

ANTIDIABETIC ACTIVITY OF SOME MEDICINAL PLANTS FROM SUBANG, WEST  
JAVA, INDONESIA: A REVIEW

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## ABSTRACT

Diabetes mellitus (DM), characterized by hyperglycemia, is a genetically and clinically heterogeneous group of disorders with the common feature of glucose intolerance. Type I (insulin-dependent diabetes mellitus), type II (non-insulin-dependent diabetes mellitus), other specific types, and gestational diabetes mellitus are the four primary subtypes of diabetes mellitus, as per the World Health Organization's recommendations. The cellular-mediated autoimmune destruction of pancreatic  $\beta$  cells is the cause of type 1 DM, or juvenile-onset diabetes. Contrarily, insulin resistance, typically leading to insulin deficiency, causes type 2 diabetes. Researchers are currently searching for novel anti-diabetic compound candidates derived from natural ingredients and empirically demonstrated to possess anti-diabetic properties. Researchers are doing this to replace anti-diabetic drugs, which are currently associated with a variety of side effects. This area in West Java, Indonesia, is home to many medicinal plants, such as *Annona muricata*, *Artocarpus heterophyllus*, *Syzygium aromaticum*, *Nephelium lappaceum*, *Andrographis paniculata*, *Zingiber officinale*, and *Kaempferia galanga*. Various mechanisms have scientifically demonstrated their anti-diabetic properties. Consequently, this review article examines the potential of numerous medicinal plants that are indigenous to Subang, West Java, Indonesia and possess anti-diabetic properties.

**KEYWORDS:** Diabetes mellitus, *Annona muricata*, *Artocarpus heterophyllus*, *Syzygium aromaticum*, *Nephelium lappaceum*, *Andrographis paniculata*, *Zingiber officinale*, *Kaempferia galanga*.

## INTRODUCTION

Diabetes mellitus (DM) is a significant public health issue worldwide. The failure of glucose homeostasis, which is characterized by impaired carbohydrate, fat, and protein metabolism, is the result of defects in insulin secretion and/or insulin action.<sup>[1,2]</sup> This disease is a metabolic disorder. Elevated blood glucose is the third most significant risk factor for premature death, following high blood pressure and tobacco use, according to the International Diabetes Federation (IDF) report.<sup>[2]</sup> Furthermore, diabetes mellitus has emerged as one of the most significant causes of morbidity and mortality on a global scale. By 2040, experts anticipate a significant increase in patients to 642 million, primarily in low- and middle-income countries.<sup>[3]</sup> DM and its micro- and macro-complications persist as a significant global health issue, despite the introduction of numerous anti-diabetic agents from natural and synthetic sources.<sup>[4]</sup> Current modern drugs for DM frequently suffer from limitations such as high cost, inadequate efficacy, and a variety of side effects.<sup>[5]</sup> Medicinal plants with anti-diabetic activity, particularly in developing countries,

offer a viable alternative for managing DM due to their cost-effectiveness, accessibility, widespread cultural acceptance, and reduced side effects, given the aforementioned deficiencies of conventional medicine.<sup>[6]</sup> The use of medicinal plants for the treatment of a variety of diseases has expanded globally due to their perceived safety in comparison to synthetic drugs.<sup>[7,8]</sup> Investigating active compounds in natural ingredients, particularly medicinal plants that people have traditionally used to treat DM in various countries, is one method of obtaining new drugs to treat DM.<sup>[9,10]</sup> Research is ongoing to develop these drugs. The objective is to identify novel compounds for the treatment of DM that exhibit low toxicity and mild side effects, thereby preventing patients from experiencing harm.<sup>[11,12]</sup> This review article examines medicinal plants that are indigenous to Subang, West Java, Indonesia, and possess anti-diabetic properties.

*Annona muricata*

*Annona muricata* is a tropical plant that features dark green, oval-shaped leaves and white-fleshed fruit with

spiny green skin. Due to its sweet and sour flavor, people frequently use the fruit of this plant as an ingredient in food, ice cream, or juice.<sup>[13]</sup> The *A. muricata* plant possesses the potential to treat a variety of diseases, including cancer, gout, tumors, hypertension, diabetes mellitus, ulcers, diarrhea, and allergies.<sup>[14]</sup> Researchers reported that administering *A. muricata* at doses of 100 and 200 mg/kg decreased blood glucose levels in mice induced by streptozotocin.<sup>[15]</sup>

#### ***Artocarpus heterophyllus***

The *Artocarpus heterophyllus* plant serves as an example of a potential medicinal agent. This plant belongs to the *Moraceae* family and thrives in tropical climates. People regard *A. heterophyllus* as a nutrient-dense source of carbohydrates, minerals, dietary fiber, and vitamins, among other things.<sup>[16]</sup> DM is also reported to be managed using the bark. The administration of *A. heterophyllus* at doses of 50, 100, and 150 mg/kg was reported to decrease the blood glucose levels of mice that were induced by alloxan.<sup>[17]</sup> *A. heterophyllus* was also found to stop the enzymes  $\alpha$ -amylase and  $\alpha$ -glucosidase from working, with IC<sub>50</sub> values of 4.18 mg/mL for  $\alpha$ -amylase and 3.53 mg/mL for  $\alpha$ -glucosidase.<sup>[18]</sup>

#### ***Syzygium aromaticum***

*Syzygium aromaticum* is an Indonesian aromatic plant that has the potential to alleviate toothaches, stomach ulcers, and diabetes.  $\beta$ -caryophyllene,  $\alpha$ -humulene, eugenol, isoeugenol, and eugenol acetate are the primary chemical components of this plant.<sup>[19]</sup> The oleanolic acid and maslinic acid in *S. aromaticum* can improve glucose homeostasis and lower post-meal hyperglycemia in diabetic rats.<sup>[20]</sup> This is done by stopping the breakdown of carbohydrates and lowering the activity of glucose transporters in the digestive tract. It was found that giving *S. aromaticum* stopped the  $\alpha$ -amylase enzyme working with an IC<sub>50</sub> value of 74.53  $\mu$ g/mL, which had a diabetes-fighting effect.<sup>[21]</sup>

#### ***Nephelium lappaceum***

*Nephelium lappaceum* is a tropical fruit originating from Indonesia. Reports suggest that this plant can prevent diabetes and cancer, enhance bone health, lower the risk of heart disease, and improve digestion. The chemical compounds contained in *N. lappaceum* are saponins, tannins, vitamin C, flavonoids, calcium, phosphorus, magnesium, folic acid, choline, potassium, zinc, vitamin A, and vitamin B complex.<sup>[22]</sup> Administration of *N. lappaceum* at a dose of 500 mg/kg was reported to reduce alloxan-induced blood glucose levels in mice.<sup>[23]</sup>

#### ***Andrographis paniculata***

Researchers empirically use *Andrographis paniculata* Nees., also known as bitter, as a medicine for respiratory diseases, diabetes, cancer, obesity, skin infections, herpes, dysentery, fever, sore throat, urinary tract infections, diarrhea, and to reduce inflammation.<sup>[24]</sup> The main chemicals in this plant are andrographolide lactone group compounds, which make up about 2.5% of the

dried simplicia.<sup>[25]</sup> Administration of *A. paniculata* at doses of 434.6 and 1303.8 mg/kg was reported to reduce blood glucose levels in mice induced by a high-fructose diet.<sup>[26]</sup>

#### ***Zingiber officinale***

*Zingiber officinale* is a spice commonly used for culinary and medicinal purposes for centuries. *Z. officinale* is a medicinal plant belonging to the *Zingiberaceae* family that has long been used for antimicrobial, anti-diabetic, nephroprotective, hepatoprotective, anti-inflammatory, anticancer, and immunomodulatory treatment.<sup>[27]</sup> Administration of *Z. officinale* at a dose of 4 mL/kg can reduce blood glucose levels in rats induced by streptozotocin.<sup>[28]</sup> Apart from that, in tests carried out in vitro, *Z. officinale* was reported to be anti-glycating, with an IC<sub>50</sub> value of 290.84  $\mu$ g/mL.<sup>[29]</sup>

#### ***Kaempferia galanga***

*Kaempferia galanga* is an herbal plant known for its rhizomes, which are used in traditional medicine and as a cooking spice. This plant has green leaves and flowers that grow above the ground. Various traditional medicines use the fragrant aroma of *K. galanga*'s rhizome due to its reported anti-inflammatory, antimicrobial, and antioxidant properties.<sup>[30]</sup> In vitro tests, *K. galanga* was found to stop the activity of  $\alpha$ -amylase and  $\alpha$ -glucosidase at concentrations of 100, 200, 300, 400, and 500  $\mu$ g/mL.<sup>[31]</sup>

### **CONCLUSION**

Various types of medicinal plants in Indonesia have the potential to serve as alternative medicines for the treatment of diabetes mellitus. Empirical and scientific tests have proven the effectiveness of all these plants in reducing blood glucose levels. The active compounds in these plants, possessing anti-diabetic properties through diverse working mechanisms, are inseparable. It is hoped that research on medicinal plants can be used to improve DM treatment and replace anti-diabetic drugs, which currently have many side effects.

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