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# POTENTIAL OF BUTTERFLY PEA FLOWER (CLITORIA TERNATEA) EXTRACT AS AN ANTIDIABETIC AGENT: LITERATURE REVIEW

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**Abstract:** Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia due to insulin deficiency or insulin resistance. The global prevalence of diabetes mellitus continues to increase, posing a significant health and economic burden to society. Conventional pharmacological treatments that are currently available often cause unwanted side effects, so alternative therapies that are safer and more effective are needed. This study aims to collect and analyze data related to the effectiveness of flower extract as an antidiabetic agent in reducing blood glucose levels and preventing complications associated with diabetes. The potential of Clitoria ternatea as an antidiabetic agent was explored through a systematic literature review. Article searches were conducted using scientific databases such as Google Scholar, ScienceDirect, and Mendeley with the keywords "Clitoria ternatea AND diabetes AND blood glucose". The inclusion criteria applied included experimental studies conducted on diabetic samples, interventions with bay flower extract administration, and publications within the last 5 years (2021-2025). From a total of 1,858 articles identified, by applying the PRISMA-ScR method, eight articles were obtained that met the inclusion criteria. The results of the analysis showed that flower extract was effective in reducing blood glucose levels in both diabetes-induced experimental animals and diabetic patients. This antidiabetic effect is thought to be due to the flavonoids and other bioactive compounds in butterfly pea flower that act as α-amylase enzyme inhibitors, antioxidants, and anti-inflammatories. These findings indicate the potential of Clitoria ternatea as a promising therapeutic alternative in the management of diabetes mellitus.

**Keywords:** butterfly pea flower, clitoria ternatea, diabetes, glucose level

## INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterized by high blood glucose levels (hyperglycemia), which occurs due to insulin deficiency, insulin resistance, or a combination of both mechanisms (Hardianto, 2021). This disease has a long-term nature and develops progressively, characterized by disturbances in the metabolism of carbohydrates, fats, and proteins that hinder their optimal utilization by the body (Simatupang & Kristina, 2023).

Globally, diabetes is almost doubling every year. According to a 2022 report by the International Diabetes Federation (IDF), an estimated 537 million adults aged 20-79 years worldwide have been diagnosed with diabetes. This number is projected to increase significantly to 643 million adults by 2030, which is equivalent to 1 in 9 adults. Furthermore, it is projected to increase further to 784 million adults by 2045, equivalent

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to 1 in 8 adults. This data indicates an alarming trend of increasing diabetes prevalence globally, emphasizing the importance of more effective prevention and treatment efforts to address this health burden. In 2021, diabetes will be the cause of death for an estimated 6.7 million people. In, an estimated 44% of the 240 million people with diabetes are undiagnosed, while as many as 541 million people, or about 1 in 10 people, have glucose intolerance (IDF, 2021). In Indonesia, the prevalence of diabetes mellitus reaches 1.5% of the total population or around 172.5 million people. (Safitri et al., 2023).

Diabetes mellitus is a condition that can affect individuals of various age groups, ranging from children to elderly individuals. If diabetes mellitus (DM) is not treated properly, it will lead to a number of complications that can be life-threatening for diabetics. These complications can affect the eyes, heart, kidneys, and other important organs (Rahmayunita et al., 2023). Untreated diabetes increases the risk of retinopathy, heart attack, vision loss, skin conditions, and other diseases (Ridwan & Setiawan, 2023).

Treatment of diabetes mellitus with pharmacological therapies, such as metformin, α- glucosidase inhibitors (acarbose), and sulfonylureas can result in side effects, such as weight gain. Risk of hypoglycemia, and disorders of the digestive system (Rosni et al., 2021). Therefore, the use of herbal therapies that are safer and have minimal side effects is needed in the management of diabetes. One of the herbal therapies that can be used as a long-term treatment for diabetes is the use of bay flowers as a support in holistic therapy (Mendrofa et al., 2024).

The bay flower (Clitoria ternatea) is widely recognized in traditional medicine in various countries for its various health benefits. This plant generally grows as a vine and is often found in yards or the edges of rice fields. However, nowadays butterfly pea flowers are increasingly cultivated as ornamental plants because of their extraordinary properties. Butterfly pea flowers are included in the group of underutilized crops that have many benefits. This plant has a distinctive value in traditional therapy because every part of it, from seeds, roots, stems, and leaves, to flowers, is believed to have benefits for the healing process and improving limb function. Butterfly pea flower processing is easy to learn and understand, and this plant is easily found in Indonesia (Khoirunnisa & Ikaningtyas, 2023). Pharmacologically, telling flowers have various potentials, such as analgesic, anti-inflammatory, antibacterial, antacid, antioxidant, antiparasitic,

antihistamine, antidiabetic, immunomodulator, anticancer, and influence the regulation of the central nervous system (CNS) (Besan et al., 2023).

Several previous studies have proven that butterfly pea flower extract can reduce high blood glucose levels and can be utilized to treat various diseases, making it a potential traditional herbal medicine. Therefore, it is important to further explore the effectiveness of the butterfly pea flower as an agent to suppress the rise of glucose levels in the blood. The purpose of this study is to conduct a comprehensive analysis of the effectiveness of buying flower (Clitoria ternatea) as an antidiabetic agent, with particular emphasis on its ability to suppress the rise in blood glucose levels, as well as explore the therapeutic potential of Clitoria butterfly pea extract in managing hyperglycemia, which is one of the main indicators of diabetes mellitus. Thus, this study is expected to provide a deeper understanding of the mechanism and benefits of bay flowers as a safe and effective alternative treatment in diabetes management. In addition, the aim of this study is also to review the results of previous relevant studies and explore the potential of buying flowers to prevent diabetic complications. Through this approach, it is hoped that this study can present a more thorough understanding of the benefits of buying flowers as an adjunct therapy in the management of diabetes.

## RESEARCH METHODS

### Study Design

This study used the PRISMA-ScR literature review method to map and analyze related literature. Research questions focused on topic exploration, with inclusion/exclusion criteria based on publication time, study type, and supporting characteristics. Data searches were conducted in ScienceDirect, Mendeley, and Google Scholar using specific keywords. Article selection used the PRISMA flowchart, evaluated based on title, abstract, and content. Data that met the criteria were extracted to a structured template (study design, participants, findings). The analysis was synthesized in a narrative/table to identify the effect of the butterfly pea flower (Clitoria ternatea) on reducing blood sugar in diabetes.

### Eligibility Criteria

In searching for journals, there are several things that the author pays attention to, to meet the inclusion criteria as follows: 1) research conducted in the last 5 years in the

2021 - 2025 timeframe. 2) the research was conducted on samples induced by diabetes as well as on diabetic patients. 3) conduct experiments on the administration of bay flower therapy in samples that match the criteria.

**Source of Information**

Data sources were searched in several databases, namely Google Scholar, Science Direct, and Mendeley, with a period from 2021 - 2025. The search strategy used the keywords "clitoria ternatea AND diabetes AND blood glucose" to obtain a total of 1,858 journals. After that, a filtering process was carried out which resulted in 1,041 journals. Furthermore, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method was used to evaluate the relevance of each journal. The final result obtained 8 journals that are relevant to our research.

**Article Screening**

The sourcing process was conducted collaboratively by all authors, where each evaluated the articles or studies independently by reviewing the titles and abstracts of all studies found. The study search was conducted through journal platforms such as Google Scholar, Science Direct, and Mendeley, which resulted in a total of 1,858 journals. Next, study selection was conducted by applying predefined inclusion and exclusion criteria.

Table. 1. Inclusion and Exclusion Criteria

| Inclusion Criteria | Exclusion Criteria |
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| ● Type of Research: This research includes only clinical studies i.e. experimental research.<br>● Participants: samples with diabetes.<br>● Type of Intervention: butterfly pea flower administration.<br>● Journal with a period of the last 5 years (2021 - 2025). | ● Publications that are not full text or open access.<br>● Types of research: literature review, systematic review, scooping review, etc.<br>● Participants: sample who not diabetes.<br>● Journal is not relevant to the topic.<br>● Research Languages foreign other than English and Indonesian.<br>● Multiple studies in addition to testing butterfly pea flowers (Clitoria ternatea). |

## RESULT

Our search results from several databases found a total of 1,858 articles with vulnerabilities from 2021 to 2025, and we evaluated the articles. Then we screened by title, inclusion, and exclusion criteria. Based on the results, we determined eight article titles as the source data for our literature review. The eight journals we determined were from different sources such as the Tropical Journal of Natural Product Research, Journal of Drug Delivery and Therapeutics, Smart Medical Journal, Forte Journal, Pharmacy Education, Journal of Pharmaceutical and Sciences, Journal of Health Science and Research, and Sainstekes Magazine.

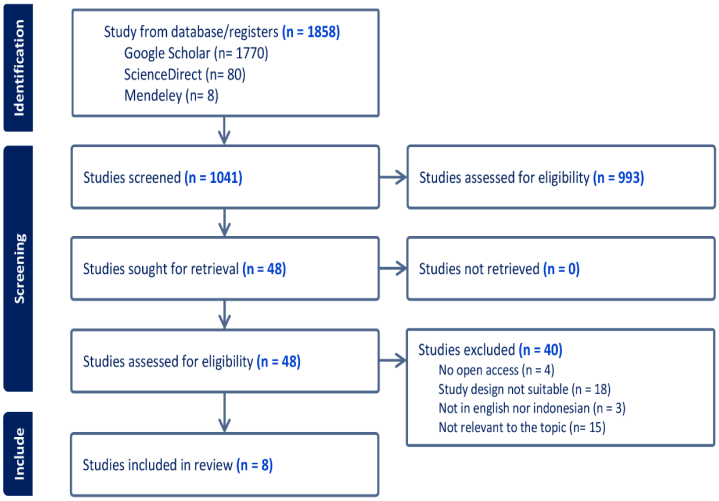


Fig. 1. Flow Chart PRISMA of Literature Search

Table. 2. Results of Article Analysis

| No | Author/Year | Title | Methods | Sample | Results |
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| 1. | Utami et al. (2024) | Antidiabetic and antioxidant activity of Clitoria ternatea flower extracts and fractions on blood | Experiment | 36 Mice | Based on research by Utami et al., the results showed that in butterfly pea flower extract using ethanol and in the ethyl acetate fraction, there are flavonoid compounds that are thought to play an active role in antidiabetic and antioxidant activities. Testing the antidiabetic effect is done on hyperglycemic rats that have been given 150 mg/kg BW alloxan induction on days one to three. Testing in rats decreased glucose levels because butterfly pea flower have an inhibitory effect on the enzyme alpha-amylase. Flavonoid |

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| | | glucose and MDA in rats induced by alloxan | | | content is higher in ethyl acetate of butterfly pea flower with ethanol of butterfly pea flower. Reducing compounds called flavonoids have the ability to inhibit various oxidation reactions. |
| 2. | Sunarti & Octavini (2023) | Efek Antidiabetes Fraksi N-Heksana, Etil Asetat, Dan Air Dari Bunga Telang (Clitoria Ternatea L.) Pada Tikus Jantan yang Diinduksi Streptozotocin-Nicotinamid | Experiment | 30 Mice | In the research conducted by Sunarti & Octavini, there are three fractions (water, n-hexane, and ethyl acetate) that will be tested for antidiabetic activity. Before the fraction is done, butterfly pea flower extraction is carried out using 70% ethanol. Testing was carried out on male rats that had been induced by streptozotocin and nicotinamide. Male rats that are testing butterfly pea flower are rats that have been induced by nicotinamide and streptozotocin. On day 14 there was a decrease of 59.06% in the ethyl acetate fraction, 57.97% in the n-hexane fraction, and 48.07% in the water fraction. This group of ethyl acetate and n-hexane fractions showed considerable changes in reducing the concentration of glucose in the blood of mice. This is because ethyl acetate and n-hexane can be able to isolate steroids, anthocyanins, saponins, and flavonoids, effectively reducing blood sugar. |
| 3. | Gunawan et al. (2023) | The Effect of Butterfly Pea Extract on Blood Glucose Levels in White Rats with Metabolic Syndrome Model | Experiment | 30 Mice | In a study conducted by Gunawan et al., butterfly pea flower extract testing was carried out on mice that had been given HFFD (high fat, high fructose diet) for 28 days and up to 31 days given STZ-Na (streptozotocin sodium) to create a metabolic syndrome in mice. This study gives butterfly pea flower extract to mice with different doses, such as 100 mg/kg, 200 mg/kg, and 400 mg/kg. Based on the results obtained, the three doses of butterfly pea flower extract were able to reduce blood glucose levels. This is because butterfly pea flower contain flavonoids that can keep cells from hyperglycemic stress. However, the 200 mg/kg dose has very good effectiveness compared to the others. This is because the dose of 100 mg/kg has low |

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| | | | | | effectiveness, while 400 mg/kg can have an impact on hypoglycemia. |
| 4. | Dewi et al. (2023) | Evaluation of Clitoria ternatea L. Flower Extract in Preventing Complications of Diabetes Mellitus | Experiment | 36 Mice | Research conducted by Dewi et al. indicated that rats that received butterfly pea flower extract significantly decreased MDA levels. Of the four groups that received treatment, acarbose and various vulnerable doses of butterfly pea flower extract were lower than the diabetic control group. The group with a dose of 600 mg/kg of flower extract was most effective in reducing blood sugar, MDA, and HbA1c levels; this effect was equivalent to the acarbose group. A 600 mg/kg dose can effectively reduce but cannot reach normal levels. Intestinal glucosidase and pancreatic amylase are two other enzymes that are inhibited by butterfly pea flower extract in this study. This is because the butterfly pea flower has a mechanism to suppress enzyme activation. Butterfly pea flower have also been shown to have anti-glycation action that helps eliminate free radicals and methylglyoxal conjugates to protect themselves from AGE (advanced glycation end). And also, butterfly pea flower have polyphenol content that can reduce MDA levels so that they can prevent the occurrence of ROS (Reactive Oxygen Species). |
| 5. | Zilmi et al. (2024) | Uji Antidiabetes Bunga Telang (Clitoria ternatea) pada Pasien Diabetes Melitus Tipe 2 di Puskesmas Cempaka Putih Jakarta Pusat | Experiment | 30 Respondent | In a study conducted by Zilmi et al., the results of data management showed that there was a decrease in blood sugar levels in DM patients after giving butterfly pea flower decoction, and the ANOVA test results showed a value of p = 0.000 (<0.005), which means that H0 is rejected so that the five groups are significantly different (1 gram dose, 3 doses, 5 gram dose, comparison group (metformin), and control group). Based on the results of the Tukey HSD post hoc test, it was found that the intervention of 5 gr of butterfly pea flower had very high effectiveness. Compared to the group of 3 gr of butterfly pea flower given as an |

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| | | | | | intervention, it did not show a significant decrease in the control group. However, there was a significant difference from the control group. |
| 6. | Pangondian et al. (2023) | Potensi Ekstrak Bunga Telang (*Clitorea Ternatea L.*) Terhadap Antidiabetes Pada Mencit Puting Jantan (*Mus Musculus*) | Experiment | 25 Mice | In a study conducted by Pangondian et al., there were different doses given to mice (250 mg/kg, 500 mg/kg, and 1000 mg/kg). Butterfly pea flower contain saponins, flavonoids, and alkaloids that are able to lower blood glucose. This is evidenced by the decrease in mice that have been treated with oral sonde. Based on the results, mice given different doses decreased blood sugar. The biggest decrease in blood sugar was at a dose of 1000 mg/kg, and also of the three doses, a significant decrease in blood sugar levels was seen in the comparison between doses of 250 mg/kg and 500 mg/kg. |
| 7. | Simangunsong et al. (2023) | Effectiveness of Butterfly Pea Ethanol Extract on Decreasing Blood Glucose Levels of Male Mice | Experiment | 25 Mice | Based on research by Simangunsong et al., it was proved that butterfly pea flower have alkaloid content characterized by the presence of brown precipitation in the alkaloid content test, flavonoids characterized by the presence of red color in the addition of Mg + HCl, and tannins characterized by the presence of green or blue-black color in the addition of 1% $FeCl_3$. In testing the effectiveness of antidiabetes, tests were carried out on mice given different doses of butterfly pea flower extract (50 mg/kg, 100 mg/kg, and 200 mg/kg). Tests were carried out on mice that had been induced with alloxan. During 14 days of observation, the blood sugar content of mice decreased. In mice with a dose of 50 mg/kg after induction, it was 301.3 mg/dL after 14 days to 203.3. In mice with a dose of 100 mg/kg after being induced, it was 322.7 mg/dL after 14 days to 178.5. In mice with a dose of 200 mg/kg after induction, it was 319 mg/dL after 14 days to 104 mg/dL. |

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| 8. | Ginting et al. (2022) | In Vivo study of Antidiabetic Activity from Ethanol Extract of Clitoria ternatea L. Flower | Experiment | 25 Mencit | In the study of Ginting et al., there were rats that had been treated with alloxan induction. In testing on rats, there were three different doses of butterfly pea flower extract (200 mg/kg, 400 mg/kg, and 600 mg/kg) with one positive control by administering glibenclamide. On testing for 10 days, there was a decrease in blood sugar levels of the four groups. Based on existing data, the group with a dose of 400 mg/kg of bay flower has a high effectiveness compared to the others. Butterfly pea flower can be used as herbal medicine for diabetes, as evidenced by the activity of pancreas regeneration in diabetic rats. This is because butterfly pea flower contain alkaloids to lower blood sugar, flavonoids that can act as antioxidants, and tannins that inhibit glucose absorption. |

## DISCUSSION

Butterfly pea flower herbal therapy has potential as an antidiabetic and is beneficial for maintaining the health of diabetics in the long term. For diabetic patients who usually experience hyperglycemia with above-normal blood glucose levels, this method is an effective intervention strategy in helping prevent disease complications (Mendrofa et al., 2024).

Research conducted by Sunarti & Octavini (2023) showed that fractions of butterfly pea flower extract, especially the ethyl acetate fraction, have a significant hypoglycemic effect on streptozotocin- nicotinamide-induced rats. In this study, the ethyl acetate fraction at a dose of 400 mg/kgBB was able to reduce blood glucose levels to 109.72 mg/dL. In addition, there was no significant difference between the ethyl acetate fraction and the positive control using antidiabetic drugs, thus indicating its effectiveness as a therapeutic agent. These findings further corroborate that the active compounds contained in the ethyl acetate fraction, especially flavonoids and anthocyanins, have a role in lowering blood glucose levels through inhibition of α-amylase and α-glucosidase enzymes, which are involved in carbohydrate digestion. Similar results were also obtained in the study of Utami et al. (2024), which showed that in rats given alloxan, ethanol extract and ethyl acetate fraction of butterfly pea flower had strong antidiabetic

effects. The blood glucose level decreased by 45.6 mg/dL when the ethyl acetate fraction was given at a dose of 300 mg/kgBB. In addition, this fraction also reduced malondialdehyde (MDA) levels by 76.5%, indicating a strong antioxidant effect. These antioxidant effects are important in the context of diabetes because hyperglycemia is often associated with oxidative stress, which can damage pancreatic cells and worsen insulin resistance. Therefore, protection against oxidative stress through antioxidants such as flavonoids in butterfly pea flowers may be an additional mechanism contributing to its antidiabetic effect.

The study conducted by Gunawan et al. (2023) also supported the previous findings by evaluating butterfly pea flower extract in mice used as a model of metabolic syndrome. In this study, rats were given butterfly pea flower extract at doses of 100, 200, and 400 mg/kgBB for 28 days. The results showed that blood glucose levels decreased significantly in all treatment groups, with the largest decrease of 168.35 mg/dL at a dose of 400 mg/kgBB. This finding indicates a dose-response relationship, where the higher the dose administered, the greater the effect of lowering blood glucose levels observed. By increasing cell sensitivity to insulin and increasing insulin release, butterfly pea flowers can reduce blood sugar levels, which is supported by the flavonoid content in it.

In addition to its hypoglycemic effect, the bay flower also shows the potential to inhibit the progression of diabetic complications. This was studied in the research of Simangunsong et al. (2023), the results showed that the administration of ethanol extract of butterfly pea flower (Clitoria ternatea) at a dose of 200 mg/kg body weight (BW) had a significant effect in reducing blood glucose levels in mice. The blood glucose levels of mice which originally reached 319 mg/dL after alloxan induction, decreased to 104.93 mg/dL. This finding indicates the potential of butterfly pea flower ethanol extract as an effective hypoglycemic agent in managing hyperglycemia in experimental animal models induced by diabetes. This study proves that in addition to reducing blood glucose levels, butterfly pea flower extract also plays a role in improving pancreatic function through the mechanism of protecting beta cells from oxidative damage. Thus, the effect of butterfly pea flower is not only temporary in lowering blood glucose but also contributes to the maintenance of pancreatic function in the long term.

The research proposed by Pangondian et al. (2023) also showed that butterfly pea flower extract at doses of 250, 500, and 1000 mg/kgBB significantly reduced blood

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glucose levels in rats compared to the negative control ($p < 0.05$). The mechanism proposed in this study involves the inhibition of gluconeogenic enzymes, such as glucose-6-phosphatase, as well as an increase in glucokinase activity, which plays a role in regulating glucose metabolism. Thus, bay flower not only inhibits glucose absorption in the gastrointestinal tract but also increases glucose utilization by body cells, which contributes to a more stable control of blood glucose levels.

In addition, a study conducted by Dewi et al. (2023) highlighted the role of bay flowers in preventing diabetic complications through the mechanism of antiglycation and inhibition of oxidative stress. This study proved that butterfly pea flower extract can inhibit the formation of Advanced Glycation End Products (AGEs), the end products of glycation reactions that are often associated with vascular complications in diabetics. In addition, the extract was also shown to reduce HbA1c and MDA levels, which are markers of long-term blood glucose control and oxidative stress. Thus, bay flower not only plays a role in lowering blood glucose levels in the short term but also has a protective effect in the long term against diabetes-related complications. This finding was further strengthened by the study of Ginting et al. (2022), who evaluated the effectiveness of ethanol extract of butterfly pea flower in reducing blood glucose levels in rats given alloxan. When the extract was given in doses of 200, 400, and 600 mg/kgBB, blood glucose levels decreased significantly. Administration at a dose of 200 mg/kgBB produced the best results, reducing blood glucose levels to 48.2 mg/dL. Statistical analysis with One-Way ANOVA and Kruskal-Wallis showed significant differences between treatment groups, supporting the effectiveness of butterfly pea flower as a potential antidiabetic agent.

Research by Zilmi et al. (2024) showed that bay flower consumption reduced fasting blood glucose (GDP) levels in patients with type 2 diabetes. The study used a pretest-posttest control group design with five groups, including three groups with bay flower doses (1, 3, and 5 grams), one metformin group, and one control. The dose of 5 grams in 250 mL of water gave the greatest reduction in GDP ($p=0.000$). One-way ANOVA and Post Hoc Tukey HSD analysis proved significant differences between groups. This effect is related to increased glucose uptake by cells, stimulation of insulin release, and prevention of AGE production, which plays a role in reducing long-term diabetic complications.

Taken together, the results of these studies suggest that bay flower has potent antidiabetic activity through a variety of mechanisms, including inhibition of carbohydrate digestive enzymes, increased insulin secretion and sensitivity, and protection against oxidative stress that can damage pancreatic cells. These activities suggest that buying flowers has great potential as a supportive therapy in the management of diabetes, both to lower blood glucose levels and prevent long-term complications.

## CONCLUSION

Butterfly pea flower (Clitoria ternatea) shows significant potential as an antidiabetic therapy through various mechanisms, including inhibition of carbohydrate digestive enzymes, increased insulin secretion, and protection against oxidative stress that can damage pancreatic cells. Research shows that bay flower extract, especially the ethyl acetate fraction, is effective in lowering blood glucose levels in animal models and humans, as well as reducing the risk of long-term diabetic complications. In addition, bay flower also inhibits the formation of glycation end products that contribute to vascular complications. Thus, bayflower is not only beneficial in the management of blood sugar levels but also plays a role in maintaining the long-term health of diabetics.

## ADVICE

The need for further research on butterfly pea flowers, especially in clinical trial research due to the lack of clinical trial research on butterfly pea flowers. This is because butterfly pea flowers have potential as an herbal treatment that can be used by people with diabetes mellitus.

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