
Moraceae	Baliti	<i>Ficus elastica</i>	Leaves, Barks	Pounded, Paste	0.17	0.09
Fabaceae	Makahiya/Yaya	<i>Mimosa pudica</i>	Roots	Decoction, Infusion, Poultice, Pounded, Paste, Extraction	0.43	0.68
Fabaceae	Akasya	<i>Acacia confusa</i>	Barks	Decoction	0.07	0.07
Fabaceae	Mani	<i>Arachis hypogaea</i>	Seeds	Consumption of fruits(seeds)	0.10	0.06
Fabaceae	Sambag	<i>Tamarindus indica</i>	Fruit, Flower	Decoction, Infusion, Poultice, Consumption of fruits	0.27	0.57
Bixaceae	Switis	<i>Bixa orellana</i>	Seeds	Decoction, Infusion, Poultice, Pounded	0.23	0.23

continued...

Table 3: Cont'd.						
Family name	Manobo name	Scientific name	Plant parts used	Mode of preparation	Rfc (%)	Use value
Moringaceae	Kamunggay	<i>Moringa oleifera</i>	Leaves	Decoction, Pounded	0.93	3.58
Musaceae	Saging (Cardava)	<i>Musa paradisiaca</i>	Leaves, Fruits, Roots, Stem	Decoction, Infusion, Poultrice, Pounded, Paste, Consumption of fruits	0.70	1.27
Lauraceae	Abukado	<i>Persea americana</i>	Leaves	Decoction, Infusion, Poultrice, Consumption of fruits	0.27	0.63
Lytharaceae	Granada	<i>Punica granatum</i>	Fruit	Decoction, Consumption of fruits	0.07	0.20
Combretaceae	Talisay	<i>Terminalia catappa</i>	Leaves	Decoction, Paste, Extraction	0.30	0.30
Annonaceae	Labana	<i>Annona muricata</i>	Leaves, Fruit	Decoction, Infusion, Poultrice, Paste, Consumption of Leaves	0.93	2.00
Oxalidaceae	Iba	<i>Averrhoa bilimbi</i>	Leaves, Fruit	Decoction, Infusion, Poultrice, Consumption of fruits, Extraction	0.57	2.02
Oxalidaceae	Balingbing	<i>Avverhoa carambola</i>	Leaves, Fruit	Decoction, Pounded, Paste	0.07	0.13
Convolvulaceae	Camote	<i>Ipomoea batatas</i>	Leaves, Roots	Decoction, Infusion, Poultrice, Consumption of its roots(tuber)	0.67	0.73
Piperaceae	Buyo	<i>Piper betle L.</i>	Leaves	Paste	0.53	1.43
Menispermaceae	Panyawan	<i>Tinospora rumphii</i>	Leaves, Barks	Decoction, Infusion, Poultrice, Pounded, Paste, Squeezing	0.97	2.03
Malvaceae	Gumamela	<i>Hibiscus rosa-sinensis</i> Linn.	Flower	Pounded	0.83	0.83

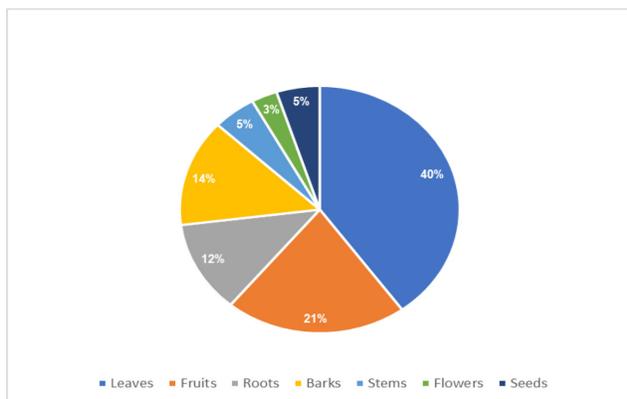


Figure 2: Plant parts used as Medicinal Plants.

use the fruits. 14(%) percent use the barks. 12(%) percent uses the Roots; 5(%) uses the Stems and Seeds; meanwhile, 3(%) percent identified the flowers in treating the specific illnesses.

For medicinal plants to be fully utilized, it requires preparation to harness their optimum effectiveness. Figure 3 shows the various mediums of each plant; the majority of the medicinal plants were prepared

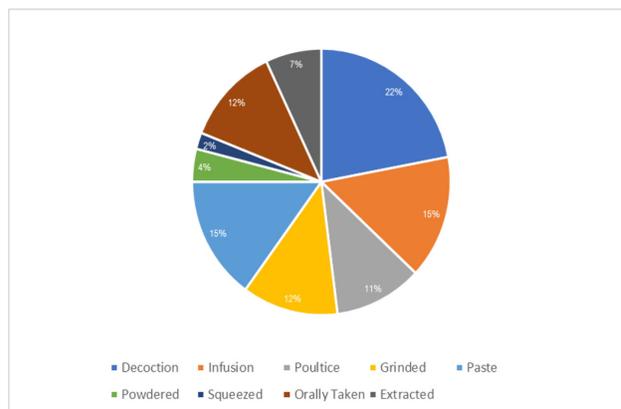


Figure 3: Mode of preparation of the Medicinal Plants.

by decoction (22%) before application to the specific diseases. Secondly, it was followed by Infusion and preparation by paste (viscous) with (15%). Thirdly, followed by Grinding (12%) using mortar and pestle or like tools and can be directly taken orally (12%). Moreover, it can also be prepared by Poultrice (11%), Extraction (7%), Powdered (4%), and finally Squeezing (2%) of the plant parts.

Furthermore, Table 4 shows the list of diseases that can be treated by the documented medicinal plants from the three (3) Barangays of the Manobo tribe of Don Marcelino, Davao Occidental Philippines. The medicinal plants with the highest relative frequency of citation (RFC) are *Psidium guajava* are used to treat Digestive Disease, Respiratory Disease, Bites and Bleeding, Dermatological Disease, Oral and Pharyngeal, Gastrointestinal Disease, Wounds, Sprain, Diabetes Circulatory Diseases, Fever. Secondly, *Alpinia purpurata* (Vieill.) K. Schum is used to medicate Respiratory Disease, Fever, Headache, Body Pain, Gastrointestinal Disease, over fatigue, Digestive Diseases, Oral and Pharyngeal Disease, Inflammation, Dermatological Disease, Poisoning. Moreover, the medicinal plants with the highest use value are *Moringa oleifera* and *Kalanchoe pinnata*. *Moringa oleifera* is used to cure Respiratory Disease, Wounds, Fever, Kidney Disease, Circulatory Disease, Oral and Pharyngeal Disease, Inflammation, Eye Infection, Paralysis, Gout, Headache and Diabetes. Additionally, *Kalanchoe pinnata* is used to treat Bites and Bleeding, Respiratory Disease, Dermatological Disease, Oral and Pharyngeal, Wounds, Inflammation, Headache, Bruises, Circulatory Disease and Fever. Table 4 shows the corresponding medicinal plants and the category of diseases that it can be used for treatment.

DISCUSSION

The Manobo tribes dominate the upland areas of Don Marcelino, Davao Occidental. The selected study sites, which are barangay Kinanga, constitute the 8.81 % of the population of the Municipality of Don Marcelino while barangay Lawa consist of 8.87 % while barangay Lanao represents the 2.49 % of the population of the Municipality of Davao Occidental. Most of the selected Manobo respondents are 46 years old above (86.07%) and 45 years Old below (13.03 %) which somehow reflects the general trends of the age of the general population of the inhabitants of the municipality which constitute 58.85 percent (%) belongs to the age of 15 to 65 years old while 14 years below is around 37.44 percent (5) while 3.71 % belongs to the 65 years old above (PhilAtlas, 2022).^[13] The municipality of Don Marcelino constitutes coastal and upland barangays which are highly favorable for the growth of a variety of plants.^[7] In fact, four (4) plants from Fabaceae family were recorded to be abundant in the study site. The Fabaceae family has been considered as the largest families known to have medical and therapeutic properties reported in various studies around the world.^[16-18]

The recognition of the plant usage pattern by traditional communities could be indicative of the underlying phytochemical properties of the plant. In previously conducted ethnobotanical and ethnomedicinal surveys, it was documented that certain plant families and higher taxa are highly utilized than other plant species.^[19] Moreover, the abundance of species from Moraceae family, considered as traditional medicine of its biological activities could be attributed on its wide components of bioactive compounds. The various plant species from the family have been reported to treat various ailments such as gastric problems, inflammation, and cancer.^[20] Furthermore, the abundance of medicinal plants from *Zingiberaceae* family is due to its popular usage as a source of food and as traditional medicine and to produce various industrial products such as natural dyes. Their rhizomes are reported to possess active nutritional, pharmacological, and medicinal properties.^[21]

The higher medicinal utilization of leaves is due to their abundance and can be easily replenished. Leaves possess abundant storage of chemical compounds through photosynthesis including alkaloids, coumarin, essential oils, flavonoids, and tannins, which are active components of most herbal preparations in high concentrations.^[22] Moreover, the high usage of leaves in making herbal medicines as compared to other plant parts can be attributed to its convenience of collection and it poses a lesser threat to its local flora. Furthermore, it indicated that the survival and continuity of medicinal plant are greatly maintained and that it ensures sustainable utilization of the plants. Previous ethnobotanical surveys in the Philippines reported leaves as the most frequently used plant parts. The utilization of leaves for medicinal usage is common, as reported by previous ethnobotanical studies of any Indigenous tribes.^[23] According to Hamel et al. (2018)^[24] leaves are the known site for active secondary metabolites, and the frequent use of leaves can be attributed to its presence of rich functional groups. Additionally by the study of Khan et al. (2014)^[25] stated that the use of leaves is not vital to the plant life cycle compared to other plant parts such as the roots, flowers, etc., and reported that high utilization of leaves is due to its accessibility.

Most of the bioactive compounds in plants can be extracted by water.^[26] A decoction is an extraction process that involves continuous hot extraction using a measured quantity of water as a solvent. The plant parts were dried, ground, and powdered, then the plant material was placed into a clean beaker. Water is then transferred by pouring and then stirred. Constant heating was then applied until reached the boiling point to facilitate the extraction of plant extract to facilitate

Table 4: Treated Diseases by the Medicinal Plants used by the Manobo Tribe from Don Marcelino, Davao Occidental.

Species Name	Treated Diseases
<i>Psidium guajava</i>	Digestive Disease, Respiratory Disease, Bites and Bleeding, Dermatological Disease, Oral and Pharyngeal, Gastrointestinal Disease, Wounds, Sprain, Diabetes Circulatory Diseases, Fever
<i>Syzygium aqueum</i>	Fever, Respiratory Diseases, Eye Infection
<i>Allamanda cathartica</i> Linn.	Gastrointestinal Disease
<i>Aloe barbadensis</i> Mill.	Falling Hair
<i>Areca catechu</i>	Dermatological Disease, Respiratory Disease, Bites and Bleeding, Oral and Pharyngeal Disease, Gastrointestinal Disease
<i>Cocos nucifera</i>	Wounds, Inflammation, Body Pain, Fever
<i>Artocarpus heterophyllus</i> Lam.	Fever, Dermatological Disease, Wounds, Gastrointestinal Disease, Respiratory Disease, Sprain Anemia, Kidney, Oral and Pharyngeal Disease, Bites and Bleeding
<i>Artocarpus communis</i>	Antidiabetic, Fever, Oral and Pharyngeal Disease, Gastrointestinal Disorder, Arthritis, Body Pain, Circulatory Disease
<i>Azadirachta indica</i>	Inflammation, Fever, Respiratory Disease, Gastrointestinal Disease, Dermatological Disease Bites and Bleeding
<i>Bambusa vulgaris</i>	Falling Hair, Relapse, Gastrointestinal Disease, Circulatory Disease
<i>Cymbopogon citratus</i>	Circulatory Disease, Gastrointestinal Disease, Inflammation
<i>Basella alba</i> Linn.	Fever, Sprain, Gastrointestinal Disease, Inflammation, Digestive Disease, Kidney, Dermatological Disease
<i>Kalanchoe pinnata</i>	Bites and Bleeding, Respiratory Disease, Dermatological Disease, Oral and Pharyngeal, Wounds, Inflammation, Headache, Bruises, Circulatory Disease, Fever
<i>Capsicum frutescens</i>	Circulatory Disease, Arthritis, Oral and Pharyngeal, Respiratory Disease, Gastrointestinal Disease
<i>Carica papaya</i>	Dengue, Digestive Disease, Respiratory Disease, Dermatological Disease, Oral and Pharyngeal Disease, Wounds, Poison
<i>Citrus × microcarpa</i>	Gastrointestinal Disease, Respiratory Disease, Headache
<i>Origanum vulgare</i>	Gout, Fever, Sprain, Gastrointestinal Disease, Headache, Respiratory Disease, Dermatological Disease
<i>Vitex negundo</i>	Respiratory Disease, Fever
<i>Curcuma longa</i> L.	Digestive Disease, Respiratory Disease, Kidney, Dermatological Disease, Gastrointestinal Disease, Wounds, Inflammation, Sprain, Bruises, Fever
<i>Alpinia purpurata</i> (Vieill.) K. Schum.	Respiratory Disease, Fever, Headache, Body Pain, Gastrointestinal Disease, Overfatigue, Digestive Diseases, Oral and Pharyngeal Disease, Inflammation, Dermatological Disease, Poisoning
<i>Zingiber officinale</i>	Gastrointestinal Disease, Respiratory Disease, Fever, Digestive Disease, Inflammation, Dermatological Disease, Oral and Pharyngeal Disease
<i>Euphorbia hirta</i>	Inflammation, Respiratory Disease, Bites and Bleeding, Dermatological Disease Gastrointestinal Disease, Dengue, Eye Infection, Fever
<i>Manihot esculenta</i>	Gastrointestinal Disease, Digestive Disease, Wounds
<i>Ficus elastica</i>	Sprain, Body pain, Headache
<i>Mimosa pudica</i>	Poisoning, Menstrual Flow, Fever, Gastrointestinal Disease, Wounds, Kidney, Bites and Bleeding Dermatological Disease
<i>Acacia confusa</i>	Body Pain
<i>Arachis hypogaea</i>	Malnutrition, Respiratory Disease
<i>Tamarindus indica</i>	Fever, Respiratory Disease, Gastrointestinal Disease, Headache, Eye Infection
<i>Bixa orellana</i>	Relapse, Wounds, Gastrointestinal Disease

continued...

Table 4: Cont'd.

Species Name	Treated Diseases
<i>Moringa oleifera</i>	Respiratory Disease, Wounds, Fever, Kidney Disease, Circulatory Disease, Oral and Pharyngeal Disease, Inflammation, Eye Infection, Paralysis, Gout, Headache, Diabetes
<i>Musa paradisiaca</i>	Gastrointestinal Disease, Circulatory Disease, Wounds, Poisoning, Anemia
<i>Persea americana</i>	Dermatological Disease, Diabetes, Bites and Bleeding, Circulatory Disease, Headache, Gastrointestinal Disease, Oral and Pharyngeal Disease, Kidney Disease, Respiratory Disease
<i>Punica granatum</i>	Gastrointestinal Disease, Fever
<i>Terminalia catappa</i>	Wounds, Relapse, Inflammation, Sprain, Dermatological Disease
<i>Annona muricata</i>	Sprain, Kidney Disease, Respiratory Disease, Antidiabetic, Circulatory Disease, Wounds, Myoma, Digestive Disease
<i>Avverhoa bilimbi</i>	Respiratory Disease, Fever, Wounds, Gastrointestinal Disease, Digestive Disease, Beri-Beri, Oral and Pharyngeal Disease, Dermatological Disease, Inflammation, Headache
<i>Avverhoa carambola</i>	Fever, Bites and Bleeding, Dermatological Disease
<i>Ipomoea batatas</i>	Anemia, Malnutrition, Gastrointestinal Disease, Digestive Disease
<i>Piper betle</i> L.	Gastrointestinal Disease, Respiratory Disease, Wounds, Sprain, Dermatological Disease, Oral and Pharyngeal Disease, Inflammation, Circulatory Disease, Body Pain, Arthritis
<i>Tinospora rumphii</i>	Respiratory Disease, Gastrointestinal Disease, Body Pain, Oral and Pharyngeal Disease, Circulatory Disease, Wounds, Diabetes, Dermatological Disease, Eye Infection
<i>Hibiscus rosa-sinensis</i> L.	Dermatological Disease

the extraction.^[27] A decoction is the most utilized preparation for medicinal plants prior to the application due to its convenience and simplicity. An abundant quantity of plant materials can be extracted at a time. The solvent can be used repeatedly. This method does not require filtration after extraction.

Primarily, the decoction and pounded leaves of *Moringa oleifera* were used as primary treatment for Wounds, Fever, and respiratory-related diseases. The study of Olowa *et al.* (2012)^[28] supports the medicinal attributes of *Moringa oleifera* as an antibiotic for wounds, cuts, and sores. Moreover, previous studies demonstrate the medicinal properties of *Moringa oleifera* in treating colds,^[29] diabetes, hypertension and stomachache,^[30] cough and low blood pressure^[31] and as a potential cure for cancer.^[32] Secondly, the ground leaves of *Kalanchoe pinnata* are used to cure various ailments such as wounds, bruises, and oral and dermatological related diseases. Previous studies by Gurnani *et al.* (2014)^[33] reported the potential of the *K. pinnata* in treating a wide range of diseases namely diabetes, diuresis, dissolution of kidney stones, and respiratory tract infections. Furthermore, the said medicinal plants were effective in treating boils, arthritis, and athletes' foot.^[34]

The decoction, infusion, poultice and pounded leaves of *Psidium guajava* were identified to treat wounds, bites and bleeding and gastrointestinal-related diseases. The study of Olowa *et al.* (2012)^[28] further supports the ability of *P. guajava* in treating wounds and scabies.

Previous studies by Tantengco *et al.* (2018)^[31] identified the effectiveness of *P. guajava* in treating diarrhea, stomachache, toothache, dizziness, and colds. Moreover, *P. guajava* is also a promising medicinal plant for treating cancer.^[32]

Furthermore, the decoction, paste, and squeezed whole plants of *Euphorbia hirta* are used to treat dengue, eye infection, and respiratory-related diseases. Similar ethnobotanical studies reported the utilization of *Euphorbia hirta* as an alternative treatment for dengue.^[20,29,35] Recent studies demonstrated the wide range of medicinal properties of *Euphorbia hirta*; it possesses Anti-allergic, Anti-bacterial, Anti-diabetic, Anti-diarrheal, Anti-oxidant, Antitumor and Anxiolytic and sedative and Diuretic activity.^[36] The infusion, poultice, paste and powdered fruit of *Alpinia purpurata* (Vieill.) K. Schum. is used to medicating headache, fever, and respiratory-related diseases. Traditionally, the different parts of *Alpinia purpurata* (Vieill.) K. Schum. is utilized traditionally for the treatment of the fungal disorder, in cancer therapy, as an anthelmintic, treatment of ulcer, cardiac disorder, treatment of arthritis, antidiuretic, dyspepsia, antipyretic, diabetes, burning of the liver, and kidney disease.^[37]

The Infusion, Poultice, Paste, Powdered, and Extraction of *Curcuma longa* L. fruit is used to treat fever and gastrointestinal-related ailments. Previous study further substantiated the medicinal attributes of *C. longa* L. in treating diarrhea, abdominal pain, flatulence, arthritis,

and lower hypertension.^[28] Moreover, it can also remedy constipation and urinary tract infections.^[30]

The pounded and extracted leaves of *Origanum vulgare* use to treat headaches, respiratory and gastrointestinal-related illnesses. The *O. vulgare* herb has been reported to possess multiple potentials including allelopathic potential, antibacterial property, insecticidal property; free radical scavenging, and radio-protective components from herb extracts.^[38] Currently, *O. vulgare* has been reported to have anti-epileptic, anti-urolithic, anticancer, antidiabetic, antiprotozoal, anthelmintic, and antiviral activities. Furthermore, the plant is effective against cardiovascular and respiratory disorders, and digestive diseases, possess larvicidal properties.^[39]

The decoction, infusion, poultice, pounded, paste, and squeezed leaves and barks of *Tinospora rumphii* are used to cure gastrointestinal and oral and pharyngeal-related diseases. Moreover, Olowa et al. (2012)^[28] also cited *Tinospora rumphii* as remedy for gastrointestinal illness namely stomachache. Furthermore, it is also used in treating toothache and ringworm^[29] Fever, flatulence,^[31] blisters, diabetes, and kidney trouble.^[30]

The leaves and fruits of *Annona bilimbi* are prepared by decoction. Infusion, poultice, extraction, and direct consumption of fruits can help improve digestive and respiratory organs. The result was supported by several pharmacological studies and has demonstrated the ability of the plant parts to have an inhibitory agent that can function as an antimicrobial, antioxidant, antidiabetic, antihypertensive, thrombolytic, hypolipidemic, and hepatoprotective agent.^[40] The leaves and fruit of *Annona muricata* are prepared by decoction, Infusion, Poultice, and Paste (viscous) prior to its application as alternative medicines for diabetes, kidney, and circulatory-related ailments. The species of *A. muricata* are frequently cited as a remedy for diarrhea^[28,30] and as an antidote for cancer, diabetes and hypertension.^[30]

The leaves and fruit of *Carica papaya* can be prepared by grinding and direct consumption of fruits as an antidote to digestive tract ailments and oral and pharyngeal-related diseases. Several studies identified *C. papaya* as a treatment for Dengue,^[29-30] relief for inflamed tonsils (Olowa et al. 2012), Headache,^[31] and a promising cure for cancer.^[32]

The extracted Juice from *Citrus × microcarpa* can be used to cure to headaches and respiratory-related diseases. The curative agent of *C. × microcarpa* is extended to cure dry cough, remedy for phlegm.^[28,31] Moreover, it has been reported to have Anti-inflammatory, Anti-microbial, Anti-cancer, and Anti-parasitic activity.^[41]

The fruit of *Zingiber officinale* can be prepared Infusion, Poultice, and Paste (viscous) is used primarily for gastrointestinal and respiratory-related diseases. It has been reported to treat muscle pain, sore throat and cough.^[30] Moreover, it has been considered a traditional ayurvedic medicine with a curative agent against gastrointestinal diseases, Anti-inflammatory, Larvicidal, Antioxidant and Anti-microbial activity, and active preventive effects against breast cancer, and ovarian cancer.^[42]

The leaves of *Piper betle* L. are applied and Paste to the part of the body experiencing gastrointestinal and respiratory-related diseases. The plant species is traditionally, medicinally important in the world.^[43] The betel leaves are utilized as mouth freshener and also known to have a curative agent for many communicable and non-communicable diseases such as bronchial asthma, cold, cough, stomachalgia, rheumatism and can also mitigate wide range of diseases namely bad breath, boils, and abscesses, conjunctivitis, constipation, swelling of gums, cuts and injuries.^[44] The essential oil of betel leaves possesses anti-bacterial, anti-protozoan and anti-fungal properties. Furthermore, it reduces the adherence of early dental plaque bacteria.^[44]

It is also found that Betel has significant anti-proliferative activity *in vitro* and *in vivo* prostate cancer models.^[45] The species of *Artocarpus heterophyllus* Lam. is used to treat wounds, bites and bleeding by decoction and infusion of the leaves, roots and barks. It was previously reported that *Artocarpus heterophyllus* has broad range of pharmacological properties such as Anti-infective, Anti-cancer, Anti-inflammatory, and Anti-diabetic.^[46] The pharmacological properties of the *A. heterophyllus* are due to the presence of phytonutrients including saponins, lignins, and isoflavones. These phytonutrients possess antiulcer, anticancer, and anti-aging properties^[46-47] reported that alkaloids, carbohydrates, flavonoids, triterpenoids, proteins are present in *A. heterophyllus*.

The leaves, stem, roots, stem and fruits of *Musa paradisiaca* is used to treat gastrointestinal and circulatory related disease by decoction, Infusion, Poultice, Pounded, Paste, and direct consumption of fruits. Furthermore, *M. paradisiaca* are reported to cure diarrhea,^[31] abate bleeding wounds,^[28] hemonausea and headache.^[30] Its rich medicinal uses could be attributed to the abundance of saponins in peel, leaf and flower.^[48-49]

The decoction of *Cymbopogon citratus* stem is used to treat Circulatory and Gastrointestinal related diseases. *Cymbopogon citratus* comprises the following functional groups namely of alcohols, aldehydes, esters, ketones, and terpenes. The presence of essential oils is one the most reported phytoconstituents. The plant also

contains phytoconstituents such as flavonoids and phenolic compounds. Previous studies indicated the species of *Cymbopogon citratus* with various pharmacological activities such as antibacterial, anti-amoebic, antidiarrheal, antifilarial, antifungal and anti-inflammatory properties. Furthermore, pharmacological activities such as antimalarial, antimutagenicity, antimycobacterial, antioxidants, hypoglycemic, and neuro-behavioral has been reported.^[50] The leaves of *Vitex negundo* are recorded to treat respiratory-related diseases by preparation of Decoction, Infusion and Poulitice. Similarly, the decoction of leaves and shrub was also reported to treat Cough, stomach ache, asthma and sore throat.^[36]

Basella alba Linnaeus is used to treat Inflammation and digestive related diseases by preparing pounded, pasting (viscous) or by direct consumptions of its leaves. The daily consumption of *Basella alba* has a positive effect on the total-body vitamin A in men. Secondly, the leaves of *B. alba* are traditionally used as medicine to bring sound refreshing sleep when it is administered on the head for half an hour before bathing.^[51] A paste prepared of the plant root is applied to swellings and as a rubefacient. The decoction of the plant leaves is used for mild laxative effects. The application of pulped prepared leaves helped relieves boils and ulcers. Moreover, during the age ayurveda, it is used for treating hemorrhages, skin diseases, sexual weakness, and ulcers and as laxative agent in children and pregnant women.^[52-54]

The results of the current studies were also supported by previous studies on the Medicinal Plants by the Manobo tribe from various places in Mindanao, Philippines. In Agusan Del Norte, the Manobo tribe also utilizes *Psidium guajava* as treatment for loose bowel movement (LBM) and gastrointestinal discomfort (GD), *Kalanchoe pinnata* for stomachache, *Origanum vulgare* and *Vitex negundo* for cough, *Euphorbia hirta* for fever and *Tinospora rumphii* as treatment for toothache.^[8] Secondly, the Manobo tribe of Prosperidad Agusan Del Sur used *Euphorbia hirta* as treatment for Dengue, Eye infection and Malaria. *Ficus* genus was also reported as a treatment for broken bones. *Musa sp.* was also reported as treatment for muscle pain and spasm.^[9] Thirdly, from the Manobo tribe of Sibagat Agusan del Sur reported *Psidium guajava* L., *Kalanchoe pinnata*, *Ficus* sp. and *Tinospora rumphii* as treatment for cuts and wounds.^[10] Moreover, the Manobo tribe from Bayugan city reported also the utilization of the *Capsicum* genus as an appetite enhancer, insect bites, skin diseases, and infections. *Carica papaya* as treatment for Body pain, constipation, and dengue fever. *Vitex negundo* as treatment of Cough, gas pain and flatulence, headache, postpartum care, and recovery. *Curcuma longa*

L. is used as a treatment for arthritis, diabetes, cough, fever, gas pain, flatulence, insect bites, menstrual problems, and wounds. *Euphorbia hirta* is used to treat colds, dengue fever, fever, skin diseases. *Mimosa pudica* as a treatment for Child sleeplessness, diabetes, dysentery, hypertension, and urinary problem ^[11]. The Manobo tribe from Surigao Del Sur also reported *Areca catechu* L., *Cocos nucifera* L. and *Piper betle* L. being used as ritual healing.^[12]

The results of this study also revealed the presence and density of medicinal flora in the upland areas of the Don Marcelino Manobo tribe in Davao Occidental. Their ancestral lands are niches for rich medicinal plant resources that should have been extensively recorded and protected. These findings reinforced the issuance of a Certificate of Ancestral Domain Title (CADT) by the National Commission on Indigenous People (NCIP) and the Department of Environment and Natural Resources (DENR) between indigenous communities, which provides a critical component in biodiversity preservation strategy. The Indigenous protected areas programs should be expressed by the Local Government Units (LGU), which could potentially result in considerable economic and cultural benefits for the Manobo. The government should also safeguard the IP's right to use, access, and act as stewards of their ancestral lands. Both local people and the LGU should proactively get involved in biodiversity conservation programs and strategies for sustainable management and protection of medicinal plant resources as part of the world's cultural heritage.

This study presents the rich medicinal plant knowledge of Manobo from the Upland areas of Don Marcelino, Davao Occidental. Anthropogenic activities could be observed in the upland areas such as deforestation, logging and over-exploitation and, hence, a need for conservation policy and strict protection must be implemented by the local government units. It is highly recommended for the Manobo people's participation as key informants in governmental programs for conservation to sustain their cultural heritage of traditional medicine and conserve these cultural community resources. Ethnomedicinal survey such as this could provide a way for further pharmacological investigations and clinical studies to validate the effectivity of folk medicinal plants.

CONCLUSION

The ethnobotanical survey of medicinal plants used by the Manobo tribes identified 41 species from 28 families identified to have medicinal properties. The study on

the medicinal plants was conducted through Focus Group Discussion (FGD) and Structure Interviews using Questionnaires on the practicing Manobo Healers. The practicing healers of the tribes constitute the respondents. The practicing healers were determined from referral from IPMR. The demographic profile, medicinal plants, plant parts, mode of preparation and the various treated diseases were documented. *Psidium guajava*, *Alpinia purpurata* (Vieill.) K. Schum., *Kalanchoe pinnata*, *Citrus × microcarpa*, *Vitex Negundo*, and *Tinospora rumphii* are the most cited medicinal plants. Additionally, *Moringa oleifera*, *Kalanchoe pinnata*, *Psidium guajava*, *Euphorbia hirta* and *Alpinia purpurata* (Vieill.) K. Schum is frequently used medicinal plants identified by the Manobo tribe from Don Marcelino, Davao Occidental Philippines. Moreover, the leaves of the medicinal plants are the most used parts and are prepared by decoction prior to administration to the specific ailments. Furthermore, further study on the screening of novel compounds is highly desirable to further substantiate the medicinal properties of the identified plants. Lastly, the conservation of medicinal plants in the locality is highly desirable. Local government units must safeguard the IPs right to use, access, and act as stewards of their ancestral lands. Both local people and the LGU should proactively get involved in biodiversity conservation programs and strategies for sustainable management and protection of medicinal plant resources as part of the world's cultural heritage.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

FGD: Focus Group Discussion; **UV:** Used Value; **RFC:** Relative Frequency of Citation; **FPIC:** Free Prior Informed Consent; **NCIP:** National Commission on Indigenous People; **IPMR:** Indigenous Person Mandatory Representative; **LGU:** Local Government Unit.

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