The Use of the *Bauhinia forficata L.* Plant as a Complementary Treatment for Low-income People with the Condition of Type 2 Diabetes Mellitus

**Amanda Karen Alves Goes [a],
Marta Marília Ribeiro da Costa Silva [a]
and João Ronaldo Tavares de Vasconcellos Neto [b++*]**

[a] *Unidade de Ensino Superior de Feira de Santana, Graduanda em Biomedicina, Brazil.*
[b] *Unidade de Ensino Superior de Feira de Santana, Brazil.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

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ABSTRACT

Introduction: Diabetes *Mellitus* (DM) is a chronic condition that affects thousands of people around the world, resulting in serious consequences due to increased blood glucose. There are different types of DM, the main ones being type 1, type 2 and gestational, each with its own distinct characteristics. Type 2 DM, in particular, is considered a global epidemic due to its significant increase. The treatment of type 2 DM is broad and can include different approaches, from medicinal agents to complementary therapies, such as herbal medicine. In this context, the plant *Bauhinia*

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++*Professor;*
**Corresponding author: Email: joao.neto@gruponobre.edu.br, jrtvasconcellosneto@gmail.com;*

forficata L. has aroused interest due to its potential hypoglycemic and antioxidant effects, making it a low-cost treatment option for regulating glycemic indices.

Objective: This study aims to analyze the potential of the *Bauhinia forficata L.* plant as a low-cost method for regulating glycemic indexes in people with type 2 Diabetes *Mellitus*, seeking to investigate the effectiveness, adverse effects and best way of administering this plant as a complement to conventional diabetes treatment.

Methodology: The study methodology consisted of an exploratory-descriptive bibliographic study with a qualitative approach. The bibliographic survey was carried out in databases such as LILACS, SciELO and PubMed, using inclusion and exclusion criteria to select relevant articles published between 2014 and 2024.

Results and Discussion: *Bauhinia forficata L.* emerges as a promising option to complement the treatment of type 2 DM, offering a low-cost and potentially effective alternative for regulating glycemic indexes. However, more studies are needed to confirm its long-term safety and effectiveness, as well as determine the best form of administration to maximize its therapeutic benefits.

Conclusion: The flavonoids kaempferol, kaempferitrin and quercetin, present in *Bauhinia forficata L.*, demonstrate hypoglycemic activity. However, it is essential to consider the potential adverse effects of these compounds, such as mutagenicity and DNA damage, particularly at high doses. Although some studies show efficacy in reducing blood glucose levels.

1. INTRODUCTION

Diabetes *Mellitus* (DM) is a chronic disease characterized by high blood glucose levels and insufficient or improper insulin production by the pancreatic beta cells. DM affects thousands of individuals worldwide, leading to consequences arising from hyperglycemia. It is classified into three main types: type 1 DM, type 2 DM, and gestational DM, with other types related to different causes [1,2].

Type 1 DM is of autoimmune nature, characterized by the total or partial destruction of the Langerhans islet cells located in the pancreas, resulting in insulin deficiency. On the other hand, type 2 DM, present in about 90% of cases, is not only associated with genetic predisposition but also with the individual's lifestyle, as it is caused by low insulin secretion and/or insulin resistance. Gestational DM is defined by hyperglycemia caused by a metabolic disorder resulting from glucose intolerance, involving insulin production and resistance. The global increase in the number of individuals with type 2 DM has led to it being considered an epidemic, according to the World Health Organization [3,4,2].

Due to the damage and complications caused by type 2 DM, treatment is comprehensive, directly related to the level and stage of the disease, being provided as management, medication, insulin therapy, and complementary treatments, such as the use of medicinal plants. Thus, it is possible to see that there are various treatments available for the patient. However, the choice of each antidiabetic agent is according to each individual's needs, so it is necessary to take into account body weight, duration of type 2 DM, age, risks related to hypoglycemia and cardiovascular risk, not only concurrent treatments in use, and finally, other complications that interfere with their quality of life [5,6,7].

Given that there is a wide range of medication agents, the American Diabetes Association together with the Association for the Study of Diabetes recommended a specific management approach for each patient, aiming to decrease blood glucose levels, as well as avoiding complications, such as weight gain. Therefore, the first-line treatment is Metformin. Based on this, according to the American Association of Clinical Endocrinologists (AACE) Guidelines, continuous monitoring of the individual over 3 months is indicated for evaluation, adding another antidiabetic agent if glycemic goals have not been achieved. However, drugs are no longer satisfying individuals, and many are opting for complementary and alternative medicine [8,9,10,11].

From this perspective, Brazil has available in the SUS (Unified Health System) the National Policy of Integrative and Complementary Practices (PNPIC), which includes homeopathy, anthroposophic medicine, thermalism/

crenotherapy, traditional Chinese medicine/acupuncture, and phytotherapy. However, due to the high demand, the Ministry of Health has included other practices to be used (Ordinance nº 849, of March 23, 2017). Subsequently, phytotherapy has been widely used as an alternative therapy among diabetic individuals, since its combination with antidiabetic agents is safe, not only because it is a natural compound but also because it is more economically accessible. One plant that stands out for its antidiabetic effect is *Bauhinia forficata Link*, available in the Unified Health System (SUS), as an alternative therapy [12,13,14,15,6].

Known as "Pata-de-vaca," the plant belongs to the *Fabaceae* family, named for its bilobate leaf. The plant has several properties, being depurative, tonic, diuretic, combating elephantiasis, reducing glucosuria, and exerting hypoglycemic action. Its hypoglycemic action is due particularly to the isolation of kaempferol-3,7-O-(alpha)-dirhamnoside, as well as to its chemical composition of canferitrin and canferol, i.e., flavonoids, responsible for this hypoglycemic effect. Many experimental studies have confirmed its properties, and interest in this plant has been increasing, especially in Brazil, where it is estimated that by the year 2030, about 8.9 million individuals will have a prognosis of diabetes. Therefore, the high prevalence of type 2 DM demands effective therapies [16,17,6,18,2,19].

Fig. 1. *Bauhinia forficata* plant
Source: (Carvalho; Oliveira; Siqueira, 2021)

Therefore, this article aims to investigate how the *Bauhinia forficata L.* plant functions as a low-cost method for regulating glycemic levels in individuals with type 2 Diabetes *Mellitus*. Given that 50% of diabetics have the condition but are unaware of it, it becomes a public health issue, as type 2 DM is the most frequent among cases, reaching up to 90%. Additionally, since treatment is costly due to continuous medication, a complementary treatment is necessary to reduce expenses and, especially, to exert a hypoglycemic action, where the *Bauhinia forficata Link* plant stands out in both requirements. Thus, the general objective is to investigate the potential for regulating glycemic levels of the extract from the *Bauhinia forficata L.* plant.

2. METHODOLOGY

2.1 Study Design

This was a bibliographic study of an exploratory-descriptive nature with a qualitative approach, and these data were used for the elaboration of the scientific article. According to Gil, bibliographic research is developed based on previously elaborated material, mainly consisting of books and scientific articles, i.e., it is the type of research that involves theoretical survey of a specific subject through the collection of information about what different authors report on the topic [20].

A study is exploratory in nature when it involves bibliographic survey, interviews with individuals who have had (or have) practical experiences with the researched problem, and analysis of examples that stimulate understanding. Its basic purpose is to develop, clarify, and modify concepts and ideas for the formulation of subsequent approaches. Thus, this type of study aims to provide greater knowledge for the researcher about the subject so that they can formulate more precise problems or create hypotheses that can be researched in subsequent studies [20].

According to Gonçalves, descriptive research records, analyzes, classifies, and interprets observed facts, often establishing relationships between them. Regarding the approach, this study is qualitative. Minayo describes qualitative research as one in which the researcher's concern is not directed towards the quantitative profile of the data, but rather towards the value of the information that can be collected, correlating phenomena and variables to reality, in order to understand this experience in deeper dimensions, encompassing creativity and directing towards the construction of scenarios and new perspectives within the same reality [21,22].

2.2 Data Collection

Data collection was carried out through bibliographic review by searching for scientific productions on the proposed theme from the period 2014 to 2024. The inclusion criteria for content selection were those published in full accordance with the theme, documents, regulations, health entity standards on the topic, articles published in Portuguese, English, and Spanish.

Exclusion criteria included articles that were not relevant to the theme, duplicated materials, incomplete materials, debates, reviews, abstracts, and materials unavailable in full. Literature search was performed in the following databases: Latin American and Caribbean Literature in Health Sciences (LILACS), Scientific Electronic Library Online (SciELO), and PubMed. It is worth noting that the LILACS and BDENF databases were consulted through the Virtual Health Library (VHL). Searches were conducted using the Health Sciences Descriptors (DeCS) from the Regional Library of Medicine (Bireme): Diabetes *Mellitus* type 2, Integrative Practices, and Bauhinia, in Portuguese, English, and Spanish with the aid of boolean operators "AND" and "OR", as shown in Table 1.

Table 1. Result of searches

Keywords	Descriptor 01	Descriptor 02	Descriptor 03
	Diabetes Mellitus, Type 2	**Complementary therapies**	**Bauhinia**
Alternative term	Adult-Onset Diabetes Mellitus Diabetes Mellitus, Adult Onset Diabetes Mellitus, Adult-Onset Diabetes Mellitus, Ketosis Resistant Diabetes Mellitus, Ketosis-Resistant Diabetes Mellitus, Maturity Onset Diabetes Mellitus, Maturity-Onset Diabetes Mellitus, Non Insulin Dependent Diabetes Mellitus, Non-Insulin-Dependent Diabetes Mellitus, Noninsulin Dependent Diabetes Mellitus, Noninsulin-Dependent Diabetes Mellitus, Slow Onset Diabetes Mellitus, Slow-Onset Diabetes Mellitus, Stable Diabetes Mellitus, Type II Diabetes, Maturity-Onset Diabetes, Type 2 Ketosis-Resistant Diabetes Mellitus Maturity Onset Diabetes Maturity Onset Diabetes Mellitus Maturity-Onset Diabetes Maturity-Onset Diabetes Mellitus MODY NIDDM Non-Insulin-Dependent Diabetes Mellitus Noninsulin Dependent Diabetes Mellitus Noninsulin-Dependent Diabetes Mellitus Slow-Onset Diabetes Mellitus Stable Diabetes Mellitus Type 2 Diabetes Type 2 Diabetes Mellitus		

2.3 Data Analysis

Therefore, data analysis will proceed in three stages: firstly, through a floating reading, where the researcher begins to gain an overview of the participants' opinions; the second stage will involve an exhaustive reading, i.e., a thorough and repeated examination of all collected data; and the third stage will involve the construction of categories for a better data analysis. After data collection, a screening process was conducted to eliminate duplicate records (Fig. 2). Subsequently, abstracts of each article were read to identify those relevant to the research topic (Fig. 2).

For the analysis of the selected articles, the specific objectives of this article were established, which were organized into three axes: Axis I - Description of the active properties of the plant *Bauhinia forficata L.* in the control of glycemic indices; Axis II - Identification of potential adverse effects in the therapeutic use of the plant; Axis III - Evaluation of the best administration method for glycemic control. The results of the articles were read considering these axes, as shown in the results obtained in Fig. 3. These methodological steps were essential to guide the preparation of the research results, aligned with the established specific objectives.
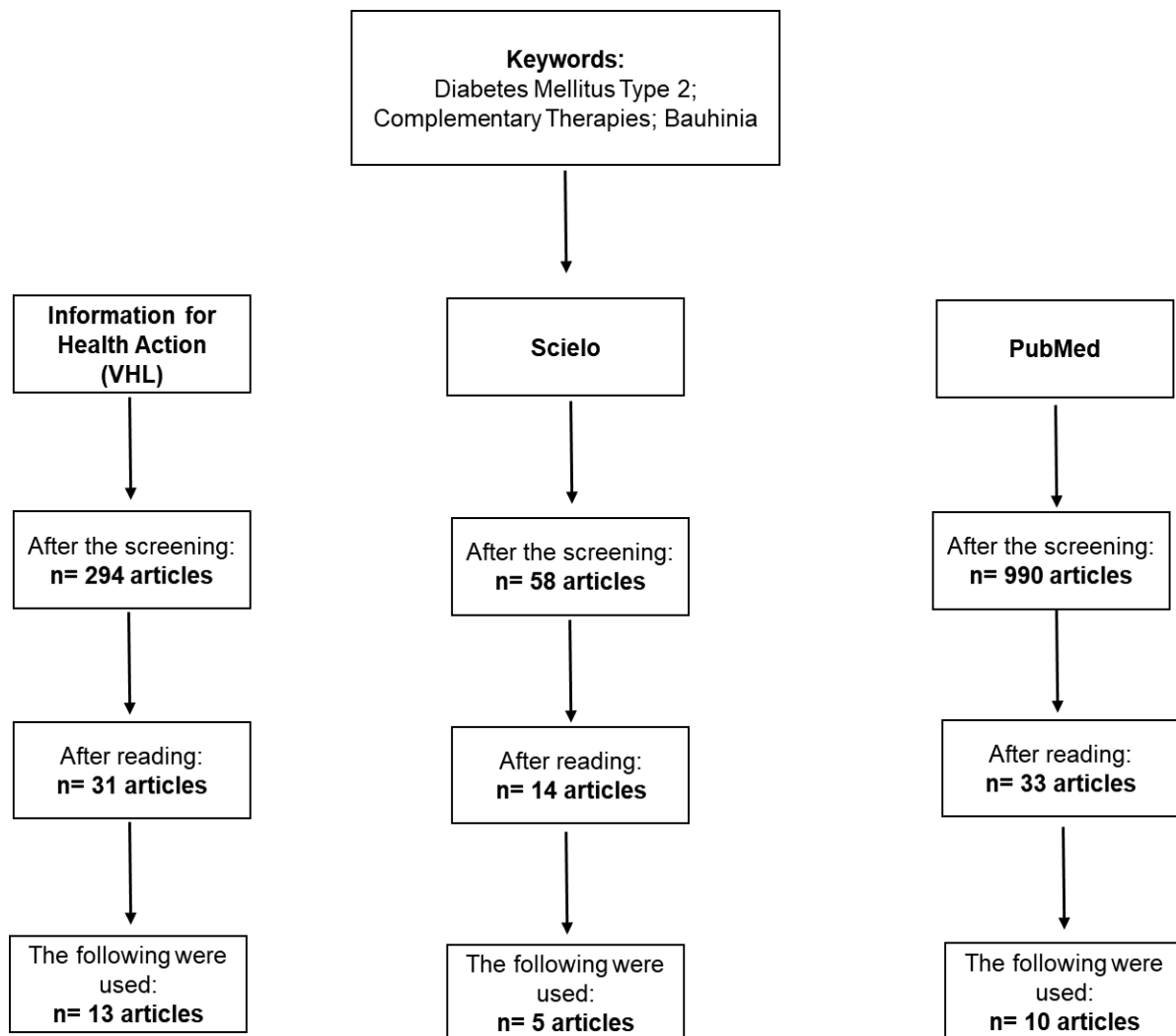

Fig. 2. Flowchart about the descriptors used and their obtained results concerning each database
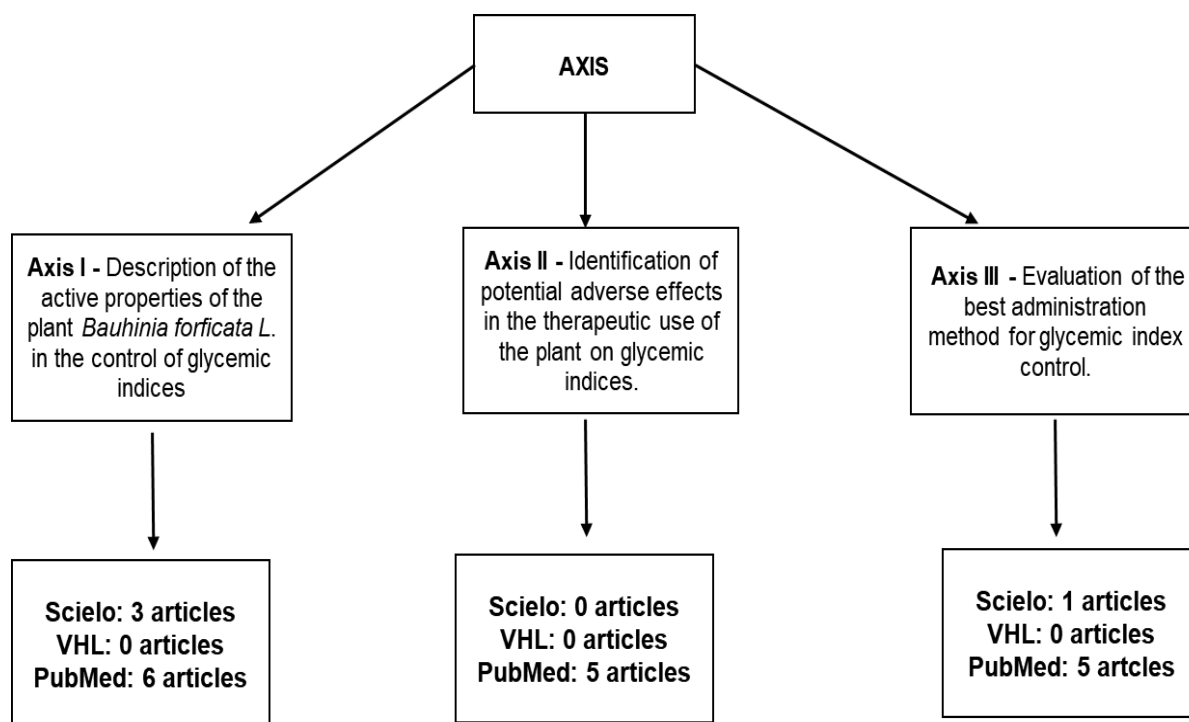
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                        ┌──────────┐
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Axis I - Description of the active properties of the plant *Bauhinia forficata L.* in the control of glycemic indices	Axis II - Identification of potential adverse effects in the therapeutic use of the plant on glycemic indices.	Axis III - Evaluation of the best administration method for glycemic index control.
Scielo: 3 articles **VHL: 0 articles** **PubMed: 6 articles**	**Scielo: 0 articles** **VHL: 0 articles** **PubMed: 5 articles**	**Scielo: 1 articles** **VHL: 0 articles** **PubMed: 5 artcles**

Fig. 3. Flowchart regarding the axes and their respective results based on the reading conducted from each database

3. RESULTS AND DISCUSSION

Bauhinia forficata L. plant has aroused interest due to its chemical composition rich in flavonoids, such as kaempferitrin, kaempferol, and quercetin, which are recognized for their hypoglycemic properties. Clinical studies by Juliani (1929) already pointed to the potential of the plant to reduce blood glucose levels, both in humans and animals such as rabbits and dogs. This antidiabetic activity has been mainly associated with the presence of these flavonoids, which act to contribute to the regulation of glycemic indices [23,17].

In addition to the hypoglycemic effect, the chemical components of *Bauhinia forficata* also exhibit antioxidant properties. Flavonoids such as kaempferol and quercetin have been identified as antioxidant agents present in the plant, capable of combating oxidative stress associated with diabetes. Other studies suggest that the plant also has the ability to inhibit digestive enzymes, which can affect glucose absorption and contribute to the regulation of blood sugar levels [24,6].

Kaempferitrin emerges as an important chemical and pharmacological marker in preparations of *Bauhinia forficata*, considered one of the main compounds responsible for its therapeutic properties. This flavonoid, along with kaempferol and quercetin, has been pointed out as crucial in the hypoglycemic activity of the plant. Additionally, the presence of other compounds such as alkaloids, steroids, and tannins complements the vast biological property of *Bauhinia forficata* [25,4].

The therapeutic use of *Bauhinia forficata L.* plant raises concerns about possible adverse effects associated with its components, especially flavonoids. Studies highlight that prolonged ingestion of flavonoids such as quercetin and kaempferol may result in mutagenicity and DNA damage, particularly in interaction with copper ions, suggesting a possible pro-oxidant activity of these compounds. Furthermore, although natural flavonoids are generally considered safe, it is prudent to avoid excessive use of supplements until their biological effects and potential adverse effects are better understood [14,26].

Kaempferol has been the subject of toxicological studies to assess its safety. Divergent results suggest that while *in vitro* studies kaempferol may exhibit genotoxic activity, *in vivo* studies have not observed carcinogenic effects. However, some contraindications for its use are

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pointed out, such as in patients with folic acid and iron deficiency, as well as in combination with the drug etoposides [27].

The genotoxicity of flavonoids, including quercetin, is a concern discussed in the literature. Experimental studies highlight that high doses of these compounds can induce adverse effects, such as amino acid modification and drug metabolism, as well as mutagenic action under certain circumstances. Therefore, despite their common presence in the human diet, flavonoid supplementation should be approached with caution to avoid unwanted side effects [28].

Flavonoids have several positive aspects; however, it is necessary to be concerned about their prolonged ingestion, as quercetin and kaempferol can cause DNA damage and mutagenicity. Therefore, it is essential not to use such compounds for an extended period, especially in combination with supplementation, as understanding the adverse effects of their combination is necessary. Conversely, according to Alam et al. (2020), kaempferol doses in *in vitro* studies may cause genotoxic effects; however, in *in vivo* studies, divergent results were obtained as carcinogenic actions were not observed. However, the use of kaempferol is contraindicated for patients with folic acid and iron deficiencies [14,27,26].

Quercetin is also a compound that moderation of its use should be obtained, as its high dose includes several adverse effects, not only mutagenicity, but it has the ability to alter amino acids and the metabolism of some drugs, therefore, its use must be administered with caution, as its presence is even in the human diet [28].

The administration of *Bauhinia forficata* for the regulation of glycemic indices has been explored through different methods, with infusion standing out as an effective approach. Studies have shown that plant infusion is capable of raising non-porous SH indices and reducing lipid peroxidation, attributed to the phenolic and flavonoid constituents present in the plant. Furthermore, the aqueous extract of *B. forficata* leaves has shown promise in decreasing hyperglycemia, glycosuria, and uremia, as well as combating lipid peroxidation and increasing hepatic glycogen in pregnant rats, due to the presence of flavonoids such as kaempferol [17,24].

Results from clinical and experimental studies support the effectiveness of *Bauhinia forficata* in reducing glucose and insulin resistance in patients with type 2 diabetes (DM2). Studies in streptozotocin-induced diabetic rats showed a significant decrease in plasma glucose after administration of plant extracts. Likewise, consumption of *Bauhinia forficata* tea has been associated with a reduction in glucose levels in DM2 patients compared to those who did not consume the tea. [29,24].

Comparing different administration methods, such as infusion and capsules containing standardized extract, it was observed that both can have positive effects on reducing glucose and insulin resistance. However, studies have also shown divergent results, with some indicating a significant decrease in fasting glucose after plant tea intake, while others found no significant differences. Given the divergence of results and the need for more research, it is important to continue investigating the therapeutic effects of *Bauhinia forficata* and determine the best administration method for the treatment of DM2. More studies are needed to fully understand the benefits and potential risks associated with the use of this plant in regulating glycemic indices [16,30,7,31,32,33].

Regarding its administration forms, there are several; however, many studies demonstrate that the plant has a hypoglycemic effect when consuming the plant tea. However, according to the research conducted by Russo et al., 1990, no significant difference was observed in usage; however, there was a decrease in plasma insulin levels in those who ingested it [7].

In addition, another administration method known to be quite effective is infusion, as it has been observed to increase non-porous SH indices and lipid peroxidation. In comparison to the use of the plant's aqueous extract, it has been favorable in reducing hyperglycemia, uremia, glycosuria, not only effective in combating lipid peroxidation, in pregnant rats. Thus, there are discrepancies in research results, however [16,24,7].

4. CONCLUSION

Therefore, according to the result, the compounds responsible for the hypoglycemic activity of the *Bauhinia forficata L.* plant

are kaempferol, kaempferitrin, and quercetin, since other components such as alkaloids, steroids, and tannins are also part of the plant's composition. Very little is known regarding their adverse effects; however, it is important to highlight that long-term intake of quercetin and kaempferol can cause mutagenicity and DNA damage, therefore, it is prudent to use flavonoids in the appropriate dose until their adverse effects are properly understood. Similarly, quercetin is a compound that should be used with moderation due to its ability to modify amino acids and drug metabolism if used in high doses. Due to the variety of ways the plant can be used, many studies diverge, some proving that the plant has the ability to reduce glycemic indices, however, some did not observe a significant difference, but it is evident that individuals who consumed the tea experienced a reduction in blood glucose compared to those who did not consume the tea. Therefore, given the disagreement of studies, it is necessary to conduct more experiments with the plant, investigating its optimal administration method, as well as understanding the plant's adverse effects, so that it can contribute to future research and consequently contribute to the complementary management of Type 2 Diabetes *Mellitus*.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Marmitt DJ, et al. Clinical trials with plants in diabetes mellitus therapy: A systematic review. Expert Review of Clinical Pharmacology. 22 abr. 2021;14(6):735–747.
   Carvalho AC, Oliveira AA, Da S, Siqueira, L DA P. Plantas medicinais utilizadas no tratamento do Diabetes Mellitus: Uma revisão / Medicinal plants used in the treatment of Diabetes Mellitus: A review. Brazilian Journal of Health Review. 11 jun. 2021;4(3):12873–12894.

2. Munhoz ACM, Frode TS. Isolated Compounds from Natural Products with Potential Antidiabetic Activity - A Systematic Review. Current Diabetes Reviews. 19 dez. 2017;14(1).

3. Souza BVC, DE, et al. Bauhinia forficata in the treatment of diabetes mellitus: A patent review. Expert Opinion on Therapeutic Patents. 2018;28(2).

4. Tahrani AA, Barnett AH, Bailey CJ. Pharmacology and therapeutic implications of current drugs for type 2 diabetes mellitus. Nature Reviews Endocrinology. 24 jun. 2016;12(10):566–592.

5. Franco RR, et al. Antidiabetic potential of Bauhinia forficata Link leaves: A non-cytotoxic source of lipase and glycoside hydrolases inhibitors and molecules with antioxidant and antiglycation properties. Biomedicine & Pharmacotherapy. 1 mar. 2020;123:109798.

6. Tonelli CA, et al. Clinical efficacy of capsules containing standardized extract of Bauhinia forficata Link (pata-de-vaca) as adjuvant treatment in type 2 diabetes patients: A randomized, double blind clinical trial. Journal of Ethnopharmacology. jan. 2022;282: 114616.

7. Hermayer KL, Dake A. Newer oral and noninsulin therapies to treat type 2 diabetes mellitus. Cleveland Clinic Journal of Medicine. maio 2016;83(5 suppl 1):S18–S26.

8. Levin P. Practical combination therapy based on pathophysiology of type 2 diabetes. Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy. out. 2016;9:355–369.

9. Hanefeld M, Raccah D, Monnier, L. Individualized, patient-centered use of lixisenatide for the treatment of type 2 diabetes mellitus. Expert Opinion on Drug Metabolism & Toxicology. 3 nov. 2016; 13(3):311–321.

10. Sari Y, et al. The knowledge, attitude, practice and predictors of complementary and alternative medicine use among type 2 diabetes mellitus patients in Indonesia. Journal of Integrative Medicine. jul. 2021; 19(4):347–353.

11. Figueredo CA DE, Gurgel IGD, Gurgel Junior GD. The National Policy on Medicinal Plants and Phytotherapeutics: Construction, perspectives and challenges. Physis: Collective Health Magazine. 2014;24(2):381–400.

12. Damnjanovic I, et al. Herbal self-medication use in patients with diabetes mellitus type 2. Turkish Journal of Medical Sciences. 2015;45:964–971.

13. Alkhalidy H, Wang Y, Liu D. Dietary Flavonoids in the Prevention of T2D: An Overview. Nutrients. 31 mar. 2018;10(4): 438.

14. Dacal M, Del PO, Silva IS. Impacts of integrative and complementary practices on the health of chronic patients. Health in Debate. Sept. 2018;42(118)724–735.

15. Pozzobon A, et al. Verification of the hypoglycemic effect of the medicinal plant Bauhinia forficata in individuals with type 2 diabetes mellitus. Con Scientiae Saúde. 28 Mar. 2014;13(1):69–75.

16. Bonilha I, DE F, et al. Biological potential of plants of the genus Bauhinia. Revista Cubana de Farmacia. 1 set. 2015; 49(3).

17. Mariánge PC, et al. Effects of Bauhinia forficata Link Tea on Lipid Profile in Diabetic Patients. Journal of Medicinal Food. mar. 2019;22(3):321–323.

18. Jun EP, et al. Chemical profile of the volatile fraction of Bauhinia forficata leaves: An evaluation of commercial and in natura samples. Food Science and Technology. 23 set. 2022; 42(e34122).

19. Gil, Antonio C. Como Elaborar Projetos de Pesquisa. Rio de Janeiro: Grupo GEN, 2022. E-book.
ISBN 9786559771653.
Available:https://integrada.minhabiblioteca.com.br/#/books/9786559771653/
Acesso em: 03 abr. 2024.

20. Gonçalves JE. Research techniques in social sciences. [s.l.] Editora Vozes; 2003.

21. Minayo MC, DE L. Social research: theory, method and creativity. 19a. ed. Petrópolis: Editora Vozes; 2001.

22. Marques DVB, et al. Preservation of phenolic compounds on dried leaf infusion of *Bauhinia forficata* Link. Brazilian Journal of Pharmaceutical Sciences. 15 maio 2023;59:e22076.

23. Franco RR, et al. Antioxidant and anti-glycation capacities of some medicinal plants and their potential inhibitory against digestive enzymes related to type 2 diabetes mellitus. Journal of Ethnopharmacology. abr. 2018;215:140–146.

24. Bieski IGC, et al. Ethnobotanical study of medicinal plants by population of Valley of Juruena Region, Legal Amazon, Mato Grosso, Brazil. Journal of Ethnopharmacology. set. 2015;173:383–423.

25. Luna SLRD, Garza RER, Saldíva SOS. Environmentally Friendly Methods for Flavonoid Extraction from Plant Material: Impact of Their Operating Conditions on Yield and Antioxidant Properties. The Scientific World Journal. 28 ago. 2020; 2020: 1–38.

26. Alam W, et al. Kaempferol as a Dietary Anti-Inflammatory Agent: Current Therapeutic Standing. Molecules. 7 set. 2020;25(18):4073.

27. AL-Ishaq RK, et al. Flavonoids and their Anti-Diabetic Effects: Cellular Mechanisms and Effects to Improve Blood Sugar Levels. Biomolecules. 1 set. 2019; 9(9).

28. Zaccaron C, et al. The effect of the medicinal plant Bauhinia forficata (Link) on us diabetics type 2. Conscientiae Saúde. 10 June 2014;13(2):171–178.

29. Salgueiro ACF, et al. Predictive antidiabetic activities of plants used by persons with Diabetes mellitus. Complementary Therapies in Medicine. 1 dez. 2018;41:1–9.

30. Gasparini P, et al. Bauhinia forficata link extract attenuates insulin resistance by preserving glucose uptake in gastrocnemius muscle. Natural Product Research. 23 ago. 2022;37(12):2031–2036.

31. KI Perera H. Antidiabetic Effects of Pterocarpus marsupium (Gammalu). Euro. J. Med. Plants. [Internet]. 2016 Apr. 1 [cited 2024 May 22];13(4):1-14.
Available:https://journalejmp.com/index.php/EJMP/article/view/249

32. Abigail LCD, Metuaghan EA. Evalution of Anti-Diabetic Potential of Aqueous

Extract of Luffa cylindrica (Native Sponge/Sponge Gourd) Leaf and Seed on Alloxan Induced Diabetic Wistar Rats. Int. J. Biochem. Res. Rev. [Internet]. 2019 Mar. 4 [cited 2024 May 22];25(1): 1-8.

Available:https://journalijbcrr.com/index.php/IJBCRR/article/view/528

33. Naveen J, Baskaran V. Antidiabetic plant-derived nutraceuticals: A critical review. European Journal of Nutrition. 2018 Jun;57:1275-99.

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