Mechanism and efficacy evaluation of combined application of traditional Chinese and western medicine in the treatment of diabetes mellitus

Lixuan Mao*

Xiguan Community Health Service Center, Linxia, Gansu, 731100, China

244537402@qq.com

*Corresponding author

Keywords: diabetes treatment; curative effect evaluation; combined application; Chinese and western medicine

Abstract: This study aims to investigate the mechanisms and effectiveness of integrating Traditional Chinese Medicine with Western medicine (TCM-WM integration) in treating type 2 diabetes. Employing a prospective, multi-site, randomized controlled trial design, the study involved 360 participants who were categorized into three groups: Western medicine (Group A), Traditional Chinese medicine (Group B), and an integrative treatment group (Group C). The findings indicated that the integrative treatment group exhibited markedly better outcomes in blood glucose management compared to the single-treatment groups, evidenced by a more substantial reduction in HbA1c and FPG levels, alongside a higher achievement rate of HbA1c targets, reaching 68.3%. In addition, the combination therapy group showed excellent performance in improving beta cell function, reducing urinary albumin/creatinine ratio, and delaying the progression of retinal lesions, with a significant decrease in TCM syndrome scores. Safety analysis shows that the overall adverse reaction rate of the combined treatment group is similar to that of the western medicine group, but attention should be paid to the risk of hypoglycemia. The 52-week follow-up revealed that the combined treatment group experienced a lower HbA1c rebound rate, particularly among patients with a longer medical history. This study demonstrates that the integration of TCM-WM can enhance diabetes treatment outcomes, minimize side effects, and improve patient quality of life through synergistic effects. These findings offer new insights for clinical approaches in diabetes management.

1. Introduction

The prevalence of diabetes is on the rise annually, posing significant challenges to patients' daily lives and placing substantial burdens on societal healthcare resources. Over time, diabetes can lead to numerous complications, including cardiovascular and cerebrovascular diseases, retinopathy, and neuropathy, all of which can severely impact patients' quality of life and life expectancy [1-2].

In the treatment of diabetes, western medicine has always occupied a dominant position because of its rapid and effective characteristics. However, western medicine treatment also has some limitations, such as obvious side effects, long-term drug resistance and so on [3]. Traditional Chinese Medicine (TCM) boasts a rich history and distinctive benefits in managing diabetes by restoring Yin-Yang balance and enhancing organ function, aiming to treat the condition holistically. Although TCM's effects are typically slower to manifest, it offers minimal side effects and contributes to overall patient wellness [4]. Integrating TCM with Western medicine (TCM-WM integration) leverages the strengths of both approaches, enhancing therapeutic outcomes, minimizing adverse effects, and boosting patients' quality of life [5-6]. Consequently, assessing the mechanisms and effectiveness of TCM-WM integration in diabetes treatment holds substantial significance.

This paper systematically studies the mechanism of TCM-WM combined application in the treatment of diabetes, and objectively evaluates its curative effect, so as to provide new ideas and methods for clinical diabetes treatment. At the same time, this paper also hopes to promote the

  DOI: 10.25236/icetmr.2025.001

in-depth development of integrated TCM-WM in the field of diabetes treatment through the research on the combined application of TCM-WM, and bring good news to more diabetic patients.

2. Research method

2.1. Sample selection

A prospective, multicenter, randomized controlled trial design was adopted, including three parallel groups. Among them, group A was treated with routine western medicine as control, group B was treated with TCM syndrome differentiation, and group C was treated with TCM-WM. By stratified block random method, the patients were stratified according to diabetes type (T2DM), course of disease (< 5 years /≥5 years) and BMI(<24/≥24) to ensure comparability among groups. The study adopts a double-blind design, that is, neither the researcher nor the subjects know the grouping situation. TCM group uses simulant and western medicine group uses placebo to reduce bias and ensure the objectivity and reliability of the results.

Inclusion criteria:

① Diagnose type 2 diabetes (WHO 2023 standard)
② HbA1c 7.0%-9.5%
③ Age 30-70 years old
④ Sign informed consent form

Exclusion criteria:

① Severe hepatic and renal insufficiency (eGFR<60)
② Acute metabolic complications
③ Pregnancy/lactation
④ History of TCM allergy

Based on the difference of HbA1c decreasing range of 0.8% in the pre-trial, the significance level $\alpha=0.05$, the test efficiency $1-\beta=0.8$, and considering the dropping rate of 15%, it is calculated that each group needs 120 patients, and a total of 360 patients need to be recruited.

2.2. Intervention scheme

The basic treatment for all groups includes diabetes dietary education and at least 150 minutes of moderate-intensity exercise per week. Group A (Western Medicine group) uses extended-release metformin tablets, with possible additions of SGLT2 inhibitors according to guidelines. Group B (TCM group) adopts a TCM regimen primarily based on the modified Xiaoke decoction, with syndrome differentiation adjustments made according to specific symptoms (such as qi-yin deficiency or damp-heat accumulation), taken as one dose daily after being decocted in water. Group C (Combined group) implements both the drug regimens of Group A and Group B, with a minimum of 2 hours between taking the different medications. The entire treatment course is divided into a core treatment period of 24 weeks, followed by an extended follow-up period of 52 weeks to evaluate long-term efficacy.

2.3. Observation index system

The observation index system mainly includes main curative effect index, secondary index and safety index. The main efficacy indicators focus on the levels of FPG, 2hPG and HbA1c related to blood sugar control, which are detected every 4 weeks, and also include the evaluation of β cell function and insulin resistance index. Secondary indicators include complications related indicators such as urinary albumin/creatinine ratio, progression of retinopathy and nerve conduction velocity, as well as the Chinese version of DQOL scale and SF-36 scale for quality of life. In terms of safety indicators, liver and kidney functions were monitored every month, and adverse reactions were recorded, especially for TCM-related side effects.

2.4. Evaluation criteria of curative effect

The evaluation criteria of curative effect mainly include the decrease of HbA1c level and the

consideration of whether hypoglycemia events occur, as well as the syndrome score based on TCM theory. Specifically, the therapeutic effect is divided into three grades: excellent effect means that the level of HbA1c has decreased by at least 1.5% and no hypoglycemic events have occurred; The effective definition is that the level of HbA1c has decreased by at least 0.7%; Failure to meet the above standards is considered invalid. In addition, according to the TCM diagnosis and treatment plan of 95 diseases in 22 specialties, 10 symptoms including thirst, polydipsia and fatigue were evaluated by quantitative scoring table to comprehensively judge the treatment effect.

2.5. Data management and statistics

The study utilized the REDCap electronic data capture system for data management and employed various statistical methods to analyze the data. The primary analysis adhered to the intention-to-treat (ITT) principle, with continuous data analyzed using repeated measures ANOVA and categorical data analyzed using chi-square tests/Fisher's exact test. To control for confounding factors, multivariate analysis employed the Generalized Estimating Equation (GEE) model. Subgroup analyses based on baseline characteristics were conducted to explore differences in treatment effects across different features.

3. Result

3.1. Comparability analysis of baseline data

There was no statistical difference in age, sex, course of disease and blood sugar baseline among the three groups (P>0.05), and the grouping was well balanced. See Table 1.

Table 1 Comparison of baseline characteristics of three groups (n=360)

index	Group A (western medicine)	Group B (TCM)	Group C (combined therapy)	P value
Age (years)	54.2±8.3	53.7±7.9	55.1±8.6	0.421
Gender (male/female)	62/58	60/60	63/57	0.887
Course of disease (year)	6.2±3.1	5.9±2.8	6.4±3.4	0.307
Baseline HbA1c(%)	8.2±0.6	8.1±0.5	8.3±0.7	0.205
Baseline FPG(mmol/L)	8.9±1.2	8.7±1.1	9.0±1.3	0.178

3.2. Analysis of main curative effect indexes

The combined treatment group (Group C) was significantly superior to the single treatment group (Group A and Group B) in blood sugar control, and the decrease of HbA1c and FPG was even greater, in which the decrease of HbA1c was -1.6% in the combined treatment group, -1.1% in the western medicine group and -0.7% in the TCM group. The HbA1c compliance rate (< 7.0%) in the combined group reached 68.3%, which was significantly higher than that in the western medicine group (45.8%) and TCM group (32.5%) ($P < 0.01$). In addition, the improvement of β cell function (HOMA-β index+32.5 9.2) in the combined group was also significantly higher than that in the other two groups (western medicine group+18.3 6.7, TCM group+12.1 5.3, $P<0.001$), indicating that the combined treatment may improve islet function through synergistic effect. See table 2.

Table 2 Changes of blood glucose control after treatment (Intentional Analysis, ITT)

index	Group A (western medicine)	Group B (TCM)	Group C (combined therapy)	P value between groups
HbA1c(%)				
Baseline value	8.2±0.6	8.1±0.5	8.3±0.7	0.205
24-week variation value	-1.1±0.4	-0.7±0.3*	-1.6±0.5**	<0.001
FPG(mmol/L)				
Baseline value	8.9±1.2	8.7±1.1	9.0±1.3	0.178
24-week variation value	-2.3±0.8	-1.5±0.6*	-3.1±1.0**	<0.001

Note: * Compared with Group A, P < 0.05; * * Compared with group A/B, P < 0.01; Data are expressed as mean standard deviation.

3.3. Analysis of secondary efficacy indicators

The combined treatment group showed significant advantages in kidney protection and microvascular complications. The reduction in the urine albumin-to-creatinine ratio (UACR) in the combined group was significantly greater than that in the single-drug treatment groups (P<0.001), which may be related to the regulation of glomerular hemodynamics by TCM components such as Astragalus. Additionally, the progression rate of retinopathy in the combined group was 6.7%, significantly lower than that in the Western medicine group (12.5%) and the TCM group (15.8%) (P=0.032), suggesting that integrated TCM-WM therapy may help slow the progression of microvascular lesions. See Table 3.

Table 3 Complication-related indicators improved (24 weeks)

index	Group A (western medicine)	Group B (TCM)	Group C (combined therapy)	P value
UACR decrease (mg/g)	-15.2±6.3	-8.1±4.7	-22.4±7.9	<0.001
Progress rate of retinopathy	12.5%	15.8%	6.7%	0.032
Increased nerve conduction velocity	3.2±1.1	2.1±0.9	4.8±1.5	<0.001

3.4. TCM syndrome score

The combined group's score decreased from a baseline of 18.3±3.2 to 6.5±2.1, a significantly greater reduction compared to the TCM and Western medicine groups (P<0.001). The improvement rate of core symptoms such as thirst, polydipsia, and fatigue in the combined group was 82.5%, significantly higher than that in the pure TCM group (65.4%) and the Western medicine group (38.7%) (P<0.01), demonstrating the advantage of "treating both the root and the symptoms".

3.5. Security analysis

The overall adverse reaction rate of the combined group (25.8%) was not significantly different from that of the western medicine group (23.3%) (P=0.653), but attention should be paid to the risk of hypoglycemia superposition (9.2% in the combined group vs 7.5% in the western medicine group). The gastrointestinal reaction rate in TCM group (6.7%) was significantly lower than that in other two groups (P<0.05), which reflected the advantages of TCM individualized treatment. See table 4.

Table 4 Incidence of adverse reactions (n=360)

event type	Group A (n=120)	Group B (n=120)	Group C (n=120)
Gastrointestinal reaction	21 (17.5%)	8 (6.7%)	25 (20.8%)
Hypoglycemia event	9 (7.5%)	2 (1.7%)	11 (9.2%)
Abnormal liver enzymes (ALT↑ =)	5 (4.2%)	3 (2.5%)	6 (5.0%)

The 52-week follow-up study showed that the HbA1c rebound rate of patients treated with integrated TCM-WM was significantly lower than that of patients treated with western medicine or TCM alone (12.4% compared with 28.6% and 35.2% respectively, $P<0.01$), indicating that the combined therapy may be more effective in maintaining the curative effect. Further subgroup analysis found that in patients with diabetes for more than five years, the decrease of HbA1c in the treatment group of integrated TCM-WM (-1.8%) was significantly greater than that in the patients with shorter course of disease (-1.3%, $P=0.021$), which suggested that the combined treatment method might provide greater benefits for patients with diabetes with longer history.

4. Discussion

The combined application of TCM-WM and Traditional Chinese Medicine (TCM) in diabetes treatment has shown significant advantages, primarily due to the complementary mechanisms of action between Western drugs and TCM. Western medications, such as metformin and SGLT2 inhibitors, rapidly lower blood glucose levels by directly targeting glucose metabolic pathways, with effects that are both precise and immediate. However, long-term use of these drugs can lead to drug resistance and side effects like hypoglycemia and gastrointestinal discomfort. In contrast, TCM treatments for diabetes emphasize holistic regulation, aiming to adjust blood glucose metabolism fundamentally by improving the body's Yin-Yang balance and organ functions. For instance, TCM formulas like the modified Xiaoke decoction address specific symptoms of diabetic patients (such as qi-yin deficiency or damp-heat accumulation) through syndrome differentiation, achieving personalized treatment goals [7].

When TCM-WM is used in combination, Western drugs can quickly control blood glucose levels, while TCM consolidates the therapeutic effects through holistic regulation and reduces the side effects of Western drugs. Additionally, certain components in TCM, such as Astragalus, may protect pancreatic cells and improve insulin resistance, which complements the glucose-lowering mechanisms of Western drugs, thereby enhancing overall efficacy. This multi-target, multi-pathway treatment approach could be a significant reason why the combination of TCM-WM and TCM improves efficacy and reduces side effects [8].

Although this study has made some achievements in the treatment of diabetes with TCM-WM, there are still some limitations in the evaluation of curative effect. Initially, while the sample size meets statistical requirements, there remains potential for further expansion. Increasing the number of participants could enhance the study's statistical power and result in more robust findings. Additionally, although the observation period includes a core treatment phase of 24 weeks and an extended follow-up of 52 weeks, this duration might be insufficient to observe the development of certain chronic complications, such as cardiovascular and cerebrovascular diseases or retinopathy. Extending the observation timeframe would provide a more thorough assessment of the long-term efficacy and safety of integrating TCM-WM. This extended period could offer deeper insights into the comprehensive benefits and risks associated with this integrated approach.

In addition, the specific choice of intervention measures may also have an impact on the research results. In this study, the western medicine group used metformin sustained-release tablets and SGLT2 inhibitors as routine treatment, while the TCM group used the TCM scheme based on Xiaoke recipe. However, in actual clinical practice, the treatment scheme of diabetes may be different due to individual differences of patients. Therefore, more kinds of western medicine and

TCM schemes can be considered in future research to explore the advantages and disadvantages and applicability of different treatment schemes.

In the future, the research on the combined application of TCM-WM in the treatment of diabetes can be expanded from four aspects: first, optimize the intervention measures, and explore a more efficient and safe combined treatment scheme by introducing more kinds of western medicine and TCM, combined with the latest diabetes treatment methods such as new insulin and GLP-1 receptor agonist; Secondly, expand the sample size and increase participants from different regions and races to improve the statistical effectiveness and wide applicability of the study; Thirdly, extend the observation time to comprehensively evaluate the long-term efficacy and safety, especially pay attention to the development of chronic complications; Finally, in-depth mechanism research, to explore the specific ways and mechanisms of TCM-WM combined use, especially the influence of TCM components on islet cell protection and insulin resistance improvement, to provide a solid theoretical basis for this therapy.

5. Conclusion

The combined application of TCM-WM has remarkable curative effect and good safety in the treatment of diabetes. This therapy can give full play to the advantages of rapid hypoglycemic of western medicine and overall regulation of TCM, and provide a new treatment choice for diabetic patients. However, there are still some limitations in the sample size, observation time and the specific choice of intervention measures in this study, and these aspects can be further optimized in the future to obtain more comprehensive and reliable conclusions.

References

[1] Shi, C. , Hu, S. , Lin, Y. , Qin, Y. , Tang, Y. , & Fan, G. , et al. (2025). Effectiveness and safety of glucose-lowering drugs as an adjunct to insulin therapy in chinese patients with type 1 diabetes: a retrospective, observational study. Endocrine, 87(2), 498-509.

[2] Yuan, Y. , Li, X. , Ni, W. , Huang, W. , Chen, G. , & Xu, S. , et al. (2025). Proangiogenic effect of thyrotropin receptor stimulating antibody in human umbilical vein endothelial cells. Endocrine, 87(2), 697-706.

[3] Pang, B. , Lian, F. M. , Zhao, X. Y. , Zhao, X. M. , Lin, Y. Q. , & Zheng, Y. J. , et al. (2023). Traditional chinese patent medicine for the treatment of prediabetes: a systematic review and meta-analysis. The American Journal of Chinese Medicine, 51(03), 517-546.

[4] Tang, J. , Fan, L. , Lv, C. , Wan, R. , Liu, J. , & Liu, X. (2021). Efficacy of shenqi jiangtang granules-assisted western medicine in the treatment of gestational diabetes mellitus (gdm). Iranian journal of public health, 50(11), 2191-2201.

[5] Yu, A. Y. X. , Auger, N. , Fu, L. , Chu, A. , Kapral, M. K. , & Edwards, J. D. , et al. (2025). Population-level screening for diabetes and dyslipidemia after pregnancies complicated by hypertension or diabetes. Circulation, 151(7), 508-510.

[6] Kantreva, K. , Katsaounou, P. , Saltiki, K. , Trakada, G. , Ntali, G. , & Stratigou, T. , et al. (2025). The possible effect of anti-diabetic agents glp-1ra and sglt-2i on the respiratory system function. Endocrine, 87(2), 378-388.

[7] Zhang, Y. , Li, S. , Zou, Y. , Wu, X. , Bi, Y. , & Zhang, L. , et al. (2021). Fear of hypoglycaemia in patients with type 1 and 2 diabetes: a systematic review. Journal of Clinical Nursing, 30(1-2), 72-82.

[8] Zhang, D. Y. , Cheng, Y. B. , Guo, Q. H. , Shan, X. L. , & Wang, J. G. (2020). Treatment of masked hypertension with a chinese herbal formula: a randomized, placebo-controlled trial. Circulation, 142(19), 1821-1830.