



Effectiveness of Various Plants as Traditional Medicine in the Treatment of Diabetes Mellitus

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ABSTRACT

Introduction: Diabetes mellitus is an endocrine disorder characterized by hyperglycemia, glycosuria, and hyperlipidemia. Various plants are used as natural antidiabetics.

Objective: to know plants that are efficacious as antidiabetics as an alternative in the treatment of diabetes mellitus.

Methods: literature review. Data sources came from research journals on plants that are efficacious as antidiabetics from national and international sources. The data search strategy used was to search the literature directly through the Google search engine and use the Google Scholar, Pubmed, and Science Direct databases with the keywords "plants that are efficacious as antidiabetics", "secondary metabolites of plants as antidiabetics". Inclusion criteria included national journals on the efficacy of sungkai plants with Sinta accreditation 1-6, and Scopus indexed international journals with Q1- Q4 rankings. Exclusion criteria included journals that did not focus on plants as antidiabetics and journals that were not accredited.

Results: Results: From the reviewed national and international journals, it was found that various plants have antidiabetic properties and have been tested for safety in animal experiments and traditionally by the community.

Conclusion: Based on the literature that has been collected, it can be concluded that there have been many studies on plants that are efficacious as antidiabetics ranging from Kumis Kucing plant, pegagan plant, red betel leaves, and various other plants that have been studied experimentally, the content of quercetin, pomolic acid, tormentic acid, and eucalyptus acid with different mechanisms of action from each other contained in these plants plays a role in reducing blood sugar levels.

Keywords: Diabetes Mellitus, plant, blood sugar levels, secondary metabolites.

Received 04 Oct., 2024; Revised 14 Oct., 2024; Accepted 16 Oct., 2024 © The author(s) 2024.

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I. INTRODUCTION

The availability of various types of plants provides various benefits for humans, one of which is a medicinal ingredient. Indonesia has a very high biodiversity, so it is dubbed mega biodiversity. The available biodiversity is utilized to meet the needs of the community, especially for food and medicine. The use of plants as medicine has been carried out by people in Indonesia since ancient times, where this knowledge has been obtained from generation to generation. Usually, people make use of the plants that grow around their homes. There are many benefits of plants in medicine, including as an appetite enhancer, improving body fitness, hepatoprotector, and antidiabetic mellitus. (1)

Management of diabetes is a global health problem and successful treatment is yet to be discovered. Currently available therapies for diabetes include insulin and various oral antidiabetic agents such as sulfonylureas, biguanides and glinides. Many of them have a number of serious adverse effects; therefore, the search for more effective and safer hypoglycemic agents is one of the important areas of investigation. Medicinal plants are rich source of various bioactive phytochemicals. Many Indian medicinal plants have been found to be useful in the management of diabetes acting through variety of mechanisms. Medicinal plants provide better alternatives as they are less toxic, easily available and affordable and many of the currently available drugs have been derived directly or indirectly from them.(2)

Diabetes mellitus (DM) is an endocrine disorder characterized by hyperglycemia, glycosuria, and hyperlipaemia. It causes serious comorbidities, which are categorized as intense, and subacute. These include, but are not restricted to, retinopathy, neuropathy, nephropathy, heart problems, hypoglycemia, diabetic ketoacidosis, hyperosmolar non-ketotic disorder, polydipsia, frequent urination, absence of energy, visual disability, and weight reduction, and extreme eating (polyphagia). The World Health Organization (WHO) supported the evaluation of curative plants based on their effectiveness, low cost, and lack of adverse effects.³ There are so many antidiabetic plants whose natural products tackle diabetes and directly impact insulin discharge from the pancreas.⁽³⁾

Diabetes Mellitus (DM) is chronic disease that is still a major health problem in Indonesia. DM sufferers continue to increase along with the increasing level of prosperity and human lifestyle. The International Diabetes Federation (IDF) in 2019 said that an estimated 463 million people suffer from diabetes and this number is projected to reach 578 million by 2030, and 700 million by 2045. ⁽⁴⁾

According to WHO data, Indonesia ranks 4th largest in the number of people with diabetes mellitus in the world and in 2000 there were an estimated 4 million people with diabetes mellitus in Indonesia. This number is expected to continue to increase. In 2010 it is estimated to be 5 million and in 2030 It is estimated that around 21.3 million Indonesians suffer from diabetes mellitus. The most important therapy for Diabetes Mellitus (DM) is food by regulating the diet of the patient. The patient works with a nutritionist to determine what foods can be consumed. Drugs can be given if food therapy is not successful. Nowadays, many people prefer treatment by using medicinal plants compared to chemical drugs. One of the reasons is because medicinal plants have many advantages, in addition to being easily available, easy to plant, can be mixed by yourself and are cheap.⁽⁵⁾

The pancreas is instrumental in maintaining blood glucose homeostasis. The concentration of glucose concentration in the blood is determined by the balance that exists between the following processes namely absorption of glucose from the gastrointestinal tract, glucose transportation by cells (mainly in the liver), and excretion of glucose by urine. The hormone insulin produced by beta cells of the pancreas plays an important role in glucose metabolism. an important role in glucose metabolism. Insulin has four effects that can reduce blood glucose levels and increase carbohydrate storage, including insulin facilitates the entry of glucose into most cells. Glucose molecules do not easily penetrate the cell membrane without insulin to absorb glucose from the blood.⁽⁶⁾

The small pores system in the liver sinusoidal endothelial cells is the site where the transfer of nutrients between blood and liver take place. In diabetic control, the liver sinusoidal was identified as congested because of the accumulation of high glucose concentration in blood. Section of the entire test extracts treated group exhibited moderate hepatic congestion due to the reduction in the blood glucose level. In diabetic control, it was identified that small droplets of lipids are retained as pericentre globular micro steatosis which may due to hyperglycemia that impaired the normal process of synthesis and elimination of triglycerides. In standard control and the test extracts treated group section showed a minimal pericentre globular micro steatosis that pointed out that the impairment in the triglycerides synthesis and elimination was balanced.⁽⁷⁾

II. METHODOLOGY

The method used was a literature review. Data sources came from research journals on plants that are efficacious as antidiabetics from national and international sources. The data search strategy used was to search the literature directly through the Google search engine and use the Google Scholar, Pubmed, and Science Direct databases with the keywords “plants that are efficacious as antidiabetics”, “secondary metabolites of plants as antidiabetics”. Inclusion criteria included national journals on the efficacy of sungkai plants with Sinta accreditation 1-6, and Scopus indexed international journals with Q1-Q4 rankings. Exclusion criteria included journals that did not focus on plants as antidiabetics and journals that were not accredited.

III. RESULTS AND DISCUSSION

Diabetes mellitus is a disease that is quite vulnerable to sufferers. because this disease can be caused by many factors, such as lifestyle, environment, genetics, and age. The many plants that contain secondary metabolites that act as anti-diabetes can be an alternative for the community to be able to control blood sugar levels. Diabetes mellitus treatment is often replaced with herbal remedies. The use of herbal medicine increased from 15.2% in 2000 to 2006 to 38.3%. In Indonesia, traditional medicine has been used for a long time. This is because many plants that can be used as natural medicine in Indonesia.⁽⁸⁾

Alloxan is a well-known diabetogenic agent that is frequently used to assess the antidiabetic drug capabilities of natural products and plants derived from diabetes research. It is synthetically recognized as 5,5-dihydroxyl pyrimidine 2,4,6-trione. Alloxan is a natural complex, a urea subsidiary, and a cytotoxic glucose analog. The compound has the subatomic formula $C_4H_2N_2O_4$ and has a virtual subatomic physique of 142.06. Alloxan-induced diabetes is a type of insulin-dependent diabetes mellitus caused by alloxan administration to

animals. It has been effectively used to induce diabetes in bunnies, mice, rodents, apes, cats, and dogs. The mechanism of action generally includes fractional degradation of the beta cells of pancreatic islets.(3)

From various research results regarding potential of Indonesian plants that have antidiabetic activity obtained that cinnamon water extract can reduce blood glucose levels by 94.51% and cinnamon ethanol extract by 94.88%; a decrease in blood glucose levels by the blood glucose levels by water extract of black glutinous rice black glutinous rice water extract by 57.57 blood glucose levels by % ; decrease in blood glucose levels by ethanol extract of blood glucose levels by ethanol extract of singawang leaves by 1.65% and water extract of Singawang leaves by 6.25%; decrease in blood glucose levels by ethanol extract of ethanol extract of bangle rhizome was 50.28% and the IC₅₀ value of 98.31 ppm. (4)

Red betel leaf plant (*Piper crocatum* Ruiz & Pav) is a biodiversity plants that are often used by the community for generations for various treatments such as diabetes, hepatitis, hypertension, hemorrhoid, toothache medicine. Red betel through an enzymatic mechanism can reduce blood glucose. Red betel leaf extract showed decreased glucose levels in white rats that were induced alloxan. As a strong oxidant, alloxan is widely used in experimental animals to induce insulin-dependent diabetes (type 1). It works by increasing generation of reactive oxygen species from metabolic reactions in the body, together with massive increase of cytosolic calcium concentration, and it can rapidly cause destruction of pancreatic β -cells. (9,10)

According to the results of research by Nurulita et al., (2008), the compounds that have antidiabetic activity are flavonoids, steroids/triterpenoids and tannins. One of the plants that are used as natural herbal medicine is pegagan plant (*Centella asiatica* (L.) Urban), this plant contains several secondary metabolite compounds including triterpenoids, saponins, flavonoids, tannins and alkaloids. Secondary metabolite compounds can treat diabetes mellitus.(11)

Some plants of the genus *Rubus*, which a class of berries, are also reported to have antihyperglycemia activity such as *Rubus ulmifolius* Schott, *Rubus ellipticus* Smith, *Rubus occidentalis* and *Rubus idaeus* L. Overall, the antihyperglycemic effect of the of these *Rubus* plants is attributed to their chemical content, namely polyphenols and terpenoids that have the potential to reduce blood glucose levels. One of the *Rubus* species in Indonesia is *Rubus rosifolius*. Indonesia is *Rubus rosifolius* Sm. which is known as arbei. name arbei. Arbei fruit is commonly used as a laxative and to treat fever. and overcome fever, while the leaves are made into tea to treat menstrual pain, flu and morning sickness. The results showed that arbei fruit has the effects of antidiabetic, anticancer, antimicrobial, anti-inflammatory and antihypertensive antihypertensive. Arbei leaves (*Rubus rosifolius* Sm.) have antioxidant activity, pancreatic elastase inhibitor and have high phenol content. The isolation results of pure compounds show, arbei leaves contain quercetin, pomolic acid, tormentic acid, euscaphic acid, ellagic acid, B-Caryophyllene, rosifoliol and nevadensin (5,7-dihydroxy-6,8,4'-trimethoxyflavonol). Some of these compounds have been shown to have effects as antihyperglycemia, namely quercetin, pomolic acid, tormentic acid, and euscaphic acid with different mechanisms of action each other. The chemical content of arbei leaves (*Rubus rosifolius* Sm.) which has the potential as an antihyperglycemia, and there have been no reported studies of antihyperglycemia research from arbei leaves, then the test was carried out the effectiveness of arbei leaf extract (*Rubus rosifolius* Sm.) on the reduction of blood glucose levels in mice induced by alloxan induced mice.(12)

Research conducted by Rao et al., (2012) distilled water extract of ganitri leaves (*Elaeocarpus ganitrus* Roxb.) based on chitosan at a dose of 200 mg / kgBB shows the potential antidiabetic effect on streptozotocin-induced rats. Bay leaves have the same chemical compounds as ganitri leaves, namely flavonoids such as quercetin and tannins that work as hypoglycemics.(6)

Clinical evidence showed that improving lifestyle by maintaining healthy body weight and modest physical exercise can avoid Type 2 diabetes mellitus. Moreover, in a short time, lifestyle modification fails to exert its effects on diabetes, and it is tough to maintain the modified lifestyle. Nowadays, combined therapy of several oral hypoglycemic agents exhibits an efficient treatment for glycemic control in the management of diabetes. However, the available combinational therapies possess numerous side effects. The inclusion of phytoconstituents in combination therapy provides more efficient treatment with significantly decreased side effects in the management of diabetes. Phytochemicals are considered less toxic compared with their synthetic counterparts. Therefore, it is the need of the hour to explore phytochemicals for drug intervention that can help prevent and treat Type 2 diabetes mellitus with fewer side effects.(13)

Type 2 Diabetes mellitus is the most common type of diabetes that arises from insulin production defects or reduced peripheral tissue response towards insulin. The complications associated with Type 2 diabetes are nephropathy, retinopathy, neuropathy, and cardiovascular disease. The phytochemical treatment in type 2 diabetes has fewer adverse effects and might be considered a better replacement of the existing oral therapy. The inclusion of phytoconstituents in combination therapy provides more efficient treatment with significantly decreased side effects in diabetes management. The plant's available literature represents that the methanol extract was influential in the treatment of diabetes; however, the study was conducted at pilot scale only, and no reports were available for the responsible specialized metabolites or compounds responsible for its therapeutic activity.(13)

The number of plants that contain secondary metabolites that can act as antidiabetics so that it can be an alternative treatment for the community to be able to use these plants. Plant testing as one of the drugs that can control blood sugar levels has been widely done. Starting from plant extracts to isolates from plants. So that people can use many other alternatives besides consuming chemical drugs.

IV. CONCLUSIONS

Based on the literature that has been collected, it can be concluded that there have been many studies on plants that are efficacious as antidiabetics ranging from Kumis Kucing plant, pegagan plant, red betel leaves, and various other plants that have been studied experimentally, the content of quercetin, pomolic acid, tormentic acid, and eucalyptus acid with different mechanisms of action from each other contained in these plants plays a role in reducing blood sugar levels.

ACKNOWLEDGMENTS

Thank you to the lecturers and educational staff of the Faculty of Pharmacy and Faculty of Medicine, Andalas University and all those involved directly or indirectly in helping, guiding and providing ideas and ideas to the author in completing this literature review.

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