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DOI: <https://doi.org/>**Research Article****KMF Publishers**
www.kmf-publishers.com/jbpph/OPEN  ACCESS**Integrating Unani Medicine in the Management of Type 2 Diabetes Mellitus****Zulfiqar Qadrie¹, Mudasir Maqbool^{2*}**¹Department of Pharmacology, Government Medical College Baramulla, Jammu and Kashmir, India²Department of Pharmaceutical Sciences, University of Kashmir, Hazratbal, Jammu and Kashmir, India

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ABSTRACT

Type 2 Diabetes Mellitus (T2DM) is a prevalent chronic condition that poses significant health challenges globally. Despite advances in conventional medicine, managing T2DM remains complex, with patients often experiencing side effects from long-term pharmaceutical treatments. Unani medicine, a traditional system with roots in ancient Greek and Islamic healing practices, has garnered attention for its potential role in managing type 2 diabetes mellitus (T2DM). Unani therapies focus on balancing the body's humours—blood, phlegm, yellow bile, and black bile—using natural remedies derived from herbs, minerals, and animal products. These formulations aim to regulate blood sugar levels, enhance insulin sensitivity, and address the underlying causes of diabetes, such as metabolic imbalances and inflammation. Key Unani herbs, such as Jamun (*Syzygium cumini*), Methi (*Trigonella foenum-graecum*), and Karela (*Momordica charantia*), are noted for their hypoglycemic and anti-inflammatory properties. Additionally, Unani dietary guidelines emphasise the importance of a balanced diet, regular exercise, and maintaining overall bodily harmony, complementing pharmacological interventions. Preliminary clinical studies and anecdotal evidence suggest that Unani medicine may offer a promising adjunctive therapy, enhancing glycemic control, reducing complications, and improving the quality of life for patients with type 2 diabetes mellitus (T2DM).

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INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) has emerged as a major global health concern, affecting millions of people worldwide. The prevalence of type 2 diabetes mellitus (T2DM) has seen an alarming rise in recent decades, reflecting the impact of urbanisation, sedentary lifestyles, and unhealthy dietary habits on human health. As a chronic metabolic disorder characterised by persistent hyperglycemia, type 2 diabetes mellitus (T2DM) results from a combination of insulin resistance and impaired pancreatic β -cell function. This multifactorial condition has far-reaching implications, not only for the affected individuals but also for healthcare systems globally (1). According to the International Diabetes Federation (IDF), the number of adults living with diabetes has surpassed 500 million globally, with T2DM accounting for approximately 90% of all cases. This surge in prevalence is not confined to high-income countries. Still, it is increasingly observed in low- and middle-income nations, where urbanisation and changes in lifestyle patterns have dramatically altered traditional diets and physical activity levels (2). The associated healthcare costs and economic burdens are substantial, with billions spent annually on treatment, management, and complications arising from the disease. T2DM is clinically characterised by chronic hyperglycemia, often accompanied by classic symptoms such as excessive thirst (polydipsia), frequent urination (polyuria), and unexplained weight loss. Beyond these immediate symptoms, T2DM is a leading cause of severe long-term complications, including cardiovascular disease, kidney disease, neuropathy, and retinopathy (3). Cardiovascular disease significantly increases the risk of heart

attacks, strokes, and other cardiovascular conditions, making it a major contributor to global mortality. Diabetic nephropathy is a common complication, often leading to end-stage renal disease (ESRD) and the need for dialysis or kidney transplantation. Chronic high blood sugar levels can damage nerves, resulting in sensory loss, pain, and in severe cases, limb amputation. Type 2 diabetes mellitus (T2DM) is also a leading cause of preventable blindness, resulting from damage to the retinal blood vessels. These complications not only reduce the quality of life but also impose significant economic and social burdens on patients and their families (4). The management of T2DM has traditionally relied on lifestyle modifications, oral hypoglycemic agents, and insulin therapy. While these interventions have been effective in controlling blood glucose levels, they are not without limitations. Long-term use of medications, such as sulfonylureas and insulin, is associated with side effects, including weight gain, hypoglycemia, and gastrointestinal discomfort. Despite advancements in pharmacotherapy, a substantial proportion of patients fail to achieve optimal glycemic targets, leading to disease progression and complications. Conventional therapies often focus on blood glucose control without addressing the underlying causes of type 2 diabetes mellitus (T2DM), such as chronic inflammation and oxidative stress. These challenges underscore the need for alternative and complementary approaches that can address the multifaceted nature of type 2 diabetes mellitus (T2DM) (5). Complementary and alternative medicine (CAM) systems, including Unani medicine, have gained recognition for their holistic approach to health and disease management. Unani medicine, with its roots in

ancient Greek and Islamic traditions, offers a unique perspective on Type 2 diabetes mellitus (T2DM) by focusing on restoring balance within the body's humoral system. According to Unani principles, T2DM results from an imbalance of phlegm (balgham) and black bile (sawdā'), which disrupt metabolic processes and lead to the characteristic symptoms of diabetes. Unani medicine's therapeutic strategies include the use of natural formulations derived from plants such as Jamun (*Syzygium cumini*), Methi (*Trigonella foenum-graecum*), and Karela (*Momordica charantia*) to regulate blood sugar levels and improve insulin sensitivity (6). It also emphasises dietary modifications, advocating for a balanced diet low in sugars and high in fibre to correct humoral imbalances and support overall health. Recommendations for regular physical activity and stress management are integral to enhance metabolic efficiency and prevent disease progression. The integration of Unani medicine with conventional treatments has the potential to address some of the limitations of modern therapies. By targeting the root causes of T2DM, such as inflammation and metabolic dysregulation, Unani interventions can complement pharmacological therapies, reduce the need for medications, and improve patient outcomes. The global burden of type 2 diabetes mellitus (T2DM) necessitates innovative, integrative approaches to its prevention and management. Unani medicine, with its holistic philosophy and reliance on natural remedies, represents a promising adjunct to conventional therapies. By addressing both the symptoms and underlying causes of Type 2 Diabetes Mellitus

(T2DM), Unani medicine has the potential to enhance glycemic control, reduce complications, and improve the quality of life for millions of patients worldwide. However, rigorous scientific validation and standardised protocols are essential to harness its benefits in contemporary healthcare (7) fully.

HISTORICAL BACKGROUND OF UNANI MEDICINE

Unani medicine, often referred to as Greco-Arabic medicine, traces its origins to the ancient Greek system of medicine, which was subsequently refined, developed, and expanded by Islamic scholars during the medieval period. This integrative system of healthcare is grounded in the philosophical and empirical knowledge of the ancient Greeks, particularly in the works of pioneers such as Hippocrates and Galen (2, 8). These foundational figures introduced the humoral theory, a concept that emphasises the importance of balancing the body's four humours: blood (dam), phlegm (balgham), yellow bile (safra), and black bile (sawdā'). This theory posits that health results from the equilibrium of these humours, while any imbalance leads to disease. The role of physicians in Unani medicine is to diagnose such imbalances and restore harmony within the body, a perspective that is remarkably holistic and patient-centred (9).

The development of Unani medicine reached its zenith during the Islamic Golden Age, when scholars such as Avicenna (Ibn Sina), Rhazes (Al-Razi), and Abulcasis (Al-Zahrawi) made

significant contributions to its knowledge base. Avicenna's monumental work, "The Canon of Medicine," synthesised Greek philosophy with Islamic principles, serving as a cornerstone of medical education for centuries in both the East and the West. Al-Razi, often referred to as the "father of paediatrics," introduced detailed clinical observations and emphasised the importance of evidence-based medicine, while Al-Zahrawi's contributions to surgery and medical instruments remain influential to this day. These scholars infused the Greek humoral theory with their observations, empirical findings, and ethical considerations, creating a robust framework for diagnosis and treatment that addressed both physical and psychological dimensions of health (9, 10).

The core concept of Unani medicine revolves around the balance of the four humours, which are thought to govern both physiological and pathological processes. Each humour is associated with specific qualities—blood with hot and moist, phlegm with cold and wet, yellow bile with hot and dry, and black bile with cold and dry. These qualities influence an individual's temperament (*mizaj*), which is a foundational principle in Unani medicine. Temperaments are categorised into nine types, ranging from balanced to extreme forms of hot, cold, moist, or dry. A person's temperament determines their susceptibility to specific diseases, dietary preferences, and overall health. Physicians use this understanding to tailor treatments, making Unani medicine inherently personalised (11, 12). Unani medicine employs a comprehensive and

integrative approach to health, combining herbal remedies, dietary modifications, physical activity, detoxification techniques, and spiritual practices to promote overall well-being. Its holistic philosophy recognises the interconnectedness of the mind, body, and environment, emphasising prevention as much as cure. This makes it a dynamic and adaptable system of medicine that addresses not only the symptoms of illness but also its root causes. Herbal remedies form the backbone of Unani therapeutics. Natural resources, including plants, minerals, and animal products, are utilised to formulate products that are believed to restore humoral balance (13, 14). For instance, plants such as *Asparagus racemosus* (*Shatavari*), *Nigella sativa* (*Kalonji*), and *Terminalia chebula* (*Haritaki*) are frequently used due to their diverse pharmacological properties, including anti-inflammatory, antioxidant, and immunomodulatory effects. These remedies are prepared in various forms, such as powders, decoctions, syrups, and oils, to suit the patient's specific needs and the nature of their ailment. Unlike conventional medicine, which often isolates active compounds, Unani practitioners use whole plants or their parts to preserve the synergy of bioactive components, aligning with its holistic ethos (14, 15).

Dietary guidelines in Unani medicine are equally critical, as food is considered both a source of nourishment and a therapeutic tool. Physicians prescribe diets based on the patient's temperament and the nature of their ailment. Foods are classified according to their inherent

qualities (hot, cold, moist, or dry) and their effects on the body. For example, individuals with a cold and moist temperament may be advised to consume foods with hot and dry qualities to counterbalance their inherent humoral state. Specific dietary regimens are also prescribed during different seasons, reflecting the sensitivity of Unani medicine to environmental influences on health (16). Additionally, certain foods, such as honey, garlic, and pomegranate, are considered “functional foods” due to their therapeutic properties and are commonly incorporated into treatment plans. Physical activity is another integral component of Unani medicine. Exercise is considered essential for maintaining humoral balance and promoting overall well-being. Unani texts categorise exercises into various types based on their intensity, duration, and effects on the body. For example, moderate exercises, such as walking or yoga-like movements, are recommended for general health maintenance, while specific physical activities may be prescribed for individuals with certain humoral imbalances (17). Physicians also consider the patient’s age, temperament, and current health status when recommending an exercise regimen, ensuring a personalised approach. Detoxification techniques, known as “Ilaj Bil Tadbeer” (Regimental Therapy), play a vital role in Unani medicine. These therapies aim to eliminate toxins and excess humours from the body, thereby restoring balance and preventing disease progression (18). Standard techniques include cupping (Hijama), venesection (Fasd), leech therapy, and steam baths. Each method is chosen

based on the patient’s condition and the type of humoral imbalance that has been diagnosed. For instance, cupping is often used to treat conditions associated with excessive black bile, such as chronic pain and depression. At the same time, venesection is employed for diseases linked to an overabundance of blood, such as hypertension (19).

Spiritual practices and mental health are also given due importance in Unani medicine, reflecting its holistic perspective. Islamic principles, which heavily influenced the development of Unani medicine, emphasise the role of mental and spiritual well-being in overall health. Practices such as prayer, meditation, and mindfulness are encouraged to reduce stress, enhance emotional resilience, and foster a sense of inner peace. These practices are believed to indirectly influence the humoral balance by calming the mind and stabilising physiological processes (20). The adaptability and reliance on natural resources have ensured the continued relevance of Unani medicine, particularly in regions with limited access to modern healthcare. In countries like India, Pakistan, Iran, and Bangladesh, Unani medicine is an integral part of traditional healthcare systems, providing affordable and accessible treatment options for a wide range of ailments. Its emphasis on prevention, personalised care, and holistic healing resonates with contemporary trends in global healthcare, where there is an increasing demand for integrative and patient-centred approaches (21).

Despite its enduring relevance, Unani medicine faces challenges in the modern era. These include the need for rigorous scientific validation, standardisation of herbal formulations, and integration with conventional medical systems. Efforts are being made to address these challenges through collaborative research, clinical trials, and policy support. For instance, studies investigating the pharmacological properties of Unani herbs have provided valuable insights into their mechanisms of action, paving the way for evidence-based applications. Moreover, establishing regulatory frameworks and quality control standards is essential to ensure the safety and efficacy of Unani therapies in contemporary healthcare settings (22).

PATHOPHYSIOLOGY OF T2DM AND THE UNANI PERSPECTIVE

Type 2 Diabetes Mellitus (T2DM) is primarily characterised by chronic hyperglycemia, which arises due to a combination of insulin resistance and impaired insulin secretion by the pancreatic β -cells. This metabolic disorder has become increasingly prevalent globally, with its pathophysiology intricately linked to genetic predisposition, sedentary lifestyles, and unhealthy dietary habits. Conventional medicine identifies these factors as primary contributors, emphasising the role of excessive caloric intake, physical inactivity, and genetic susceptibility in the development of T2DM. Over time, these factors contribute to increased insulin resistance in peripheral tissues and a gradual decline in β -cell functionality, creating a vicious cycle of hyperglycemia, inflammation, and metabolic

dysregulation (23). From the perspective of Unani medicine, type 2 diabetes mellitus (T2DM) is understood through a fundamentally different lens. Rooted in its humoral theory, Unani medicine attributes diabetes to imbalances in the bodily humours, particularly an excess of phlegm (balgham) and black bile (sawdā'). These humoral imbalances are believed to disrupt the digestive and metabolic processes that regulate blood sugar levels. According to Unani physicians, this disequilibrium disrupts the balance of hot, cold, moist, and dry qualities within the body, leading to the characteristic symptoms of diabetes, such as excessive thirst (polydipsia), frequent urination (polyuria), fatigue, and unintentional weight loss (24). The Unani conceptualisation of T2DM extends beyond its symptoms, delving into its root causes, including inflammation and oxidative stress, which are now recognised as significant contributors to the disease's progression even in modern biomedical research. Unani medicine's approach to managing diabetes focuses on restoring humoral balance, thereby addressing both the symptoms and the underlying causes. This approach integrates dietary modifications, herbal remedies, physical activity, and lifestyle adjustments to restore the balance of humours and promote overall metabolic health (25).

Dietary modifications are a cornerstone of Unani treatment for type 2 diabetes mellitus (T2DM). The system emphasises the importance of individualised nutritional plans based on a patient's temperament (mizaj) and the nature of their humoral imbalance. Foods are categorised

by their inherent qualities—hot, cold, moist, or dry—and their effects on the body. For instance, patients with an excess of phlegm might be advised to consume foods with hot and dry qualities, such as ginger, cinnamon, and black pepper, to counteract the imbalance. Conversely, the excessive presence of black bile might be addressed with foods that have cooling and moist properties. Unani dietary guidelines also recommend the inclusion of low-glycemic index foods, whole grains, and natural herbs, which align with modern nutritional recommendations for managing type 2 diabetes mellitus (T2DM) (26, 27).

Herbal formulations play an equally pivotal role in Unani medicine's therapeutic strategy for T2DM. A wide range of natural remedies, derived from plants, minerals, and animal products, are utilised to regulate blood sugar levels, enhance insulin sensitivity, and combat inflammation. Key Unani herbs for diabetes management include: These herbs are often used in combination to improve their therapeutic efficacy. They may be prepared as powders, decoctions, or infusions, depending on the patient's condition and individual needs. Unlike conventional pharmaceuticals, which target specific molecular pathways, Unani herbal remedies aim to restore systemic balance, thereby addressing multiple aspects of the disease simultaneously (28, 29).

Lifestyle adjustments are another integral component of Unani diabetes management. Regular physical activity is prescribed to

improve circulation, enhance glucose metabolism, and maintain a healthy weight. The type and intensity of exercise are tailored to the patient's temperament and physical capabilities. For instance, moderate exercises such as brisk walking or yoga-like movements are often recommended to minimise strain while maximising metabolic benefits. Stress management also plays a prominent role in Unani medicine, given the recognised link between chronic stress and humoral imbalance. Practices such as mindfulness, prayer, and relaxation techniques are encouraged to stabilise emotional states and support overall health. These interventions align with modern findings on the detrimental effects of stress on blood sugar regulation and the importance of mental health in managing chronic diseases (30, 31).

In addition to these measures, Unani practitioners may employ regimental therapies (Ilaj Bil Tadbeer) to detoxify the body and expel excess humours. Techniques such as cupping (Hijama), venesection (Fasd), and steam baths are used selectively to address specific humoral imbalances and alleviate symptoms. For example, cupping is believed to improve circulation and reduce inflammation, while venesection may be used to release excess blood and lower blood pressure (32). Unani medicine's emphasis on individualised care and its holistic framework make it a compelling adjunct to conventional approaches for T2DM management. By addressing the disease's root causes and prioritising the patient's overall well-being, Unani medicine offers a comprehensive

strategy that complements pharmacological treatments. Furthermore, its reliance on natural remedies and non-invasive therapies makes it particularly appealing to patients seeking alternatives to conventional medications, which often come with side effects and long-term risks (33).

KEY UNANI THERAPEUTIC AGENTS FOR T2DM

Unani medicine has long employed a variety of natural remedies to manage Type 2 Diabetes Mellitus (T2DM), emphasising herbs known for their hypoglycemic, anti-inflammatory, and antioxidant properties. These remedies not only aim to lower blood glucose levels but also address underlying metabolic imbalances and promote overall health. Among the numerous herbs utilised in Unani medicine, several stand out for their efficacy and historical significance in diabetes management (34).

Jamun (*Syzygium cumini*) is a cornerstone of Unani formulations for diabetes. Its seeds, in particular, are rich in bioactive compounds, including jamboline and ellagic acid, which contribute to its potent hypoglycemic properties. Jamun enhances insulin sensitivity by improving cellular glucose uptake and reducing postprandial blood sugar spikes. Additionally, it possesses antioxidant properties that protect pancreatic β -cells from oxidative stress, a key factor in the progression of type 2 diabetes mellitus (T2DM). The regular use of Jamun seed powder or decoctions is a well-documented practice in

Unani medicine, often complemented by dietary and lifestyle interventions for optimal results (35, 36).

Methi (*Trigonella foenum-graecum*), also known as fenugreek, is another staple in Unani diabetes management. The seeds of Methi are packed with soluble fibre and bioactive compounds such as trigonelline and diosgenin. Soluble fibre slows the absorption of carbohydrates in the gut, resulting in more stable blood sugar levels after meals. Trigonelline, on the other hand, has been shown to enhance insulin secretion and improve the metabolic profile of patients with diabetes. Fenugreek also exhibits lipid-lowering properties, making it beneficial for managing associated cardiovascular risks. In Unani practice, Methi is often consumed as a powdered supplement, incorporated into meals, or brewed into teas to harness its multifaceted benefits (37, 38).

Karela (*Momordica charantia*), commonly known as bitter melon, is celebrated for its robust hypoglycemic effects. It contains active compounds such as charantin, vicine, and polypeptide-p, which collectively mimic the action of insulin. These compounds facilitate glucose uptake by cells and reduce glucose production in the liver, effectively lowering blood sugar levels. Beyond its hypoglycemic properties, Karela has anti-inflammatory and antioxidant effects that support pancreatic health and reduce systemic inflammation associated with diabetes. Unani practitioners often recommend Karela in the form of fresh juice,

powders, or dried fruit preparations, depending on the patient's condition and tolerance (39, 40). Neem (*Azadirachta indica*) has a long-standing reputation in Unani medicine as a versatile therapeutic agent. Its leaves are particularly effective in modulating glucose metabolism and reducing oxidative stress. Neem has been shown to enhance insulin sensitivity and decrease fasting blood glucose levels. Its anti-inflammatory properties also help mitigate the chronic inflammation often observed in patients with diabetes. In Unani practice, Neem leaves are consumed as decoctions or powders and are sometimes incorporated into topical applications to address skin complications arising from diabetes (41, 42).

Gudmar (*Gymnema sylvestre*), aptly known as the “sugar destroyer,” plays a unique role in Unani diabetes management. The bioactive compounds in Gudmar leaves, such as gymnemic acids, interact with taste receptors on the tongue, temporarily suppressing the sensation of sweetness and helping to curb sugar cravings. This effect is particularly beneficial for patients struggling with dietary compliance. Additionally, Gudmar enhances pancreatic function by stimulating insulin secretion and promoting the regeneration of β -cells. It also inhibits glucose absorption in the intestines, contributing to better glycemic control. Gudmar is often administered as a powdered supplement or infused into teas, providing a natural and effective means to support metabolic health (43, 44).

These herbs are often used in combination to

amplify their therapeutic effects, reflecting the holistic ethos of Unani medicine. For instance, a formulation might include Jamun for its glucose-lowering properties, Methi for its insulin-enhancing effects, and Neem for its anti-inflammatory benefits. Such combinations are tailored to the individual's temperament (*mizaj*) and the specific nature of their humoral imbalance, ensuring a personalised approach to treatment (45).

The preparation and administration of these remedies are guided by principles that prioritise the preservation of their natural synergy and balance. Unlike conventional pharmaceuticals that often isolate active compounds, Unani medicine values the holistic use of whole plants or their parts, ensuring that all bioactive components work in harmony. This approach not only enhances efficacy but also minimises side effects, making Unani remedies a safe and sustainable option for long-term diabetes management (46). Furthermore, the use of these herbs is often integrated with dietary and lifestyle recommendations to maximise their benefits. Patients are advised to follow a balanced diet that complements the qualities of the prescribed herbs, engage in regular physical activity, and adopt stress management practices such as mindfulness and prayer. This integrative strategy underscores the Unani philosophy of treating the whole person rather than just the disease, addressing physical, emotional, and environmental factors that contribute to health (47).

Unani Dietary and Lifestyle Recommendations

Diet and lifestyle are integral components of Unani medicine, serving as both preventive and therapeutic tools for managing Type 2 Diabetes Mellitus (T2DM). This holistic approach emphasises the importance of tailoring dietary habits, physical activity, and stress management practices to restore and maintain humoral balance, thereby addressing both the symptoms and underlying causes of the disease. Unani practitioners place a strong emphasis on dietary guidelines that prioritise foods with specific qualities conducive to balancing the humours (48). For individuals with type 2 diabetes mellitus (T2DM), the focus is on consuming foods with a low glycemic index, which helps regulate blood sugar levels by releasing glucose into the bloodstream gradually. Whole grains, such as barley and oats, are preferred due to their high nutrient density and ability to promote satiety, thereby reducing the likelihood of overeating. Fresh vegetables, particularly those rich in fibre and antioxidants, are recommended to support digestion, enhance insulin sensitivity, and combat inflammation (49).

Unani dietary recommendations also stress the avoidance of sugary, processed, and fried foods, which are considered detrimental to humoral balance and overall metabolic health. Such foods are believed to exacerbate the accumulation of harmful humours, contributing to hyperglycemia and systemic inflammation. Instead, medicinal herbs and spices, such as cinnamon and turmeric, are often incorporated into meals for their therapeutic properties. Cinnamon is known to enhance insulin sensitivity and lower fasting

blood sugar levels, while turmeric possesses potent anti-inflammatory and antioxidant effects that protect pancreatic β -cells from oxidative damage (50). Physical activity is another cornerstone of Unani medicine's approach to managing Type 2 diabetes mellitus (T2DM). Regular exercise is recommended not only to enhance glucose metabolism but also to maintain a healthy weight, which is crucial for reducing insulin resistance. Unani practitioners recommend moderate physical activities, such as brisk walking, yoga-like movements, or swimming, tailored to the individual's temperament and physical capacity. These activities are believed to facilitate the circulation of blood and other humours, ensuring their proper distribution throughout the body. Exercise is also seen as a means to expel excess humours, particularly phlegm, which is often associated with the pathogenesis of diabetes in Unani theory (51).

Stress management practices are equally integral to the Unani framework, reflecting the belief that emotional well-being is closely tied to physical health. Chronic stress is thought to disrupt humoral balance by increasing the levels of black bile and phlegm, thereby exacerbating metabolic dysfunctions. To counteract this, Unani medicine incorporates practices such as meditation, prayer, and mindfulness techniques. These practices aim to calm the mind, stabilise emotional states, and promote a sense of inner peace, which in turn supports the body's natural ability to regulate blood sugar levels. By addressing stress, Unani practitioners aim to prevent the cascading effects

of emotional distress on physical health, recognising the interconnectedness of mental and metabolic well-being (52). In essence, the Unani approach to diet and lifestyle is deeply rooted in its holistic philosophy, focusing on harmonising the body's internal environment with external influences. For T2DM management, this translates into a comprehensive strategy that not only targets glycemic control but also enhances overall health and quality of life. The emphasis on natural, sustainable, and individualised interventions ensures that the recommendations are both practical and adaptable to diverse patient needs. By integrating these practices into daily routines, individuals with T2DM can achieve better management of their condition and reduce the risk of complications, all while aligning with the principles of balance and harmony central to Unani medicine (53).

EVIDENCE SUPPORTING UNANI MEDICINE IN T2DM

Preliminary clinical studies and observational data have begun to substantiate the role of Unani medicine as a complementary approach to conventional diabetes therapies, providing promising insights into its efficacy in managing Type 2 Diabetes Mellitus (T2DM). These initial findings suggest that Unani remedies can significantly enhance glycemic control, reduce complications, and improve the overall quality of life for individuals living with diabetes. For example, research on Jamun (*Syzygium cumini*) seed powder has demonstrated its significant impact on both fasting and postprandial blood glucose levels (54). The bioactive compounds in

Jamun seeds, such as jamboline and ellagic acid, contribute to these effects by enhancing insulin sensitivity and reducing glucose absorption in the intestines. Such results not only corroborate the traditional use of Jamun in Unani medicine but also align with contemporary biomedical understandings of glucose metabolism (55).

Fenugreek (*Trigonella foenum-graecum*) supplementation provides another compelling example of the potential benefits of Unani remedies. Clinical studies have demonstrated that fenugreek seeds enhance glycemic control by slowing carbohydrate absorption in the gastrointestinal tract and promoting insulin secretion. These effects are primarily attributed to its high soluble fibre content and the presence of bioactive compounds, such as trigonelline. Furthermore, fenugreek has been shown to have lipid-lowering properties, which are particularly beneficial for diabetic patients at a heightened risk of cardiovascular disease. The dual impact of fenugreek on glucose and lipid metabolism underscores its value as a multifaceted therapeutic agent within the Unani framework (56).

Similarly, bitter melon (*Momordica charantia*) has garnered significant attention for its insulin-mimetic properties, evidenced in both animal and human studies. The active components of bitter melon, including charantin and polypeptide P, act like insulin, facilitating glucose uptake by cells and reducing hepatic glucose production. These effects make bitter melon a valuable natural remedy for achieving better glycemic control.

Additionally, its anti-inflammatory and antioxidant properties further support pancreatic health, helping to mitigate the progressive damage to β -cells often observed in patients with type 2 diabetes mellitus (T2DM) (57).

These findings collectively highlight the potential of Unani medicine to complement modern pharmacological treatments. By addressing not only the symptoms of diabetes but also its underlying mechanisms, Unani remedies offer a holistic approach that aligns with the growing emphasis on integrative and patient-centred care. However, while the preliminary evidence is promising, the need for further large-scale, randomised controlled trials cannot be overstated. Robust clinical studies are crucial for establishing the efficacy and safety of Unani interventions, thereby facilitating their broader acceptance within contemporary healthcare systems (58).

Moreover, such trials would provide critical insights into the standardisation of Unani formulations and the identification of optimal dosages and treatment protocols. This is particularly important given the complexity and variability of natural remedies, which can be influenced by factors such as plant species, geographical origin, and preparation methods. Addressing these variables through rigorous research would enhance the reliability and reproducibility of Unani treatments, paving the way for their integration into evidence-based medical practice (59).

INTEGRATING UNANI MEDICINE WITH CONVENTIONAL THERAPIES

The integration of Unani medicine with modern therapeutic approaches offers a synergistic strategy for managing Type 2 Diabetes Mellitus (T2DM), blending the strengths of traditional and contemporary healthcare systems. This holistic approach aims to address the multifaceted nature of T2DM by combining Unani's natural and individualised treatments with the evidence-based precision of modern medicine. Achieving this synergy, however, requires careful attention to several critical factors, including patient education, collaborative care, and regulatory oversight (60).

Patient education is a cornerstone of integrating Unani medicine into the management of type 2 diabetes mellitus (T2DM). It is essential to inform patients about the benefits and limitations of Unani practices, enabling them to make well-informed decisions about their care. Many patients may be unfamiliar with the principles of Unani medicine, such as its emphasis on humoral balance and the use of natural remedies. Educating patients about the therapeutic potential of Unani interventions, including their ability to complement conventional therapies, can enhance their acceptance and adherence (61). This education should also clarify that while Unani medicine offers promising solutions, its remedies are not a replacement for conventional treatments in severe or acute cases. Transparent communication about potential side effects,

interactions with pharmaceutical drugs, and the importance of following prescribed dosages is equally critical. By empowering patients with knowledge, healthcare providers can foster trust and encourage active participation in their treatment plans (62).

Collaborative care between Unani practitioners and conventional healthcare providers is another vital element in this integrative approach. The complexity of T2DM necessitates a multidisciplinary strategy, where the strengths of each system are leveraged to optimise patient outcomes. For instance, Unani practitioners can focus on restoring humoral balance and addressing chronic inflammation through the use of natural remedies and lifestyle modifications. At the same time, conventional providers manage acute symptoms and monitor critical metrics such as HbA1c levels (63). Effective collaboration requires open communication, mutual respect, and an understanding of each system's unique contributions and roles. Healthcare teams should work together to develop comprehensive treatment plans that incorporate Unani therapies as adjuncts to modern medical protocols. This partnership can also facilitate the early identification of potential contraindications, ensuring that patients receive coordinated and cohesive care. Integrating Unani medicine into multidisciplinary diabetes management programs has the potential to enhance patient satisfaction, improve glycemic control, and reduce the risk of complications (64).

Regulatory oversight is a foundational

requirement for the safe and effective integration of Unani medicine into mainstream healthcare. Standardising Unani formulations and establishing stringent quality control measures are essential to ensure their safety, efficacy, and consistency. Given the natural origin of Unani remedies, factors such as plant species, cultivation methods, and preparation techniques can significantly influence their pharmacological properties (65). Without standardised protocols, the therapeutic effects of Unani formulations may vary, posing risks to patients and undermining the credibility of the system. Regulatory bodies should collaborate with Unani experts to develop guidelines for the sourcing, preparation, and testing of herbal remedies. These guidelines should include rigorous clinical testing to validate the efficacy of Unani therapies in managing T2DM, thereby paving the way for their broader acceptance within evidence-based medicine. Moreover, clear labelling, dosage recommendations, and safety information should be mandated to protect patients and promote informed use (66).

In addition to quality control, regulatory frameworks should address the integration of Unani medicine into national healthcare systems. This includes recognising qualified Unani practitioners, providing them with opportunities for professional development, and facilitating their participation in collaborative care settings. Establishing channels for dialogue and knowledge exchange between Unani and conventional medical communities can also promote mutual understanding and foster

innovation (67).

The integration of Unani medicine with modern therapeutic approaches is a promising strategy for addressing the global challenge of type 2 diabetes mellitus (T2DM). By prioritising patient education, fostering collaborative care, and ensuring robust regulatory oversight, this approach can maximise the benefits of both systems while minimising risks. As interest in holistic and patient-centred care continues to grow, the synergistic potential of Unani and modern medicine offers a valuable pathway for enhancing the management of T2DM and improving patient outcomes on a global scale (68).

CONCLUSION

Unani medicine treats both the symptoms and causes of Type 2 Diabetes Mellitus (T2DM) holistically and integratively. Unani medicine, based on centuries-old Greek and Islamic traditions, emphasises natural medicines, food, and lifestyle changes to balance the humoral system. This comprehensive method aligns with modern personalised care concepts, making it a beneficial addition to traditional medications in the fight against the global diabetes epidemic. Unani medicine emphasises maintaining health by balancing four physiological humours: blood (dam), phlegm (balgham), yellow bile (safra), and black bile (sawdā'). Abnormalities in phlegm and black bile affect metabolic processes in T2DM, according to doctors. By addressing interrelated systemic dysfunctions, Unani medicine complements biological understanding

of insulin resistance and reduced insulin secretion by restoring humoral equilibrium. Natural cures are central to Unani medicine. Jamun, Methi, Karela, and Neem are popular herbs known for their hypoglycemic, anti-inflammatory, and antioxidant properties. Jamun enhances glucose metabolism and protects pancreatic β -cells, whereas Karela naturally mimics the effects of insulin. These treatments help manage glycaemic levels and slow diabetic complications. Dietary changes improve Unani treatments. Hot, cold, moist, or dry foods affect the body's humours. Sugary and processed foods are avoided, while low-glycemic index foods, whole grains, and vegetables stabilise blood sugar. Spices like cinnamon and turmeric boost insulin sensitivity and reduce inflammation. Dietary suggestions are tailored to individual temperaments (mizaj) for adequate care. Lifestyle changes are essential to Unani. Walking or yoga-like workouts improve glucose metabolism and weight management. Meditation and prayer for stress management can stabilise emotions and prevent humoral imbalance. This holistic approach to diabetes care tackles physical, mental, and emotional aspects. Unani medicine complements mainstream medicines due to its integrative character. Modern therapies, such as metformin, manage blood glucose, whereas Unani remedies address chronic inflammation and oxidative stress. Combining these methods enhances treatment outcomes, reduces complications, and facilitates a sustainable diabetes care plan. Unani medicine treats Type 2 diabetes mellitus (T2DM) symptoms and causes holistically by using

natural medications, nutrition, and lifestyle changes. In line with personalised care, it enhances the efficacy and sustainability of traditional medicines. Research, standardisation, and interdisciplinary collaboration can unlock the full potential of this ancient system, despite its challenges. An increasing global diabetes epidemic makes Unani medicine a significant instrument for enhancing health and quality of life.

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