



# Exploring the Antidiabetic Potential of Unani Medicine: A Comprehensive Review

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## Abstract:

Diabetes mellitus, characterized by hyperglycemia, is a chronic metabolic disorder affecting millions worldwide. Despite advancements in conventional medicine, interest in herbal remedies for diabetes management persists due to their perceived efficacy and minimal side effects. Firstly, the molecular mechanisms underlying diabetes pathogenesis and the rationale for utilizing herbs as therapeutic agents are elucidated in Unani medicine. Unani medicine, an ancient system of healing, offers a rich repository of natural remedies for various ailments, including diabetes mellitus. This comprehensive review aims to explore the antidiabetic potential of Unani medicine through an analysis of its principles, herbs, formulations, and therapeutic approaches. We systematically examine the literature on Unani pharmacology and traditional knowledge to identify plants and herbal formulations with documented antidiabetic properties. This article also highlights the diverse mechanisms of action employed by Unani medicines, including enhancement of insulin secretion, modulation of glucose metabolism, and attenuation of diabetic complications. Additionally, we discuss the role of lifestyle modifications, dietary interventions, and holistic approaches advocated by

Unani practitioners in diabetes management. Furthermore, the review addresses the safety profile, challenges, and future perspectives of integrating Unani medicine into mainstream diabetes care. Overall, this review underscores the potential of Unani medicine as a valuable adjunctive therapy for diabetes management, emphasizing the need for further research and clinical validation to harness its full therapeutic benefits.

**Keywords:** Diabetes; Unani Medicine; Medicinal plants; Herbal Medicine; Anti-diabetic effect.

## **Introduction:**

Diabetes mellitus stands as one of the most prevalent and challenging chronic metabolic disorders worldwide, characterized by hyperglycemia resulting from defects in insulin secretion, action, or both.<sup>1</sup> Its multifactorial etiology and diverse manifestations pose significant healthcare burdens, impacting individuals' quality of life and straining healthcare systems globally.<sup>2</sup> While conventional pharmaceutical interventions play a crucial role in diabetes management, interest in complementary and alternative medicine (CAM) approaches, including traditional systems like Unani Medicine and herbal remedies, has surged in recent decades.<sup>3</sup> Unani Medicine, an ancient holistic healing system with roots tracing back to Greco-Arabic traditions, offers a unique perspective on health and disease.<sup>4</sup> Central to Unani philosophy is the concept of balance and harmony among the four humors (blood, phlegm, yellow bile, and black bile) and the body's natural constitution (Mizaj).<sup>5</sup> Unani physicians diagnose and treat diseases by restoring this balance through individualized interventions encompassing pharmacotherapy, dietetics, regimental therapy, and surgery.<sup>6</sup> Herbal medicine constitutes a cornerstone of Unani pharmacotherapy, with a rich repository of plant-based formulations aimed at managing various ailments, including diabetes.<sup>7</sup> Herbal medicine, characterized by the use of plant-derived substances for therapeutic purposes, has been an integral component of healthcare practices across cultures for millennia.<sup>8</sup> Herbal remedies offer a diverse array of bioactive compounds with potential pharmacological effects, including antidiabetic properties. Plants like bitter melon, fenugreek, cinnamon, and gymnema have garnered considerable attention for their purported efficacy in lowering blood glucose levels and improving insulin sensitivity.<sup>9</sup> These botanical agents act through various mechanisms, including enhancing insulin secretion, inhibiting glucose absorption, and modulating insulin signaling pathways.<sup>10</sup>

Despite the growing interest in herbal medicine and Unani approaches for diabetes management, several challenges persist.<sup>11</sup> Standardization of herbal preparations, elucidation of their mechanisms of action,

validation through rigorous clinical trials, and integration with conventional therapies remain areas of ongoing research and debate.<sup>12</sup> Furthermore, the potential for herb-drug interactions and variability in bioactive constituents underscore the need for caution and informed decision-making.<sup>13</sup> This article sets the stage for a comprehensive exploration of the antidiabetic potential of herbs within the context of Unani Medicine, highlighting the synergies and challenges inherent in integrating traditional wisdom with modern healthcare paradigms.<sup>14</sup> Through interdisciplinary collaboration and evidence-based practice, the quest for effective, safe, and holistic approaches to diabetes care continues, with herbal medicine and Unani therapeutics poised to play pivotal roles in this endeavor.<sup>15</sup>

Diabetes affects an estimated 537 million adults worldwide between the age of 20 to 79 (10.5% of all adults in this age range).<sup>16</sup> By 2030, 643 million people will have diabetes globally, increasing to 783 million by 2045. According to the IDF 10th edition, the incidence of diabetes has been rising in South-East Asia (SEA) nations for at least 20 years, and current estimates have outperformed all previous forecasts.<sup>17</sup> However, keep in mind that these statistics might have changed since then due to various factors such as advancements in healthcare, changes in lifestyle, and improvements in disease management.<sup>18</sup> For the most accurate and up-to-date information, it's best to refer to recent reports from organizations like the IDF or the World Health Organization (WHO).<sup>19</sup>

Diabetes can affect individuals of any gender, but certain types of diabetes may have different prevalence rates among males and females.<sup>20</sup> Type 1 diabetes is an autoimmune condition where the body's immune system mistakenly attacks insulin-producing cells in the pancreas. It can occur at any age but is often diagnosed in children, teenagers, or young adults. Historically, there has been a slight predominance of type 1 diabetes among males compared to females.<sup>21</sup> Type 2 diabetes is the most common form of diabetes, characterized by insulin resistance and relative insulin deficiency. It often develops in adults but is increasingly diagnosed in children and adolescents due to rising obesity rates.<sup>22</sup> Historically, type 2 diabetes has shown a slightly higher prevalence among males, but this gap has been narrowing in recent years.<sup>23</sup>

Gestational Diabetes occurs during pregnancy and typically resolves after childbirth. While it affects both genders indirectly (as it occurs in pregnant individuals), it's more prevalent in females.<sup>24</sup> Other Types of diabetes are also other less common types of diabetes, such as monogenic diabetes (e.g., maturity-onset

diabetes of the young), which can occur in both males and females but may have different prevalence rates depending on the specific subtype.<sup>25</sup> While there may be variations in the prevalence of different types of diabetes among genders, it's important to note that factors such as genetics, lifestyle, and environmental influences play significant roles in the development of diabetes, regardless of gender.<sup>26</sup>

### **Etiologies of Diabetes:**

Understanding the underlying causes of diabetes is crucial for developing effective prevention strategies, treatment approaches, and lifestyle interventions aimed at managing the condition and reducing its complications.<sup>27</sup> Additionally, early detection through screening and regular monitoring is essential for optimal management and improved outcomes for individuals with diabetes.<sup>28</sup> The etiology, or causes, of diabetes can vary depending on the type of diabetes:

**Type 1 Diabetes (Autoimmune Destruction):** Type 1 diabetes is primarily an autoimmune disorder where the body's immune system mistakenly attacks and destroys the insulin-producing beta cells in the pancreas. The exact cause of this autoimmune response is not fully understood but likely involves genetic predisposition and environmental triggers, such as viral infections or certain dietary factors.<sup>29</sup>

**Type 2 Diabetes (Insulin Resistance):** Type 2 diabetes is characterized by insulin resistance, where the body's cells become less responsive to the effects of insulin. While genetics play a significant role, lifestyle factors such as obesity, sedentary lifestyle, unhealthy diet (high in refined carbohydrates and sugars), and aging contribute to insulin resistance. Chronic inflammation and certain hormonal imbalances may also play a role.<sup>30</sup>

**Gestational Diabetes (Hormonal Changes):** Gestational diabetes occurs during pregnancy when hormonal changes and weight gain can make cells more resistant to insulin. This type of diabetes usually resolves after childbirth, but it increases the risk of developing type 2 diabetes later in life. Genetics, obesity, and a history of gestational diabetes in previous pregnancies are risk factors.<sup>31</sup>

**Other Specific Types:**

**Genetic Mutations:** Some rare forms of diabetes, such as maturity-onset diabetes of the young (MODY) and neonatal diabetes, result from specific genetic mutations affecting insulin production or function.<sup>32,33</sup>

**Pancreatic Disorders:** Diseases or conditions that damage the pancreas, such as pancreatitis, cystic fibrosis, or pancreatic cancer, can impair insulin production and lead to diabetes.<sup>34</sup>

**Medications and Chemicals:** Certain medications, such as glucocorticoids, antipsychotics, and some HIV medications, can increase blood sugar levels and contribute to the development of diabetes. Chemicals such as those found in pesticides and other environmental toxins may also play a role.<sup>35,36</sup>

**Clinical features of diabetes:**

These clinical features can vary in severity and presentation depending on the type of diabetes, individual factors such as age and overall health, and how well the condition is managed.<sup>37</sup> It's essential to consult a healthcare professional for proper diagnosis, treatment, and management of diabetes.<sup>38</sup> Diabetes is a chronic condition that affects how your body uses blood sugar (glucose). Here are some of the clinical features associated with diabetes:

**Polyuria:** Increased urination is a common symptom of diabetes. Excess glucose in the blood leads to the kidneys working harder to filter and absorb the glucose. This results in increased urine production.<sup>39</sup>

**Polydipsia:** Excessive thirst is another hallmark symptom. The body tries to compensate for the fluid lost through increased urination by increasing thirst.<sup>40</sup>

**Polyphagia:** Increased hunger can occur, especially in type 1 diabetes, where the body lacks insulin, the hormone necessary for glucose uptake by cells. Cells are essentially starving, triggering hunger signals.<sup>41</sup>

**Weight loss:** Despite increased hunger, unexplained weight loss may occur in individuals with type 1 diabetes due to the body breaking down muscle and fat for energy because glucose can't enter cells without insulin.<sup>42</sup>

**Fatigue:** Diabetes can cause fatigue due to inefficient glucose metabolism, leading to decreased energy production in cells.<sup>43</sup>

Blurred vision: High blood sugar levels can cause fluid to be pulled from the lenses of your eyes, affecting your ability to focus, leading to blurry vision.<sup>44</sup>

Slow wound healing: Diabetes can impair the body's ability to heal wounds due to poor circulation and compromised immune function.<sup>45</sup>

Numbness or tingling: Over time, high blood sugar levels can damage nerves, leading to peripheral neuropathy, which can cause numbness, tingling, or burning sensations, usually starting in the feet and hands.<sup>46</sup>

Recurrent infections: High blood sugar levels can weaken the immune system, making individuals with diabetes more susceptible to infections, especially urinary tract infections, yeast infections, and skin infections.<sup>47</sup>

Gestational complications: Pregnant individuals with gestational diabetes may experience complications such as high birth weight in babies, preterm birth, and preeclampsia.<sup>48</sup>

### **Complication of Diabetes:**

These complications highlight the importance of early diagnosis, aggressive management of diabetes, and comprehensive healthcare to prevent or delay the onset of complications and improve overall quality of life for individuals with diabetes.<sup>49</sup> Regular monitoring, lifestyle modifications (such as maintaining a healthy diet, exercising regularly, and avoiding tobacco use), and adherence to prescribed medications are essential components of diabetes management.<sup>50</sup> Diabetes can lead to various complications that affect multiple organ systems in the body. These complications can arise due to prolonged periods of uncontrolled high blood sugar levels, as well as other factors such as insulin resistance, inflammation, and abnormal lipid metabolism.<sup>51</sup>

Some common complications of diabetes include:

Cardiovascular Disease: Diabetes significantly increases the risk of heart disease and stroke. High blood sugar levels can damage blood vessels over time, leading to atherosclerosis (hardening and narrowing of the arteries), hypertension (high blood pressure), and dyslipidemia (abnormal levels of cholesterol and triglycerides), all of which contribute to cardiovascular complications.<sup>52</sup>

**Nephropathy (Kidney Disease):** Diabetes is a leading cause of chronic kidney disease (diabetic nephropathy). High blood sugar levels and hypertension can damage the tiny blood vessels in the kidneys, impairing their ability to filter waste products from the blood properly. This can eventually progress to kidney failure, requiring dialysis or kidney transplantation.<sup>53</sup>

**Neuropathy (Nerve Damage):** Diabetes can cause damage to the nerves throughout the body, leading to various forms of neuropathy. Peripheral neuropathy affects the nerves in the extremities (hands and feet), causing symptoms such as numbness, tingling, burning sensations, and pain. Autonomic neuropathy affects the nerves that control involuntary bodily functions, leading to digestive problems, sexual dysfunction, bladder dysfunction, and cardiovascular issues.<sup>54</sup>

**Retinopathy (Eye Disease):** Diabetes is a leading cause of vision loss and blindness in adults. High blood sugar levels can damage the small blood vessels in the retina (diabetic retinopathy), leading to vision problems such as diabetic macular edema, proliferative retinopathy, and eventually, blindness if left untreated.<sup>55</sup>

**Foot Complications:** Diabetes increases the risk of foot problems due to poor circulation and nerve damage. Peripheral neuropathy can reduce sensation in the feet, making it difficult to detect injuries, infections, or ulcers. Poor circulation can slow wound healing, leading to chronic ulcers and, in severe cases, foot or leg amputation.<sup>56</sup>

**Skin Complications:** Diabetes can affect the skin in various ways, including dryness, itching, fungal infections (such as yeast infections), bacterial infections (such as cellulitis), and slow wound healing. High blood sugar levels provide an ideal environment for bacteria and fungi to thrive.<sup>57</sup>

**Gastroparesis:** Diabetes can affect the nerves that control the stomach muscles, leading to delayed emptying of the stomach contents into the small intestine (gastroparesis). This can cause symptoms such as nausea, vomiting, bloating, heartburn, and fluctuations in blood sugar levels.<sup>58</sup>

**Mental Health Issues:** Diabetes is associated with an increased risk of depression, anxiety, and other mental health disorders. Managing a chronic condition like diabetes can be stressful and may impact emotional well-being. Additionally, fluctuations in blood sugar levels can affect mood and cognitive function.<sup>59</sup>

**Management of diabetes:**

Remember, diabetes management is highly individualized. Work closely with your healthcare team to develop a personalized plan that meets your needs and helps you live a healthy, fulfilling life despite having diabetes. Managing diabetes involves a combination of lifestyle changes, medication (if necessary), and regular monitoring.<sup>60</sup>

**Healthy Eating:** A balanced diet is crucial. Focus on whole grains, fruits, vegetables, lean proteins, and healthy fats. Limit refined carbohydrates, sugary drinks, and high-fat foods.<sup>61</sup>

**Regular Exercise:** Physical activity helps control blood sugar levels, improves insulin sensitivity, and contributes to weight management. Aim for at least 30 minutes of moderate-intensity exercise most days of the week.<sup>62</sup>

**Weight Management:** Maintaining a healthy weight is important for managing diabetes. If you're overweight, even a modest weight loss can improve blood sugar levels.<sup>63</sup>

**Medication:** Depending on the type and severity of diabetes, medication may be necessary. This could include insulin injections, oral medications to lower blood sugar levels, or other drugs to manage associated conditions like high blood pressure or high cholesterol.<sup>64</sup>

**Blood Sugar Monitoring:** Regular monitoring helps you understand how your lifestyle choices and medication are affecting your blood sugar levels. This information allows you to make necessary adjustments.<sup>65</sup>

**Regular Medical Check-ups:** Regular visits to your healthcare provider are essential for monitoring your diabetes and overall health. They can also provide guidance on managing your condition effectively.<sup>66</sup>

**Foot Care:** Diabetes can affect circulation and nerve function, increasing the risk of foot problems. Check your feet regularly for any cuts, sores, or signs of infection, and seek medical attention if you notice anything unusual.<sup>67</sup>

**Stress Management:** Stress can affect blood sugar levels, so it's important to find healthy ways to manage stress, such as relaxation techniques, exercise, hobbies, or talking to a counselor.<sup>68</sup>



Quit Smoking: Smoking can worsen diabetes complications, such as heart disease and circulation problems. If you smoke, quitting is essential for your overall health.<sup>69</sup>

Education and Support: Educate yourself about diabetes and seek support from healthcare professionals, support groups, or online communities. Understanding your condition and connecting with others facing similar challenges can make managing diabetes easier.<sup>70</sup>

### **Antidiabetic Effect of Medicinal Plants:**

The antidiabetic properties of certain medicinal plants have been studied extensively, offering promising avenues for managing diabetes. While these medicinal plants show promise in managing diabetes, it's essential to consult with a healthcare professional before incorporating them into your treatment regimen, especially if you're already taking medication for diabetes.<sup>71</sup> Additionally, more research is needed to fully understand their mechanisms of action and optimal dosages for therapeutic benefits.

Gymnema Sylvestre: Gymnema Sylvestre, also known as Gurmar in Hindi, is a woody climbing shrub native to India, Africa, and Australia. It has been used in traditional Ayurvedic medicine for centuries, particularly for its potential antidiabetic properties.<sup>72</sup>

Stimulating Insulin Production: Gymnema Sylvestre contains compounds known as gymnemic acids. These compounds may stimulate insulin production by the pancreas, helping to lower blood sugar levels in individuals with diabetes.<sup>73</sup>

Reducing Sugar Absorption: Gymnemic acids in Gymnema Sylvestre may also block sugar absorption in the intestines. By inhibiting the absorption of glucose from the digestive tract, Gymnema Sylvestre can help prevent spikes in blood sugar levels after meals.<sup>74</sup>

Improving Insulin Sensitivity: Some studies suggest that Gymnema Sylvestre may improve insulin sensitivity, allowing cells to better respond to insulin and take up glucose from the bloodstream. This can help lower overall blood sugar levels and reduce the risk of complications associated with diabetes.

**Regenerating Pancreatic Beta Cells:** There is some evidence to suggest that *Gymnema Sylvestre* may have regenerative effects on pancreatic beta cells, which are responsible for producing insulin. By promoting the regeneration of these cells, *Gymnema Sylvestre* could potentially enhance insulin production and secretion.

**Reducing Sweet Cravings:** *Gymnema Sylvestre* is often referred to as the "sugar destroyer" because of its ability to temporarily suppress the taste of sweetness. Some research suggests that chewing *Gymnema Sylvestre* leaves or taking supplements containing its extracts may reduce cravings for sweet foods, which can be beneficial for individuals with diabetes trying to manage their blood sugar levels.<sup>75</sup>

#### **Antidiabetic effect of *Momordica charantia*:**

*Momordica charantia*, commonly known as bitter melon or bitter gourd, is a tropical vine widely cultivated for its edible fruit, which has a distinct bitter taste. In addition to its culinary uses, bitter melon has a long history of use in traditional medicine, particularly in Asia, Africa, and the Caribbean, for its potential health benefits, including its antidiabetic effects.<sup>76</sup>

**Improving Insulin Sensitivity:** Bitter melon contains compounds that may help improve insulin sensitivity, allowing cells to more effectively respond to insulin and uptake glucose from the bloodstream. This can help lower blood sugar levels and reduce insulin resistance, a key feature of type 2 diabetes.<sup>77</sup>

**Stimulating Insulin Secretion:** Some studies suggest that bitter melon may stimulate insulin secretion from the pancreas, leading to increased insulin levels in the bloodstream. This can help facilitate glucose uptake by cells and lower blood sugar levels, particularly after meals.<sup>78</sup>

**Inhibiting Glucose Absorption:** Bitter melon may also inhibit the absorption of glucose from the intestines, reducing the amount of sugar that enters the bloodstream after eating. By slowing down the digestion and absorption of carbohydrates, bitter melon can help prevent spikes in blood sugar levels.<sup>79</sup>

**Reducing Inflammation:** Chronic inflammation is often associated with insulin resistance and type 2 diabetes. Bitter melon contains anti-inflammatory compounds that may help reduce inflammation in the body, potentially improving insulin sensitivity and glucose metabolism.<sup>80</sup>

**Antioxidant Activity:** Bitter melon is rich in antioxidants, including vitamins C and E, flavonoids, and phenolic compounds. These antioxidants help neutralize harmful free radicals in the body, which can

contribute to oxidative stress and damage to cells and tissues. By reducing oxidative stress, bitter melon may help protect pancreatic beta cells and improve insulin secretion.

**Regulating Gluconeogenesis:** Bitter melon may also regulate gluconeogenesis, the process by which the liver produces glucose from non-carbohydrate sources, such as amino acids and fatty acids. By modulating gluconeogenesis, bitter melon can help maintain stable blood sugar levels, particularly during fasting periods.<sup>81</sup>

### **Antidiabetic effect of *Trigonella foenum-graecum*:**

*Trigonella foenum-graecum*, commonly known as fenugreek, is an herb native to the Mediterranean region, southern Europe, and western Asia. It has been used for centuries in traditional medicine, particularly in Ayurveda and traditional Chinese medicine, for various health conditions, including its potential antidiabetic effects.<sup>82</sup>

**Improving Insulin Sensitivity:** Fenugreek seeds are rich in soluble fiber, which can help slow down the absorption of carbohydrates and sugars in the digestive tract. This can lead to more stable blood sugar levels and improved insulin sensitivity, allowing cells to better respond to insulin and uptake glucose from the bloodstream.<sup>83</sup>

**Enhancing Insulin Secretion:** Some studies suggest that fenugreek may stimulate insulin secretion from the pancreas, leading to increased insulin levels in the bloodstream. This can help facilitate glucose uptake by cells and lower blood sugar levels, particularly after meals.<sup>84</sup>

**Reducing Glycemic Response:** Fenugreek may also help reduce the glycemic response to meals, which is the increase in blood sugar levels that occurs after eating. By slowing down the digestion and absorption of carbohydrates, fenugreek can help prevent spikes in blood sugar levels and improve overall glycemic control.<sup>85</sup>

**Inhibiting Glucose Absorption:** Fenugreek seeds contain compounds, such as galactomannan, which may inhibit the absorption of glucose from the intestines. This can help reduce the amount of sugar that enters the bloodstream after eating and lower postprandial (after-meal) blood sugar levels.

**Increasing Glucose Utilization:** Fenugreek may enhance glucose utilization by cells, promoting the uptake and metabolism of glucose for energy production. This can help lower blood sugar levels and reduce the risk of hyperglycemia (high blood sugar).<sup>86</sup>

**Anti-inflammatory and Antioxidant Effects:** Fenugreek contains various bioactive compounds, including flavonoids and polyphenols, with anti-inflammatory and antioxidant properties. These compounds help reduce inflammation and oxidative stress in the body, which are associated with insulin resistance and diabetes complications.<sup>87</sup>

Overall, fenugreek shows promise as a natural remedy for diabetes, particularly for improving insulin sensitivity, lowering blood sugar levels, and reducing the risk of complications associated with diabetes. However, more research is needed to fully understand its mechanisms of action and optimal dosages for therapeutic benefits. Individuals with diabetes should consult with their healthcare provider before using fenugreek or any other herbal supplement to ensure it is safe and appropriate for their specific condition.

### **Conclusion:**

The antidiabetic potential of medicinal plants presents a promising avenue for the management and treatment of diabetes mellitus. Through extensive research, numerous plant-derived compounds have demonstrated significant efficacy in lowering blood glucose levels, improving insulin sensitivity, and mitigating diabetic complications. These natural remedies offer a holistic approach to diabetes care, often with fewer adverse effects compared to conventional medications. However, further studies are warranted to elucidate the mechanisms of action, optimize dosages, and assess long-term safety. Integrating medicinal plants into mainstream diabetes management protocols could provide complementary therapeutic options and enhance overall patient outcomes. Embracing the wealth of nature's pharmacopoeia in the fight against diabetes holds immense potential for the development of novel and effective therapeutic interventions.

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