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The effect of acupuncture therapy on glycemic control in type 2 diabetes mellitus (Xiao Ke) patients with Kidney Yin Deficiency Syndrome

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ABSTRACT

A metabolic disorder known as diabetes mellitus (DM) is characterized by hyperglycemia, or abnormally elevated blood glucose levels, resulting from insulin resistance or deficiency. This quantitative study aimed to investigate the effect of acupuncture therapy on blood glucose levels in individuals with type 2 diabetes and kidney yin deficiency syndrome (*Xiāo Kě*). The research was conducted in Bekasi, West Java, from March to June 2025. A purposive sampling technique was employed to select 20 participants aged 20–30 years. Females constituted 65% of the participants, while males accounted for 35%, with a median age of 27 years. Regarding occupation, 25% were employees, 20% were housewives, and 55% were self-employed. Participants received daily acupuncture treatments over six consecutive days. Blood glucose levels were measured before and during the intervention. The mean pre-intervention blood glucose level was 136.25 mg/dL (range: 128–142 mg/dL), which decreased to a mean of 115.80 mg/dL after the intervention (range: 110–121 mg/dL). The mean reduction in blood glucose was 24.45 mg/dL, representing a 17.94% decrease. In one subset of participants, 15% experienced a reduction of 23 mg/dL. The Shapiro–Wilk normality test indicated that the data were normally distributed ($p > 0.05$). A paired-sample t-test revealed a statistically significant difference between pre- and post-intervention blood glucose levels ($p < 0.05$). These findings indicate that acupuncture therapy significantly reduces blood glucose levels in individuals with type 2 diabetes and kidney yin deficiency syndrome.

Keywords: acupuncture, blood sugar, deficiency syndromedo kidney, diabetes, *Xiao ke*

INTRODUCTION

Diabetes mellitus (DM) is one of the most prevalent chronic metabolic disorders and is classified as a non-communicable disease. It is characterized by disturbances in carbohydrate, lipid, and protein metabolism, resulting in hyperglycemia or elevated blood glucose levels. Hyperglycemia occurs when insulin production is insufficient, insulin resistance develops, or both conditions coexist. This metabolic imbalance impairs the cellular utilization of glucose, leading to persistently elevated blood sugar levels over an extended period (Agustina et al., 2022). According to the International Diabetes Federation, approximately 537 million adults were living with diabetes in 2021, and this number is projected to increase to 643 million by

2030 (International Diabetes Federation, 2021). These figures underscore diabetes as a major global health challenge that demands comprehensive and sustainable management strategies.

Effective glycemic control remains the cornerstone of diabetes mellitus management. Conventional therapeutic approaches, including oral hypoglycemic agents and insulin therapy, aim to stabilize blood glucose levels; however, not all patients achieve satisfactory glycemic outcomes. Some encounter adverse effects, drug dependence, or difficulties in maintaining long-term adherence. These limitations have prompted growing interest in alternative and complementary therapies, such as acupuncture, which has gained popularity among patients who do not respond optimally to pharmacological treatments (Pan et al., 2021).

Recent data indicate that the prevalence of type 2 diabetes mellitus (T2DM) in Indonesia reached approximately 10.8% in 2021, affecting around 20.4 million adults. This places Indonesia among the countries with the highest diabetes burden globally. Non-communicable diseases (NCDs), including diabetes mellitus, account for 73% of total deaths in the country, with cardiovascular disease as the leading cause. Although the prevalence of T2DM continues to rise, effective prevention and management programs can help mitigate this trend. These observations highlight the need to control modifiable risk factors such as obesity and high-fat dietary intake to reduce diabetes prevalence (WHO, 2024). Diabetes mellitus is linked to increased risks of cardiovascular disease, cerebrovascular accidents, renal failure, blindness, and neuropathy, among other severe complications. Classical clinical manifestations include polyphagia, polyuria, polydipsia, blurred vision, persistent fatigue, and unexplained weight loss. Promoting public awareness of these symptoms is crucial for early diagnosis and prevention of advanced complications (Kumar et al., 2023).

T2DM management often integrates conventional medical approaches with complementary treatments such as Traditional Chinese Medicine (TCM). In TCM, syndromes such as qi-yin deficiency and dysfunction of the spleen and kidneys are frequently implicated in T2DM pathophysiology. Therapeutic strategies commonly involve herbal remedies and acupuncture (Bao et al., 2021). A network meta-analysis demonstrated that combining TCM with Western medicine was more effective than standard treatment alone in reducing fasting blood glucose (FBG), two-hour postprandial glucose (2hPG), and hemoglobin A1c levels, with fewer adverse events reported (Ma et al., 2023).

Unlike modern biomedicine, TCM emphasizes syndromic differentiation rather than disease classification. Diabetes mellitus corresponds to the syndrome known as Xiāo Kě, characterized

by excessive thirst, polyphagia, weight loss, blurred vision, frequent urination, pruritus, and fluctuations in body composition ranging from emaciation to obesity. Xiāo Kě is considered to arise from the imbalance of internal (endogenous) and external (exogenous) factors that disrupt systemic harmony (Ng et al., 2024).

According to Open Data Jabar (2025), the number of diabetes cases in West Java reached 44,846 in 2023. A preliminary survey conducted at Ndalem PUIN Daun Mas, Bekasi City, recorded 240 patients reporting elevated blood glucose levels in the preceding three months. The increasing prevalence of T2DM, combined with the limitations of conventional therapies in maintaining long-term glycemic stability, has intensified interest in safe and effective alternative approaches. Acupuncture, integral to TCM's holistic framework, has demonstrated potential in improving parameters such as hemoglobin A1c, fasting blood glucose, and insulin sensitivity (ISI). Within TCM theory, diabetes is often associated with kidney Yin deficiency—a condition believed to contribute to pathogenesis—and acupuncture is employed to restore physiological balance and promote recovery (Si et al., 2025).

Given these considerations, this study aims to evaluate the effects of acupuncture on blood glucose fluctuations among individuals with type 2 diabetes mellitus and kidney Yin deficiency syndrome (Xiāo Kě). The main objective is to assess acupuncture's efficacy as an adjunctive therapy for glycemic control and to explore its potential in addressing metabolic disorders associated with kidney Yin imbalance through a holistic, balance-centered therapeutic approach.

METHOD

This quantitative study employed a pre- and post-test design with a single group. Blood glucose levels were measured before and after the acupuncture intervention administered to the same group of patients. Comparisons between the pre-test and post-test results reflected the observed changes in blood glucose levels following treatment. Sampling was conducted using a purposive sampling technique based on specific predetermined inclusion criteria. The research design followed the framework proposed by Hidayat (2014), consisting of three main stages: the initial test (pre-test) before treatment, the treatment phase (intervention) involving acupuncture administration to research subjects, and the final test (post-test) conducted after treatment completion.

The study population comprised 240 individuals diagnosed with diabetes mellitus. Participants were selected using purposive sampling according to the inclusion criteria: diagnosed with type 2 diabetes mellitus accompanied by kidney Yin deficiency syndrome, aged between 20 and 30 years, not currently undergoing other treatments, and willing to participate in six consecutive days of acupuncture therapy. Exclusion criteria included voluntary withdrawal from the study, irregular attendance in therapy sessions, and conditions such as pregnancy or breastfeeding. The study was conducted at Ndalem PUIN Daun Mas, Bekasi City, West Java, beginning with a preliminary investigation in March 2025 and concluding in June 2025.

The research instruments served as tools for the systematic collection of quantitative data for subsequent statistical analysis (Sugiyono, 2021). Instruments included informed consent forms, respondent compliance sheets, observation sheets documenting participant identity and blood glucose levels, and a digital glucometer with writing materials for measurement recording. Quantitative data processing was performed in sequential stages: data verification (editing), coding, entry into statistical software (SPSS), and tabulation to enable systematic grouping and preparation for analysis.

Data analysis comprised univariate and bivariate approaches. Univariate analysis was employed to describe blood glucose levels as a single variable. Bivariate analysis was then conducted to assess the correlation between pre-test and post-test measurements. Data normality was evaluated using the Shapiro–Wilk test. If data demonstrated a normal distribution ($p > 0.05$), hypothesis testing was performed using the Independent Samples t-test. For data that did not meet normality assumptions, the Wilcoxon test was applied. Homogeneity of variance was further assessed using Levene's test ($p > 0.05$).

RESULTS

Based on the data presented in Table 1, the frequency distribution summarizes the demographic characteristics of 20 research subjects across three variables: age, gender, and occupation. With respect to age, the participants ranged from 22 to 30 years. The most frequent age was 27 years, comprising 6 subjects (30% of the sample), followed by 28 years with 4 subjects (20%). The ages of 23, 24, 29, and 30 years each included 2 subjects (10% per group). The least represented ages were 22 and 26 years, with 1 participant (5%) in each category. In terms of gender, the sample was predominantly female, consisting of 13 participants (65%), while the remaining 7 participants (35%) were male. Regarding occupation, the majority of participants were

entrepreneurs (11 individuals, 55%), followed by employees (5 individuals, 25%) and housewives (4 individuals, 20%).

Table 1. Frequency Distribution of Research Subjects by Age, Gender, and Occupation

Variable	Frequency	Percentage (%)
Age		
22 years	1	5
23 years	2	10
24 years	2	10
26 years	1	5
27 years	6	30
28 years	4	20
29 years	2	10
30 years	2	10
Sex		
Female	13	65
Male	7	35
Occupation		
Employee	5	25
Housewife	4	20
Entrepreneur	11	55

Table 2 presents the frequency distribution and descriptive statistics of blood glucose levels for 20 research subjects, based on three measurements: pre-intervention, post-intervention, and the corresponding reduction. In the pre-intervention phase, blood glucose levels ranged from 128 mg/dL to 142 mg/dL. The most frequently observed value was 138 mg/dL, recorded in 4 out of 20 subjects. Several other values, specifically 133, 137, 139, and 141 mg/dL, were each observed in 2 subjects. The remaining values (128, 129, 130, 131, 135, and 136 mg/dL) occurred in only one subject each. The summary statistics for this group indicate a mean blood glucose level of 136.25 mg/dL, a median of 137.5 mg/dL, and a standard deviation of 4.29 mg/dL.

Table 2. Frequency Distribution and Descriptive Statistics of Pre- and Post-Intervention Blood Glucose Levels (n=20)

Pre-Intervention		Post-Intervention	
Value (mg/dL)	**Freq. (f)**	**Value (mg/dL)**	**Freq. (f)**
128	1	110	2
129	1	111	1
130	1	112	1
131	1	113	1
133	2	115	4
135	1	116	3
136	1	117	2
137	2	118	1
138	4	119	2
139	2	120	1
141	2	121	2
142	2		
Total	**20**	**Total**	**20**
Mean	136.25	**Mean**	115.8
Median	137.5	**Median**	116
Std. Dev.	4.29	**Std. Dev.**	3.365

Following the intervention, blood glucose levels ranged from 110 mg/dL to 121 mg/dL. The most frequent post-intervention value was 115 mg/dL (4 subjects), followed by 116 mg/dL (3 subjects). The values 110, 117, 119, and 121 mg/dL were each recorded in 2 subjects, while 111, 112, 113, 118, and 120 mg/dL were observed in one subject each. The descriptive statistics for this phase show a mean of 115.8 mg/dL, a median of 116 mg/dL, and a standard deviation of 3.37 mg/dL.

Table 3 provides a frequency distribution detailing the amount of reduction in blood glucose levels observed across 20 research subjects. The observed reductions ranged from a minimum of 18 mg/dL to a maximum of 23 mg/dL. The smallest reduction, 18 mg/dL, was seen in 2 subjects, accounting for 10% of the sample. The largest reduction, 23 mg/dL, was observed in 3 subjects, representing 15% of the group. A reduction of 19 mg/dL also occurred in 3 subjects (15%). The most common outcomes were reductions of 20 mg/dL, 21 mg/dL, and 22 mg/dL;

each of these values was recorded for 4 subjects, with each group representing 20% of the total sample.

Table 3. Frequency Distribution Based on the Reduction in Blood Glucose Levels

Blood Glucose Levels	Frequency	Percentage %	Mean	Median	Std. Dev.
18	2	10	20.70	21.00	1.593
19	3	15			
20	4	20			
21	4	20			
22	4	20			
23	3	15			

Overall, the average (mean) reduction in blood glucose levels for the entire group was 20.70 mg/dL. The median reduction was 21.00 mg/dL, indicating that half of the subjects experienced a reduction of 21 mg/dL or more. The standard deviation was 1.593 mg/dL, suggesting the reduction amounts were clustered fairly closely around the mean.

Bivariate analysis was conducted following the univariate analysis test for the presence or absence of a normal distribution in the data. The Shapiro-Wilk test was used to determine whether the data occurred normally because sample size consisted of only 20 subjects, which is below 50.

Table 4. Normality Test of Blood Glucose Level Reduction

	Shapiro-Wilk (Sig.)		
	Statistic	**df**	**Sig.**
Pre-Test	.169	20	.145
Post-Test	.156	20	.382

Table 4 shows that the data were normally distributed, since the results of the Shapiro-Wilk normality test were larger than 0.05. Because of this, a T-test was run later on. The results of the Paired Sample T-Test, as shown in Table 5, demonstrated a statistically significant difference between the measures taken before and after the intervention, with a Sig. (2-tailed) value of 0.000 < 0.005. There was an average change of 24.45 mg/dL between the pre- and post-tests.

Table 8. Paired Sample T-Test

	Paired Differences							
			SE	95% CI				Sig.
	Mean	Std. Dev	Mean	Lower	Upper	T	df	(2-tailed)
Pre-Post	24.45	1.932	.432	19.546	21.354	47.327	19	.000

DISCUSSION

There was a high prevalence of renal Yin deficiency syndrome and type 2 diabetes mellitus among the 20 participants in this study, 30% of whom were 27 years old, indicating a concerning occurrence among young adults. This pattern is likely influenced by modern lifestyle factors such as poor dietary habits, physical inactivity, and elevated stress levels. Most respondents were female (65%), which may relate to the hormonal roles of estrogen and progesterone in glucose metabolism regulation, as well as socio-cultural behavioral distinctions. The majority of participants were self-employed (55%), a demographic often characterized by less physical activity and inadequate fluid intake, which, from a traditional medicine perspective, may impair kidney function and disrupt metabolic and hormonal balance. These findings are consistent with previous studies emphasizing the interrelationship between age, gender, occupation, and lifestyle factors in the pathogenesis of diabetes (Gaisani, 2023; Rizqi et al., 2024). Univariate analysis was employed to describe sample characteristics, while additional statistical tests, including the Shapiro–Wilk test for normality, served as the foundation for bivariate analysis. This study highlights the necessity of preventive lifestyle interventions, particularly among high-risk groups such as the self-employed, to curb the increasing prevalence of diabetes from an early age.

All participants (n = 20, 100%) exhibited fasting blood glucose levels ≥126 mg/dL prior to the intervention, confirming the diagnosis of type 2 diabetes mellitus. Following acupuncture therapy, all participants demonstrated reductions in blood glucose levels. Post-intervention, the highest blood glucose level recorded was 121 mg/dL (10% of participants), while the lowest was 110 mg/dL (10% of participants). The greatest reduction was observed at 115 mg/dL (20% of participants). These findings suggest that acupuncture may serve as an effective complementary therapy for individuals with type 2 diabetes mellitus and renal Yin deficiency

syndrome by facilitating blood glucose reduction. The underlying mechanism is hypothesized to involve stimulation of acupuncture points such as BL20, ST36, and SP6, which promote energy (qi) circulation and balance autonomic nervous activity, thereby enhancing glucose metabolism regulation. These results align with prior research (Cao et al., 2023; Chen et al., 2022) demonstrating acupuncture's beneficial role in diabetes management and complication control.

Paired-sample t-test analysis revealed a statistically significant effect of acupuncture therapy on changes in blood glucose levels among patients with type 2 diabetes mellitus (Xiāo Kě) and renal Yin deficiency syndrome, with a significance value (ρ) of 0.000. All participants who initially had blood glucose levels >126 mg/dL showed marked reductions post-treatment. The statistical analysis confirmed a significant decrease from pre- to post-intervention values (Sig. (2-tailed) = 0.000, $p < 0.005$), with a mean difference of 24.45 mg/dL, indicating a clinically meaningful improvement in glycemic control.

These results are consistent with findings from Wahyu's research, which reviewed randomized controlled trials (RCTs) in China, the United Kingdom, Iran, Egypt, and Taiwan. That meta-analysis reported that individuals with type 2 diabetes receiving acupuncture therapy experienced a mean HbA1c reduction of 0.57 units compared to the control group (SMD = -0.57; 95% CI = -1.15 to 0.02; p = 0.060) (Wahyu et al., 2024). Similarly, Purwanto (2020) noted that acupuncture contributes to improved glucose metabolism and a lower body mass index, thereby reducing the risk of chronic diseases. Additional studies have confirmed that acupuncture at ST36 (Zusanli) enhances pancreatic β-cell morphology and insulin sensitivity. The principal meridians targeted in acupuncture for type 2 diabetes include the Stomach Yangming and Bladder Taiyang meridians of the foot, as well as RN12 and RN4 (Cao et al., 2023; Dou et al., 2021; Park et al., 2023).

CONCLUSION

The findings of this study indicate that most participants were self-employed (55%), female (65%), and within the productive age group (27 years/30%). According to Traditional Chinese Medicine (TCM), all participants were diagnosed with type 2 diabetes mellitus, a condition characterized by impaired insulin regulation and energy imbalance, as evidenced by chronic hyperglycemia (≥126 mg/dL) prior to the intervention. Following acupuncture treatment, blood glucose levels in all 20 patients decreased, ranging from 110 to 121 mg/dL. The Paired Sample

T-Test revealed a highly significant difference (ρ = 0.000), with a mean reduction of 24.45 mg/dL. These findings suggest that acupuncture may serve as an effective adjunctive therapy for improving metabolic stability and organ function in individuals with kidney Yin deficiency syndrome and type 2 diabetes mellitus.

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