

# Herbal Therapy on Fasting Blood Glucose Levels and HbA1c in Type 2 Diabetes Mellitus Patients: A Systematic Review

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## Abstract

**Aims:** To investigate the effectiveness of herbal extracts in reducing Fasting Blood Glucose (FBS) and HbA1c levels in patients with type 2 Diabetes Mellitus (T2DM) and identify gaps in evidence-based practice for the use of herbal therapies in T2DM management.

**Methods:** A literature search was conducted across three major databases: ProQuest, PubMed, and Google Scholar, using specific keywords combined with Boolean logic (“AND” and “OR”) to enhance search precision. The quality of the studies was assessed using the JBI Critical Appraisal tool and ROB 2.0, which evaluate the risk of bias across five domains. Eight studies that met the inclusion criteria were systematically analyzed.

**Results:** The analysis revealed three main themes: (1) a decrease in FBS, (2) a decrease in both FBS and HbA1c, and (3) no significant decrease in either parameter. Certain herbal extracts, such as *Bauhinia forficata*, barberries, a combination of berries and fenugreek, and Jinlida have been shown to significantly reduce FBS and HbA1c levels.

**Conclusions:** The findings of this study provide valuable insights into the potential use of herbal extracts as complementary therapies for T2DM. These results may contribute to the development of evidence-based nursing practices for the use of herbal treatments in T2DM care.

*Keywords:* diabetes mellitus, fasting blood glucose, HbA1c, herbal therapy

## Introduction

Diabetes mellitus (DM) is a condition that arises from metabolic disorders of the pancreas and is characterized by elevated blood sugar levels or hyperglycemia. This occurs because of the decreased insulin production by the pancreas. Based on the International Diabetes Federation (IDF), 537 million people (20-79 years old) live with DM, and this number is expected to increase to 643 million by 2035 (IDF, 2021). DM is the 6th most deadly disease in the world according to the World Health Organization (WHO) (Nasution et al., 2021). The majority of deaths occur at the age of 45-54 years who live in urban areas rather than people who live in rural areas (Kistianita et al., 2018). According to the 11<sup>th</sup> Atlas of DM released by the IDF, Indonesia has the 4th largest number of diabetics after China, India, and the USA (IDF, 2025). As reported by 2018 Basic Health Research (Riskesdas) data from the Ministry of Health in Indonesia, the prevalence of DM has increased from 6.9% in 2013 to 8.5% in 2018. Riskesdas

(2018) also reported that the prevalence of DM is higher in women (1.7%) than in men (1.4%).

The increasing number of patients with DM will affect the adult mortality rate and increase the burden on public health. Several factors can increase the prevalence of DM, including age, family history, lack of physical activity, and an uncontrolled diet (Nasution et al., 2021). Prediction by the International Diabetes Federation (IDF) in 2035 can lead to several new problems (Saeedi et al., 2019). A high-sugar diet and a lack of physical activity can increase oxidative stress in the human body (Lestari et al., 2021). Oxidative stress damages pancreatic beta cells that function in insulin secretion in the body, and free radicals that cause oxidative stress cause insulin resistance, which affects the absorption of glucose in muscles and fat, thereby increasing blood glucose levels (Lestari et al., 2021). The current management of DM is conventional treatment, but there are some side effects such as hypoglycemia and other digestive problems. Herbal therapy is an alternative treatment for DM.

Herbal therapy is an alternative for ancient parents who have many benefits as medicinal ingredients and are still used today; one of these is a type 2 DM drug with minimal side effects (Harefa, 2020). Herbal therapy is part of traditional medicine that is still preserved; the parts used are usually the roots, leaves, or skin of the herbal plants themselves (Kharisma & Ediati, 2023). Culture also significantly influences the preference for herbal therapies. Traditions and beliefs within a community can influence individual choices. If the social environment and family have long used and trusted herbal therapies, individuals will tend to adopt this practice. Social support and collective beliefs strengthen the sustainability of traditional therapies in communities (Marwati & Amidi, 2019). In the context of nursing practice, the use of herbal therapy is increasingly being recognized as a part of complementary nursing, which is an additional approach to support primary medical treatment. Nurses can integrate herbal therapy into patient care using an evidence-based approach, ensuring patient safety, and considering potential interactions with conventional medications. This approach aims not only to reduce symptoms but also to enhance patients' overall quality of life. Complementary nursing provides a space for patients who prefer traditional medicine while also ensuring that the treatments received are safe and effective. With a proper understanding of the benefits and potential risks, nurses can educate patients about herbal treatment options as an alternative or adjunct to conventional medicine, helping them make more informed decisions about their health (Plotnikoff & Lillehei, 2022).

The aim of current systematic review is to summarize the effectiveness of herbal plants in reducing Fasting Blood Glucose (FBS) and glycated hemoglobin (HbA1c) levels so that the wider community has choices that have proven their benefits in reducing FBS and HbA1c levels. In previous studies, there were limited randomized control trial studies that compared herbal extracts with others (Prameswari et al., 2024). Previous studies examining herbal therapy for other diseases have also not been systematic reviews (Annisa et al., 2023; Peltzer & Pengpid, 2019). Moreover, this study can also be used as evidence for the treatment of conservative patients who believe in traditional medicine using herbs rather than conventional medications.

## Methods

A literature search was performed using three databases: ProQuest, PubMed, and Google Scholar. This study used PICOT Method (Population: Adults with T2DM, Intervention: Herbal therapy, Comparison: -, Outcome: FBS and HbA1c, Time: 2014-2024) with the keywords (*Herb Therapy OR Complementary Therapy*) AND (*HbA1c OR Glucose Blood Level*) AND (*Adult*) AND (*Diabetes mellitus*) AND (*Randomized OR Randomized Controlled Trial*) which have been narrowed using boolean logic techniques namely “AND” and “OR” to find specific literature. This study was registered in Prospero with registration number CRD420251056327.

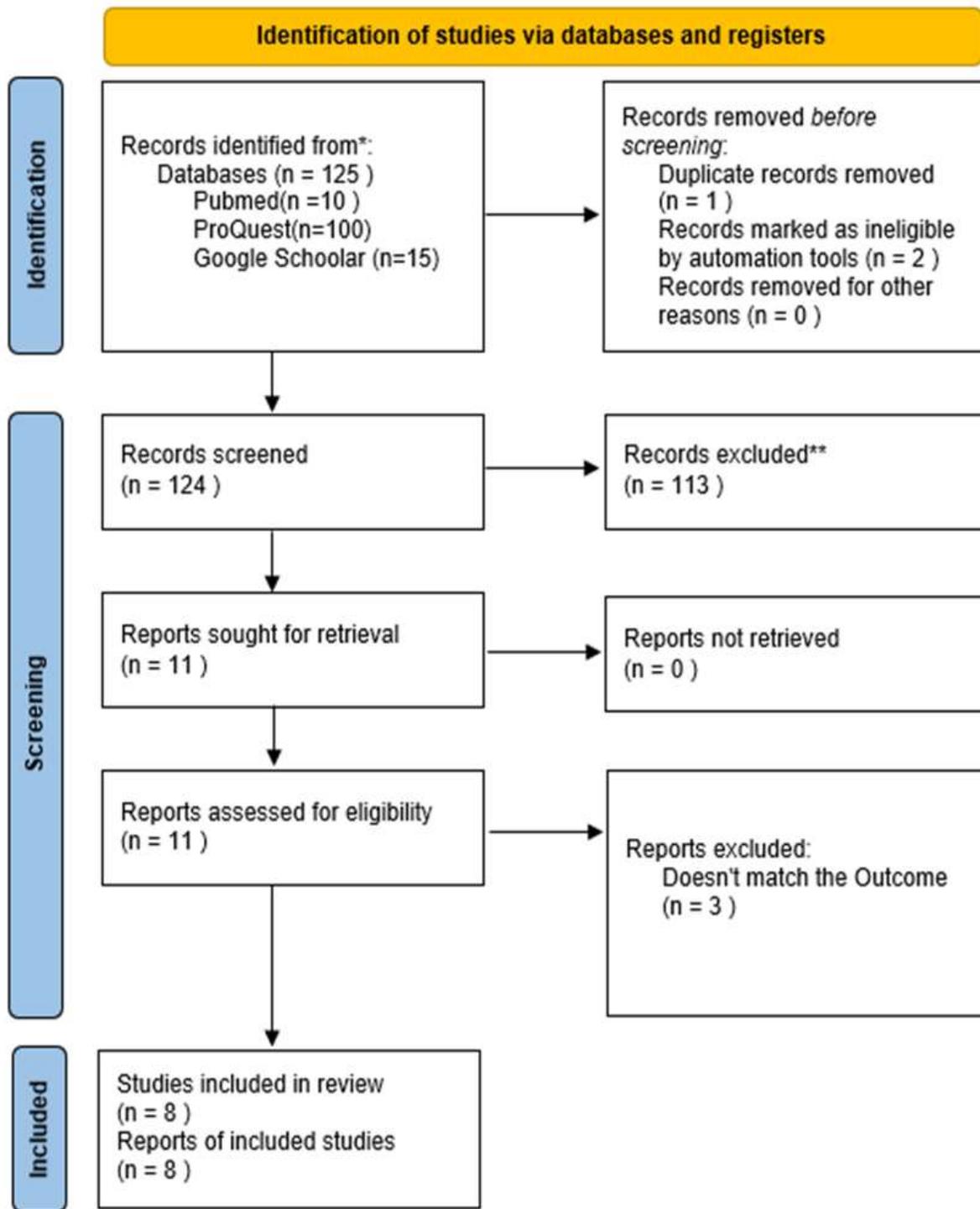
Search results from each database were collected. Duplicate detection was performed, followed by removal of duplicate articles. The remaining articles were screened based on their titles and abstracts. All articles were then pooled for screening based on the eligibility criteria. The reasons for the exclusion of each article are attached to the PRISMA flow chart (Figure 1).

The inclusion criteria in this systematic review were as follows: 1) study design: randomized control trial; 2) Population aged 18-75 years, with T2DM; 3) herbal therapy intervention on HbA1c/FBS levels; 4) control group using placebo or metformin; and 5) use of international journals in the full text and English Language. The exclusion criteria were as follows: 1) Protocol studies and systematic reviews. Flow chart of the literature search and selection process.

Study quality assessment also used the ROB 2.0 tool (Chandler et al., 2016). This tool evaluates 5 domains, viz: bias in randomization, bias due to diversion from the intervention, bias due to missing outcome data, bias in outcome measures, and bias in reporting results. All authors assessed each inclusion study and wrote the results on a spreadsheet that was visualized using the ROBVIS instrument. This systematic review used guidelines to analyze the quality of reporting among selected studies. The JBI Critical Appraisal Checklist for Randomized Controlled Trials was used in this study. This instrument contains 13 questions to assess the methodological quality of a study and the risk of bias from the study design, conduct, and analysis.

## Results

After searching the three databases, a total of 125 articles were collected. Two duplicate studies were found in different databases, resulting in 124 studies. At the screening stage, 113 studies were excluded because they did not follow PICOT, resulting in 11 studies. Of the 11 studies, three were excluded because they did not answer the purpose of this systematic review and were not closely related to complementary herbal therapy and HbA1c or FBS levels; therefore, only eight studies were categorized as appropriate. Six of the eight studies showed a low risk of bias, while one study showed a risk of bias of some concern because in domain 2, there was bias in the provision of interventions. In the study by Hadi et al. (2020), the population and intervention were not blinded. In addition, some studies have a high risk of bias, because in domains two and four there is some concern bias, because the intervention provider is not blinded, and it is not explained whether the treatment given to the control and intervention groups is identical. Then, in domain four, there is some bias regarding no clarity on whether the person measuring the research results is blinded (Figure 2), meanwhile the quality of the included study is considered high and moderate quality (Figure 3).



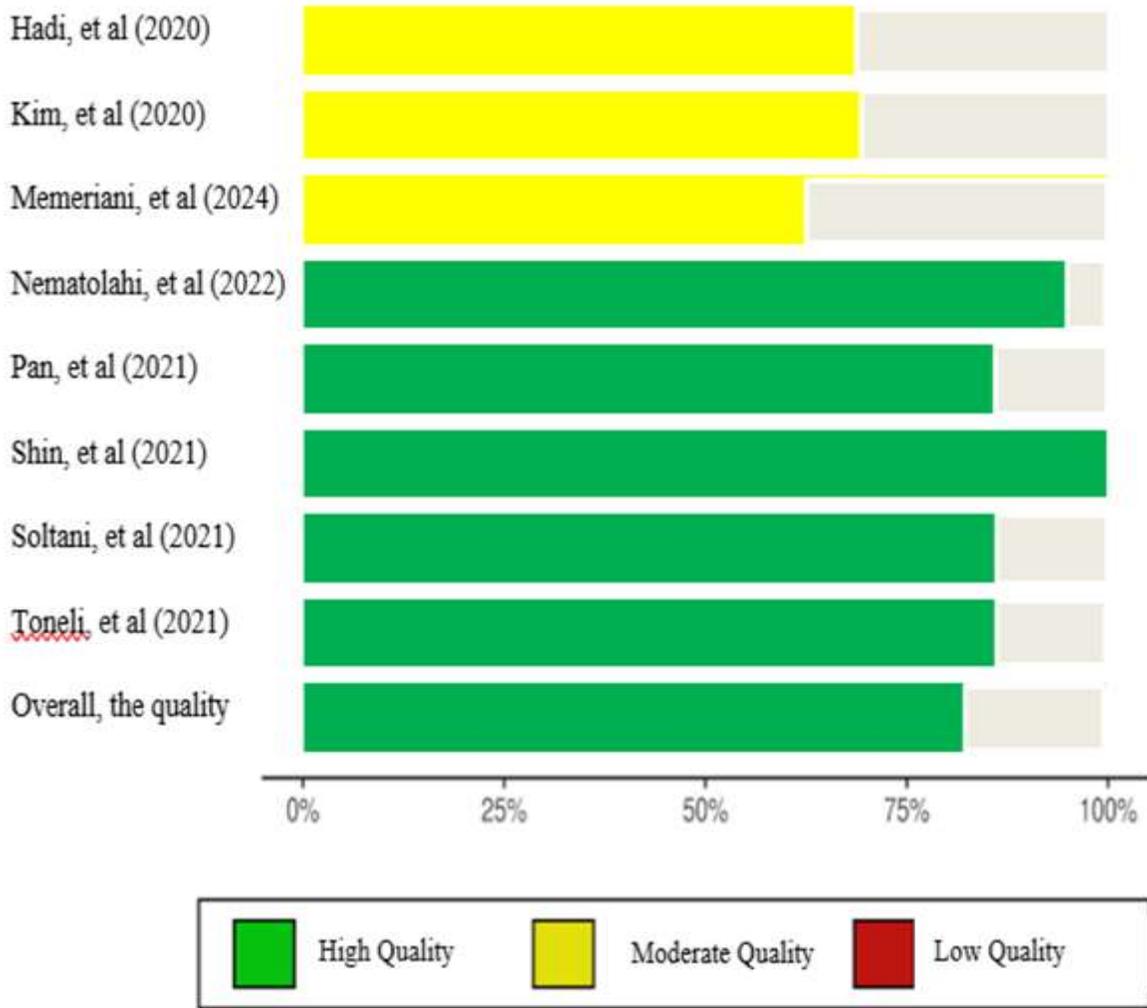
**Figure 1.** PRISMA Flowchart

		Risk of bias domains					
		D1	D2	D3	D4	D5	Overall
Study	Hadi, et al 2020						
	Kim,et al 2020						
	Memeriani, et al 2024						
	Nematolahi, et al 2022						
	Pan, et al 2021						
	Shin, et al 2021						
	Soltani, et al 2021						
	Tonelli, et al 2021						

Domains:  
 D1: Bias arising from the randomization process.  
 D2: Bias due to deviations from intended intervention.  
 D3: Bias due to missing outcome data.  
 D4: Bias in measurement of the outcome.  
 D5: Bias in selection of the reported result.

Judgement  
 High  
 Some concerns  
 Low

**Figure 2.** Risk of Bias



Note: High quality (100-80%), Moderate quality (79-50%), Low quality (<50%)

**Figure 3.** Quality of the study

**Table 1.** Description of Analysis Study

Authors	Methods	Population	Intervention	Result
Amir Hadi, et al (2020)	Parallel Randomised Clinical Trial	48 Patients with T2DM	fenugreek extract at a dose of 1500 mg/day for 8 weeks	FBS levels decreased from (141.88±24.16 mg/dl) to 132.6 ± 21.21mg/dl), there is a decrease of 9.28 mg/dl, (p=0.019), this study did not measure HbA1c.
Kim, et al (2020)	Randomised Double Blinded Clinical Trial	70 Patients with T2DM	Bittermelon extract capsules at 2380 mg/day for 12 weeks	Bittermelon only showed a significant decrease FBS levels, namely from (145.9 ±34.5 mg/dl) down to (140.5 ± 31.9 mg/dl), experiencing a 5.4 mg/dl decrease (p=0.014). There was no significant reduction in HbA1c (p=0.235)
Memeriani, et al (2024)	Single blinded, Randomised Control Trial	42 patients with T2DM	The intervention group was given 1000 mg P. atlantica oleoresin capsules +500 mg/day Metformin in 12 weeks, the control group was only given 500 mg Metformin/day.	P. atlantica oleoresin and Metformin, can decrease FBS levels from (198±73.95 mg/dl) to (154.09±34.14mg/dl) (-43.91, a decrease also occurred in the control group which was (180.28 ±53.48 mg/dl) to (141.8 ±43.40 mg/dl) (-38.47) and there was no significant decrease (p=0.88). In HbA1c there was a decrease of (8.58%± 1.52) to 7.96%± 1.15 (-0.62%) while in the control group there was a decrease from (8.5%±1.76) to (7.94%± 1.42) (-0.56%) (p=0.89), but there was no significant decrease in HbA1c.
Nematollahi, et al (2022)	Randomised Control Clinical Trial	50 patients T2DM	Intervention of 500 mg combination capsules (300 mg barberies + 200 mg fenugreek) 3 x a day (900 mg barberies +600 mg fenugreek a day), carried out for 12 weeks	In the intervention group there was a decrease in FBS from (163.92 ± 56.27 mg/dl) to (149.52 ± 54.44 mg/dl) (p=0.1) (-14.4 mg/dl) while in the control group there was an increase from (137.64±41.50mg/dl) to (139.32 ±26.79mg/dl) (+1.68 mg/dl) (p=0.05) In control group there was decreased in HbA1c but not significant (7.12% ±1.42) to (6.76 %±0.90) (p=0.08)
Pan, et al (2021)	Double-Blinded, Randomized Control	148 patients T2DM	Administration of the intervention with Jinlida extract	In the intervention group, FBS level decreased from (160± 38.734 mg/dl) to (142.5±38.013 mg/dl) the placebo control group decreased from (158±27.56 mg/dl) to (151.3 ± 31.88 mg/dl)

	Clinical Trial		9000mg/day for 16 weeks,	(-6.7 mg/dl) ( $p>0.05$ ), while in the intervention group there was a decrease in HbA1c from $(7.83\% \pm 0.69)$ to $(7.15\% \pm 1.01)$ ( $-0.68\%$ ) ( $p<0.01$ ).
Shin, et al (2020)	Double Blinded, Randomised Clinical Trial, Crossover	12 patients T2DM	Administered intervention 3.52 g of <i>Scutellaria baicalensis</i> extract + <500 mg metformin/day for 8 weeks	FBS pre-intervention was $(127.8 \pm 5.4 \text{ mg/dl})$ and afterwards increased to $(131.0 \pm 64) \text{ mg/dl}$ ( $+2.2 \text{ mg/dl}$ ) ( $p=0.724$ ), while HbA1c increased from $(6.53\% \pm 0.16)$ to $(6.56\% \pm 0.19)$ ( $+0.03\%$ ) ( $p=0.892$ ).
Soltani, et al (2021)	Randomized Controlled Clinical Trial	65 patients T2DM	The intervention group received barberry extract 10 ml (1000 mg)/day, while the control group received standard treatment. The study lasted 8 weeks.	There was a significant decrease in FBS from 125 (114.8-134.5) mg/dl to 117.5 (107-128.8) mg/dl ( $-7.5 \text{ mg}$ ) the control group increased from 128 mg/dl to 134 mg/dl ( $+6 \text{ mg/dl}$ ) ( $p=0.001$ ). In HbA1c the intervention group decreased from 7.4% (6.8-7.7) to 7% (6.4-7.7) ( $-0.4\%$ ) the control group increased from 7.2% (6.7-8.4) to 7.5% (6.8-7.9) ( $+0.3\%$ ) ( $p=0.045$ ).
Tonelli, et al (2021)	Randomised Double Blinded Clinical Trial	92 patients T2DM	Intervention with 300 mg of <i>Bauhinia forficata</i> per day for 16 weeks.	Showed a decrease in fasting blood glucose levels (FBS) from $(178.58 \text{ mg/dl})$ to $155 \pm 58 \text{ mg/dl}$ ( $-23 \text{ mg/dl}$ ). While in HbA1c there was a decrease from $(8.4\% \pm 3.2)$ to $(7.6\% \pm 3.4)$ ( $0.8\%$ ) ( $p<0.001$ ). there was a significant decrease between FBS and HbA1c. In control group there was decreased in $(197 \pm 68 \text{ mg/dl})$ to $(189 \pm 53 \text{ mg/dl})$ and decreased in HbA1c from $(8.8\% \pm 3.2)$ to $(8.9\% \pm 3.4)$ . The comparison of p value after the intervention in FBS ( $p=0.01$ ) and in HbA1c is ( $p<0.001$ ).

**Table 2.** Synthesis of journal articles

Item Review	Hadi, et al (2020)	Kim, et al (2020)	Memeri ani,et al (2024)	Nematollah i, et al (2022)	Pan, et al (2021)	Shin, et al (2020)	Soltani,et al, (2021)	Tonelli, et al (2021)
<b>Herbal Therapy</b>								
Bitter melon		√ <sup>a</sup>						
fenugreek	√ <sup>a</sup>			√ <sup>b</sup>				
<i>P. atlantica oleoresin</i>			√ <sup>c</sup>					
<i>Bauhinia forficata</i>								√ <sup>b</sup>
<i>Scutellaria baicalensi</i>						√ <sup>c</sup>		
<i>s</i>								
Berberis				√ <sup>b</sup>			√ <sup>b</sup>	
<i>Jinlida</i>					√ <sup>b</sup>			

a\* can significantly reduce FBS levels (p<0.05)

b\* can significantly reduce FBS and HbA1c levels (p<0.05)

c\* can't significantly reduce FBS and HbA1c level (p>0.05)

## Discussion

### Potential of Herbal Therapy on FBS Decrease

According to Kim et al. (2020), bittermelon contains bioactive compounds, such as charantin, vicine, and polypeptide-P, which can increase the uptake of glucose into muscle cells, thereby lowering fasting blood sugar levels. This is similar to the action of insulin, in which glucose is used more by cells for energy, thereby reducing blood sugar levels. Bittermelon also reduces glucose production in the liver through a process called gluconeogenesis, in which the liver produces less glucose during fasting; therefore, FBS levels remain lower. In the study of Kim et al. (2020), which discussed bittermelon, the absence of a significant decrease in FBS and HbA1c levels may be due to the fact that this study was conducted in Korea from October to March, this study was conducted in winter. A decrease in temperature can affect metabolism, insulin resistance, and blood glucose control. Physical activity also decreases in winter because of extreme weather compared with summer, resulting in lower blood glucose control. Low exposure to sunlight can also cause vitamin D deficiency, which is useful in reducing insulin resistance. In addition, diet is also influential because, in winter, Koreans tend to consume high-calorie foods that can increase blood glucose levels (Kim et al., 2014).

Hadi et al. (2020) research on fenugreek can also significantly reduce FBS levels. This significant decrease can occur due to the content of 4-hydroxyisoleucine which can increase insulin secretion in the pancreas and insulin sensitivity, and it also plays a role in inhibiting glucose absorption in the intestine. Fenugreek can also inhibit alpha-amylase compounds, thereby inhibiting the breakdown of carbohydrates into glucose. It can also increase the secretion of irisin, which increases the freezing of fat into energy and increases insulin sensitivity. In a previous study by Hassani et al. (2019), which discussed the administration of fenugreek at a dose of 5 g twice a day for eight weeks, this study showed a significant decrease in FBS which was 23.15 mg/dl. This also shows that the difference in dosage affects the effectiveness and magnitude of the decrease in FBS levels (Hadi et al., 2020; Hassani et al., 2019). In addition to lowering FBS levels, fenugreek can lower systolic blood pressure.

Herbal therapy using bittermelon and fenugreek can be used as complementary therapy to help reduce fasting blood glucose levels but has not been able to reduce HbA1c levels. It is important for patients to adhere to how to use herbal extracts, adhere to doses, in addition to herbal treatment patients must also adhere to the conventional treatment given, the recommended diet, and also regulate activity patterns. Nurses are responsible for educating and providing information regarding the use of herbal extracts, dosage of herbal extracts, and potential side effects that may occur. Nurses are also responsible for coordinating with doctors in the selection of herbal therapies used so that they do not conflict with contraindications in patients (Sari et al., 2023).

### **Potential of Herbal Therapy to Reduce FBS and HbA1c**

The decrease in FBS and HbA1c levels in this review can be considered significant if the p-value ( $p < 0.05$ ). Four studies showed a significant decrease in FBS and HbA1c levels. In a study by Tonelli et al. (2021), which discussed the antidiabetic effect of *Bauhinia forficata*, it was shown that it could significantly reduce FBS and HbA1c. *B. forficata* is an herbal plant originating from Brazil. In Brazil, this plant is often used as a traditional treatment for DM by utilizing the leaves. Regular consumption of *B. forficata* capsules can also control the inflammation caused by T2DM. *B. forficata* has bioactive contents such as kaempferitrin, kaempferol, and quercetin which help increase signal activation by insulin so that glucose absorption by body cells can occur, besides that kaempferol can also increase adiponectin secretion which can increase insulin sensitivity in the body, the bioactive content of *B. forficata* also has anti-inflammatory effects which can also increase insulin sensitivity. The bioactive content of *B. forficata* can also reduce oxidative stress, which can reduce pancreatic beta-cell function (Pinafo et al., 2019). Similar research by Souza et al. (2020) also showed a significant decrease in FBS and HbA1c levels (FBS by 273 mg/dl and HbA1c by 0.3%), by giving a 500 mg of *B. forficata* extract and a longer duration of 18 weeks, which could also increase the pharmacological effects of *B. forficata*.

In a study by Soltani et al. (2021), the administration of the herbal medicine Berberis syrup extract significantly decreased FBS and HbA1c levels. The decrease in FBS and HbA1c levels can occur because of the alkaloid content in berberis, which is almost similar to that of *B. forficata*, (Berberine alkaloids) that can increase insulin sensitivity, increase glycolysis (sugar breakdown) in the peripheral parts of the body, which can then be utilized as energy, inhibit gluconeogenesis in the liver, antioxidants, anti-inflammatory effects, and inhibition of glucose absorption in the intestine. By decreasing

FBS levels and stabilizing them, HbA1c levels can also decrease over time. Berberis also contains anthocyanins that can reduce oxidative stress, which can damage pancreatic beta cells, as well as increase insulin release and adenosine monophosphate-activated protein kinase (AMPK) activation, which can increase glucose transport to muscle cells (Budianto et al., 2022). In addition, research by Yin et al., with the administration of Berberine at 500 mg three times a day, with a study duration of 12 weeks, showed a significant decrease in FBS levels (66.658 mg/dl), and a decrease in HbA1c (2%). This study proves that a dose of 500 mg 3 times a day is more effective in reducing FBS and HbA1c levels than that reported by Soltani et al. (2021) and Yin et al. (2008).

Nematollahi et al. (2022) also discussed berberis, but the intervention was combined with fenugreek and significantly reduced FBS and HbA1c levels. Both herbal plants had a synergistic effect on reducing the FBS and HbA1c levels. Berberis with berberine content can activate AMPK, inhibit gluconeogenesis in the liver, and have antioxidant and anti-inflammatory effects. Fenugreek has galactomannan content that can inhibit glucose absorption in the gastrointestinal tract and reduce postprandial blood glucose. Fenugreek also contains 4-hydroxy isoleucine, which stimulates pancreatic beta cells to produce insulin. The diosgenin content in this plant can also repair the beta cells in the liver. Berberis and fenugreek have different bioactive contents but have the same mechanism of action and the synergistic, synergism of antidiabetic properties of this plant combination are proven to be better than a single dose of one of the plants. The combination of berberis and fenugreek in this study also did not have significant side effects on the digestive system compared with single dosing. In a previous study by Hadi et al. (2020), who provided fenugreek intervention of 1500 mg per day for a duration of 8 weeks, and research by Soltani et al. (2021), who provided berberine intervention of 300 mg per day, the results showed that Hadi et al. (2020), succeeded in reducing FBS levels by 9.28 mg/dl, but could not reduce HbA1c levels (Hadi et al., 2020). Berberine at a dose of 1000 mg/day showed a significant decrease in FBS by 7.5 mg/dl and HbA1c by 0.4% (Soltani et al., 2021). Nematollahi et al. (2022), who tested the combination of fenugreek and berberine at a dose of 300 mg berberine and 200 mg fenugreek three times a day for 12 weeks, showed that this combination has a synergistic effect on each other.

Pan et al. (2021) discuss herbal medicine concoctions made from dried plant parts which are then called Jinlida. Jinlida has also been certified by the Food and Drug Administration Agency in China. Just like other herbal plants that can significantly reduce FBS and HbA1c levels, Jinlida also has the same mechanism in reducing FBS and HbA1c levels, by activating AMPK which inhibit gluconeogenesis in the liver, increase glucose absorption in peripheral tissues in muscles, and reduce insulin resistance by increasing lipid metabolism. Jinlida also has antioxidant effects that can reduce the risk of oxidative stress in the body which improves insulin resistance and also reconstructs pancreatic beta cells. Interestingly, of the four studies that can reduce FBS and HbA1c levels, only Jinlida can significantly increase the time in range (TIR), which is a sign that the proportion of glucose time in the normal range (Pan et al., 2021), was also proven correct by previous research by Lian et al. (2015), with the administration of a nine gram dose of Jinlida with a duration of 12 weeks. This intervention significantly reduced HbA1c levels by 0.53%. This shows that the duration of Jinlida intervention can increase the effect of reducing HbA1c and FBS levels because, in the study by Pan et al. (2021) with the same dose, but a different duration of 16 weeks, resulted in a decrease in HbA1c levels by 0.68% (Lian et al., 2015).

Pan et al. (2021) showed that in the placebo control group, there was a significant decrease in HbA1c, which was 0.45% ( $p < 0.01$ ). Most likely, this is due to a certain belief in Jinlida consumption drugs, and Lian's research also experienced something similar, namely, in the placebo group experiencing a significant decrease in HbA1c. According to Colagiuri et al. (2015), the placebo effect can be significant due to a psychological expectation mechanism or a belief that certain treatments can improve their health, and social effects can also increase this placebo effect; in this case, the Chinese people already believe in Jinlida herbal therapy, and in its application of course, other Chinese people will believe the effect. In addition, this placebo effect can increase the effectiveness of Jinlida in reducing FBS and HbA1c levels.

In the inclusion study, no studies stated that the results could reduce HbA1c levels alone, possibly because HbA1c is a biomarker that interprets blood glucose two to three months back, and if an herbal plant cannot reduce FBS levels, HbA1c levels cannot be controlled significantly (Sherwani et al., 2016). This reflects the nursing practice that herbal therapy can certainly be used as a complementary therapy to support the main treatment for T2DM. Herbal therapy can also be used in addition to some cases of patients who have strong cultural values and beliefs in herbal ingredients can also be given herbal therapy interventions *B. forficata*, berberis, a combination of berberis and fenugreek, and Jinlida.

### **No Significant Effect on the Decrease of FBS and HbA1c**

Research conducted by Memeriani et al. (2024), which discusses the intervention of *P. Atlantica oleoresin*, showed that it cannot significantly reduce FBS and HbA1c, because it only has anti-inflammatory and antioxidant properties provided by alpha-penine compounds; the concentration and bioavailability are not strong enough to reduce oxidative stress in the body and reduce glucose levels. The dose of only 500 g/day in this study is also one of the reasons for the absence of significance in the decrease in FBS and HbA1c, because in a previous study with the administration of *P. Atlantica oleoresin* at 10cc/4g three times a day can significantly reduce FBS levels, even though there is no significant reduction in HbA1c (Raziani et al., 2022). The absence of significance in reducing FBS and HbA1c levels in a study by Shin et al. (2020) study discussing *Scutellaria baicalensis* is due to the different effects and mechanisms possessed by *Scutellaria baicalensis*, by increasing the modulation of microbiota in the intestine, changes in microbiota in the intestine will improve glucose metabolism and reducing systemic inflammation through the production of short-chain fatty acids. In addition, the short study duration of eight weeks can also affect the decrease in HbA1c, because HbA1c is an interpretation of blood glucose two to three months back. Previous in vivo research by Ansari et al. (2020), who administered as much as 400 mg/kg *Scutellaria baicalensis* to rats, also showed no significant reduction in HbA1c.

### **Limitations**

The limitation of this systematic review is that it only uses international journals with RCT methods, so they do not use Indonesian language journals, and journals with quasi-experimental methods are not included.

### **Contribution To Global Nursing Practice**

Herbal therapy is a part of complementary therapy, which is a modality to help optimize the effectiveness of conventional therapy. In handling T2DM, nurses as caregivers can adjust herbal therapy according to the patient's health condition and consider contraindications to conventional treatment to maintain normal FBS and HbA1c levels

in the future. In addition, nurses can also act as educators in providing health education to patients and families about the benefits, risks, side effects, expected results, duration of treatment, interactions of alternative and complementary medicine with conventional medicine, and how to access information. Moreover, nurses, as managers, can consider the healthcare team as a collaboration to use herbal therapy for T2DM patients.

### **Conclusion**

Several herbal extracts can be used as complementary therapy in DM and have been shown to significantly reduce FBS and HbA1c levels such as *Bauhinia forficata*, berberis, a combination of berberis and fenugreek, and Jinlida. Herbal extracts of bittermelon and fenugreek can also significantly reduce FBS but cannot significantly reduce HbA1C. Herbal extracts such as *P. oleoresin* and *S. baicalensis* cannot reduce FBS and HbA1c levels. Nurses play a role as caregivers, educators, and managers in the issue of herbal therapy for T2DM patients. This systematic review could be used as evidence-based nursing to develop nursing interventions for nursing plans related to complementary nursing in herbal therapy for T2DM patients.

### **Author Contribution**

The authors have made substantial contributions to the conception and design of this study. IDPND, AMT, PFI, NAJR The authors took responsibility for data analysis (IDPND), interpretation (IDPND, AMT, PFI), and discussion of the results (IDPND, AMT, PFI, NAJR). The authors read and approved the final manuscript IDPND, AMT, PFI, NAJR

### **Conflict of Interest**

The authors declare that there are no conflicts of interest.

### **References**

- Annisa, R., Tania, M., & Kurnia, D. (2023). Menjaga kadar kolesterol dan tekanan darah untuk kesehatan jantung dengan konsumsi minuman herbal teh hijau. *Jurnal Inovasi Dan Pengabdian Masyarakat Indonesia*, 2(3):54-7. <https://doi.org/10.26714/jipmi.v2i3.131>
- Ansari, A., Bose, S., Lim, S.-K., Wang, J.-H., Choi, Y.-H., & Kim, H. (2020). Combination of *Scutellaria baicalensis* and metformin ameliorates diet-induced metabolic dysregulation in mice via the gut–liver–brain axis. *The American Journal of Chinese Medicine*, 48(6):1409-1433. <https://doi.org/10.1142/S0192415X2050069X>
- Budianto, R. E., Linawati, N. M., Arijana, I. G. K. N., Wahyuniari, I. A. I., & Wiryawan, I. G. N. S. (2022). Potensi senyawa fitokimia pada tumbuhan dalam menurunkan kadar glukosa darah pada diabetes melitus: Potential of phytochemical compounds in plants in lowering blood glucose levels in diabetes. *Jurnal Sains Dan Kesehatan*, 4(5), 548–556. <https://doi.org/10.25026/jsk.v4i5.1259>
- Chandler, J., McKenzie, J., Boutron, I., & Welch, V. (2016). *Cochrane methods 2016*. Wiley. <https://doi.org/10.1002/14651858.CD201601>
- Colagiuri, B., Schenk, L. A., Kessler, M. D., Dorsey, S. G., & Colloca, L. (2015). The placebo effect: From concepts to genes. *Neuroscience*, 307, 171–190. <https://doi.org/10.1016/j.neuroscience.2015.08.017>

- Hadi, A., Arab, A., Hajianfar, H., Talaei, B., Miraghajani, M., Babajafari, S., Marx, W., & Tavakoly, R. (2020). The effect of fenugreek seed supplementation on serum irisin levels, blood pressure, and liver and kidney function in patients with type 2 diabetes mellitus: A parallel randomized clinical trial. *Complementary Therapies in Medicine*, 49, 102315. <https://doi.org/10.1016/j.ctim.2020.102315>
- Harefa, D. (2020). Pemanfaatan hasil tanaman sebagai tanaman obat keluarga (TOGA). Madani: *Indonesian Journal of Civil Society*, 2(2), 28–36. <https://doi.org/10.35970/madani.v2i2.233>
- Hassani, S. S., Fallahi Arezodar, F., Esmaeili, S. S., & Gholami-Fesharaki, M. (2019). Effect of fenugreek use on fasting blood glucose, glycosylated hemoglobin, body mass index, waist circumference, blood pressure and quality of life in patients with T2DM diabetes mellitus: A Randomized, double-blinded, placebo-controlled clinical trials. *Galen Medical Journal*, 8, e1432. <https://doi.org/10.31661/gmj.v8i0.1432>
- Kharisma, K. P. M. D., & Ediati, J. S. (2023). Aktivitas ekstrak daun kelor (*Moringa Oleifera* Lamk.) terhadap mencit yang diinduksi glukosa sebagai obat alami antidiabetes. *Jurnal Ilmiah Farmasi Simplisia*, 3(2), 139–145. <https://doi.org/10.30867/jifs.v3i2.433>
- Kim, Y. J., Park, S., Yi, W., Yu, K.-S., Kim, T. H., Oh, T. J., Choi, J., & Cho, Y. M. (2014). Seasonal variation in hemoglobin A1c in korean patients with type 2 diabetes mellitus. *Journal of Korean Medical Science*, 29(4), 550–555. <https://doi.org/10.3346/jkms.2014.29.4.550>
- Kistianita, A. N., Yunus, M., & Gayatri, R. W. (2018). Analisis faktor risiko diabetes mellitus tipe 2 pada usia produktif dengan pendekatan WHO stepwise step 1 (Core/Inti) di puskesmas kendal kerep kota Malang. *Preventia: The Indonesian Journal of Public Health*, 3(1). <https://doi.org/10.17977/um044v3i1p85-108>
- Lestari, L., Zulkarnain, Z., & Sijid, S. A. (2021). Diabetes Melitus: Review etiologi, patofisiologi, gejala, penyebab, cara pemeriksaan, cara pengobatan dan cara pencegahan. *Prosiding Seminar Nasional Biologi*, 7(1). <https://doi.org/10.24252/psb.v7i1.24229>
- Lian, F., Tian, J., Chen, X., Li, Z., Piao, C., Guo, J., Ma, L., Zhao, L., Xia, C., Wang, C.-Z., Yuan, C.-S., & Tong, X. (2015). The efficacy and safety of Chinese herbal medicine Jinlida as add-on medication in type 2 diabetes patients ineffectively managed by metformin monotherapy: A double-blind, randomized, placebo-controlled, multicenter trial. *Plos One*, 10(6), e0130550. <https://doi.org/10.1371/journal.pone.0130550>
- Marwati, M., & Amidi, A. (2019). Pengaruh budaya, persepsi, dan kepercayaan terhadap eputusan pembelian obat herbal. *Jurnal Ilmu Manajemen*, 7(2), 168. <https://doi.org/10.32502/jimn.v7i2.1567>
- Megawati, F., Agustini, N. P. D., & Krismayanti, N. L. P. D. (2020). Studi retrospektif terapi antidiabetik pada penderita diabetes mellitus rawat inap di Rumah Sakit Umum Ari Canti periode 2018. *Jurnal Ilmiah Medicamento*, 6(1). <https://doi.org/10.36733/medicamento.v6i1.718>
- Nasution, F., Andilala, A., & Siregar, A. A. (2021). Faktor risiko kejadian diabetes mellitus. *Jurnal Ilmu Kesehatan*, 9(2), 94. <https://doi.org/10.32831/jik.v9i2.304>
- Peltzer, K., & Pengpid, S. (2019). The use of herbal medicines among chronic disease patients in Thailand: A cross-sectional survey. *Journal of Multidisciplinary Healthcare*, 12, 573–582. <https://doi.org/10.2147/JMDH.S212953>
- Plotnikoff, G. A., & LILLEHEI, A. S. (2022). Herbal medicines. *Complementary Therapies in Nursing: Promoting Integrative Care*, 378.

- Pinafo, M. S., Benedetti, P. R., Gaiotte, L. B., Costa, F. G., Schoffen, J. P. F., Fernandes, G. S. A., Chuffa, L. G. A., & Seiva, F. R. F. (2019). Effects of *Bauhinia forficata* on glycaemia, lipid profile, hepatic glycogen content and oxidative stress in rats exposed to Bisphenol A. *Toxicology Reports*, 6, 244–252. <https://doi.org/10.1016/j.toxrep.2019.03.001>
- Prameswari, S. A., Afifah, A., Pratiwi, M., Rahmania, F., Fatah, M. R., Ningsih, E. F., Maulana, K., & Khaerunnisa, G. E. N. (2024). The potential of herbal plant extracts as a complementary therapy in diabetes mellitus: a literature review. *JOS | Universitas Jenderal Soedirman. Medical and Health Journal*, 3(2). <https://doi.org/10.20884/1.mhj.2024.3.2.11344>
- Raziani, Y., Qadir, S. H., Hermis, A. H., Nazari, A., Othman, B. S., & Raziani, S. (2022). Pistacia atlantica as an effective remedy for diabetes: A randomised, double-blind, placebo-controlled trial. *Australian Journal of Herbal and Naturopathic Medicine*, 34(3), 118–124. <https://search.informit.org/doi/10.3316/informit.631353930549167>
- Sari, I. K., Nur, S. A., Morika, H. D., Sartiwi, W., & Hasrinal, H. (2023). Pengaruh pemberian jus Mengkudu terhadap penurunan tekanan darah pada pasien hipertensi di wilayah kerja Puskesmas Andalas. *Jurnal Kesehatan Saintika Meditory*, 6(1). <https://doi.org/10.30633/jsm.v6i1.1837>
- Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., Colagiuri, S., Guariguata, L., Motala, A. A., Ogurtsova, K., Shaw, J. E., Bright, D., & Williams, R. (2019). Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Research and Clinical Practice*, 157, 107843. <https://doi.org/10.1016/j.diabres.2019.107843>
- Sherwani, S. I., Khan, H. A., Ekhzaimy, A., Masood, A., & Sakharkar, M. K. (2016). Significance of HbA1c test in diagnosis and prognosis of diabetic patients. *Biomarker Insights*, 11, BMI.S38440. <https://doi.org/10.4137/BMI.S38440>
- Soltani, R., Ghanadian, S. M., Iraj, B., Homayouni, A., Esfahani, T. S., & Akbari, M. (2021). The effects of Berberis integerrima fruit extract on glycemic control parameters in patients with type 2 diabetes mellitus: A randomized controlled clinical trial. *Evidence-Based Complementary and Alternative Medicine*, 2021, 1–7. <https://doi.org/10.1155/2021/5583691>
- Souza, I. D. D., Ramos, E. M., Reis, F. J. M. D., Vieira, H. M. R., Ramos, I. B., Teodoro, P. A. M., Rosa, A. C. G., Abreu, A. C. D., Lima, J. P., Facco, G. G., & Nascimento, V. A. D. (2020). A case report of type 2 diabetes mellitus with adjuvant use of *Bauhinia forficata* in pharmacological treatment. *European Journal of Medicinal Plants*, 49–56. <https://doi.org/10.9734/ejmp/2020/v31i1530324>
- Yin, J., Xing, H., & Ye, J. (2008). Efficacy of berberine in patients with type 2 diabetes mellitus. *Metabolism*, 57(5), 712–717. <https://doi.org/10.1016/j.metabol.2008.01.013>