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Ethnomedicinal study of animals and plants used by Agusanon Manobo in La Paz, Agusan del Sur, Philippines

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ABSTRACT

This study documented the ethnomedicinal use of plants and animals by the Agusanon Manobo in La Paz, Agusan del Sur. A semi-structured questionnaire was used to gather information from 50 informants between the ages of 25-80 years old from two different barangays. The most commonly used medicinal animals were determined using fidelity level (FL) and informant consensus factor (ICF). The medicinal plant species having local importance was determined using the relative frequency of citation (RFC). Ten species of medicinal animals from ten families have been documented during the survey. The most commonly used animals are *Malayophyton reticulatus* (baksan) was used to cure digestive system related ailments, the most preferred animal part to be used is the bile. A total of 39 species with medicinal values were documented for ethnomedicinal plants, there were 27 plant families noted, and mostly from Lamiaceae. Leaves were widely used plant parts and decoction was the most common way of preparation that is administered orally. The ethnomedicanal plants reported having highest RFC values is *Artemisia vulgaris* (hilbas) used for treating respiratory related ailments. It was also mentioned by the Agusanon Manobo that there was no side effects on taking medicinal animals and plants thus, advance scientific investigation is needed to further validate the pharmacological effects and active components present in these medicinal animals and plants.

Keywords: *Artemisia vulgaris, baksan, hilbas, Malayophyton reticulatus*

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1 Introduction

Ethnomedicine examines and translates health-related knowledge and theories that people inherit and learn by living in a culture. Each society has a particular medical culture or "ethnomedicine," which forms the culture's medical common sense, or logic. An ethnomedical system has interrelated notions about the body, the causes and prevention of illnesses, diagnosis and treatment (Quinlan 2011). The information and folk knowledge regarding the medicinal and therapeutic uses of these indigenous animals and plant materials have been handed down from generation to generation through verbal communication. Traditional medicine is used globally and has a rapidly growing economic importance. In developing countries, traditional medicine is often the only accessible and affordable treatment available (Bussmann & Sharon 2006).

The traditional medicinal knowledge of indigenous people across the globe has played an important role in identifying living organisms which are endowed with medicinal values important for treating human and livestock health problems (Kendie et al. 2018). The treatment of human diseases using animals and animal-derived

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treatments is known as zootherapy (Costa-Neto 1999). Using animals and their products to treat patients suffering from various health problems has a long tradition. It is still prevalent in many parts of the world, even when medical science has achieved great heights (Jugli et al. 2019). Animals and their products had been used traditional treatments, playing significant roles in healing practices, magic rituals, and religious practices amongst various cultures and communities. The use of ethnomedicinal animals is believed to treat various types of ailments (Gomez et al. 2021). Animals are not the only source of ethnomedicine, but also the plants around us. The use of medicinal plants was discovered a long time ago. This is most affordable and easily accessible source of treatment as traditional medicines remained in the primary healthcare system (Omac et al. 2021; Belayneh et al. 2014). An indigenous medicinal plant in the Philippines is in need of assessment in the different vegetation types in terms of species richness, diversity, and ecological status. Plant-base medicines are the beginning of ethnomedicine where pharmaceuticals were developed (Blasco et al. 2014). Tuklas Lunas, a program that gave birth to the *Vitex negundo* (lagundi) and *Blumea balsamifera* (sambong) as medicinal products, continues to pursue drug discovery and development by leveraging on the country's very own biodiversity.

On the other hand, the Manobo tribe is one of the populous indigenous group of people in the island of Mindanao, Philippines and that includes the Agusanon Manobo tribe in the province of Agusan del Sur. Manobo, the name may come from Mansuba from man (person or people) and suba (river), meaning river people. An indigenous community seems to hold the habitual knowledge of herbal remedies for different minor to chronic diseases (Abbasi et al. 2009). Approximately 80% of the population depends exclusively on animals and plants for their health and healing (Majumdar et al. 2006).

The traditional knowledge has been passed on verbally from one generation to another (Bora et al. 2012). The knowledge on the use of different animals and plants in traditional medicine by different ethnic communities is generally passed orally from one generation to another, and this knowledge is sometimes lost with the death of the elderly knowledgeable person. Nowadays, traditional knowledge system is fast eroding due to urbanization. Also, given that most medicines available in the country are developed abroad and are distributed by multinational companies, these products are usually offered at higher prices which in turn becomes a barrier for Filipinos to access treatment. To develop drugs that are sourced locally makes them more accessible and affordable to communities. So, it is vital to study and document the ethnobiological information regarding the therapeutic use of different animals and plants in traditional medicine among different ethnic communities before the traditional cultures are completely lost (Trivedi 2002). The findings of this research would be of great help to all fields of sciences and in future studies. It will also provide insights on the utilization, management, and conservation of medicinal animals and plants in the area. Thus, the main objective of the study was to assess and identify the ethnozoological and ethnobotanical usage as a medicinal source in treating different diseases. This paper also provides insights on the treatment process of each animal and plant species with notes on the frequency of usage, its effectivity, and dosage which is a vital information that are rarely been presented in this type of study. The informant consensus factor, relative frequency of citation, fedility level of the species and internetwork analysis were also presented to increase the confidence level of the most important organisms with medicinal values used by the Agusanon Manobo tribe in La Paz, Agusan del Sur.

2 Materials and Methods

Description of the study Area

La Paz is a municipality in the landlocked province of Agusan del Sur. The municipality has a land area of 1,481.12 square kilometers or 571.86 square miles which constitutes 14.83% of Agusan del Sur's total area (Figure 1). Its population as determined by the 2015 Census was 28,217. This represented 4.03% of the total population of Agusan del Sur province, or 1.09% of the overall population of the Caraga region. La Paz is composed of 15 barangays, the municipal center of La Paz is situated at approximately 8° 17' North, 125° 49' East, in the island of Mindanao. Elevation at these coordinates is estimated at 25.2 meters or 82.7 feet above mean sea level.

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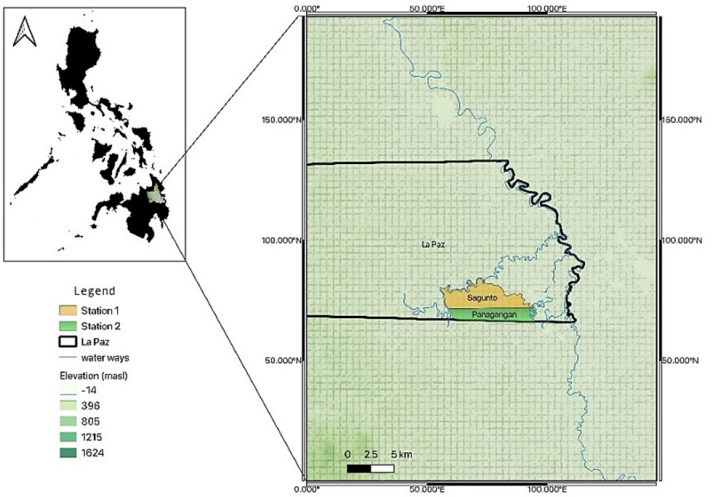

Figure 1. Map of the Philippines showing the location of the study area, La Paz, Agusan del Sur.

Data Collection

Surveys were done in Barangay Sagunto and Barangay Panagangan in La Paz, Agusan del Sur. Respondents (n=50) from both Barangays participated in the ethnomedicinal survey. The respondents were selected using the following criteria: (a) 25 years old and above; (b) availability of the respondents; (c) willingness to participate; (d) being a member of the Agusanon Manobo tribe; and (e) the accessibility of the participant's area (Gomez et al. 2021).

A semi-structured questionnaire on medicinal animal and plant utilization was utilized. This questionnaire was adapted from Gomez et al. (2021) with few modifications. The survey was performed from January to February 2022. The local name, usage, preparation, and specific part of the animal and plant species used for treatment were included in the questionnaire. Also, the frequency of usage, and effectiveness of the medicine in terms of its fast-acting properties when applied were noted. With the help of a local guide, the questions were translated orally into the Agusanon Manobo dialect.

The ethnomedicinal data about the use of animals and plants were collected using participatory rural appraisal (PRA) methods, where the informants also sometimes become the investigator themselves. It involved an informal interview/meetings, open and group discussion among family members (Gomez et al. 2021; Omac et al. 2021).

Ethical consideration

In keeping the views of the local community's cultural values, the data collected were handled with care. The free and prior informed concent was utilized in this study and was based on the NCIP Administrtive Order No. 3 series of 2012. The respondents were informed that the study was carried out for academic reasons and not for commercial purposes. A mayor's permit and barangay's permit was secured before the conduct of the study. An individual informed consent was also obtained from the respondents before the face to face interview, allowing the researcher to collect data for the study (Gomez et al. 2021).

Species identification

Animal identification

The local name of the animals and their associated medical attributes were recorded in this study. Local names of the animals was translated by the local guide into common name. A photo of an animal was shown to the respondents for verification of species they have mentioned. Species identification was done using the published journal article (i.e. Weinell et al. 2019; Diesmos et al. 2015).

Plant identification

During interview, common plants mentioned were observed around the area and were photo-documented for further identification. Plants were initially identified with the help of availabe

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taxonomic literature (i.e. Fernando et al. 2004; Merrill 1903; Pelser et al. 2011- onwards) and further verified with the help of plant experts in Caraga State University.

Relative frequency of citation (RFC)

Relative frequency of citation index shows the local importance of each species. The RFC value was calculated using the formula RFC=FC/N; where FC is the number of informants mentioning the use of species and N is the number of informants participating in the survey (Vitalini et al. 2012). This RFC index varies from 0 to 1, where RFC index is 0, it means that 0 refers to the animals as useful and when RFC index 1 it indicates that all informants in the survey refer to animals as useful (Mohomodly et al. 2014).

Fidelity level (FL)

The most commonly used animals in the treatment of a particular disease category by informants of the study area were also determined. Fidelity level (FL) was used to identify the residents most preferred species used for treating specific ailments. The FL was calculated using the formula follows:

$$FL=Np/N \times 100$$

where Np is the number of informants that claim as a use of a specific animal species to treat a particular ailment and N is the total number of the informants who utilized the medicinal plant/animal to treat any given disease (Freedman et al. 1986).

Informant consensus factor (ICF)

Informant consensus factor was calculated to estimate the relationships between the numbers of use reports in each category (Nur) minus the number of species used (Nt) and the number use reports in each category. The formula is ICF= Nur – Nt/ Nur – 1, the values of ICF ranges 0 to 1. The high values close to 1 indicates relatively few taxa (usually species) are used by the large proportion of the people, whereas a low value indicates that the informants disagree on the taxa to be used in the treatment within a category of illness (Logan 1986; Heinrich et al. 1998).

Data analysis

Collected data were analyzed using microsoft excel for entering, calculating and analyzing data. The SPSS version 14 was used for statistical computing as well as for graphics and the significance level was considered at alpha = 0.05. To compare the species variation and abundance, the ANOSIM or the analysis of similarity was used (Table 1).

The inter-network analysis was done in this study to gain more network information between the animal and plant species used, the organisms parts used, treatment process and applications, and disease treated. These were analyzed using Gephi software version 0.9.4.

3 Results and Discussion

Medicinal animals recorded

Ten species belonging to 10 families were reported by the Agusanon Manobo to have ethnomedicinal benefits (Table 2). The Manobo of Eastern Mindanao believe that animals such as goats, deer, turtles, monkey, snakes (python and cobra), electric eel, chicken, cat, lizard, and even part of the newly born baby have ethnomedicinal benefits (Gomez et al. 2021). This finding indicate that traditional medicinal practitioners and indigenous people are mostly dependent on the wild sources which might be related to the availability of animals in their area as source of medicine and food. The present investigation shows that various indigenous communities use animals in their traditional medicines, pythons were the most used animal by the Agusanon Manobo. Skin, meat, blood, and marrow are among the python body parts utilized in medicine, in addition to bile. Individuals who consume python bile utilize it by ingesting it directly or drying it, then

Table 1. ANOSIM coefficient interpretation (Sop et al. 2012).

Range	Verbal Interpretation
0.00 to 0.25	No difference/Similar
0.26 to 0.75	Some separation/Some Dissimilarities
0.75 to 0.99	Well Separated/Wdissimilarities
1	Totally Dissimilar

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cutting it into pieces and ingesting it with water or putting it in an empty capsule and drinking it (Gomez et al. 2021; Zulkarnain et al. 2021).

Animal parts and its derivatives used

Results indicate that different parts of medicinal animals and derivatives are used for healing values. It shows that bile (26%) is the most commonly used animal part, followed by blood (18%), feces and egg (11%), liver (10%), flesh (8%), horn (7%), skin (4%), and honey an animal derivatives (2%) (Figure 2).

The snakes that are usually used in Agusanon Manobo are cobras and pythons. Pythons or 'sanca' have been known as domesticated snakes, although not as famous as the cobra. The Agusanon Manobo tribe used the bile of phyton as thier primary source of medicine. Bile is a yellow, orange, or slightly green aqueous fluid that is the "exocrine" secretion of the liver. It forms first in bile canaliculi enclosed between parenchymal cells of the liver and flows continuously into ever enlarging ducts to exit the liver via two hepatic ducts (David et al. 2014). Agusanon Manobo use the python bile by swallowing it directly or drying it, then cut it into pieces and swallowed with water or put in an empty capsule and drunk. The python bile is believed to be able to overcome colds/ runny nose, malaria fever, fever, cough, shortness of breath, aches, and increase body immunity.

Treatment process of medicinal animals

The Agusanon Manobo have six ways of preparing ethnomedicinal animals to treat ailments. This includes ingestion of animal parts (39%), followed by decoction (28%), ointment (20%), topical patching (8%), roasting (3%) and offering (1%) (Figure 3).

Results of this study is also comparable to the reports of Gomez et al. (2021) in the Manobo

Table 2. List of ethnomedicinal animals used by the Agusanon Manobo in La Paz, Agusan del Sur.

Animal family	Scientific name	Local name	Common name	Animal part used	Treatment process	Disease/ ailment treated	Mode of preparation
Anatidae	*Anas platyrhynchos* Linnaeus, 1758	pato	domesticated duck	blood	ingestion	leukemia	Blood drained in the snake body and drink fresh.
Apidae	*Apis dorsata* Fabricius, 1793	putyukan	giant common bee	honey	ingestion	teething	Drink the honey
Bovidae	*Capra hircus* Linnaeus, 1758	kanding	goat	feces	grilled, fried, crushed, decoction	measles, fatigue	Grilled feces is crushed into a powder, boiled with hot water & served as a tea.
Cervidae	*Rusa marianna* Desmarest, 1822	usa	deer	horn	crushed & decoction, paste	wounds, swelling, bites	Horn is boiled with water and served as a tea.
Elapidae	*Ophiophagus hannah* Cantor, 1836	banakon	cobra	blood, skin, flesh, bone	chewing, ingestion	headache, stomachache, diarrhea, spasm, swelling, bites, high blood, diabetes, rheumatism	Blood drained in the snake body and drink fresh.
Gekkonidae	*Hemidactylus frenatus* Dumeril & Bibron, 1836	tuko	common house gecko	bone, flesh, internal organs, skin, tail, blood	grilled, fried, crushed, decoction	headache, fatigue	Grilled & crushed into powder & water added. Served as a tea
Geoemydidae	*Siebenrockiella leytensis* Taylor, 1920	bao	turtle	bone, flesh, internal organs (liver), shell,	decoction, ingestion, steam, bath, fried, ointment	stomachache, asthma, rheumatism, malaria, cough	Turtle's body part is boiled with water and served as a tea.
Hirudinea	*Hirudo medicinalis* Lamarck, 1818	linta	leech	jaw	topical patching	rheumatism	Attached /paste in the affected area
Phasuanidae	*Gallus domesticus* Linnaeus, 1758	manok	domesticated chicken	blood, egg	ingestion, offering	fever, measles	Blood from the chicken is used as an offering
Pythonidae	*Malayophyton reticulatus* Schneider, 1801	baksan	reticulated python	bone, flesh, internal organ (bile), skin, fats, liver	decoction, ingestion, ointment, steam bath	headache, stomachache, fever, diarrhea, asthma, high blood, diabetes, malaria	Decocted bile is taken orally, fats is used as ointment.

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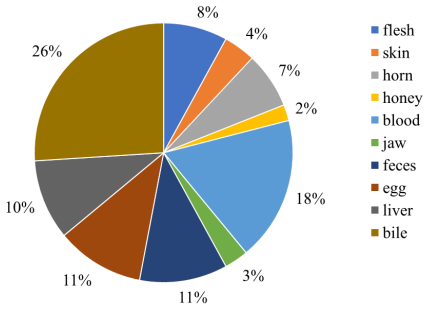

Figure 2. Percentage compostion of animal parts and its derivatives used as medicine by the Agusanon Manobo tribe in selected barangay in La Paz, Agusan del Sur.

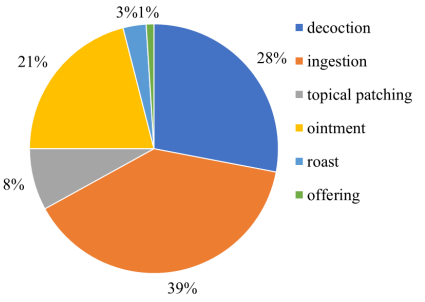

Figure 3. Percentage compostion of treatment process of animal medicine by the Agusanon Manobo tribe in selected barangay in La Paz, Agusan del Sur.

Umayamnon where 11 ways of preparing ethnomedicinal animals. Offering of animals to cure certain diseases was also mentioned in this study which is also unique among Agusanon Manobo tribe. Different indigenous tribal groups also sacrifice animals for different rituals and religious purposes in keeping with their mythological myths and beliefs. The Manobo of Eastern Mindanao believed that epidemics are attributed to sea-demons' malignancy, and by way of appease and lure to this plague-spirits to hurry off with their outbreak, offering was performed in the nearest rivers (Garvan 1927). For the Agusanon Manobo they made offerings like fresh chicken blood to cure a specific ailment caused by the spirit.

Informant consensus factor (ICF) of animals

The Agusanon Manobo have indicated that some diseases are cured through treatment using their identified medicinal animals and these diseases were grouped into different categories. The highest recorded ICF values indicated the best level of agreement among the informants in terms of the use of the medicinal animals species reported. The digestive system related ailments got the highest computed ICF (0.94); (Table 3).

Digestive system disorders are one of the most common types of ailments affecting humans. Several ethnomedicinal studies revealed that the use of medicinal animals by traditional people against digestive system disorders is a common practice throughout the world (Tangjitman et al. 2015). Digestive system disorders, particularly diarrhea, was the fifth leading cause of global mortality, as approximately 100 million people died worldwide in 2012 from these types of disorders. Moreover, in South-East Asia, diarrhea has been the cause of 10% of deaths among children below the age of 5 years. Few investigators have reported on the pharmacological relevance of the animals used in digestive system disorders (Tangjitman et al. 2015).

Fidelity level of animals

Many indigenous people were found to lack formal education, but they have knowledge about the use of local animal resources for traditional medicines. Fidelity levels (FL) demonstrate the percentage of respondents claiming the use of a certain animal or its product for the same ailments. A higher FL of or close to 100 for a specific animal indicates that all of the used reports mentioned the same method for using the animals as medicine for the same diseases. Six animal species with medicinal purposes have FL of 100 (Table 4).

The honey of bee species (*Apis mellifera*) is known to relieve wart, asthma, diarrhea, throat pain, stomachache, cough, and tuberculosis and achieves the highest fidelity level (Kendie et al. 2018). On the other hand, Jaroli et al. (2010) reported that blood of pigeon (*Columba livia*) is used to treat paralysis, in this study the Agusanon Manobo tribe used blood of chicken to treat fever and measles.

Relative frequency of citation (RFC) of animals

Relative frequency of citation (RFC) index was calculated to determine the local importance of each species. The family Pythonidae had the highest number of citations (62%), while the Apidae yielded the lowest RFC value (4%); (Figure 4).

Snakes are among the animals that have most influenced the human psyche since ancient times. In Mexico, the Aztecs made extensive use of the ophidiofauna: several species were consumed, offered to the gods and used as medicines (Fita

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et al. 2010). Mardiastuti et al. (2021) reported that reptile species indicated that the local people believe that reptiles, in general, were excellent as traditional medicine and able to cure various diseases. The use of reptiles for medicinal purposes has been commonly practiced in many parts of the world, not only in Indonesia. Global reviews on wildlife use by local people elsewhere revealed that at least 284 species of reptiles have been used as traditional medicine (Alves et al. 2013).

Frequency of use, effectivity and animals dosage

The result on the frequency of the use and effectivity of animals to cure diseases, where also determined in this study. *Malayophyton reticulatus* was considered the most widely used animal and the most effective (Table 5). Different people have different ways and basis in utilizing ethnomedine. This study also shows of how much dosage of animal based medicine use to cure certain diseases and how often it was taken. Agusanon

Table 3. Informant Concensus Factor values of the diseases cured by the medicinal animals used by the Agusanon Manobo tribe in selected barangays in La Paz, Agusan del Sur.

Category	Diseases/ ailment	Animal family most used	Used citation	Animal taxa used	ICF
Digestive system ailments	Stomachache and diarrhea	Pythonidae	68	5	0.94
Fever ailments	Fever	Phasuanidae	16	2	0.93
Dermatological problems	Wounds, bites, and measles	Bovidae	37	4	0.92
Muscle-skeletal ailments	Spasm and rheumatism	Bovidae	35	6	0.85
Blood-related ailments	High blood, diabetes, and malaria, luekemia	Elapidae	55	9	0.85
Nervous system ailments	Headache	Elapidae	13	3	0.83
Inflammation and body pain	Swelling and teething	Cervidae	9	3	0.75

Table 4. List of fidelity level (FL) for ethnomedicinal animals in treatment of certain ailment used by the Agusanon Manobo tribe in selected barangay in La Paz, Agusan del Sur.

Scientific name	Common/ local name	Disease/ ailment	Frequency of citation	Total number of citation	Fidelity level
Anas platyrhynchos Linnaeus, 1758	duck/ pato	leukemia	4	4	100
Apis dorsata Fabricius, 1793	bee/ putyukan	dental ailment due to teething	2	2	100
Capra hircus Linnaeus, 1758	goat/ kanding	measles	12	13	92
		spasm	10	13	77
Gallus domesticus Linnaeus, 1758	chicken/ manok	fever	8	13	62
		measles	12	13	92
Hemidactylus frenatus Dumeril & Bibron, 1836	gecko/ tuko	headache	2	5	40
		asthma	5	5	100
Hirudo medicinalis Lamarck, 1818	leech/ linta	rheumatism	4	4	100
Ophiophagus hannah Cantor, 1836	banakon/ cobra	headache	10	17	59
		stomachache	6	17	35
		diarrhea	1	17	6
		spasm	3	17	18
		highblood	13	17	77
		diabetes	14	17	82
		malaria	11	17	65
Malayophyton reticulatus Schneider, 1801	phyton/ baksan	headache	1	31	3
		stomachache	29	31	94
		fever	10	31	32
		diarrhea	22	31	71
		asthma	1	31	3
		rheuma	4	31	13
		highblood	2	31	7
Rusa marianna Desmarest, 1822	deer/ usa	wounds	8	8	100
		swelling	5	8	63
		bites	5	8	63
Siebenrockiella leytensis Taylor, 1920	turtle/ bao	stomachache	10	12	83
		asthma	12	12	100
		diabetes	1	12	8

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Manobo recommends a daily dosage of 1-10 grams for *Malayophyton reticulatus* (baksan) and *Ophiophagus hannah* (banakon), and 1-20 grams for *Siebenrockiella leytensis* (bao) (Table 5). Baksan and banakon are taken once a day, while bao is taken twice a day.

In the ancient medicine, every part of the turtle is consumed, such as their meat, as well as their skin, heads, eggs, shells and even their blood, urine, and bile. Turtle meat is also believed to enrich your blood and cool your body, causing turtle soup to be recommended by alternative medicinal practitioners like Sheng-Nong for menopausal symtoms such as night sweats hot flashes and irritability (Crandall 2014).

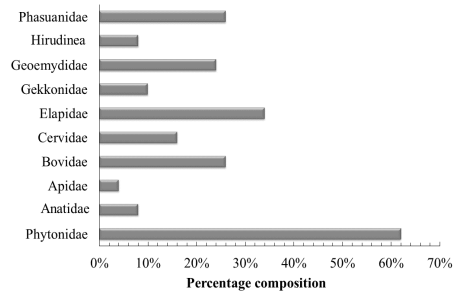

Figure 4. Relative Frequency of Citations of Animals mentioned by the Agusanon Manobo tribe in selected barangay in La Paz, Agusan del Sur.

Analysis of similarity (ANOSIM) and internetwork analysis (INA) of medicinal animals

The analysis of similarity in animals between Barangay Panagangan and Sagunto shows that there are some similarities in animals used (ANOSIM R= 0.26). The findings of this ethnozoology study suggested that the traditional zootherapeutic remedial measures followed and practiced by the Agusano Manobo tribe of La Paz, Agusan del Sur plays an important role in their primary healthcare. The documentation of this indigenous information on animal-based medicines should be very helpful in the formulations of strategies for sustainable management and conservation of bio-resource as well as providing potential for novel drug discoveries.

The data obtained from the respondents were further analyzed to have an overview of what animals (orange node coded with A) having different internetwork relationships in terms of: (a) animal parts used (yellow nodes coded with AP); (b) treatment process and application (green nodes coded with T); and (c) disease treated (blue nodes coded with D). Internetwork analysis shows that the animal having great medicinal importance is the *Malayophyton*

Table 5. Frequency of use, effectivity of the mentioned ethnomedicinal and animal dosage used by the Agusanon Manobo tribe in selected barangay in La Paz, Agusan del Sur.

Scientific name	Local name	Frequency of Use			Effectivity		Animal Dosage: Gram		
		Always	Sometimes	Fast (1 - 12 hrs)	Moderate (13 - 24 hrs)	Slow (Above 24 hrs)	No Idea	1 to 10	11 to 20
Malayophyton reticulatus Schneider, 1801	baksan	29	2	30	1	-	2	29	-
Hirudo medicinalis Lamarck, 1818	linta	-	4	2	2	-	4	-	-
Siebenrockiella leytensis Taylor, 1920	bao	11	1	10	1	-	2	-	12
Anas platyrhynchos Linnaeus, 1758	pato	-	4	-	1	3	-	4	-
Apis dorsata Fabricius, 1793	putyukan	-	2	-	-	2	-	2	-
Gallus domesticus Linnaeus, 1758	manok	10	3	12	1	1	1	10	2
Rusa marianna Desmarest, 1822	usa	4	4	8	-	-	-	8	-
Ophiophagus hannah Cantor, 1836	banakon	5	12	14	1	1	2	15	-
Capra hircus Linnaeus, 1758	kanding	12	1	1	10	1	1	12	-
Hemidactylus frenatus Dumeril & Bibron, 1836	tuko	-	5	-	4	1	2	2	3

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reticulatus (A10) having variuos unique interconnections (Figure 5).

Medicinal plants species

Thirty nine species from 27 families were documented to have ethnomedicinal uses (Table 6). In the Philippines, indigeneous people passed their knowledge about the use of plants as medicine to their next generation through oral tradition that is why until now the practice is still present especially to the tribe living outside the city (Gruyal et al. 2014; Ahmad et al. 2011).

Majority of plant family recorded in this study belongs to Lamiaceae (12%), followed by Malvaceae (10%), Asteraceae and Poaceae (8%), Convolvulaceae and Euphorbiaceae (5%) (Figure 6). These results are in agreement with the study of Fiscal (2017) on medicinal plants in Laguna, which also showed Lamiaceae as the botanical family with the highest number of plant species.

Plant part used

Different parts of the plants were used by the Agusanon Manobo tribe to cure various diseases. Among the recorded parts, leaves (50%) are the most commonly used for Agusanon Manobo tribe in La Paz followed by fruit (14%), stem (10%), wood (7%), bark (6%), whole plant (5%), flower (3%), sap and, root crop (2%), and seeds (1%) (Figure 7).

Leaves are found to be the most commonly used part of the plant for herbal medication. One reason for this is that leaves are the easiest to take and they preserve the wholeness of the plants as they are easily regenerated, unlike stems and roots. Moreover, important chemical compounds such as tannins, essentials oils, and flavonoids are stored in the leaves at high concentrations (Morilla et al. 2014). Many ethnobotanical studies not only in the Philippines documented similar results in which leaves are the most commonly used plant parts. Because leaves are easy to gather and not destructive to the plants thus, helping maintaining its sustainability for future use (Tantengco et al. 2018; Bhatta & Datta 2018).

Treatment process of medicinal plants

The Agusanon Manobo has six (6) ways of preparing medicinal plants depending on how

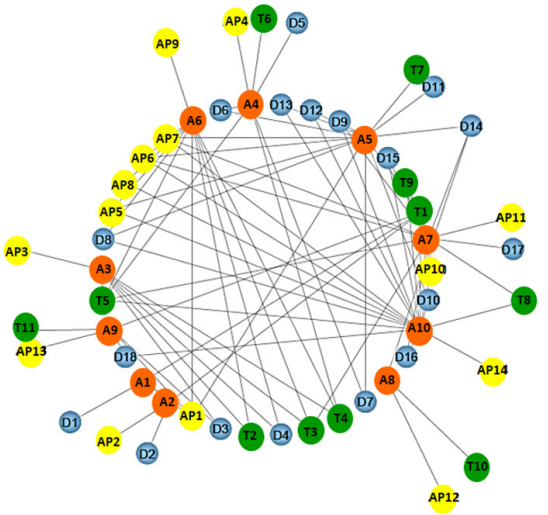

Figure 5. Internetwork relationship between disease treated, animal parts and derivative used as medicine, its treatment process and applications, and disease/ailment treated and ethnomedicinal animals used by the Agusanon Manobo tribe of La Paz Agusan del Sur.

Animal species coding:A1. *Anas platyrhynchos* Linnaeus, 1758; **A2**. *Apis dorsata* Fabricius, 1793; **A3**. *Capra hircus* Linnaeus, 1758; **A4**. *Rusa marianna* Desmarest, 1822; **A5**. *Ophiophagus hannah* Cantor, 1836; **A6**. *Hemidactylus frenatus* Dumeril & Bibron, 1836; **A7**. *Siebenrockiella leytensis* Taylor, 1920; **A8**. *Hirudo medicinalis* Lamarck, 1818; **A9**. *Gallus domesticus* Linnaeus, 1758; **A10**. *Malayophyton reticulatus* Schneider, 1801; **Animal parts used coding: AP1.** blood; **AP2**. honey; **AP3**. feces; **AP4**. honey; **AP5**. skin; **AP6**. flesh; **AP7**. bone; **AP8**. internal organs; **AP9**. tail; **AP10**. liver; **AP11**. shell; **AP12**. jaw; **AP13**. egg; **AP14**. fats; **Treatment process and applications coding: T1.** ingestion; **T2**. grilled; **T3**. fried; **T4**. crushed; **T5**. decoction; **T6**. paste; **T7**. chewing; **T8**. steam; **T9**. ointment; **T10**. topical patching; **T11**. offering; **Disease treated coding: D1**. leukemia; **D2**.dental ailment due to teething; **D3**. measles; **D4**. fatigue; **D5**. wounds; **D6**. swelling; **D7**. bites; **D8**. headache; **D9**. stomachache; **D10**. diarrhea; **D11**. spasms; **D12**. high blood; **D13**. diabetes; **D14**. rheumatism; **D15**. asthma; **D16**. malaria; **D17**. cough; **D18**. fever; **D19**. UTI, **D20**. toothache; **D21**. relapse; **D22**. dengue; **D23**. *Tinea versicolor*; **D24**. Anti-tetanus; **D25**. anti-bacterial; **D26**. ulcer; **D27**. inflammation; **D28**. flatulence; **D29**. muscle spasms; **D30**. schistosomiasis ; **D31** weight loss

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Table 6. Plants with ethnomedicinal uses according to the Agusanon Manobo in La Paz, Agusan del Sur.

Plant Family	Scientific name	Local name	Distribution status	Part Used	Treatment Process	Diesease/ ailment Treated	Mode of Preparation
Acanthaeae	*Graptophyllum pictum* (L.) Griff	atay-atay	cultivated	leaf	decoction	Cough, Fever	Boiled with water and serve like a tea
Annonaceae	*Annona muricata* Linn.	rabana	wild, cultivated	leaf	decoction	Diarrhea, UTI	Boiled with water and serve like a tea
Arecaceae	*Cocos nucifera* Linn.	lubi	wild, cultivated	leaf, root, flower, fruit	decoction, ingestion, paste	Wounds, toothache, UTI	Coconut water is taken orally
Asteraceae	*Artemisia vulgaris* Linn.	hilbas	wild, cultivated	leaf	decoction, paste	Cough, Fever	Boiled with water and serve like a tea
Asteraceae	*Blumea balsamifera* Linn.	sambong	wild, cultivated	leaf	decoction	Cough, fever, headache	Boiled with water and serve like a tea
Asteraceae	*Chromolaena odorata* Linn.	hagonoy	wild	leaf	paste, crushed	Wound	Crushed leaf and apply leaf extract directly to the open wound
Bixaceae	*Bixa orellana* Linn.	suwetis	wild, cultivated	leaf	decoction	Diarrhea	Boiled with water and serve like a tea
Cannabaceae	*Cannabis* sp. Linn.	wild mariwana	wild, cultivated	sap/ juice	paste, ingestion, ointment	Wound, Anti-tetanus,	Filtrate drop on the wound
Caricaceae	*Carica papaya* Linn.	kapayas	wild, cultivated	sap/ juice, root	paste, decoction	Wound, Relapse	Drop on the wound, Boiled
Clusiaceae	*Garcinia mangostana* Linn.	mangoestin	cultivated	fruit	decoction	Diarrhea, UTI, Highbood,	Boiled with water and serve like a tea
Convolvulaceae	*Cordia dichotoma* Forst. f.	anunang	wild, cultivated	bark, leaf, wood	decoction	Cough	Boiled with water and serve like a tea
Convolvulaceae	*Ipomoea batatas* (L.) Lam.	ganas	cultivated	leaf, stem	decoction	Diarrhea	Boiled with water and serve like a tea
Crassulaceae	*Kalanchoe pinnata* (Lam.) Pers.	hanlilika	wild, cultivated	leaf, flower	paste, crushed	Wound, Toothache	Paste on the wound or painful teeth
Cucurbitaceae	*Momordica charantia* Linn.	paliya	cultivated	leaf, fruit	decoction	Diarrhea	Boiled with water and serve like a tea
Ebenaceae	*Diospyros seychellarum* Hiern	sagay	wild, cultivated	leaf, stem	decoction	UTI	Boiled with water and serve like a tea
Euphorbiaceae	*Euphorbia hirta* Linn.	tawa- tawa	wild	whole plant	decoction	Cough, Relapse, Dengue	Boiled with water and serve like a tea
Euphorbiaceae	*Jatropha curcas* Linn.	tuba- tuba	wild, cultivated	leaf, bark	decoction	Headache, Stomachache, Fever	Boiled with water and serve like a tea
Fabaceae	*Senna alata* Linn.	asunting	wild, cultivated	leaf	paste, crushed	Tinea versicolor	Paste on the affected area
Lamiaceae	*Origanum vulgare* Linn.	kalabo	cultivated	leaf	decoction	Cough	Boiled with water and serve like a tea
Lamiaceae	*Mentha arvensis* Linn	herbuena	wild, cultivated	leaf	decoction	Cough, Fever	Boiled with water and serve like a tea
Lamiaceae	*Vitex negundo* Linn.	lagundi	wild, cultivated	leaf	decoction	Cough, fever	Boiled with water and serve like a tea
Lamiaceae	*Coleous amboinicus* Lour.	vicks	wild, cultivated	leaf	paste	Wound, anti-bacteria	Paste on the affected area
Malvaceae	*Kleinhovia hospita* Linn.	bitan-ag	wild, cultivated	wood, fruit	decoction	Cough	Boiled with water and serve like a tea
Malvaceae	*Corchorus olitorius* Linn.	saluyot	wild, cultivated	leaf	decoction	Ulcer	Boiled with water and serve like a tea
Malvaceae	*Allium sativum* Linn.	ahos	cultivated	root crop	decoction	Stomachache, Highblood	Boiled with water and serve like a tea
Marantaceae	*Rauvolfia serpentina* (L.) Benth.	lalat chena/ serpentina	wild, cultivated	whole plant	decoction	Arthrites, Flatulence (Panuhot), Muscle spasms (Pamaol)	Boiled with water and serve like a tea

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Table 6. Plants with ethnomedicinal uses according to the Agusanon Manobo in La Paz, Agusan del Sur.

Plant Family	Scientific name	Local name	Distribution status	Part Used	Treatment Process	Diesease/ ailment Treated	Mode of Preparation
Meliaceae	*Swietenia macrophylla* King	mahugani	wild	leaf	decoction	Stomach ache	Boiled with water and serve like a tea
Menispermaceae	*Tinospora rumphii* Boerl	panyawan	wild, cultivated	stem, leaf	decoction	Diarrhea	Boiled with water and serve like a tea
Moraceae	*Artocarpus heterophyllus* Lam.	langka	wild, cultivated	fruit	ingestion	Shistosomiasis, Relapse	Mixed with alcohol and drink
Moringaceae	*Moringa oleifera* Lam.	kamungay	cultivated	leaf, wood	decoction	Cough, headache, stomach ache	Boiled with water and serve like a tea
Myrtaceae	*Psidium guajava* Linn.	bayabas	wild, cultivated	leaf	decoction, paste, chewing, crushed	Wound	Boiled with water, Crushed and paste on the wound
Poaceae	*Paspalum conjugatum* (P.J. Berguis) Roxb.	sagbot/ carabaw grass	wild	whole plant	decoction	Diarrhea, UTI, Diabetes	Boiled with water and serve like a tea
Poaceae	*Saccharum offinarum* Linn.	tubo	cultivated	stem	decoction, ingestion	Cough, Malaria	Boiled with water and serve like a tea
Poaceae	*Cymbopogon citratus* (DC.) Stapf	tanglad	cultivated	whole plant	decoction	Hypertension/ highblood	Boiled with water and serve like a tea
Rubiaceae	*Neolamarckia cadamba* (Roxb.) Bosser	kadamba	wild, cultivated	leaf	decoction	Wound, malaria, anti-bacterial	Boiled with water and serve like a tea
Rutaceae	*Citrus microcarpa* (Bunge) Wijnands	agri	cultivated	fruit	ingestion	Cough	Whole fruit is taken orally
Solanaceae	*Capsicum frutescens* Linn.	sili	wild, cultivated	fruit	ingestion	Weight loss	Whole fruit is taken orally
Zingiberaceae	Curcuma longa Linn.	dulaw	wild, cultivated	root crop	decoction	Stomachache, arthrites, UTI	Boiled with water and serve like a tea

they apply it to the patient. Decoction is the most common way of preparing medicinal plants which (65%), followed by paste (15%), crushed (13%), ingestion (4%), ointment (2%), and lastly chewing (1%) (Figure 8).

Decoction was the most common and widely used method of concentrated brew extracted from simmered plants in boiling water (Israel & Youngkin 1997). The decoction was reported to be beneficial for it extracts its bioactive constituent when heated or boiled (Blasco et al. 2014). According to the study of Tandon et al. (2008), decoction allows to dissolute of the plant material to extract the components that are active in water-soluble like volatile organic compounds and other various chemical substances.

Informant consensus factor (ICF) of plants

The documented ethnomedicinal plants were used to treat 22 different ailments which were grouped into 8 different categories. The ICF values ranged from 0.80 to 0.89. The highest ICF value was for digestive system ailments (0.89) while the lowest ICF value was (0.80) for inflammation and pain (Table 7).

Similar of Ghorbani et al. (2011) found that digestive system disorders had the highest ICF value, whereas Juárez-Vázquez et al. (2013) noted this as their second highest observed ICF value. This ranking might be due to a lack of adequate knowledge about the pathogenicity of disease and drinking polluted water. This is one fact that although there is now access to the government healthcare system, the people living in this part of the Philippines did not lose their values and traditions in using plants as the primary source of medicine (Ramalingam et al. 2016). The ICF values reported will guide medical practioners to focus and prioritize treating diseases in this category for this is what the tribe and the communinty needed more of the medical attentions.

Relative frequency of citation (RFC) of Plants

The relative frequency of citation computation also revealed that *Artemisia vulgaris* has the highest RFC (54%) values, followed by *Diospyros seychellarum* and *Kleinhovia hospita* (40%), *Euphorbia hirta* (34%), *Origanum vulgare* (32%), and *Jatropha curcas* (26%) (Table 8). *Artemisia vulgaris, Euphorbia hirta,* and *Origanum vulgare*

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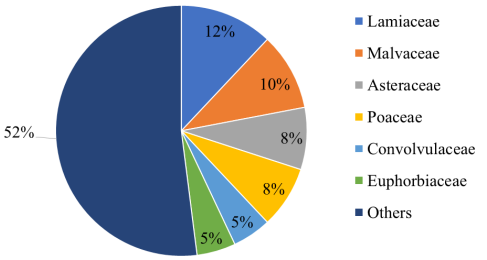

Figure 6. Percentage composition of plant families mentioned by the Agusanon Manobo tribe in selected barangay in La Paz, Agusan del Sur.

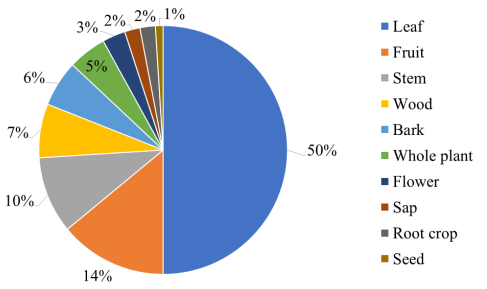

Figure 7. Percentage composition of plant parts used for medical purposes used by the Agusanon Manobo tribe in selected barangay in La Paz, Agusan del Sur.

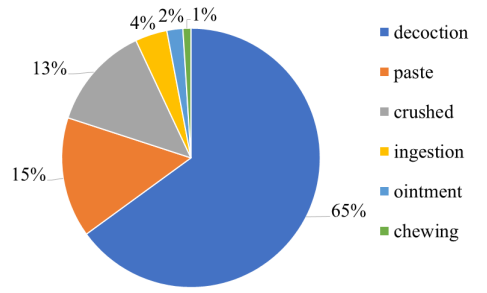

Figure 8. Percentage composition of the treatment process of the medicinal plants used by the Agusanon Manobo of La Paz, Agusan del Sur.

are used as treatments for cough and fever, abdominal pain, and body pains according to the study of Ong and Kim (2014).

Relative frequency of citation (RFC) index was calculated to determine the local importance of each species. The highest value of RFC index was scored by *Artemisia vulgaris* which demonstrate the importance of plant species to the Agusanon Manobo in La Paz, Agusan del Sur, as it is mentioned by a higher number of informants.

Frequency of use, effectivity and plant dosage

Among the ethnomedicinal plants mentioned, *Artemisia vulgaris* has been reported to have the the fastest activity to cure cough and cold (Table 9). It is one of the best known species of this genus, which has a widespread distribution in the natural habitats worlwide (Europe, Asia, North and South America, and Africa). For many centuries, this species has been mainly used for treating gynecological ailments and gastrointestinal diseases (Wichtl 2004). This study also shown the result of how much dosage of plants was to cure diseases and how often it was taken. It shows that plant dosage varies from each respondents. The *Klieinhovia hospita* (bitan-ag) has the dosage of 1-10 g and was taken thrice a day, while *Artemisia vulgaris* (hilbas) has a dosage of 11-20 g and was taken thrice a day. Interestingly wild mariwana was also mentioned in this report and it can be taken once, twice and thrice (Table 9).

Most of the Agusanon Manobo in La Paz, Agusan del Sur believed that there is no side effects on taking medicinal plants. The dose depends on the users, the one who prepares the herbs for medicine, similar to the study of Omac et al. (2021). While this study did not uncover any apparent side effects associated with the use of the medicinal plants investigated, further research is required to investigate their long-term effects on human health. It is therefore crucial to regulate the consumption of these plants as medicines and examine their active metabolic properties to ensure their safe and effective use.

Analysis of similarity (ANOSIM) and Internetwork analysis (INA) in medicinal plants

ANOSIM analysis of medicinal plants used by Agusanon Manobo in La Paz Agusan del Norte showed no significant difference in plant usage between Barangay Panagangan and Barangay Sagunto with an ANOSIM R coefficient of 0.014. ANOSIM compares dissimilarities between and within groups, with R values close to one indicating significant dissimilarities within groups and R values close to zero indicating no significant difference within and between groups (Clarke and Gorley 2001).

There are many factors for these similarities of plants species used as medicinal plants. Indigenous information of healing using plants was easily pass

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Table 7. Informant Consensus Factor (ICF) values of the diseases cured by medicinal plants reported by the Manobo Agusanon tribe of La Paz, Agusan del Sur.

Category	Diseases/ ailment	Plant most used	Numbersed citation	Animal taxa used	ICF
Digestive system ailments	diarrhea, stomachache, shistosomiasis, ulcer	*Tinospora rumphii* Boerl	132	16	0.89
Respiratory ailments	cough	*Artemisia vulgaris* Linn.	106	14	0.88
Urological ailments	urinary tract infection	*Diospyros seychellarum* Hiern	41	6	0.87
Blood related ailments	malaria, dengue, diabetes, highblood	*Euphorbia hirta* Linn.	65	9	0.87
Nervous system ailments	headache	*Jatropha curcas* Linn.	67	10	0.86
Fever ailments	fever	*Kleinhovia hospita* Linn.	73	11	0.86
Dermatological ailments	wound, Rashes,anti-tetanus, tinea versicolor, bite	*Neolamarckia cadamba* (Roxb.) Bosser	95	15	0.85
Inflammation and pain	toothache,muscle pain,athrites, swelling	*Rauvolfia serpentina* (L.) Benth.	58	12	0.80

Table 8. Relative Frequency of Citation of medicinal plants mentioned by the Agusanon Manobo tribe in La Paz, Agusan del Sur.

Scientific name	Local name	RFC	Scientific name	Local name	RFC
Artemisia vulgaris Linn.	Hilbas	0.54	*Cymbopogon citratus* (Bunge) Wijnands	Tanglad	0.12
Kleinhovia hospita Linn.	bitan-ag	0.40	*Momordica charantia* Linn.	Paliya	0.12
Diospyros seychellarum Hiern	Sagay	0.40	*Allium sativum* Linn.	Ahos	0.12
Euphorbia hirta Linn.	tawa-tawa	0.34	*Cocos nucifera* Linn.	Lubi	0.10
Origanum vulgare Linn.	Kalabo	0.32	*Paspalum conjugatum* (P.J. Berguis) Roxb.	Karabaw grass	0.08
Jatropha curcas Linn.	tuba-tuba	0.26	*Hibiscus rosa-sinensis* Linn.	Gumamela	0.08
Blumea balsamifera Linn.	Sambong	0.24	*Coleous amboinicus* Lour.	Vicks	0.08
Neolamarckia cadamba (Roxb.) Bosser	Kadamba	0.24	*Saccharum offinarum* Linn.	Tubo	0.08
Mentha arvensis Linn.	Herbuena	0.20	*Garcinia mangostana* Linn.	Mangoestin	0.08
Rauvolfia serpentina (L.) Benth.	lalat chena	0.20	*Artocarpus heterophyllus* Lam.	Langka	0.06
Chromolaena odorata Linn.	Hagonoy	0.18	*Tinospora rumphii* Boerl	Panyawan	0.06
Cordia dichotoma Forst. f.	Anunang	0.16	*Curcuma longa* Linn.	luyang dilaw	0.06
Cannabis sp. Linn.	wild mariwana	0.16	*Kalanchoe pinnata* (Lam.) Pers.	Hanlilika	0.06
Annona muricata Linn.	Rabana	0.14	*Corchorus olitorius* Linn.	Saluyot	0.04
Vitex negundo Linn.	Lagundi	0.14	*Carica papaya* Linn.	Kapayas	0.04
Moringa oleifera Lam.	Kamungay	0.14	*Capsicum frutescens* Linn.	Sili	0.04
Swietenia macrophylla King	Mahugani	0.14	*Citrus microcarpa* (Bunge) Wijnands	Agri	0.04
Graptophyllum pictum (L.) Griff	atay-atay	0.12	*Ipomoea batatas (L.)* Lam.	Ganas	0.04
Psidium guajava Linn.	Bayabas	0.12	*Bixa orellana* Linn.	Suwetis	0.02
Senna alata Linn.	Asunting	0.12			

Table 9. Frequency of use, effectivity of cited ethnomedicinal plants, and dosage of medicinal plants mentioned by the Agusanon Manobo tribe in La Paz, Agusan del Sur.

Scientific name	Local name	Frequency of Use		Effectivity Category			Plant Dosage: Grams		Daily Dosage		
		Always	Sometimes	Fast (1 - 12 hrs)	Moderate (13 - 24 hrs)	Slow (Above 24 hrs)	1 to 10	11 to 20	Once	Twice	Thrice
Kleinhovia hospita Linn.	bitan-ag	15	5	2	4	14	16	4	3	5	12
Cordia dichotoma Forst. f.	anunang	6	2	-	4	4	8	-	-	4	4

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Scientific name	Local name	Frequency of Use			Effectivity Category		Plant Dosage: Grams		Daily Dosage		
		Always	Sometimes	Fast (1 - 12 hrs)	Moderate (13 - 24 hrs)	Slow (Above 24 hrs)	1 to 10	11 to 20	Once	Twice	Thrice
Origanum vulgare Linn.	kalabo	10	6	-	6	10	10	6	-	6	6
Graptophyllum picyum (L.) Griff	atay-atay	5	1	-	1	5	1	5	2	1	3
Mentha arvensis Linn.	herbuena	8	2	5	2	3	3	-	-	-	3
Euphorbia hirta Linn.	tawa- tawa	15	2	15	2	15	10	6	1	10	3
Diospyros seychellarum Hiern	sagay	20	-	1	15	4	15	-	3	5	10
Artemisia vulgaris Linn.	hilbas	22	5	17	5	4	15	12	7	9	11
Corchorus olitorius Linn.	saluyot	2	-	-	-	2	2	-	-	-	-
Cannabis sp. Linn.	wild mariwana	1	7	1	2	5	2	-	2	2	2
Jatropha curcas Linn.	tuba- tuba	13	-	-	3	10	4	9	-	3	10
Carica papaya Linn.	kapayas	-	2	-	-	2	2	-	2	-	-
Paspalum conjugatum (P.J. Berguis) Roxb.	Karabaw grass	4	-	-	2	2	2	2	1	1	2
Artocarpus heterophyllus Lam.	langka	-	3	-	-	3	1	1	-	-	2
Tinospora rumphii Boerl	panyawan	-	3	-	-	3	1	2	1	-	2
Rauvolfia serpentina (L.) Benth.	lalat chena	8	2	2	1	7	8	2	2	2	6
Blumea balsamifera Linn.	sambong	11	1	-	8	4	12	5	1	2	16
Hibiscus rosa-sinensis Linn.	gumamela	1	3	-	1	3	3	1	1	-	2
Neolamarckia cadamba (Roxb.) Bosser	kadamba	10	2	-	-	12	2	10	1	1	10
Curcuma longa Linn.	luyang dilaw	3	¬-	-	3	-	2	1	-	1	2
Annona muricata Linn.	rabanna	7	-	-	4	3	6	1	2	1	4
Psidium guajava Linn.	bayabas	6	-	-	6	-	4	2	1	3	2
Vitex negundo Linn.	lagundi	7	-	-	7	-	1	4	1	-	4
Coleous amboinicus Lour.	vicks	4	-	-	-	4	3	1	-	2	2
Saccharum offinarum Linn.	tubo	4	-	-	3	1	1	3	1	2	1
Kalanchoe pinnata (Lam.) Pers.	hanlilika	4	-	-	-	4	1	3	-	-	4
Garcinia mangostana Linn.	mangoestin	4	-	-	2	2	2	2	-	-	4
Senna alata Linn.	asunting	6	-	-	2	4	3	3	1	2	3
Capsicum frutescens Linn.	sili	1	-	1	-	-	1	1	-	-	2
Bixa orellana Linn.	suwetis	1	-	-	-	1	1	-	-	-	1
Chromolaena odorata Linn.	hagonoy	7	2	-	5	4	1	3	4	-	-
Cymbopogon citratus (Bunge) Wijnands	tanglad	5	1	-	1	5	3	-	-	-	3

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Scientific name	Local name	Frequency of Use			Effectivity Category		Plant Dosage: Grams		Daily Dosage		
		Always	Sometimes	Fast (1 - 12 hrs)	Moderate (13 - 24 hrs)	Slow (Above 24 hrs)	1 to 10	11 to 20	Once	Twice	Thrice
Citrus macrocarpa (Bunge) Wijnands	agri	2	-	-	-	1	2	-	1	-	1
Cocos nucifera Linn.	lubi	5	-	-	4	1	2	2	3	1	-
Ipomoea batatas (L.) Lam.	ganas	–-	2	-	0	2	1	1	1	1	-
Moringa oleifera Lam.	kamungay	5	-	-	2	-	2	2	2	1	1
Momordica charantia Linn.	paliya	2	-	-	-	2	2	2	-	-	4
Allium sativum Linn.	ahos	4	2	-	2	4	3	2	-	2	3
Swietenia macrophylla King	mahugani	5	2	-	2	5	2	5	2	2	3

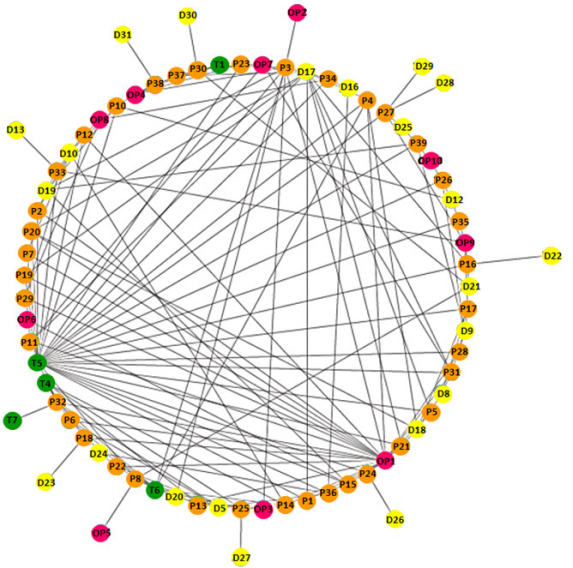

Figure 9. Internetwork relationship between disease treated, plant parts used as medicine, its treatment process and applications, and disease/ ailment treated and ethnomedicinal plants used by the Agusanon Manobo tribe of La Paz Agusan del Sur.

Plant species coding: P1. *Graptophyllum pictum* (L.) Griff; **P2**. *Annona muricata* Linn.; **P3**. *Cocos nucifera* Linn.; **P4**. *Artemisia vulgaris* Linn.; **P5**. *Blumea balsamifera* Linn.; **P6**. *Chromolaena odorata* Linn.; **P7**. *Bixa orellana* Linn.; **P8**. *Cannabis* sp. Linn.; **P9**. *Carica papaya* Linn.; **P10**. *Garcinia mangostana* Linn.; **P11**. *Cordia dichotoma* Forst. f.; **P12**. *Ipomoea batatas* (L.) Lam.; **P13**. *Kalanchoe pinnata* (Lam.) Pers.; **P14**. *Momordica charantia* Linn.; **P15**. *Diospyros seychellarum* Hiern; **P16**. *Euphorbia hirta* Linn.; **P17**. *Jatropha curcas* Linn.; **P18**. *Senna alata* Linn.; **P19**. *Origanum vulgare* Linn.; **P20**. *Mentha arvensis* Linn.; **P21**. *Vitex negundo* Linn.; **P22**. *Coleous amboinicus* Lour.; **P23**. *Kleinhovia hospita* Linn.; **P24**. *Corchorus olitorius* Linn.; **P25**. *Hibiscus rosa-sinensis* Linn.; **P26**. *Allium sativum* Linn.; **P27**. *Rauvolfia serpentine* (L.) Benth.; **P28**. *Swietenia macrophylla* King; **P29**. *Tinospora rumphii* Boerl; **P30**. *Artocarpus heterophyllus* Lam.; **P31**. *Moringa oleifera* Lam.; **P32**. *Psidium guajava* Linn.; **P33**. *Paspalum conjugatum* (P.J. Berguis) Roxb.; **P34**. *Saccharum offinarum* Linn.; **P35**. *Cymbopogon citratus* (Bunge) Wijnands; **P36**. *Neolamarckia cadamba* (Roxb.) Bosser; **P37**. *Citrus microcarpa* (Bunge) Wijnands; **P38**. *Capsicum frutescens* Linn.; **P39**. *Curcuma longa* Linn.; **Plant parts used coding: OP1**. leaves; **OP2**. roots; **OP3**. flower; **OP4**. fruit; **OP5**. sap; **OP6**. bark; **OP7**. wood; **OP8**. stem; **OP9**. whole plant; **OP10**. root crop; **Treatment process and applications coding: T1**. ingestion; **T2**. grilled; **T3**. fried; **T4**. crushed; **T5**. decoction; **T6**. paste; **T7**. chewing; **T8**. steam; **T9**. ointment; **T10**. topical patching; **T11**. offering; **Disease treated coding: D1.** leukemia; **D2**. teething; **D3**. measles; **D4**. fatigue; **D5**. wounds; **D6**. swelling; **D7**. bites; **D8**. headache; **D9**. stomachache; **D10**. diarrhea; **D11**. spasms; **D12**. high blood; **D13**. diabetes; **D14**. rheumatism; **D15**. asthma; **D16**. malaria; **D17**. cough; **D18**. fever; **D19**. UTI, **D20**. toothache; **D21**. relapse; **D22**. dengue; **D23**. *Tinea versicolor*; **D24**. anti-tetanus; **D25**. anti-bacterial; **D26**. ulcer; **D27**. inflammation; **D28**. flatulence; **D29**. muscle spasms; **D30**. shistosomiasis; **D31** weight loss

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through several generations. The geographical location of the two barangay is near with each other in which the sharing of knowledge about the usage and other information about medicinal plants has been easily passed through by indigenous communities for several decades (Olowa et al. 2012). Also the usage of plants as medicine are easily being shared compared to animals because plants are more common and diverse in the area and easily be determine its locations.

The internetwork analysis of plants species, plant parts used, its treatment process and applications, and disease treated was also analyzed (Figure 9). Each orange nodes (coded P) is represnted by 39 plants species having medicinal uses. Each nodes is connected with other nodes creating an internetwork relationship to: (a) plant parts used (pink nodes coded with OP); (b) treatment process and applications (green nodes coded T); and (c) common diseases (yellow nodes coded with D). For plant parts most used as depicted by the different interconnections is the leaves (OP1). For treatment process most nodes having variuos connection is decoction (T5) and cough (D17) is the most treated diseases in Agusanon Manobo tribe in La Paz Agusan del Sur.

4 Conclusions and Recommendations

This study shows that there is a prevailing knowledge and usage of traditional medicinal animals and plants treating certain ailments and health problems among the Agusanon Manobo in La Paz, Agusan del Sur . Ten animals were used for medicinal purposes, with *Malayophyton reticulatus* (baksan) being the most versatile in treating various diseases. *Artemisia vulgaris* (hilbas) was the most frequently cited medicinal plant among the 39 species documented. Overcollection and usage of these commonly used animals and plants could lead to population decline, highlighting the need for proper regulation. This documentation provides a catalog of useful animals and plants of the Agusanon Manobo in La Paz, Agusan del Sur and will also serve as a physical record of their culture. This may also be beneficial for those people who are still relying on the usage of medicinal animals and plants as their primary source of healthcare. This study may lead somehow to discover new and effective medicinal animals and plants that are urgently needed by the world today, such as the cure for COVID-19.

It is crucial to document, preserve, and manage indigenous knowledge as modern treatment methods advance, risking the loss of important traditional medicine knowledge with the passing of elders and experts. Community-based management and public awareness are essential to sustainably conserve medicinal species, particularly those with commercial value. Furthermore, further research should investigate the potential medicinal properties of various animal and plant species.

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5 Statement of Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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