Ethnobotanical Survey of Plants Commonly used for Diabetes in Tarlac of Central Luzon Philippines

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ABSTRACT

Introduction: Plants have been used for the treatment of diabetes in Philippine system of medicine and in other countries. They provide clues for the development of new and better oral drugs for diabetes due to the fact that prevalence of diabetes is on a steady upsurge worldwide and identified as one of the leading causes of mortality in Philippines. **Methods:** An ethnobotanical survey was carried out in Tarlac of Central Luzon Philippines to evaluate the relative efficacy of the plants used to treat diabetes. A total number of 450 respondents medically diagnosed of having diabetes were interviewed using a previously prepared questionnaire. Fidelity levels (FLs) and use values (UVs) were calculated to identify and verify most preferred plant species used in study areas. **Results:** A total of 25 plant species are utilized by the respondents to treat diabetes. Medicinal plants commonly utilized are *Momordica charantia* Linn., *Moringa oleifera* Lam, *Annona muricata* Linn., *Psidium guajava* Linn., *Lagerstroemia speciosa* (L.) Pers., *Hibiscus esculentis* Linn., *Amomum zingiber* Linn., *Myrtus cumini* Linn., *Garcinia mangostana* Linn., and *Aloe vera* Linn. Decoction process is used to prepare the leaves of the medicinal plants for medical consumption in the form of tea. **Conclusion:** This study confirms the use of different plant species to treat diabetes. It further affirms that most people with diabetes in the study areas rely on traditional medicine for their primary health care needs.

KEYWORDS: diabetes, survey, ethnobotanical, ethnomedicine, Philippines

INTRODUCTION

Plant with medicinal values is regarded as the oldest form of healthcare known to mankind. Plants such as herbs, spices, shrubs, grasses, trees had been used by all cultures in every walks of life throughout history.[1-2] Herbal medicine was an integral part of the development of modern civilization. Indeed, by nature, man observed and appreciated the great diversity of plants available that surround him. Plants provided food, clothing, shelter, fuel and medicine. Much of the medicinal use of plants seems to have been developed through observations of wild animals, and by trial and error. Men of every tribe added the medicinal power of herbs in their area to its knowledge base.[3] They meticulously gathered information on plants and developed well-defined herbal pharmacopoeias. Apparently, well into the

20th century much of the pharmacopoeia was derived from the herbal lore of native peoples. Many drugs commonly used today are of herbal origin.[4]

Diabetes is a disorder of carbohydrate, fat and protein metabolism attributed to diminished production of insulin or mounting resistance to its action. The prevalence of diabetes is on a steady increase worldwide and it is now identified as one of the major threats to human health in the 21st century. According to the Department of Health, diabetes mellitus is one of the major causes of death in Region III.[5] Early Philippine material medica started to appear only during the Spanish period. A notable development of the Galleon Trade was the cultural interchange between the two colonies not only in terms of words but even in trade and commerce; plants also were being part of such exchange.[6]

Plants have been used in treatment of diabetes all over the world for centuries. Wide variety of plant derived active principles representing numerous classes of chemical compounds have shown potential for the use in treatment of diabetes. Among the classes of chemical compounds isolated from plants with documented biological activity are

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alkaloids, glycosides, galactomannan, gum, peptidoglycan, glycopeptide, amino acids and inorganic ions.[7-8]

In view of an increasing interest to fight diabetes, this study was undertaken to identify the medicinal plants commonly utilized by the people with diabetes for treating the ailment in the province of Tarlac. It examined the frequency of medications used by the people in treating diabetes. Likely, it determined the manner of how medicinal plants are prepared for consumption.

METHODOLOGY

The study utilized a descriptive method of research. It identified and determined the most common and popularly used medicinal plant species utilized by the people with diabetes in the province of Tarlac. Tarlac is a landlocked province of the Philippines with a land area of 2,736.6 square kilometers with a population of 1,273,240 as of 2010[9] located in the Luzon Island. Its capital is Tarlac City.

The province is situated at the center of the central plains of Luzon consisting of 17 municipalities, landlocked by four provinces: Pampanga on the south, Nueva Ecija on the east, Pangasinan on the north, and Zambales on the west. It lies 15.4667° N and 120.5833° E. Approximately 75% of the province is plain while the rest is hilly to mountainous. Like the rest of Central Luzon, the province has two distinct seasons: dry from November to April and wet for the rest of the year. It is a part of Central Luzon, which is composed of Aurora, Bataan, Bulacan, Nueva Ecija, Pampanga, Tarlac, and Zambales provinces respectively.

Four hundred fifty (450) respondents with diabetes (regardless of diabetes classification) were interviewed from different municipalities of the province. A written consent was given to them before the activity. Respondents were asked or wrote the plants cronologically with medicinal values for the treatment of diabetes in a tabular form as can be seen in Table III. People with diabetes and with age ranges from 40 – 90 years old was included in the study. A voucher specimen of the identified medicinal plants used in the treatment of diabetes consisting of leaves, stem, flowers and fruits was brought to UST Herbarium, University of Santo Tomas for taxonomic verification.

Fidelity level (FL)[10] is calculated to determine the most frequently used medicinal plant species for treating diabetes while use value (UV)[11] for species is calculated to find out the relative importance of a plant species used as medicine in the study areas. Towards this end, the fidelity level of each plant was determined as follows: FL= (Ip/Iu) ×100. Ip is the number of respondents who independently mentioned the use of a plant species for the treatment of diabetes; and Iu is the total number of respondents who mentioned the plant species. The relative importance of each plant species known locally to be used as herbal remedy is reported as use value (UV) and it was calculated using the following formula: UV=∑U/ n. U is the number of use reports cited by each respondent for a given plant species and n is the total number of respondents interviewed for a given plant. The UV is helpful in determining the plants with the highest use (most frequently indicated) in the treatment of an ailment.

RESULTS AND DISCUSSION

In the Philippines the history of botany started from two periods namely, Pre-Linnaean, previous to the publication of the *Species Plantarum* by Linnaeus in 1753, and Post-Linnaean. Plant myths and legends abound in Philippine Folklore.[12] Although no written herbal lore has been handed down from ancestors, but the practice of using herbs coupled with rituals is well known thru oral records being told from generations to generations where herbolarios are the instrument of communication.

Four hundred fifty respondents (215 male and 235 female individuals, aged 40 to 90 years) medically diagnosed of having diabetes participated in the study. They were selected through purposive method from 17 municipalities (Anao, Bamban, Camiling, Capas, Concepcion, Gerona, Lapaz, Mayantoc, Moncada, Paniqui, Pura, Ramos, San Clemente, Sta. Ignacia, San Manuel, and Tarlac City, Victoria) of Tarlac province. Respondents are mostly coming from selected barangays of every municipality.

Twenty five plant species of twenty one families were mentioned by 450 respondents to treat diabetes. Table I and II confirm the findings of the World Health Organization (WHO) which estimates that eighty percent (80%) of the people living in developing countries of the world rely on traditional or folkloric medicine for their primary health care needs.[13-16]

About eighty five percent (85%) of traditional or folkloric medicine involves the use of plant extracts to cure identified ailments.[17-23] In line with the upsurge significance of traditional medicine in various healthcare systems around the world, the WHO Traditional Medicine Strategy was developed and launched in response to the World Health Assembly resolution on traditional medicine. The strategy aims to support Member States in developing proactive policies and implementing action plans that will strengthen the role traditional medicine plays in keeping populations healthy.[24]

Table I: Top ten plants used for diabetes in the province of Tarlac

Rank	Common Name (Family)	Scientific Name	English Name	Other Names	FL[a]
1	Ampalaya (Cucrbitaceae)	*Momordica charantia* Linn. *Mormodica cylindrica* Blanco *Mormodica chinensis* Spreng *Mormodica balsamina* Blanco *Mormodica muricata* Willd.	Balsam apple Bitter gourd Bitter melon Balsam pear	Apalia Apapet Margoso Paria	100.0
2	Malunggay (Moringaceae)	*Moringa oleifera* Lam. *Moringa nux-ben* Perr. *Moringa pterygosperma* Gaertn. *Guilandina moringa* Linn.	Drumstick tree Horse-radish tree Miracle tree	Arunggai Kalamungai Maruñgaai	90.67
3	Guyabano (Anonaceae	*Annona muricata* Linn. *Annona macrocarpa* Werkle *Annona bonplandiana* Kunth *Annona cearensis* Barb. Rodr. *Guanabanus muricatus* M. Gomez	Graviola Prickly custard apple Soursop	Bayubana Guayabano	88.89
4	Bayabas (Myrtaceae)	*Psidium guajava* Linn *Psidium cujavus* Linn. *Psidium aromaticum* Blanco *Guajava pyrifera* (l.) Kuntz.	Guava	Bagabas Bayauas Guyabas Tayabas	83.33
5	Banaba (Lythraceae)	*Lagerstroemia speciosa* (L.) Pers. *Lagerstroemia reginae* Roxb. *Lagerstroemia flos-reginae Retz.* *Munchausia speciosa* (L.)	Pride of India Queen's flower	Makablos Mitla Nabulong Tabangau	66.67
6	Okra (Malvaceae)	*Abelmoschus esculentus* (Linn.) Moench. *Hibiscus esculentis* Linn.	Lady fingers	Gumbo	66.62
7	Luya (Zingirberaceae)	*Amomum zingiber* Linn. *Zingiber blancoi* Hassk. *Zingiber officinale* Roscoe	Ginger	Agat Baseng Laya	65.53
8	Duhat (Myrtaceaea)	*Calyptranthes jambolana* Willd. *Eugenia cumini* (Linn.) Druce *Myrtus cumini* Linn. *Syzygium cumini* Skeels	Black plum Indian blackberry Java plum	Duat Lomboi Longboi	64.44
9	Mangosteen (Guttiferae)	*Garcinia mangostana* Linn. *Mangostana garcinia* Gaertn.	King's fruit Queen of Fruits	Kanabla Mangostan	64.42
10	Sabila (Liliaceae)	*Aloe barbadensis* Mill. *Aloe humilis* Blanco *Aloe vera* Linn. *Aloe perfoliata* Linn.	Aloe vera Burn plant	Acibar Dilang buaya Sabila pinya	62.44

[a]Fidelity level=[number of informants who independently utilized the use of a species for treating db (*l*p)/total number of informants (*l*u)]×100.
FL=(*l*p/*l*u)×100.

Figure 1 shows that the highest percentage distribution of respondents using plants as alternative health care for diabetes is 61-63 years old with 15.37% followed by 52-54 years old with 12.96% respectively.

The most commonly utilized plant (Table I and Table III) was *Momordica charantia* Linn. with 100.0% fidelity level and 25 use reports by 28 respondents giving the highest use value of 0.89. The plant is well appraised by all respondents as an antidiabetic plant. *M.charantia* Linn. is a year-round vegetable, extensively cultivated in the Philippines for its bitter edible fruit which is usually found in an open fields, thickets, and waste placebs at low and medium altitudes.[1]

Other important plants with high fidelity level and use value were *Moringa oleifera* Lam (FL of 90.67% and 20 use reports by 26 respondents with a UV of 0.77), *Annona muricata* Linn. (FL of 88.89% and 18 use reports by 24 respondents with a UV of 0.75), *Psidium guajava* Linn. (FL of 83.33%% and 17 use reports by 23 respondents with a UV of 0.74), *Lagerstroemia speciosa* (L.) Pers. (FL of 66.67% and 16 use reports by 22 respondents with a UV of 0.73), *Hibiscus esculentis* Linn. (FL of 66.62% and 14 use reports by 21 respondents with a UV of 0.67), *Amomum zingiber* Linn. (FL of 65.53% and 13 use reports by 20 respondents with a UV of 0.65), *Myrtus cumini* Linn. and *Garcinia mangostana* Linn. FL of 64.44% and 12 use reports by 19 respondents with a UV of 0.63), and Aloe vera Linn. (FL of 62.44% and 10 use reports by 15 respondents with a UV of 0.62).

Table II: Occasionally used plants for diabetes

Rank	Common Name	Scientific Name	English Name	Other Name	FL[a]
11	Abukado (Lauraceae)	*Persea gratissima* Gaertn. *Persea americana* Mill.	Avocado Alligator pear	Abokado	61.11
12	Akapulko (Fabaceae)	*Cassia alata* Linn. *Herpetic alata* Raf.	Candle bush Ringworm bush	Andadasi-a-dadakdel Bayabasin	60.00
13	Balbas pusa (Lamiaceae)	*Orthosiphon aristatus* (Blume) Miq. *Ocimum aristatum* Blume	Kidney tea Cat's whisker	Kabling-gubat Kabling-parang	59.56
14	Balanaoi (Labiatae)	*Ocimum album* Blanco *Ocimum sanctum* Linn. *Ocimum tenuiflorum* L.	Holy basil Sacred basil	Bidai Sulasi Kamangi	58.89
15	Bawang (Liliaceae)	*Allium sativum* Linn. *Allium pekinense* Prokhanov	Garlic Nectar of the Gods	Bauang Ahos	58.44
16	Caimito (Sapotaceae)	*Chrysophyllum cainito* Linn. *Calophyllum inophyllum* Linn.	Star apple Star plum	Caymito	57.78
17	Dalanghita (Rutaceae)	*Citrus aurantium* L. *var. mandarinum* *Citrus madurrensis* *Citrus reticulata* Blanco *Citrus webberi* Wester	Mandarin orange King orange	Alsem Ransas Darañgita	55.56
18	Kalingag (Lauraceae)	*Cinamomum mercadoi* Vidal *Cinamomum zeylanicum* F.-Vill.	Kalingag tree	Kandoroma Samiling	54.44
19	Kamatsile (Leguminosae)	*Pithecellobium dulce* (Roxb.) Benth. *Feuilleea dulcis* Roxb. *Inga camatchili* Perr. *Mimosa dulcis* Roxb.	Black bead Monkeypod Madras thorn	Camachile Damortis Kamachili Kamunsil	52.22
20	Kasuy (Anacardiaceae)	*Anacardium occidentale* Linn. *Acajuba occidentalis* (L.) Gaertn. *Cassuvium pomiferum* Lam.	Cashew	Balubad Sambalduke Kasul	51.33
21	Lagundi (Verbanaceae)	*Vitex negundo* Linn *Vitex leucoxylon* Blanco *Vitex paniculata* Lam.	Chinese chaste-tree Chinese chaste-	Dangla Dabtan Sagarai	46.22
22	Mankit (Rubiaceae)	*Rubia cordifolia* Linn. *Rubia tinctorum* L. var. cordifolia L.	Heart-leaved madder Indian madder	Kamagut Patudtud	42.89
23	Screw-pine	*Pandanus odoratissimus* Linn. f.	Screw-pine	Pandan lalaki	42.22
24	Saging	*Musa paradisiaca* Linn.	Banana	Kela	41.11
25	Sinta (Aranthaceae	*Andrographis paniculata* (Burm. f.) Wall. ex Nees *Justicia paniculata*	King of bitters Chiretta	Likha Serpentina	40.67

[a]Fidelity leve=[number of informants who independently utilized the use of a species for treating db (*I*p)/total number of informants (*I*u)]×100.
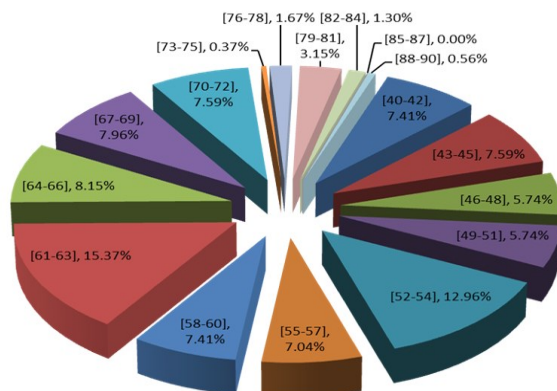FL=(*I*p/*I*u)×100.

Figure 1. Percentage distribution of respondents at different age brackets

Most of these plants are abundant in the study areas.[25] The plant with the lowest fidelity level (40.67%) and use value (0.06) is *Andrographis paniculata* (Burm. f.) Wall. ex Nees by 18 respondents but only one use report. The respondents are using the plant since they are diagnosed with diabetes. Nevertheless, the following plants such *Persea gratissima* Gaertn., Cassia alata Linn., *Orthosiphon aristatus* (Blume) Miq., *Ocimum album* Blanco, *Allium sativum* Linn., *Chrysophyllum cainito* Linn., *Citrus aurantium* L. var. mandarinum, *Cinamomum mercadoi* Vidal, *Pithecellobium dulce* (Roxb.) Benth., *Anacardium occidentale* Linn., *Vitex negundo* Linn, *Rubia cordifolia* Linn., *Pandanus odoratissimus* Linn. f.,

Musa paradisiaca Linn. and *Andrographis paniculata* (Burm. f.) Wall. ex Nees were great of help in the treatment of diabetes as per testified by the respondents in the study areas. UVs are high when there are many use-reports for a plant and low when there are few reports related to its use.

Finally, as can be seen from Table III, the leaf is considered most as the part of the plant being utilized in the treatment of diabetes. The leaves are prepared either by decoction or extraction and mostly are taken as a form of tea, once a day (1D), twice a day (2D) or thrice a day (3D). Some of these pants are also consumed as vegetables and eaten fresh by the respondents.

Table III: Preparation of the plants for consumption

Rank	Name of plant	Part/s used	Preparation	Administration	Dosage[a]	*U*	*n*	UV[b]
1	Ampalaya	Leaves	Decoction	Tea	1D	25	28	0.89
		Fruits	Decoction	Viand	1D			
		Flowers	Decoction	Tea	1D			
		Seeds	Extraction	Tea	1D			
2	Malunggay	Leaves	Decoction	Tea / Viand	2D	20	26	0.77
3	Guyabano	Leaves	Decoction	Tea	1D	18	24	0.75
		Fruit	Fresh	Eaten as raw	1D			
4	Bayabas	Leaves	Decoction	Tea	3D	17	23	0.74
		Bark	Extraction	Tea	1D			
5	Banaba	Leaves	Decoction	Tea	1D	16	22	0.73
		Flowers	Decoction	Tea	1D			
6	Okra	Fruit	Decoction /Fresh	Tea/Viand	3D	14	21	0.67
		Flowers	Decoction	Tea	1D			
7	Luya	Rhizomes	Decoction /Fresh	Tea	2D	13	20	0.65
8	Duhat	Leaves	Decoction	Tea	1D	12	19	0.63
		Fruit	Fresh	Eaten as raw	1D			
		Seeds	Extraction	Tea	1D			
9	Mangosteen	Rinds	Decoction	Tea	2D	12	19	0.63
		Fruit	Fresh	Eaten as raw	3D			
10	Sabila	Leaves	Decoction	Tea	1D	10	15	0.62
11	Abukado	Leaves	Decoction	Tea	2D	9	15	0.60
		Fruit	Fresh	Eaten as raw	2D			
12	Akapulko	Leaves	Decoction	Tea	1D	8	14	0.57
		Flowers	Decoction	Tea	1D			
13	Balbas pusa	Leaves	Decoction	Tea	3D	8	14	0.57
14	Basil	Leaves	Decoction	Tea	2D	7	13	0.53
15	Bawang	Cloves	Extraction	Tea	1D	7	13	0.53
16	Caimito	Leaves	Decoction	Tea	1D	6	12	0..50
17	Dalanghita	Fruit	Fresh	Eaten as raw	3D	6	12	0.50
18	Kalingag	Bark	Extraction	Tea	2D	5	10	0.50
19	Kamatsile	Fruit	Fresh	Eaten as raw	3D	4	8	0.50
20	Kasuy	Bark	Extraction	Tea	3D	3	7	0.43
21	Lagundi	Leaves	Decoction	Tea	1D	3	7	0.43
22	Madder	Leaves	Decoction	Tea	1D	3	9	0.33
23	Pandan	Leaves	Decoction	Tea	1D	6	20	0.30
24	Saging	Flower	Cook	Viand	2D	1	5	0.20
25	Sinta	Leaves	Decoction	Tea	1D	1	18	0.06

[a]1D-once a day; 2D-twice a day; 3D-thrice a day
[b]Use Value =[the number of use reports cited by each respondent for a given plant specie (*U*)/the total number of respondents interviewed for a given plant (*n*).
UV=∑*U/ n*.

CONCLUSION

Commonly used medicinal plants for treating diabetes are ampalaya (*Momordica charantia* Linn.), malunggay (Moringa oleifera Lam), *guyabano* (*Annona muricata* Linn.), guava (P*sidium guajava* Linn.), banaba (Lagerstroemia *speciosa* (L.) Pers.), okra (*Hibiscus esculentis* Linn.), luya (*Amomum zingiber* Linn.), duhat (*Myrtus cumini* Linn.), mangosteen (*Garcinia mangostana* Linn.), and sabila (*Aloe vera* Linn.). Occasionally utilized plants are abukado (*Persea gratissima* Gaertn.), akapulko (*Cassia alata* Linn.), balbas-pusa (*Orthosiphon aristatus* (Blume) Miq.), basil (*Ocimum album* Blanco), bawang (*Allium sativum* Linn.), caimito (*Chrysophyllum cainito* Linn.), dalanghita (*Citrus madurrensis*), kalingag (*Cinamomum mercadoi* Vidal), kamatsile (*Pithecellobium dulce* (Roxb.) Benth.), kasuy (*Anacardium occidentale* Linn.), lagundi (*Vitex negundo* Linn), madder (*Rubia cordifolia* Linn.), screw pine (*Pandanus odoratissimus* Linn. f.), saging (*Musa paradisiaca* Linn) and sinta (*Andrographis paniculata* (Burm. f.) Wall. ex Nees). Lastly, leaves are utilized for medicinal consumption and are prepared either by decoration or extraction and mostly are taken as a form of tea.

ACKNOWLEDGMENT

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