

Research Progress on Acupuncture Therapy as an Adjuvant Treatment for Type 2 Diabetes

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Abstract: *With the prosperous development of China's economy and comprehensive social progress, the quality of life for its citizens has significantly improved. However, this positive transformation has been accompanied by a quiet rise in diabetes prevalence. Diabetes mellitus (DM) is a chronic disease characterized by hyperglycemia, resulting from absolute or relative insulin deficiency and impaired insulin utilization. Type 2 diabetes (T2DM) is the most prevalent form. Concurrently, traditional Chinese medicine boasts a long-standing history of therapeutic practices. Among these, acupuncture has accumulated extensive experience in treating diabetes. This therapy demonstrates favorable efficacy in managing type 2 diabetes (T2DM) and its complications while exhibiting minimal side effects. Therefore, a systematic review of research on acupuncture for treating T2DM is conducted to explore novel therapeutic options for patients and to provide fresh insights for refining and optimizing healthcare systems.*

Keywords: Type 2 diabetes, Acupuncture, Diabetes mellitus, Research progress.

1. Introduction

Diabetes is a group of disorders characterized by impaired carbohydrate, protein, and fat metabolism due to absolute or relative deficiency in insulin secretion and/or impaired insulin utilization. With rapid socioeconomic development and improvements in living standards across China, the incidence of diabetes has been steadily rising. According to research statistics from the World Health Organization, diabetes ranks third in prevalence among major diseases, following cardiovascular diseases and cancer [1]. Type 2 diabetes mellitus (T2DM) is associated with insulin resistance and relative insulin secretion deficiency, representing the most common form of diabetes. According to the latest projections from the 2021 Global Burden of Disease (GBD) study, the number of individuals with diabetes worldwide is expected to surge to 1.3 billion by 2025, with the overwhelming majority being T2DM cases. Poor glycemic control in type 2 diabetes can lead to multiple complications due to prolonged hyperglycemia. This complex array of complications includes, but is not limited to, cardiovascular and cerebrovascular diseases, diabetic nephropathy, diabetic microvascular retinopathy, diabetic foot, and peripheral neuropathy. In the elaboration of the Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes (2020 Edition), traditional Chinese medicine (TCM) interventions for type 2 diabetes have emerged as a focal point. Leveraging its unique advantages, TCM not only reduces the risk of diabetes onset but also plays a supportive role in blood glucose regulation and provides targeted adjunctive therapies for various complications, thereby enhancing patients' quality of life [2]. Acupuncture therapy, as an innovative treatment modality, has been formally incorporated into the framework of Traditional Chinese Medicine for treating type 2 diabetes for the first time. This therapy promotes the restoration and regulation of physiological functions, carries a low risk of side effects, and demonstrates significant therapeutic efficacy [3]. Therefore, we have systematically organized and summarized the relevant research findings applied in this clinical treatment field in recent years, aiming to provide theoretical support and

reference for further exploration in clinical practice.

2. The Naming and Etiology of Diabetes

Diabetes, known in ancient times as "Xiaoke," was first documented in the *Suwen: Treatise on Strange Diseases*: "Those afflicted with spleen-dampness frequently consume sweet and rich foods, causing their qi to overflow upward and transform into Xiao Ke." [4] In ancient medical texts, diabetes was referred to by various names, such as Xiao Dan, Feng Xiao, Fei Xiao, Xiao Zhong, and Ge Xiao. During the Jin-Yuan period, Zhu Danxi, with his unique insights, classified diabetes into three types: Shang Xiao (Upper Consumption), Zhong Xiao (Middle Consumption), and Xia Xiao (Lower Consumption). This classification, based on the principles of zang-fu organ differentiation, remains referenced to this day. Alternatively, from the perspective of pathogenesis, diabetes can also be termed Yang Xiao (Yang Consumption), Yin Xiao (Yin Consumption), and Pi Dan (Spleen Consumption) [5]. The *Yellow Emperor's Inner Canon* states that the causes of diabetes primarily involve factors such as irregular eating habits, emotional imbalances, constitutional deficiencies, excessive labor or indulgence, and parasitic infections. The Chapter on the Five Transformations in the *Spiritual Pivot* records: "Those with inherently weak and deficient functions of the five viscera are prone to diabetes." This indicates that individuals with congenital physical weakness and functional insufficiency of the internal organs are more susceptible to diabetes [6]. Specifically, emotional imbalances can lead to stagnation of liver qi, which transforms into heat and scorches yin fluids. Improper diet, such as excessive consumption of rich, greasy, and sweet foods, damages the spleen and stomach, causing accumulated heat to transform into dryness, thereby injuring yin and depleting body fluids. Overwork and excessive desires further deplete vital energy, exacerbating yin deficiency and dry heat. These factors collectively cause symptoms of diabetes mellitus, including excessive thirst and drinking, rapid consumption of food with persistent hunger, frequent urination, and weight loss.

3. Understanding of Type 2 Diabetes in Traditional Chinese Medicine and Western Medicine

3.1 Traditional Chinese Medicine Understanding

The pathogenesis of diabetes mellitus centers on yin deficiency as the root cause and dry heat as the manifest symptom, with both intertwined in a complex relationship. It involves dysfunction across multiple organs and is closely associated with factors such as kidney qi deficiency, spleen-stomach disharmony, qi stagnation, and phlegm-dampness. The Yellow Emperor's Inner Canon, however, posits that internal heat in the stomach and intestines constitutes the primary pathogenesis of diabetes. Traditional Chinese medicine theory holds that weakened spleen and stomach function impairs the ability to transport and transform nutrients from food, causing substances to stagnate in the blood and trigger abnormal blood sugar elevation. Prolonged emotional stress may lead to liver qi stagnation, affecting lung and stomach fluids. Congenital deficiency or excessive sexual activity later in life can deplete kidney yin, resulting in internal heat arising from deficiency. This disrupts the physiological functions of organs such as the heart, lungs, spleen, and stomach, ultimately manifesting as polyuria and thirst. In summary, Traditional Chinese Medicine possesses a profound understanding of the pathogenesis and development of diabetes. It emphasizes a holistic approach, employing syndrome differentiation and treatment to achieve therapeutic goals by regulating the body's yin-yang balance and organ functions.

3.2 Western Medical Understanding

The core mechanism of type 2 diabetes lies in the dual effects of insulin resistance and the decline in pancreatic beta cell function. Insulin resistance refers to the diminished sensitivity of various tissues to insulin signaling, leading to reduced biological activity and efficacy of insulin. Even when insulin secretion remains normal or increases, cellular sensitivity to insulin significantly declines, preventing effective glucose uptake and utilization. The causes are complex and varied, including obesity, physical inactivity, hypertension, and high triglycerides. Secondly, pancreatic beta cells, as the core component responsible for insulin secretion within the islets, determine insulin output through their quantity and functional state. Persistent hyperglycemia, worsening insulin resistance, and genetic factors collectively lead to a decline in beta cells' ability to secrete insulin. Simultaneously, the interaction between insulin resistance and beta-cell dysfunction accelerates the progression of type 2 diabetes. Finally, beyond insulin resistance and beta-cell dysfunction, genetic predisposition, environmental factors, and lifestyle choices are also closely associated with the onset of type 2 diabetes.

4. Acupuncture Therapy

4.1 Electroacupuncture Therapy

Electroacupuncture involves inserting fine needles into acupoints. Once deqi is achieved, a microcurrent simulating the body's natural bioelectricity is applied to enhance the

needle stimulation and promote therapeutic effects. Pan Ting [7] included 72 patients in the study, randomly assigning them to a control group and an electroacupuncture group of 36 patients each. The control group received oral metformin hydrochloride tablets, while the treatment group additionally selected acupoints including Lung Shu (BL13), Spleen Shu (BL20), Kidney Shu (BL23), Zusanli, Sanyinjiao, Hegu, and Taichong acupoints. They received 30 minutes of electroacupuncture using sparse-dense wave needles for "regulating organs and unblocking meridians." Due to other reasons, 31 patients in the control group and 30 in the electroacupuncture group completed the trial. and 30 in the electroacupuncture group. Post-treatment analysis revealed significantly lower levels of FPG, 2hPBG, and HbA1c (glycated hemoglobin) in the electroacupuncture group compared to the control group ($P < 0.05$). Wang Xiang [8] A clinical trial involving 60 patients with type 2 diabetes divided participants into two equal groups of 30 each: a control group and a treatment group. The control group received standard therapy comprising lifestyle interventions, dietary management, and oral metformin hydrochloride tablets, supplemented with fine-gauge acupuncture at the following points: Feishu (BL13), Weishu (BL21), Shenshu (BL23), and Pishu (BL20). The treatment group received the same regimen supplemented with electroacupuncture therapy. Results demonstrated significant improvements in both FINS and HOMA- β scores in the treatment group compared to the control group ($P < 0.001$). Research [9] indicates that electroacupuncture can improve insulin resistance in rats with type 2 diabetes, thereby exerting a hypoglycemic effect.

4.2 Fine-Needle Therapy

Filiform needles, also known as "body acupuncture therapy," function by stimulating specific points on the body to unblock meridians and regulate internal organs. This approach aims to strengthen the body's defenses, expel pathogens, and treat diseases. Li Zhen-ting et al. [10] conducted a randomized controlled study involving 60 patients with type 2 diabetes, dividing them into a control group and an observation group, each comprising 30 subjects. The control group received conventional treatment protocols involving oral metformin hydrochloride. The observation group additionally underwent a combined intervention of fine-gauge acupuncture and moxibustion at key acupoints including Zhongwan (CV12), Qihai (CV6), Tan Zhong (CV17), Zusanli (ST36), Zhangmen (LR13), Pishu (BL20), Shenshu (BL23), Pishu (BL20), Sanyinjiao (SP6), and Zhongfu (LU11). The procedure involved inserting fine needles first. After obtaining the deqi sensation, a balanced tonification and dispersion technique was applied. Moxa cones were then fixed onto the fine needles, and warm moxibustion was performed for 30 minutes at the Zusanli and Qihai acupoints. Treatment results showed improvements in blood glucose and insulin function in both groups, with greater improvements observed in the observation group. Zheng Haiying et al. [11] conducted acupuncture treatment on 108 patients with type 2 diabetes. Results showed that the total effective rate in the treatment group reached 92.6%, significantly superior to the 78.7% observed in the control group. This study indicates that acupuncture can effectively lower patients' blood glucose levels and improve related symptoms.

4.3 Moxibustion Therapy

Moxibustion therapy primarily utilizes heat to stimulate acupoints along meridians, thereby achieving preventive and therapeutic effects. Its functions are diverse, including warming meridians to dispel cold, reinforcing yang to consolidate collapse, preventing illness and promoting health, dispersing stasis and resolving masses, tonifying qi and blood, and alleviating pain. Current literature [12] indicates that moxibustion demonstrates therapeutic efficacy in treating complications of type 2 diabetes, including diabetic peripheral neuropathy, diabetic gastroparesis, diabetic neurogenic bladder, diabetic foot, and diabetic nephropathy. Feng Wenju [13] administered moxibustion therapy to patients in the study group, targeting the primary acupoints Mingmen, Pishu, and Shen-zhu for 20 minutes following abdominal massage. The results demonstrated that the study group exhibited significantly lower blood glucose levels and markedly reduced DSQR scores compared to the control group.

4.4 Abdominal Acupuncture Therapy

Abdominal Acupuncture Therapy is rooted in the theoretical framework of Traditional Chinese Medicine. It focuses on the abdominal region of the human body, stimulating specific acupoints through needle insertion to activate abdominal meridians and promote the circulation of qi and blood. This regulates the flow of qi within the body and restores balance between yin and yang, thereby achieving therapeutic effects and restoring health. This therapy has demonstrated remarkable efficacy in clinical practice, particularly exhibiting unique advantages in treating refractory conditions and chronic diseases. In his study, Pang Nan [14] divided 68 subjects into an abdominal acupuncture group and a conventional acupuncture group, each comprising 34 participants. The abdominal acupuncture group employed the Bo-style abdominal acupuncture protocol, targeting core points including Zhongwan (CV12), Xiawan (CV11), Qihai (CV6), and Guanyuan (CV4), supplemented by points such as Huorumen (ST21), Wailing (ST31), Daxiong (ST21), Tianshu (ST25), and Qi points. The conventional acupuncture group received standard treatment targeting Zhongwan (CV12), Xiawan (CV11), Quchi (LI11), Yinlingquan (SP9), Fenglong (ST40), Zusanli (ST36), and Taichong (LR3). Research data demonstrated improvements in multiple indicators for the abdominal acupuncture group, specifically marked reductions in fasting plasma glucose (FPG), 2-hour postprandial glucose (2h PG), fasting insulin (FINS), and the insulin resistance index (HOMA-IR) ($P < 0.01$). This confirms the efficacy of abdominal acupuncture in regulating blood glucose levels. Additionally, total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C) levels were reduced ($P < 0.01$). Collectively, these findings suggest that Bo's abdominal acupuncture, as an intervention, not only effectively lowers blood glucose levels but also improves dyslipidemia, thereby reducing the risk of developing type 2 diabetes and related complications. Moreover, this treatment method is safe, effective, and free of side effects, with minimal patient discomfort, making it suitable for clinical application.

4.5 Auricular Therapy

As an important form of acupuncture, auricular therapy has gradually attracted increasing attention from researchers in recent years. Luo Jin, Wang Li, and colleagues [15] conducted an in-depth exploration of the application of auricular pressure therapy and auricular needle techniques in diabetes management. They concluded that auricular therapy can effectively promote blood glucose control in patients with type 2 diabetes, offering a simple and rapid implementation method with a low incidence of adverse reactions. Particularly in the field of adjunctive diabetes treatment, auricular therapy provides a new therapeutic option with significant clinical implications.

4.6 Microneedling Therapy

Microneedle acupuncture has garnered increasing attention due to its advantages of minimal pain and ease of operation. Bai Junwei et al. [16] reviewed the therapeutic effects of microneedle acupuncture in treating diabetes and its chronic complications, noting that this technique effectively lowers blood glucose levels and improves patients' quality of life. Future research may further explore the synergistic effects of microneedles with traditional acupuncture and their potential in clinical applications.

5. Combination Therapy

5.1 Electroacupuncture Combined with Auricular Therapy

Zhang Na, Wang Yali et al. [17] administered electroacupuncture combined with auricular therapy to 203 patients with type 2 diabetes. Electroacupuncture targeted primary points including Stomach Shu (BL21), Spleen Shu (BL20), Pancreas Shu (BL22), Middle Stomach (CV12), Zhangmen (LR13), Zusanli (ST36), Sanyinjiao (SP6), and Fenglong (ST40). Ear acupuncture involved implanting Wangbuluxing seeds at points including Stomach, Spleen, Pancreas, Hunger Point, Thirst Point, and Endocrine Point, with patients instructed to press these points daily before meals. Experimental data clearly demonstrated that after applying this treatment method, patients' fasting blood sugar (FBS) levels decreased significantly ($P < 0.01$), and blood lipid indicators such as total cholesterol (TC), triglycerides (TG), and low-density lipoprotein (LDL-C) all showed a downward trend ($P < 0.01$). Post-treatment FINS and FLP scores were also lower compared to pre-treatment levels. This indicates that the combination of electroacupuncture and auricular acupuncture not only directly regulates blood glucose levels in patients with type 2 diabetes but also promotes partial improvement in pancreatic beta cell function to a certain extent.

5.2 Combined Acupuncture and Percussion Therapy

Tapping Needle Therapy, also known as Plum Blossom Needle Therapy, Seven-Star Needle Therapy, or Skin Needle Therapy, is a method that uses specially designed shallow-insertion needles to tap the skin. This technique aims to unblock meridians and regulate the deficiency and excess states of internal organs, thereby treating diseases and alleviating pain. Wang Xuelian's study [18] selected 80 patients with type 2 diabetes diagnosed with yin deficiency

with blood stasis syndrome according to Traditional Chinese Medicine (TCM) pattern differentiation. These patients were divided into a control group and an observation group. The control group received a comprehensive treatment regimen combining medication, systematic lifestyle interventions, and dietary regulation. The observation group received fine-gauge acupuncture at points including Taixi (KI3), Shenmen (HT7), Taichong (LR3), Taiyuan (LU3), Sanyinjiao (SP6), Zusanli (ST36), Fenglong (ST40), Hegu (LI4), and Xuehai (SP10). Additionally, plum blossom needle percussion therapy was applied at Diaoyu (BL17), Pishu (BL20), Pishu (BL20), and Shenshu (BL23), with 200 percussions per point. Treatment outcomes revealed a clinical efficacy rate of 95.0% in the observation group versus 82.5% in the control group. This indicates that the combination of fine needle acupuncture and tapping therapy effectively unblocks meridians, promotes blood circulation, and resolves blood stasis, thereby benefiting patients with Type 2 diabetes characterized by yin deficiency with blood stasis.

6. Conclusion

Globally, type 2 diabetes has become an increasingly serious health issue, with its complex pathogenesis involving multiple factors such as insulin resistance and impaired pancreatic beta cell function. Traditional Chinese Medicine (TCM) posits that diabetes (referred to as “Xiaoke”) arises from constitutional yin deficiency and weakness of the five zang organs. This is compounded by external triggers such as excessive eating, emotional imbalance, and overwork or excessive desire, collectively leading to a pathological state characterized by depletion of kidney yin and excessive heat in the lung and stomach. Conventional management of this chronic condition primarily relies on oral hypoglycemic agents and insulin replacement therapy. However, many patients still face challenges such as poor glycemic control and increased risk of complications. Consequently, exploring novel therapeutic strategies and intervention approaches holds significant importance for the management of type 2 diabetes. Acupuncture therapy, as a vital treatment within traditional Chinese medicine, holds unique value in regulating human physiological functions and promoting metabolic stability. Moreover, acupuncture therapy is increasingly favored by patients due to its relative safety and lack of significant side effects. In recent years, with the deepening and expansion of research, studies on acupuncture therapy in the field of type 2 diabetes have gradually increased, and its clinical application value has become increasingly prominent. Research in this field can deepen and enrich the theoretical system of traditional Chinese medicine, not only providing patients with better and more diversified treatment options but also offering new inspiration for innovation and optimization within the healthcare system. Although the advantages of acupuncture therapy in treating type 2 diabetes have been corroborated by numerous studies, we must acknowledge several current limitations: (1) Most studies have relatively small sample sizes and lack validation from large-scale randomized controlled trials, potentially affecting the generalizability and representativeness of experimental results. (2) Research on the specific mechanisms of acupuncture’s effects remains limited, and its systematic theoretical framework is not yet fully clarified. (3) Existing literature shows an imbalance between standardized treatment protocols and individualized

approaches for different types of diabetes patients. Further research is needed to develop personalized acupuncture regimens tailored to diverse patient populations, ensuring the safe and effective application of acupuncture therapy. A review of current literature indicates that acupuncture holds significant potential for treating type 2 diabetes. Future research should focus on exploring the mechanisms of acupuncture and emphasize personalized treatment for different patient types. Simultaneously, by integrating the essence of modern medicine, we should continuously investigate the comprehensive application of acupuncture alongside other therapeutic approaches. This aims to enhance the treatment outcomes for diabetes while simultaneously improving patients’ quality of life.

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