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Utilization Of Plant as A Drug for Diabetes Mellitus By The Community Of Beutong District, Nagan Raya Regency

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Abstract. Diabetes mellitus is one of the leading causes of death in the world. Indonesia is a country with the 7th largest population of Diabetes mellitus sufferers in the world in 2015. Many people use plants as diabetes mellitus drugs, in Indonesia More than 500 types of plants have been shown to have hypoglycemic activity because these plants contain compounds that are efficacious as anti-diabetic. This study was aimed to determine as many types of plants as possible that are used as medicinal plants for diabetes mellitus in Beutong sub-district, Nagan Raya district. This research was conducted by conducting interviews with 100 respondents aged 18-60 years who knew information about plants used for Diabetes mellitus.This study used the method of interview, observation, and identification (PlantNet). The results found as many as 29 species of plants from 26 families. Myrtaceae family as the most numerous plants with the number of species as much as 10% and the family Fabaceae with the number of species as much as 7%. Leaves are the part that is most widely used as medicine and the majority of people process it in a different way. Consume by drinking more than by chewing and the recommended dose for consumption is 2 times a day after meals. Benefits for researchers can add information about medicinal plants for diabetes mellitus utilized by the people of Beutong District, Nagan Raya Regency and become one of the references for public knowledge traditional, and become a reference material for students in conducting research next.

Key words: Diabetes mellitus; medicinal plants; Beutong

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INTRODUCTION

Indonesia has more than 500 types of plants that have been shown to have hypoglycemic activity because these plants contain compounds that are efficacious as anti-diabetes such as polysaccharides, proteins, flavonoids, alkaloids, steroids, and terpenoids (Susilawati et al., 2021). The use of natural ingredients, as medicine and for other purposes, tends to increase, especially with the issue of back to nature and the prolonged crisis that has resulted in a decline in people's purchasing power. (curative), health recovery (rehabilitative) and health improvement (promotive) (Arham et al., 2017).

Diabetes mellitus is a degenerative disease, which is a disease due to the function or structure of the body's tissues or organs which progressively declines over time due to age or lifestyle choices. This disease is also known as a disease resulting from a modern lifestyle where people prefer to eat fast food, lack of physical activity because they utilize technology such as the use of motorized vehicles compared to walking (Phitri, 2013).

Beutong District is one of the sub-districts located in Nagan Raya Regency which has 24 villages, most of the residents often use plants as a source of medicine. Because, this district is still thick with herbal medicine, for various diseases including diabetes mellitus. The reason residents choose to consume medicinal plants is because they are easy to find around their homes, such as several villages in Beutong District which are located far from the Community Health Center (PUSKESMAS). Based on the results of initial observations of people with diabetes mellitus at the PUSKESMAS, Beutong District, more than 30 people with this disease were found in 2021.

Ethnobotany research on the use of medicinal plants has been carried out by researchers or local communities. However, based on observations, this study does not have in-depth data and information regarding the use and also the main efficacy of medicinal plants that can reduce blood glucose

levels in Beutong District. Then, in the results of the initial survey, there were 20 types of wild and cultivated plants that could be used as a cure for Diabetes mellitus by the people of Beutong District.

Therefore, this study aims to collect in-depth information regarding the utilization and main efficacy of medicinal plants that can reduce blood glucose levels in Beutong District. The purpose of this study was to find out as much as possible the types of plants used as medicinal plants for diabetes mellitus in Beutong sub-district, Nagan Raya district.

METHODS

Study area

The research was conducted in Beutong District, Nagan Raya Regency. This district has an area of 3,363.72 km2 with a population of around 167,672 people.

Data Collection

Data were taken from 100 respondents spread across Beutong Regency who were determined based on purposive sampling with the following criteria: people who use/consume, community leaders (male/female) aged 18-60 years who know information about plants used for Diabetes mellitus and people who are estimated to be far from PUSKESMAS and have low income (economy). The results of the interviews were obtained in writing and orally when the respondents were interviewed and documentation was carried out for research evidence.

Plant identification

Plant identification was carried out using PlantNet software and identification books. The use of PlantNet is done by photographing plants and then the results of the portraits are entered into the application, after which the identification results will appear.

Data analysis

The data obtained were analyzed descriptively by describing the description of the morphological characteristics of plants by displaying pictures, labels and documentation of the medicinal plant species of Diabetes mellitus and calculating the percentage frequency by recording all types of plants, organs used, processing methods and how to use them in the form of tables and figures. As well as calculating the Fidelity Level Index (FL) and Use Value (UV) used to test the ethnobotanical data collected. Form a consensus on the species that are effective for curing diabetes and their relative importance. In addition, it also facilitates an understanding of the potential uses of each species.

Fidelity Level

Fidelity Level (FL) shows the percentage of respondents who use a certain type of plant for the same main function as in the equation below:

$$Np/NX\ 100 = FL\ (percentage)$$

Np is the number of respondents who use a type of plant to treat a certain disease, and N is the number of plants used as medicine to treat diabetes.

Use Value (UV)

Use Value (UV) is an index in ethnobotany that has been widely used to measure the relative importance of useful plants, and prove the relative significance of locally known plants as expressed in the following equation:

$$UV = \frac{Ui}{N}$$

Ui is the number of uses stated by each informant for a particular species, and N is the total number of informants

RESULTS AND DISCUSSION

Types of Plants

This study shows that people use plants as medicine to cure diabetes mellitus. The community obtains these plants from the natural surroundings that grow wild, plant products and from the market. A total of 29 species of plants from 26 families were used as drugs for diabetes mellitus by the people of Beutong sub-district (Table 1).

Based on the data in Table 1 which shows that in this study there are differences in each family. The highest species family is the Myrtaceace family with a total of 10% and the Fabaceace family with a total of 7% species. The types of plants mentioned above are found in Beutong sub-district, Nagan Raya district and can be obtained from the market, plants that live wild in nature which are then used by the community as a cure for Diabetes mellitus.

Plant Organ

The plant organs used by the community in Beutong District, Nagan Raya Regency are stems, leaves, seeds, fruit, fruit skins, rhizomes and roots. Parts of plants used for the treatment of Diabetes mellitus are described in Figure 1.

Figure 1 has shown that the percentage of the parts of medicinal plants that are mostly used by the community in this sub-district for Diabetes Mellitus medicine is the leaves. Leaf processing is easier than other plant parts (Farhatul in Sambara, 2016) and the least used are the roots, rhizomes, and tubers.

Table 1. Species and Classification of Medicinal Plants for Healing Diabetes Mellitus Found in Beutong District, Nagan Raya Regency

Division	Class	Order	Family	Genus	Species
Magnoliophyta	Magnoliopsida	Piperales	Piperaceae	*Piper*	*Piper ornament*
		Asterales	Asteraceae	*Ageratum*	*Ageratumcony zoides*
		Rubiales	Rubiaceae	*Morinda*	*Morinda citrifolia*
		Lamiales	Lamiaceae	*Ocimum*	*Ocimum basillicum*
		Myrtales	Myrtaceae	*Syzygium*	*Syzygium polyanthum*
				Psidium	*Psidium guajava*
				Eugena/ Syzygium	*Eugena jambolanc Lam/ Syzygium cumini L*
			Thymelaeaceae	*phaleria*	*Phaleria macrocarpa*
		Magnoliales	Annonaceae	*Annona*	*Annona muricata*
		Sapindales	Anacardiaceae	*Mangifera*	*Mangifera indica*
		Violales	Cucurbitaceae	*Momordica*	*Momordica charantia*
			Caricaceae	*Carica*	*Carica papaya*
		Laurales	Lauraceae	*Persea*	*Persea americanc P. Mill*
		Fabales	Fabaceae	*Vigna*	*Vigna unguiculata*
				Pithecollobium	*Archidendron pauciflorum*
		Gentianales	Apocynaceae	*Catharanthus*	*Catharanthus roseus*
		Euphorbiales	Euphorbiaceae	*Phyllanthus*	*Phyllanthus niruri L*
		Geraniales	Oxalidaceae	*Averrhoa*	*Averrhoa bilimbi L*
	Liliopsida	Pandanales	Pandanaceae	*Pandanus*	*Pandanus amaryllifolius*
		Arecales	Arecaceae	*Cocos*	*Cocos nucifera*
		Asparagales	Asphodelaceae	*Aloe*	*Aloe vera*
		Poales	Poaceae	*Saccharum*	*Saccharum officinarum Linn*
		liliaceae	Amaryllidaceae	*Allium*	*Allium Cepa*
		Zingiberales	Zingiberaceae	*Curcuma*	*Curcuma longa*
		Poales	Poaceae	*Cymbopogon*	*Cymbopogon citratus*
Tracheophyta	Magnoliopsida	Malvales	Bombacaceae	*Durio*	*Durio Ziber*
		Theales	Clusiaceae	*Garcinia*	*Garcinia mangostana L*
Spermatophyta	Dicotyledone	Brassicales	Moringaceae	*Moringa*	*Moringa oleifera*
	liliopsida	Arecales	Araceae	*Areca*	*Areca cathecu L*

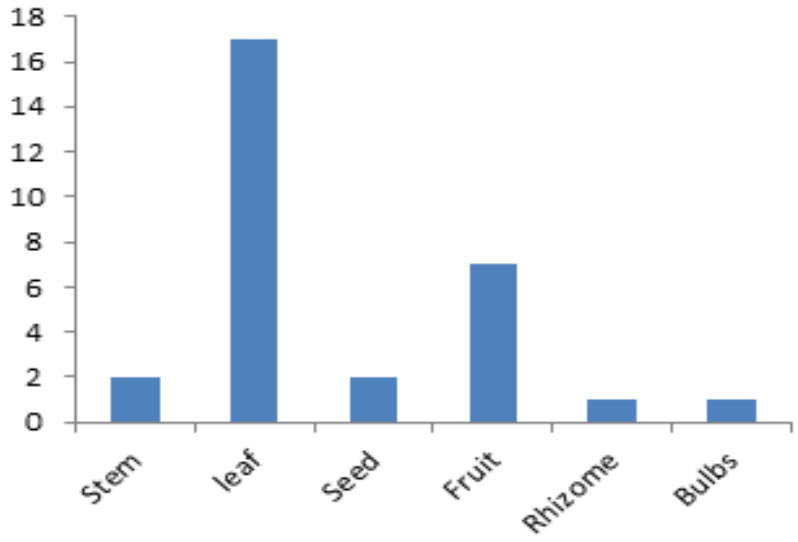

Figure 1. Parts of plants used by the community for Diabetes Mellitus medicine in Beutong District, Nagan Raya Regency

Plant Processing

The method of processing plants for the treatment of Diabetes Mellitus in Beutong District, Nagan Raya Regency is done by boiling, pounding, and blending. The method of processing plants for the treatment of Diabetes mellitus is described in Figure 3.

The method of processing plants that is usually done by the community is by boiling, growing and blending. The most frequently used method is boiling. The goal is that the substances contained in the leaves can dissolve into boiled water (Botanical in Pelokang, 2018).

The majority of people consume medicinal plants for Diabetes mellitus by drinking and a small portion of people consuming them by eating.

Diabetes mellitus Diabetes is a disease known by the public as diabetes or diabetes. Diabetes mellitus is a chronic disease among the people. Medicinal plants used by the community in Beutong District, Nagan Raya Regency to treat diabetes mellitus are Piper ornatum, Ageratumcony zoides, Morinda citrifolia, Ocimum basillicum, Syzygium polyanthum, Psidium guajava, Eugena jambolana Lam (*Syzygium cumini*), Phaleria macrocarpa, Annona muricata, Mangifera indica, Momordica charantia, Carica papaya, Persea americana P. Mill, Vigna unguiculata, Archidendron pauciflorum, Catharanthus roseus, Phyllanthus niruri, Averrhoa bilimbi L. Pandanus ammaryllifolius, Cocos nucifera, Aloe vera. Saccharum officinarum Linn. Allium Cepa. Curcuma longa. Cymbopogon citratus, Durio ziber.

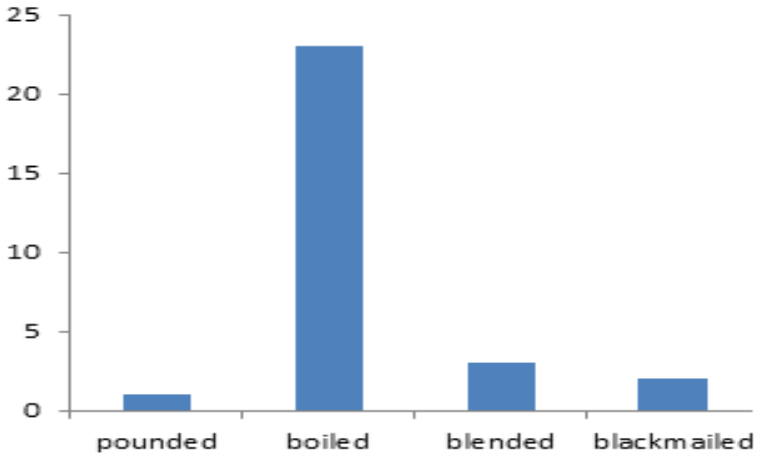

Figure 2. How to Process Plants Used by the Community for Diabetes Mellitus medicine

Table 2. Plant Name, Family, Part used, Preparation Method, UV Value, and FL Value for the treatment of Diabetes mellitus in Beutong District, Nagan Raya Regency.

Scientific Name / Local Name	Family	Parts used	Method Of Preparation	UV	FL (%)
Phyllanthus niruri, L/ Meniran	Euphorbiaceae	Leaf	Boiled	0.03	10.34
*Saccharum officinarum Linn/*sugarcane	Poaceae	stem	squeezed	0.03	10.34
*Persea americana P. Mill/*Avocado	Lauraceae	Leaf	Boiled	0.04	13.79
*Allium Cepa/*Shallot	Amaryllidaceae	Bulbs	Cooked into Gel	0.04	13.79
*Eugena jambolana Lam/ Syzygium cumini L/*Jamun	Myrtaceae	Seed	pounded	0.05	17.24
*Catharanthus roseus/*Tread Dara	Apocynaceae	Leaf	Boiled	0.05	17.24
*Durio Ziber/*Durian	Bombacaceae	Leaf	Boiled	0.05	17.24
*Phaleria macrocarpa/*God's Crown	Thymelaeaceae	Fruit	Boiled	0.06	20.69
*Aloe vera/*Aloe vera	Asphodelaceae	Leaf	Blender	0.06	20.69
*Mangifera indica/*Mango	Anacardiaceae	Leaf	Boiled	0.07	24.14
*Pandanus amaryllifolius/*Fragrant pandan	Pandanaceae	Leaf	Boiled	0.07	24.14
*Ocimum basilicum/*Basil	Lamiaceae	Leaf	Eat directly / Boiled	0.08	27.59
*Psidium guajava/*Guava	Myrtaceae	Leaf	Boiled	0.08	27.59
*Cocos nucifera/*Coconut	Arecaceae	Fruit	Consumed Direct	0.08	27.59
*Cymbopogon citratus/*Lemongrass	Poaceae	stem	Boiled	0.08	27.59
*Moringa oleifera/*Moringa	Moringaceae	Leaf	Boiled	0.08	27.59
*Archidendron pauciflorum/*Jengkol	Fabaceae	Leaf	Boiled	0.09	31.03
*Averrhoa bilimbi L./*Starfruit	Oxalidaceae	Leaf	Boiled	0.09	31.03
*Ageratumcony zoides/*Bandotan	Asteraceae	Leaf	Boiled	0.1	34.48
*Momordica charantia/*Pare	Cucurbitaceae	Fruit	Blended	0.1	34.48
*Garcinia mangostana L/*Mangosteen	Clusiaceae	Fruit	Boiled	0.1	34.48
*Annona muricata/*soursop	Annonaceae	Leaf	Boiled	0.11	37.93
*Curcuma longa/*Turmeric	Zingiberaceae	rhizome	Boiled	0.11	37.93
*Piper ornament/*Red Betel	Piperaceae	Leaf	Boiled	0.12	41.38
*Morinda citrifolia/*Noni	Rubiaceae	Fruit	Boiled	0.13	44.83
*Syzygium polyanthum/*Regards	Myrtaceae	Leaf	Boiled	0.15	51.72
*Carica papaya/*pawpaw	Caricaceae	Leaf	Boiled	0.15	51.72
*Vigna unguiculata/*Long beans	Fabaceae	Fruit	Blended/ Boiled	0.17	58.62

Note: UV = Use Value; FL= Fidelity Level

Table 2 lists the main phytochemicals identified in the medicinal plant species most frequently used in the treatment of diabetes. It is clear that the plant species found in Beutong sub-district, Nagan Raya district, have bioactive content.

Red betel (*Piper crocatum*) is one of the herbal medicines that can empirically treat diabetes mellitus because the red betel leaf contains phytochemical compounds. This is in accordance with the statement of Sutrisno., (2018) that Red Betel leaf extract (*Piper crocatum*) can inhibit and kill gram-positive and gram-negative bacteria, so that the development of these bacteria can be minimized and the odor of diabetic ulcers can be controlled.

Bandotan plant (*Ageratum conyzoides* L.*)* is widely used as a medicinal ingredient because of its properties. Delisma (2020) thatBandotan leaf ethanol extract showed a significant effect in lowering blood glucose levels in alloxan-induced male wistar rats. Administration of alloxan can cause permanent hyperglycemia rapidly within two to three days. Bandotan leaf extract contains flavonoid compounds that play a role in increasing antioxidant activity and is able to regenerate damaged pancreatic cells so that insulin deficiency can be overcome.

Table 3. The major phytochemical compounds identified in the most common plant species used in the treatment of diabetes

Plant Species	Bioactive Components	Reference
Piper ornament	Cathechin	Sutrisno, (2018)
Ageratumcony zoides	Essential Oils and Saponins	Delisma, (2020)
Morinda citrifolia	Terpenes and Acubins	Anggriani, (2020)
Ocimum basillicum	*Tannins*	Tandi, (2019)
Syzygium polyanthum	Quercitrin and fluorethin	Lolok et al,(2020)
Psidium guajava	Tannins	Sonet al, (2019)
Eugena jambolana Lam/ Syzygium cumini L	Resin and tannin	Fatin et al, (2018)
Phaleria macrocarpa	Flavonoids and saponins	Arjadiet al, (2017)
Annona muricata	*Coumaric acid*	Novianty et al, (2021)
Mangifera indica	Mangiferin	Harsanti (2019)
Momordica charantia	Charantins and lectins	Adnyana et al, (2016)
Carica papaya	Flavonoids andtannins	Pongohet al, (2020)
Persea americana P. Mill	Alkaloids	Patala, (2020)
Vigna unguiculata	Flavonoids and phenolics	Ivantirta, (2019)
Archidendron pauciflorum	Genistein and daidzein	Malinie et al, (2019)
Catharanthus roseus	Vindolicine Alkoid	Satyarsa, (2019)
Phyllanthus niruri, L.	Phyllanthin	Sujono, (2015)
Averrhoa bilimbi L.	Tannins and triterpenoids	Yazid et al, (2017)
Pandanus amaryllifolius	Terpenoids and steroids	Prameswari et al, (2013)
Cocos nucifera	Polyphenol	Agustina, (2022)
Aloe vera	Acemannan and anthraquinone	El Qahar, (2020)
Saccharum officinarum Linn	Ascorbic acid	andila,et al, (2021)
Allium Cepa	*Flavonoids*and allilprophildisulfide	Lolok et al, (2020)
Curcuma longa	Alkaloids and flavonoids	Septianaet al,(2019)
Cymbopogon citratus	Tannins and saponins	Pratiwiet al, (2020)
Durio Ziber	Essential oils and flavonoids	Amir, (2019)
Garcinia mangostana L	Xanthones	Maliangkay, (2018)
Moringa oleifera	Flavonoids and saponins	Halan, (2020)
Areca cathecu L	Arecholine Alkaloids	Sari, (2016)

Morinda citrifolia L. contains secondary metabolites that are beneficial for the health of the human body. Several types of phytochemical compounds in noni fruit are terpenes, acubin, lasperuloside, alizarin, anthraquinone substances, ascorbic acid, caproic acid, caprylic acid, scopoletin substances, and damnakantal. Meanwhile, the bioactive compounds detected as potential antidiabetic compounds in noni are alkaloids. (Anggriani, 2020).

One of the traditional plants that are efficacious as medicine is Basil (*Ocimum basilicum* L.). Basil lowers cholesterol and blood sugar levels and reduces the risk of hypertension and cardiovascular disease. Basil (*Ocimum basilicum* L.) has active compounds, namely tannins, flavonoids, saponins and alkaloids.Compounds contained in basil leaf extract that play a role in lowering blood glucose levels are flavonoids, saponins and tannins. Flavonoids play a role in lowering blood glucose levels by increasing insulin secretion in pancreatic cells. In addition, flavonoids can prevent damage to pancreatic cells because they have activity as antioxidants that work, by capturing or neutralizing free radicals associated with the OH group so that they can improve the condition of damaged tissues. Saponins can reduce blood glucose levels by increasing insulin secretion in pancreatic cells, increasing glucose uptake and inhibiting glucose absorption in the small intestine. Tannins work as antihyperglycemic agents by increasing glycogenesis (Tandi, 2019).

Leaf of *Syzygium polyanthum* Wight is one of the herbal medicines that can treat diabetes mellitus because bay leaves contain phytochemical compounds. As according to Lolok et al., (2020) that chemical compounds found in bay leaves are flavonoids, alkaloids and saponins. The main flavonoid content in the ethanolic extract of bay leaves is quersitrin and fluorethin which function as antioxidants, which work to inhibit glucose reabsorption from the kidneys, regulate enzymes involved in carbohydrate metabolism pathways, and increase insulin secretion, thereby reducing

blood glucose levels. The content of alkaloids and saponins that can stimulate insulin secretion from pancreatic beta cells.

The chemical content of the fruit, leaves, and bark of the guava is tannin. Tannins can lower blood glucose levels. This has been proven by research conducted by (Putra et al., 2019), explaining that there is an effect of giving guava leaf boiled water on blood glucose levels in patients with type II diabetes mellitus.

Fruit of *Syzygium cumini* L. known as *Boh Jambe Kleng* at the people in Beutong District. *Syzygium cumini* L. is one of the herbal medicines that is able to overcome the decrease in blood sugar levels. *Syzygium cumini* L. leaf ethanol extract contains several compounds such as alkaloids, flavonoids, terpenoids, steroids, phenolics, and saponins. As according to Fatin et al., (2018) that the action of flavonoids is also beneficial in diabetes melitus through its ability to improve glucose tolerance.

Mahkota Dewa (*Phaleria macrocarpa*) is one of the famous herbal medicinal plants in Beutong District and its properties are believed to cure diabetes. The leaves, flowers and flesh of the crown of the god can be used as medicine. However, in Beutong District, many use the crown of Dewa fruit flesh which is known to contain flavonoid compounds, saponins and alkaloids (Arjadi & Mostafa, 2017).

Soursop leaf (*Annona muricata)* has a flavonoid compound (quercetin) as a hypoglycemic agent by stimulating insulin secretion, repairing damage to pancreatic cells, and an inhibitor of the -glucosidase enzyme (Anggraini, 2019). Then, the mangiferin that mango has Mangifera indica responsible for various pharmacological activities including as antidiabetic. As according to Harsanti (2019) that the highest levels of mangiferin are in young mango leaves or leaf shoots.

Mango (*Mangifera indica*) is a plant that is widely found in the home environment of the Beutong District community. Manga leaves containThe flavonoid compounds found in leaves, stems, fruit skins and roots of mango plants, namely mangiferin are considered as compounds that are responsible for various pharmacological activities including antidiabetic. As according to Harsanti (2019) that the highest levels of mangiferin are in young mango leaves or leaf shoots.

The ability of bitter melon (*Momordica charantia)* extract also causes pancreatic cells to run normally without the influence of alloxan induction, able to control fatty peroxides by adding hydrogen to the reaction which is able to convert peroxyl radicals resulting from lipid peroxidation into less reactive radicals, so that they are unable to damage fatty acid chains and further protect them. pancreatic cells from damage. The content of bitter melon that is useful for lowering blood glucose is charantin, polypeptide-P insulin and lectins. The content of saponins, flavonoids, polyphenols, and vitamin C of bitter melon serves as an antioxidant that aims to ward off free radicals that can interfere with the survival of Leydig cells due to diabetes mellitus. (Adnyana, et al. 2016).

Papaya plant (*Carica papaya* L.) is a plant that as a whole has many benefits, both roots, leaves, flowers, fruit and seeds. Empirically, papaya flowers are usually boiled and used for diabetes mellitus (diabetes), improve appetite, cleanse blood, and jaundice medicine. Papaya flowers contain flavonoids, tannins, steroidal terpenoids, and carbohydrates (Pongoh, et al. 2020).

Avocado seeds (*Persea Americana* Mill.) are one of the plants that have medicinal properties, namely the active compounds contained in avocado seeds that have antidiabetic activity are flavonoids, alkaloids, tannins and saponins. Avocado seeds have various uses, including treating diarrhea, toothache, as well as skin and beauty treatments. Avocado seed oil also has several health benefits, one of which is weight loss. Avocado plants have been widely known to have anti-inflammatory and analgesic properties (Patala, 2020).

Long beans (*Vigna unguiculata)*It also contains high levels of flavonoids, saponins, alkaloids, tannins, phenolics and steroids. The protective effect of flavonoids in biological systems is ascribed to their capacity to transfer hydrogen or electron free radicals, activate antioxidant enzymes, catalyze metal chelates, reduce -tocopherol radicals, and inhibit oxidases. Flavonoid compounds have antioxidant effects by inhibiting various oxidation reactions. The higher the flavonoid content, the higher the antioxidant potential (Ivantirta, 2019). This antioxidant is needed in the process of improving insulin transfer into cells, and in the regeneration of cells in pancreatic insulin, especially cells that are damaged by free radicals (Solehah, 2019).

The jengkol plant (*Archidendron pauciflo* rum) belongs to the Fabaceae family, a plant belonging to the Fabaceae family which contains flavonoid compounds of the type Isoflavones (3-phenylchromen-4-ones or 3-phenyl-ã-benzopyrones) consisting of genistein, daidzein, glycitein , formononetin, biochanin-A, and wighteone. Genistein and daidzein have been shown to increase the ethanol in the skin of the

jengkol fruit, the presence of bioactive chemical compounds contained in the skin of the jengkol fruit which can stimulate pancreatic beta cells to secrete the hormone insulin. Jengkol rind extract contains several bioactive compounds including flavonoids, alkaloids, tannins and polyphenols.). Plants that have flavonoid secondary metabolic compounds can be used to treat diabetes by stimulating the secretion of the hormone insulin, for example genistein, daidzein, quercetin,

Tapak Dara Plant (*Catharanthus roseus)*is one type of ornamental plant that is useful as an herbal medicine for diabetes mellitus. LeafTapak Dara contains various antitoxin substances and biindole alkaloids such as the alcoid vindolicine which can be used for the treatment of degenerative diseases, one of which is Diabetes mellitus (Satyarsa, 2019).

Herba Meniran (*Phyllanthus niruri* L.) contains flavonoid compounds which are efficacious as antioxidants. Meniran also contains phyllanthin, hypophylantin and corilagin which have hepatoprotective potential and prevent the release of liver enzymes, reduce lipid peroxidation levels, and increase glutathione levels. Based on the in vitro antioxidant activity test, it showed that the meniran extract and its fractions showed an antioxidant effect (Sujono, 2015).

Starfruit leaves (*Averrhoa bilimbi* L.*) one of the*Plants empirically have efficacy for the treatment of Diabetes mellitus. As a medicinal ingredient used is a decoction of starfruit leaves containing tannins, flavonoids and triterpenoids. In addition, simplicia phytochemical screening from starfruit leaf extract contains flavonoids, saponins, tannins and steroids or triterpenoids.Yazid & Suryani, 2017).

Fragrant Pandan Leaves (*Pandanus ammaryllifolius)*efficacious as a drug for diabetes. In the treatment process, Pandan Wangi leaves are generally brewed with hot water and drunk regularly. As according toPrameswari & Widjanarko (2013: 19) That the research shows that the ethyl acetate extract of pandan leaves contains terpenoid and steroid compounds that have the potential as antidiabetic in vitro with an inhibitory power of 0.79% at a concentration of 3.12 ppm

Coconut (*Cocos nucifera)* can be used for the treatment of Diabetes mellitus because it contains chemical compounds such as polyphenols, flavonoids, monoterpenes / sesquitepen, phenolic acids. Some of these phytochemical compounds can function as antioxidants. Antioxidants can be defined as molecules capable of stabilizing or deactivating free radicals before they attack cells. Flavonoids with the ability as antioxidants can lower blood glucose levels. Flavonoids are protective against cell damage as insulin-producing cells and can increase insulin sensitivity. Antioxidants can suppress cell apoptosis without changing the proliferation of pancreatic cells (Agustina, 2022).

Aloe vera (*Aloe vera)* contains chemicals that have hypoglycemic properties including chromium and alprogen. It is assumed that the administration of *Aloe vera* can protect and restore the function of damaged pancreatic cells. Then the content of *Aloe vera* can work like insulin and lower blood glucose levels even though all pancreatic cells have degenerated. In one previous study, it was also stated that acemannan, anthraquinone and phytosterols in *Aloe vera* were thought to have antidiabetic effects. (El Qahar, 2020).

Sugarcane ireng (*Saccharum officinarum* Linn) has the ability as an antioxidant. Antioxidant activity in several parts of sugarcane ireng from the highest to the lowest, respectively, were: young reed, bark, old reed, old leaves, midrib, young leaves and stem contents. Ascorbic acid is a chemical compound in the form of a white crystalline powder found in sugarcane. Ascorbic acid is soluble in water and has properties as a strong antioxidant. -tocopherol is also one of the strongest natural antioxidants. -tocopherol can prevent the spread of free radicals in lipoprotein membranes and plasma and also plays a role in strengthening the immune system by stabilizing cell membranes and protecting tissues (such as eyes, skin, and liver). The antioxidant properties of reeds may also be due to the synergistic combination of several antioxidants. The combination of antioxidant -tocopherol and ascorbic acid is thought to provide better effectiveness (Andila et al. 2021).

Shallot (*Allium Cepa)* can reduce blood sugar levels in people with diabetes mellitus, namely flavonoids and allilprophildisulfide. Shallots contain flavonoid compounds and allilprophildisulfide which are hypoglycemic, which can lower blood sugar levels. This chemical compound pharmacologically can also help the pancreas work in producing insulin. Thus, the process of glucose metabolism into glycogen can run more smoothly so that glucose dissolved with the blood will decrease (Lolok, 2019).

Turmeric rhizome (*Curcuma longa*) is a type of plant used to treat diabetes mellitus. As according to Septiana et al., (2019) that the turmeric rhizome contains alkaloids, flavonoids, phenolics, and triterpenoids.

Lemongrass (*Cymbopogon citratus*) is a plant

category that is easy to grow on a variety of soils and does not require special care like other plants. People usually use lemongrass as a spice for cooking and traditional drinks. Lemongrass empirically can be used as antiprotozoal, anti-inflammatory, antimicrobial, antidiabetic, anticholinesterase, molluscidal and antifungal. The stem of the lemongrass showed the presence of tannins, saponins, flavonoids, alkaloids, steroids, terpenoids and essential oils, while the roots showed the presence of tannins, flavonoids, alkaloids, steroids, terpenoids, essential oils, phenolics and carbohydrates. The leaves contain tannins, saponins, flavonoids, alkaloids, steroids, terpenoids, essential oils, phenolics, anthraquinones, carbohydrates and glycosides (Pratiwi, 2020).

Durian (*durio ziber)*which is used to lower blood sugar levels, namely the skin. Durian fruit skin contains essential oils, flavonoids, saponins, cellulose elements, lignin, and starch content. The leaves contain saponins, flavonoids and polyphenols, while the roots contain tannins. Durian also contains lots of vitamin B1, vitamin B2, and vitamin C, as well as potassium, calcium and phosphorus. Durian leaves and roots are used as antipyretics, durian leaves can be used to treat fever, durian fruit can be used as a food supplement, a supplement for patients with hypercholesterolemia and diabetes mellitus, and as a source of natural antioxidants for the body (Amir, 2019).

Mangosteen (*Garcinia mangostana* L)especially the skin contains compounds that have pharmacological activity as antioxidants, anti-inflammatory, anti-histamine, anti-bacterial, antifungal, cancer, hypertension, stroke, and for HIV therapy.Mangosteen peel also contains xanthone compounds which are very high antioxidants, namely 66.7%, Xanthones are an active chemical that has a 3 ring structure making it very stable when in the human body (Maliangkay, 2018).

Moringa (*Moringa oleifera)* is one of the plants that can be used to lower blood glucose levels. Moringa leaf is one part of the Moringa plant that has been widely studied for its nutritional content and uses. The content in Moringa leaves that function in lowering blood glucose levels are flavonoids, vitamins A, C, and E and saponins. Flavonoids are substances that are antioxidants that can inhibit oxidation reactions. Flavonoids are able to bind free radicals so that they can reduce oxidative stress. Reduced oxidative stress can reduce insulin resistance and prevent the development of pancreatic cell dysfunction and damage (Halan, 2020).

Areca nut (*Areca catechu*) is an antidiabetic plant that can reduce hyperglycemia. Areca nut is an herbal plant that is also used by the people of Beutong District for traditional medicine. Areca nut is reported to contain arecholine alkaloid compounds which have antihyperglycemic activity. Arecholine can enter skeletal muscle cells by binding to PAT-1 (proton-coupled amino acid transporter-1). Polyphenols such as epicatechin and cirrhic acid in the ethanolic extract of areca nut also have antioxidant activity.Sari, 2016).

Based on the results of interviews with healers and people with diabetes mellitus in Beutong District, Nagan Raya Regency, it is known that after using these medicinal plants there is an increase in the patient's health condition, namely a decrease in blood sugar levels to normal and in diabetics who have wounds on their body parts regularly. slowly the wound dries.

CONCLUSION

This study reveals important information regarding the use of plants as a cure for diabetes mellitus by the people of Beutong sub-district, Nagan Raya district. This also shows the important role of medicinal plants in maintaining public health. 29 species of plants from 26 families are used by the community to treat Diabetes mellitus. Leaves are the parts of plants that are most often used by the community and the majority of people process these medicinal plants by boiling. And the authors can put forward suggestions that are expected to further researchers in order to expand the research area and the results obtained will be more varied and hopefully the results of this study can be used as a source of scientific information for the whole community especially those with diabetes mellitus.

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