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THE UTILIZATION OF ALOE VERA (*ALOE BARBADENSIS MILLER*) IN REDUCING GLUCOSE LEVELS IN PATIENTS WITH DIABETES MELLITUS

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ABSTRACT

Background: Diabetes mellitus is a disease characterized by chronic hyperglycemia and glucose intolerance caused by metabolic disturbances in insulin production, insulin action, or both. Herbal plants might be used to cure this disease. Previous research discovered that herbal plants, such as aloe vera, are more effective at decreasing the risk of diabetes because they have hypoglycemia features and can reduce blood glucose levels. **Objective:** This systematic review aims to investigate the potential of aloe vera as a dietary additive that can minimize the risk of diabetes, especially diabetes mellitus. **Methods:** The study's design was a systematic review utilizing the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) technique, which searched for articles published between 2013 and 2023 in electronic databases such as Google Scholar, Pubmed, and Science Direct. These articles were then extracted by analyzing the titles and abstracts for topical relevance. **Results:** The five articles selected indicate that aloe vera has the potential as an additional food ingredient to reduce blood glucose levels by utilizing aloe vera's hypoglycemic content and maintaining endurance in the body to prevent diabetes. Aloe vera's aloe-emodin content activates insulin and improves the rate of glycogen synthesis, proving it effective for lowering blood sugar levels. In addition to aloe-emodin, aloe vera contains chromium, which helps in the activation of insulin secretion by pancreatic cells and the increased supply chain of glucose into cells by the insulin hormone. As an outcome, it will increase the number of insulin receptors on the cell membrane, enabling insulin to bind to cells. While insulin production increases, glucose production by the liver reduces, and blood glucose drops. **Conclusion:** As a result, it can be concluded that consuming aloe vera can lower blood glucose levels and thus minimize the risk of diabetes, especially diabetes mellitus.

Keywords: Blood sugar levels, aloe vera, type II diabetes mellitus
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INTRODUCTION

Diabetes is a disease characterized by persistent hyperglycemia (Patel, Neurosciences and 2017, no date) and glucose intolerance caused by metabolic abnormalities in insulin secretion, insulin action, or both (El Qahar, 2020). Diabetes mellitus is caused by insulin resistance, which occurs when the number of insulin receptors on the cell surface decreases while insulin does not (Choi *et al.*, 2013). Even though glucose is accessible, it is unable to enter the insulin cells. Patients with diabetes mellitus can still create insulin, but the insulin produced by pancreatic beta cells is insufficient or does not function efficiently in the body, preventing glucose from entering the cells.

Diabetes mellitus is divided into two categories: Type 1 is caused by the autoimmune destruction of pancreatic cells, resulting in insufficient insulin production; Type 2 is caused by insulin production, but the individual develops insulin resistance (dos Santos *et al.*, 2021). Blood glucose levels fluctuate throughout the day. After eating, blood glucose levels rise and then return to normal within 2 hours.

According to current International Diabetes Federation and WHO statistics, the global diabetes prevalence will rise

from 382 million in 2013 to 592 million in 2035. In 2013, there were 72.1 million diabetics in Southeast Asia, a figure that is expected to rise to 123.0 million by 2035 (Kumar Thakur *et al.*, 2014). Comorbidities such as hypertension, obesity, or poor liver function are also common among adults with diabetes.

However, currently, the medicine used in diabetes treatment therapy generally has high prices that are not affordable to the middle to lower class. In addition, these medications also have side effects that are caused (Andrade *et al.*, 2020). As a result, multicomponent therapies are critical for regulating glucose levels in the body and improving the lives of patients. Anti-diabetic chemical therapy has become widely used as a kind of diabetes intervention around the world; nevertheless, they do not always adequately regulate glucose levels after meals and may induce various adverse effects such as gastrointestinal issues, edema, and even hypoglycemia.

Some people continue to use alternative medicine systems based on plant extracts that have evolved over generations and are still used to manage diabetes (Kifle *et al.*, 2021). Medicinal plants have been utilized as a source of medicine all over the world, and 80-85 percent of the population relies on medicinal plants utilizing extracts or active components as a traditional medicine to meet their basic health needs. Much research has confirmed the benefits of medicinal plants with hypoglycemic effects in the treatment of diabetes, one of which is aloe vera (Infante-Garcia, molecular and 2019, 2019).

Aloe vera (Latin: *Aloe barbadensis Miller*) is a Liliaceae plant with stunning leaves linked to the roots. Aloe vera plants are low shrubs that prefer arid environments. The plant's stem is short, and its leaves feature a circular wing (rosette). Aloe vera thrives in arid climates such as those in Africa, Asia, Europe, and the Americas. Aloe vera is a multipurpose plant since it is high in helpful nutrients and has herbal medical benefits (Choudhury *et al.*, 2018). Aloe vera contains hypoglycemic chemicals such as chromium and aloe-emodin, which aid in increasing insulin release by pancreatic beta cells (Putri *et al.*, 2022). Chromium aids the action of the insulin hormone by activating receptor cells to bind to insulin. Chromium ingested will be transported to adipose tissue and striated muscle, where it will trigger phosphorylation. As a result, aloe vera is considered a new therapy option for diabetes mellitus.

METHOD

Database Search

The design used in this study is a *systematic review* using the *Preferred Reporting Items for Systematic Reviews and Meta-analyses* (PRISMA) method. This method is carried out by using a *review*, structured evaluation, classification, and categorization of the *evidence base* that has previously been produced. The articles in this study were obtained from electronic databases published in Google Scholar, Pubmed, and Science Direct, published from 2013 to 2023. The structure of the keywords used for the literature search was "aloe vera" AND "diabetes mellitus" OR "diabetes" AND (elderly OR menopausal OR older) NOT kids. The inclusion criteria in this study were articles that were limited to the last 10 years (2013-2023), in English, available in full text, and research article type, and included a discussion of the effect of aloe *vera* on reducing blood sugar levels in patients with *diabetes mellitus*.

Data Extraction and Findings Reporting

The article search began by using predetermined keywords, namely "aloe vera" and "diabetes mellitus." From the search results using keywords, 321 articles were obtained from Science Direct, 261 articles from Google Scholar, and 9 articles from PubMed. After that, articles that were double-published and published by Science Direct, Google Scholar, and Pub-Med were eliminated. After the elimination process, only 578 eligible articles were found. The screening was continued by looking at titles that included the words "aloe vera" and "diabetes mellitus" or journals that contained the keywords "blood sugar," "aloe barbadensis Miller," and "type 2

diabetes," resulting in 67 articles. Next, read the abstract of each article to see the relevance of the article to the topic discussed in this systematic review and available in full text. The final result of this data search found 5 articles that met the requirements and were suitable for use in the systematic review.

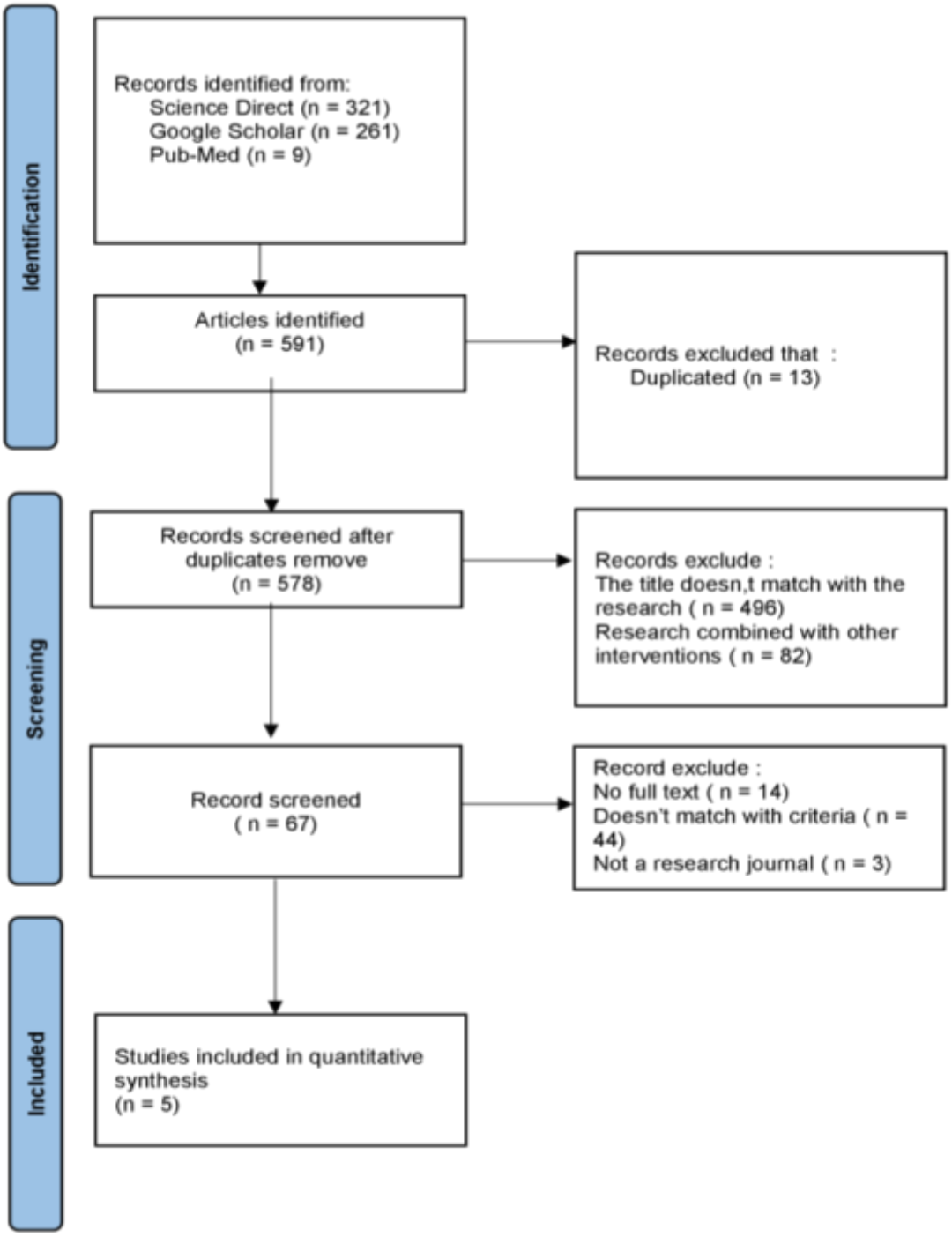

Figure 1. Research Flowchart

RESULTS

Title	Author	Methods	Respondents	Place of Research	Research Results	Conclusion
Prevalence and associated factors of herbal medicine use among adult diabetes mellitus patients at a government hospital, Ethiopia: An institutional-based cross-sectional study	Zemene Demelash Kifle, Biruk Bayleyegn, Tesfaye Yimer Tadesse, Alem Endeshaw Woldeyohanins	This study employed an institution-based cross-sectional design that was carried out from August 1 to September 28, 2020. The sample size of 419 was estimated using the single population proportion calculation, with 50% as the proportion (p) of patients utilizing herbal medicine at 95% CI, a margin of error (d) of 5%, and a non-response rate of 5%. The diabetic clinic appointment list was utilized as a foundation for sampling, and techniques such as simple random sampling were used to choose research participants.	This study included 419 diabetic patients from Debre General Hospital's diabetes care service. Laut uses an interview and questionnaire system in Tabor, which is located in the town of Debre Tabor, South Gondar Zone, Western Ethiopia.	Debre General Hospital diabetes care services Tabor, located in the town of Debre Tabor, South Gondar zone, Western Ethiopia Sea.	According to the findings of this study, female participants had 1.98 times the odds of using HM as male participants (AOR = 1.98, 95 percent CI = 1.72, 3.25). Participants with rural dwellings were 2.34 times more likely to use HM (AOR = 2.34, 95 percent CI = 1.82, 3.29) than those with urban households. The odds of using HM were 2.53 times greater in people with diabetes mellitus for more than 5 years (AOR = 2.53, 95 percent CI = 1.45, 4.67) than in those with diabetes mellitus for less than 5 years. The prevalence of HM use among persons who developed (AOR = 1.77, 95 percent CI = 1.03, 2.83) was greater than among persons who did not develop diabetes mellitus complications. The odds of using HM were 2.89 times higher in persons with a family history of diabetes mellitus (AOR = 2.89, 95 percent CI = 1.42, 3.19) than in participants without a family history of diabetes mellitus. In this study, aloe vera is used on the leaves using the gel extraction preparation method and is consumed orally. The herbal medication aloe vera is used by 48% of people.	According to this study, the usage of herbal medicines is extremely common among diabetic patients. Moringa stenoptela, Nigella sativa, Zingiber officinale, Allium sativum, Aloe vera, Podocarpus gracilis, Thymus schimperi, Vernonia amygdalina, Trigonella foenumgraecum, and Discopodium penninervum were the most commonly utilized HMs among diabetes patients. This demonstrates that aloe vera can help diabetics lower their blood sugar levels.

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Exploring the beneficial effects of Aloe vera on the kidneys of diabetic rats at the protein level.	Lilian dos Santos, Lilian Saemi Arita, Juliana Dinéia Perez, Valdemir Melechco Carvalho, Alexandre Keiji Tashima, Tatiana Sousa Cunha, Dulce Elena Casarini, Danielle Yuri Arita.	The isolation method of AV butanol fraction (ABF) was used in this study, and the experimental model was eight-week-old male Wistar rats induced by STZ and randomly assigned to four groups: controls (non-diabetics) (C, n = 6); untreated diabetes (D, n = 9); people with diabetes treated with ABF (50 mg/kg/day) (DBF, n = 6); and diabetics treated with long-acting insulin via intraperitoneal administration (0.1 IU) (DI, n = 6). Body weight was then measured and statistically examined for each group to determine differences in body weight before and after therapy. Following that, blood glucose measurements, euthanasia, and proteome analysis were carried out.	Controls (non-diabetics) (C, n = 6); untreated diabetes (D, n = 9); persons with diabetes treated with ABF (50 mg/kg/day) (DBF, n = 6); and diabetics treated with long-acting insulin by intraperitoneal infusion (0.1 IU) (DI, n = 6).	Sao Paulo, Brazil.	It was discovered in this study that all rats treated with aloe vera had a significant drop in glycemia when compared to baseline values. After 3 hours of treatment, the DBF and DI groups demonstrated hypoglycemic effects, and glycemia levels were stable for up to 6 hours.	Because V regulates proteins associated to mitochondrial activity, the vascular system, and the glycolysis/pentose pathway, this study indicated that aloe vera can really reduce glucose levels in patients with diabetes mellitus. ABF has been found to have a hypoglycemic impact and to be a useful adjuvant in the treatment of diabetes. It has the potential to cure diabetes-associated diseases by altering the expression of kidney proteins related to mitochondrial function, system blood arteries, and the glycolysis/pentose pathway. Among all the proteins mentioned. Because fructose-biphosphate aldolase A does not occur with insulin administration, additional emphasis was placed on it in this investigation. It was discovered to be altered in diabetic kidneys for the first time, and ABF treatment reverted the expression of this protein to control levels.
Metabolic effects of aloe vera gel complex in obese prediabetes and early non-treated diabetic patients:	Ho-Chun Choi M.D., Seok-Joong Kim M.D., Ki-Young Son M.D., Bum-Jo Oh M.D., M.P.H., Be-Long Cho	The double-blind RCT approach was employed in this investigation. Participants were screened before being randomly allocated to the intervention or control groups using SAS	Patients with prediabetes or early DM aged 20 years who had the following characteristics: 1. obesity (BMI of	Department of Family Medicine, Seoul National University Hospital, Seoul, South Korea	As a result, the study lost six control group members and eight intervention group participants. Body weight (P = 0.02) and BFM (P = 0.03) were considerably lower in the intervention group after	This study concludes that aloe vera gel helps lower glucose levels in prediabetic people. This is due to the fact that aloe vera gel can improve insulin sensitivity, have a hypoglycemic

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Randomized controlled trial	M.D., M.P.H., Ph.D.	9.2 randomization codes (SAS Institute, Cary, NC). For 8 weeks, participants took the Aloe QDM complex or a placebo orally, two capsules after breakfast and two after dinner. They came to the center on the day of enrollment (baseline), four and eight weeks after randomization for physical examinations, laboratory tests, and side effect evaluations. Blood samples were obtained after an 8-hour fast, and body fat was evaluated using a bioimpedance analyzer (In Body720, Biospace, Seoul, South Korea).	25 kg/m2) or abdominal obesity (waist circumference of 90 cm for men or 85 cm for women); 2. FBG disorder (100 mg/dL) or impaired glucose tolerance (2-hour oral glucose tolerance test 140 mg/dL); and 3. potential with lifestyle modifications to control blood sugar levels (FBG 180 mg/dL and HbA1c 8.0 percent).		8 weeks. Serum insulin (P = 0.04) and HOMA-IR (P = 0.047) levels were lower in the intervention group after 4 weeks; they were also lower at 8 weeks, although only marginally (P 14 0.09; P 14 0.08, respectively). FBG decreased in the intervention group (P = 0.02) after 8 weeks, although the difference between groups was not significant (P = 0.16).	impact, and lower glucose levels in prediabetic patients. In type 2 diabetic rats, it is also hypolipidemic and reduces adipocyte size. Aloe phytosterols reduced blood glucose and lipid levels, as well as visceral fat weight, in mice experiments via modifying the expression of genes involved in glucose and lipid metabolism. The Aloe QDM complex reduced body fat and enhanced insulin sensitivity in obese mice by activating AMP-activated muscle protein kinase, which is involved in the control of glucose and lipid metabolism.
Beneficial effects of Aloe vera in treatment of diabetes: Comparative in vivo and in vitro studies.	Amira Mourad Hussein Abo-Youssef, Basim Anwar Shehata Messiha.	Animal testing was used in this work, and adult male albino rats of the Wistar breed weighing around 200-250 g were used for in vivo investigations. In vitro investigations were performed on adult female Wistar albino rats weighing 150-200 g. The preparation of A. vera leaf pulp extract, induction of experimental diabetes, isolation of rat pancreatic islets, in vivo experimental design, in vitro experiment, determination of serum glucose and insulin, determination of serum malondialdehyde (MDA), superoxide dismutase	Adult male albino rats of the Wistar breed weighing around 200-250 g were used for in vivo studies in this investigation. In vitro investigations were performed on adult female Wistar albino rats weighing 150-200 g. Animals were procured from Egypt's National Research Center in Cairo. During the investigation, the animals were	Department of Pharmacology and Toxicology, Faculty of Pharmacy, Beni-Sueif University, Egypt.	The findings of this investigation revealed that rats induced with STZ underwent considerable modifications. Glimepiride and A. vera gel extract dramatically lowered serum MDA levels while considerably increasing blood GSH and SOD levels. When compared to diabetic controls, aloe vera reduced serum glucose levels while increasing serum insulin levels. Aloe vera has also been shown to boost insulin release from pancreatic islets.	The findings of this investigation revealed that rats induced with STZ underwent considerable modifications. Glimepiride and A. vera gel extract dramatically lowered serum MDA levels while considerably increasing blood GSH and SOD levels. When compared to diabetic controls, aloe vera reduced serum glucose levels while increasing serum insulin levels. Aloe vera has also been shown to boost insulin release from pancreatic islets.These findings point to a prospective anti-diabetic impact of aloe vera for

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		(SOD), and glutathione (GSH), and statistical analysis came next.	kept in plastic cages (28 cm, 43 cm, and 18 cm) under the settings of a standard laboratory.			future clinical trials involving the use of aloe vera extract to treat type II diabetes.
Antioxidant Effects and Mechanisms of Medicinal Plants and Their Bioactive Compounds for the Prevention and Treatment of Type 2 Diabetes: An Updated Review	Jeremiah Oshiomame Unuofin and Sogolo Lucky Lebelo	This study's method was an institution-based cross-sectional study with 300 participants. Fasting blood glucose levels were significantly lower in 48 prediabetic and T2DM patients who were observed for 6-8 weeks.	This study included eight prediabetic patients and eight T2DM patients who were observed for 6-8 weeks.	Department of Life and Consumer Sciences, University of South Africa, South Africa.	The results of this study showed that giving glibenclamide alone to 72 T2DM patients (49 men and 23 women) with high FBG levels did not improve FBG levels or blood glucose, whereas giving glibenclamide with 80 percent Aloe Vera juice resulted in a decrease in FBG blood glucose levels in less than two weeks with no damage to the liver or kidney. Furthermore, the Aloe QDM complex or placebo was provided orally to 136 people who were randomly assigned to sixty-eight (68) participants from each group throughout a randomized control study (8 weeks). After eight weeks of treatment, this study found a significant reduction in body weight, body fat mass, fasting blood glucose (FBG), serum insulin (FSI), and the Homeostasis Insulin Resistance-Assessment Model (HOMA-IR).	This study found that Aloe vera can lower blood glucose levels while increasing insulin levels without causing hypoglycemia.

Several research have been undertaken to determine the potential of aloe vera in lowering glycemic levels in people with diabetes mellitus, which are detailed in the article. According to the study (Abo-Youssef and Messiha, 2013), rats induced with STZ and given aloe vera gel extract revealed substantial improvements, including lower serum MDA levels, higher blood GSH and SOD levels, and lower serum glucose and higher serum insulin levels. This demonstrates that the aloe vera gel content can lower diabetes in diabetic rats. Aloe vera is not harmful to humans. This is supported by the findings of the study (Unuofin and Lebelo, 2020), which found that administering glibenclamide and 80 percent Aloe vera juice to 72 T2DM patients (49 men and 23 women) resulted in a decrease in levels of no harm to both the liver and kidneys.

DISCUSSION

Diabetes is one of the world's main public health issues. Diabetes mellitus is distinguished by hyperglycemia caused by inadequate insulin secretion, action, or both. Diabetes mellitus can lead to problems if not treated promptly. Diabetes is estimated to be the seventh greatest cause of mortality worldwide by 2030, with total deaths increasing by 50% over the next ten years. Many medications have been developed to treat and manage this illness. However, the use of antihyperglycemic medications is limited due to their negative effects and expensive cost (Omodanisi, Aboua and Oguntibeju, 2017).

Because of the several compounds found in the plant, aloe vera is often referred to as a wonder plant. Aloin, a slimy yellow substance, is found in about 30% of aloe vera leaves (Marhaeni, 2020). The nutritional value of aloe vera leaves and other green vegetables is the same (Marhaeni, 2020). Aloe vera has 17 different amino acids and is made up of 90% water and 4% carbohydrates, with the balance being minerals (Marhaeni, 2020). Aloe vera includes aloe emodin, an anthraquinone chemical molecule that can help reduce blood sugar levels (Agatha, 2015).

Aloe-emodin is an anthraquinone-based organic component that promotes glycogen production by inhibiting glycogen synthase kinase-3-beta, allowing it to control blood sugar levels. Aloe vera's aloe-emodin content (Aloe vera) can activate insulin and enhance the rate of glycogen synthesis, hence lowering blood sugar levels (Ariska, 2019). Aloe vera also contains chromium, which helps to stimulate insulin release by pancreatic beta cells, allowing the hormone insulin to more efficiently transfer glucose toward cells and into the bloodstream. This increases the amount of insulin receptors on the cell membrane, making insulin binding to cells easier. Increased insulin production causes the liver to produce less glucose, lowering blood sugar.

Aloe vera has a jelly that can be obtained by splitting the aloe vera leaf. Thymol, an antibiotic and antifungal component in the jelly, can stimulate skin cells that aid in wound healing. Salicylic acid, a pain reliever and anti-inflammatory substance found in aspirin, is found in aloe vera. Furthermore, aloe vera gel contains lignin, which helps the skin retain moisture so that it does not dry out, wrinkle, or become scaly. The yellow liquid found in aloe vera is derived from the latex present on the plant's skin. This liquid is not to be confused with aloe vera jelly, which is often used as a laxative. At least 30% of the aloe vera content is made up of two forms of aloin: barbaloin aloin and isobarbaloin aloin. Barbaloin aloin contains an additional kind of aloin, amorphous aloin, as well as aloin resin and emodin.

Because aloe vera has excellent antihyperglycemic qualities, it can help reduce blood glucose levels. According to the findings of the study (Amirehsani and Wallace, 2013), aloe vera has no negative effects on the body. When someone drinks aloe vera-boiled water, chromium helps insulin penetrate the blood sugar that accumulates in blood vessels and cells, allowing the body's metabolic processes to occur and be measured by fasting blood sugar. Aloe vera also has medicinal characteristics, including the ability to

lower plasma glucose levels (Cock, Ndlovu and Van Vuuren, 2021). At a dose of 300 mg/kg, extracts from aloe vera gel leaves increased insulin levels due to pancreatic beta cell regeneration. At a dose of 300 mg/kg, an ethanol extract of Aloe vera gel leaves from the Liliaceae family increased insulin levels due to pancreatic beta cell regeneration (Choudhury *et al.*, 2018).

(Andrade *et al.*, 2020) discovered that the leaf component of the aloe vera plant, when tested on rats induced with STZ specifically in the rat pancreas, increased rat pancreatic function. Furthermore, plasma lipids, liver cholesterol, and kidney triglycerides (TG) were lowered. This methanol extract improved insulin sensitivity by increasing insulin secretion from pancreatic beta cells, acting as an antioxidant and anti-inflammatory, inhibiting pancreatic A-amylase activity, and increasing insulin secretion from pancreatic beta cells. Even though all pancreas cells have deteriorated, the aloe vera component can work like insulin and lower blood sugar levels (Putri *et al.*, 2022).The aloe vera component, which can imitate insulin, automatically inhibits glucose production by the liver and lowers blood sugar levels (Putri *et al.*, 2022). Because it can affect the expression of kidney proteins associated to mitochondrial function, the vascular system, and the glycolysis/pentose cycle, aloe vera has been found to have hypoglycemic effects and can be used as an adjuvant. In obese patients with prediabetes and untreated diabetes, Aloe QDM combination decreases body weight and increases insulin sensitivity.

Aloe vera extract has a powerful antioxidant impact by inhibiting free radical production and improving cellular thiol status. It also stimulates the glutathione-S-transferase enzyme, inhibits the rise in serum MDA levels, and raises blood GSH and SOD levels. Diabetes is an inflammatory disease in which oxidative stress causes the loss of pancreatic beta cells, which contribute to the development of diabetes, and tumor necrosis factor-A is known to lower peripheral insulin sensitivity. Aloe vera also protects against cognitive decline by lowering oxidative stress. The results of a study (Infante-Garcia, molecular and 2019, 2019) demonstrated that lowering oxidative stress protected rats from cognitive impairment after STZ treatment. Many writers suggest that aloe vera has anti-inflammatory properties because many of its components, such as emodin and mannose-6-phosphate, exhibit anti-inflammatory effects equivalent to hydrocortisone. As a result of its powerful pancreatic inhibition, aloe vera may operate as a hypoglycemic agent, limit starch breakdown, and provide good postprandial glycemic control. In general, aloe vera consumption can lower blood glucose, TG, LDL, and TC levels; increase insulin production and pancreatic beta-cell function by increasing pancreatic islet mass; and improve glucose metabolism by lowering blood glucose levels.

Aloe vera can be ingested in the form of juice, boiled to remove the water (aloe vera extract), or as nata de aloe vera. The International Aloe Science Council (IASC) specifies three common aloe vera compounds. Leaf juice (from any portion of the aloe vera plant), inner leaf juice (from the plant's flesh), and aloe latex (from the yellow-brown sap found between the inner parenchyma) Aloin has been used in some trials to cleanse aloe vera juice in order to lessen its laxative impact and avoid diarrhea when ingested (Hidayah *et al.*, 2022). (Cock, Ndlovu and Van Vuuren, 2021) discovered that giving streptozotocin-induced diabetic rats aloe vera juice can lower serum glucose levels in vivo. Other research has found that aloe vera juice helps lower blood glucose levels (Hidayah *et al.*, 2022). Boiling aloe vera is one method of processing aloe vera without modifying or removing the content of aloe-emodin and chromium for the management of diabetic mellitus (Hidayah *et al.*, 2022). 100 grams of peeled and diced aloe vera are used to manufacture it. Then, boil up to 3 cups of boiling water and wait until the remaining water is 1 cup (Dewi, 2022). The boiled water is consumed once a day, one hour before meals (Hidayah *et al.*, 2022). Aloe vera use

on a regular basis can lower fasting blood sugar levels (Hidayah *et al*., 2022).

CONCLUSION

Diabetes mellitus is a health problem caused by impaired insulin secretion, insulin action, or both. Aloe vera (Aloe barbadensis Miller) has many benefits for traditional herbal medicine because it contains many important nutrients, including proven antidiabetic and antihyperglycemic effects. Anti-hyperglycaemic activity by inhibiting the -glucosidase enzyme found in the brush border of the small intestine causes a decrease in the rate of digestion of carbohydrates into monosaccharides that can be absorbed by the small intestine, thus reducing postprandial hyperglycemia. The content of antioxidants such as flavonoids, phenols, and vitamins C and E in aloe vera can reduce blood glucose levels through the mechanism of amylase enzyme inhibition as an inhibitor to prevent glucose digestion into absorbable products and hypoglycaemic activity through the accentuation of insulin release from cells in the pancreas and the prevention and absorption of glucose from the gastrointestinal tract. In addition, the aloe emodin content of aloe vera activates insulin and increases the rate of glycogen synthesis, which is beneficial for reducing the blood sugar ratio. Aloe vera can be consumed in the form of juice, boiled for water consumption (aloe vera extract), or in the form of nata de aloe vera. Consumption of aloe vera (Aloe barbadensis Miller) can help reduce glucose levels in patients with diabetes mellitus.

RECOMMENDATION

Consuming aloe vera can minimize the risk of diabetes because it has hypoglycaemic properties and reduces glucose levels in the blood, but even so, for more perfect prevention of diabetes, it should still be balanced by consuming foods that have a low glycaemic index, such as sweet potatoes, corn, green leafy vegetables, whole grains, nuts, and others.

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