CLINICAL CHARACTERISTICS AND TRADITIONAL MEDICINE SYNDROMES ASSOCIATED WITH HBA1C CONTROL IN INPATIENTS WITH TYPE 2 DIABETES MELLITUS

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This cross-sectional study aimed to determine the rate of HbA1c control and identify clinical characteristics and traditional medicine syndromes associated with glycemic control among patients with type 2 diabetes mellitus. A total of 197 inpatients diagnosed with type 2 diabetes mellitus were enrolled at the Traditional Medicine Hospital – Ministry of Public Security from August 2022 to August 2023. Clinical and laboratory data were collected and analyzed using SPSS 20.0. Among the participants, 76.1% had suboptimal glycemic control with HbA1c levels ≥ 7%. Significant associated factors included age under 60 years old (OR = 5.748; p = 0.038), disease duration over 10 years (OR = 2.91; p = 0.048), poor dietary adherence (OR = 14.91; p < 0.001), and insufficient physical activity (OR = 10.07; p < 0.001). Traditional medicine syndrome differentiation was statistically associated with HbA1c levels (p = 0.009), in which patients with Qi-Yin deficiency or Yin essence deficiency syndromes were less likely to achieve glycemic targets. HbA1c control remains suboptimal among patients with type 2 diabetes mellitus. Greater emphasis on lifestyle interventions and syndrome-based classification in traditional medicine may enhance individualized treatment strategies.

Keywords: HbA1c, type 2 diabetes mellitus, clinical characteristics, traditional medicine.

I. INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a complex metabolic disorder that results from the interaction between genetic predisposition and environmental factors. Its core pathophysiology involves progressive loss of pancreatic β-cell function and mass, along with increased glucagon secretion and insulin resistance in muscle, liver, and adipose tissues.[1] According to the IDF Diabetes Atlas 10th Edition, an estimated 537 million adults (aged 20 – 79) were living with diabetes in 2021, representing 10.5% of the global population in this age group. This number is expected to rise to 783 million by 2045. Additionally, around 240 million people have undiagnosed diabetes, with nearly 90% living in low- and middle-income countries. In Vietnam, the national prevalence of diabetes among adults aged 20 – 79 years was estimated at 6.0% (95% CI: 5.1% – 6.8%), with an age-adjusted comparative prevalence of 6.1% (95% CI: 5.2% – 7.0%), corresponding to approximately 3.99 million people living with the disease.[2] A 2022 national survey further reported a diabetes prevalence of 7.3% and

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Received: 13/07/2025
Accepted: 04/08/2025

a prediabetes prevalence of 17.9% among Vietnamese adults.[3] T2DM accounts for the vast majority of cases and is rising sharply, largely due to population aging, rapid urbanization, and modern environments that promote metabolic disorders.[4] Prolonged hyperglycemia is a major cause of multi-organ complications and reduced quality of life. Achieving and maintaining glycemic control, typically defined as an HbA1c level below 7%, is considered a primary goal in reducing diabetes-related complications.[5] However, clinical data from Vietnam show that the proportion of patients reaching this target remains low, ranging from only 20% to 32%. Poor glycemic control is influenced by several factors, including longer disease duration, poor treatment adherence, unhealthy lifestyle habits, overweight, and central obesity, all of which are increasingly common in the population.[6,7]

In Traditional Medicine (TM), T2DM is categorized under "*Xiaoke syndrome*" (wasting and thirsting disorder – Chứng Tiêu khát), which includes multiple clinical patterns.[8] Syndrome differentiation not only helps determine treatment strategies but also reflects the patient's underlying pathological state. A large-scale systematic review from China by Dou, et al. (2021) found that the most common TM patterns in T2DM were spleen deficiency and kidney deficiency. These syndromes were closely associated with specific herbal formulas, acupoint selections, and treatment principles.[9] Although that study did not directly evaluate HbA1c levels, it suggested that TM syndrome types may reflect the disease state and potentially influence glucose control.

In line with the growing interest in personalized medicine and the integration of Traditional and Modern approaches, this study was conducted to explore the association between HbA1c control and TM syndrome types, along with selected clinical characteristics, in hospitalized patients with T2DM. The findings are expected to support a more comprehensive and individualized approach to diabetes management.

II. MATERIALS AND METHODS

1. Subjects

The study population included patients diagnosed with T2DM who were admitted for inpatient treatment at the Traditional Medicine Hospital - Ministry of Public Security.

Inclusion criteria

Patients aged over 40 years old, regardless of gender, who voluntarily agreed to participate in the study, and were clinically diagnosed with T2DM based on the 2020 guidelines of the Vietnamese Ministry of Health.[10] Diagnosis was based on at least one of the following criteria:

a) Fasting plasma glucose ≥ 126 mg/dL (7.0 mmol/L).

b) 2-hour plasma glucose ≥ 200 mg/dL (11.1 mmol/L) during a 75-g oral glucose tolerance test.

c) HbA1c ≥ 6.5% (48 mmol/mol), measured by a standardized method.

d) Random plasma glucose ≥ 200 mg/dL (11.1 mmol/L) in a patient with classic symptoms of hyperglycemia or hyperglycemic crisis.

A diagnosis was confirmed if at least two of criteria (a), (b), or (c) exceeded the diagnostic threshold, either from the same sample or from two separate time points. Criterion (d) alone was sufficient for diagnosis.

Exclusion criteria

Patients with gestational diabetes; patients who have tongue diseases; those with severe acute or chronic illnesses; patients without HbA1c test results within the last three months; newly diagnosed patients (less than three months since diagnosis); patients for whom

BMI could not be accurately measured (due to edema, limb deformities, spinal curvature, etc.); patients with psychiatric disorders or cognitive impairment; and those who were uncooperative during clinical evaluation.

2. Methods

Study design

Cross-sectional descriptive study.

Study period

From August 2022 to August 2023.

Study location

Traditional Medicine Hospital – Ministry of Public Security.

Sample Size

The sample size was calculated using the formula for estimating a population proportion:

$$n = Z^2_{1-\alpha/2} \cdot \frac{p.(1-p)}{\Delta^2}$$

n: Required sample size.

p: The proportion of patients with regular follow-up adherence was estimated at 35%, based on the study by Tran Van Hai (2022).[11]

$Z^2_{1-\alpha/2}$: Standard normal deviate corresponding to the desired confidence level; with α = 0.05, the 95% confidence level corresponds to $Z_{1-\alpha/2}$ = 1,96.

Δ: Acceptable absolute margin of error, set at 0.05.

Using this formula, the minimum required sample size was calculated to be 178 patients. To account for a potential 10% non-response rate or incomplete data collection, the final sample was increased to 197 patients.

Sampling Method

Convenience sampling was used. Patients who met the inclusion criteria were enrolled consecutively until the required sample size was reached. Each patient was included only once during the data collection period.

Data Collection Tools: Data were collected using a structured data collection form.

Data Collection Technique: Patients were interviewed directly using the data collection form, and additional information was obtained from their medical records.

Data Processing: Data were entered and processed using Microsoft Excel and analyzed using SPSS software, version 20.0.

Study Variables

Clinical characteristics: Age, gender, duration since diagnosis (≥ 10 years/ < 10 years), height, weight, and waist circumference.

Anthropometric measurements and assessment methods:

Height was measured using a standard vertical measuring board. The subject stood upright in a relaxed posture, heels together in a V shape, and eyes facing forward. Height was measured from the top of the head to the heel. The acceptable error margin was within 0.1cm. Unit: meters (m).

Weight was measured with subjects wearing light clothing and no shoes. Participants stood in the correct position on the scale, and body weight was recorded to the nearest 0.1kg. Unit: kilograms (kg).

- Body Mass Index (BMI) was calculated using the formula:

BMI (kg/m²) = Weight (kg)/[Height (m)]²

BMI classification followed the 2004 criteria from the World Health Organization Western Pacific Regional Office (WPRO), specifically for Asian populations. Patients were classified as non-overweight (BMI < 23 kg/m²) or overweight/ obese (BMI ≥ 23 kg/m²).[12]

Waist circumference was measured using a standardized measuring tape approved by the Vietnam Directorate for standards, metrology and quality.

- *Measurement procedure:* The patient stood upright with feet 10cm apart, weight evenly distributed on both legs, and abdomen

exposed. Measurements were taken during light exhalation, avoiding muscle tension. The tape was positioned midway between the lower margin of the last rib and the top of the iliac crest. The acceptable error margin was within 0.1cm. Unit: centimeters (cm).

+ *Assessment:* Central obesity (abdominal/ upper-body obesity, apple-shaped obesity) was defined as waist circumference ≥ 90cm for males and ≥ 80cm for females.[10]

Lifestyle habits: Dietary adherence: Yes/ No; Adequate physical activity**:** Yes/No (Classification based on Ministry of Health guidelines).[10]

Traditional Medicine syndrome classification for Xiaoke (wasting and thirsting): Heat injuring fluids; Yin essence deficiency; Qi-Yin deficiency; Yin-Yang deficiency; Blood stasis.[8]

Table 1. Traditional Medicine syndrome classification for Xiaoke[8]

Syndrome Type	Inspection (Wang zhen – Visual Observation)	Auscultation & Olfaction (Wen zhen – Listening/ Smelling)	Inquiry (Wen zhen – Patient Interview)	Palpation (Qie zhen – Pulse/Touch)
Dry-Heat Damaging Fluids	Thin body habitus, red and dry tongue body with thin yellow coating	Normal voice, no cough, no hiccups	Thirst with strong desire to drink, dry mouth and throat, polyphagia, polyuria with large volume, constipation, fatigue in limbs	Dry skin, pulse slippery and rapid / wiry-thin / thin-rapid
Yin Essence Deficiency	Thin body, red and small dry tongue	Normal voice, no cough, no hiccups	Frequent urination with turbid urine, dry mouth with desire to drink, five-center heat, tidal fever, dizziness, tinnitus, soreness/ weakness of lumbar and knees, spermatorrhea, insomnia, spontaneous sweating, itching	Dry skin, thin and rapid pulse
Qi-Yin Deficiency	Pale or reddish tongue with thin white coating, dull complexion	Weak voice, possibly shortness of breath or shallow respiration	Dry mouth with thirst, excessive hunger or poor appetite with abdominal fullness, polyuria, loose stool, fatigue, dizziness, confusion, warm palms and soles, low back/knee pain, limb numbness, spontaneous/night sweats	Deep and thin pulse

Yin-Yang Deficiency	Dark complexion, pale tongue with dry white coating	Normal voice, no cough, no hiccups	Polydipsia and polyuria, or edema with oliguria and turbid urine, cold intolerance, cold limbs, spontaneous sweating, early morning diarrhea (Wu Geng Xie)	Deep, thin, and weak pulse
Blood Stasis	Thin body with dark complexion, dusky tongue with stasis spots or sublingual venous distension, thin white or scanty coating	Normal voice, no cough, no hiccups	Dry mouth, frequent urination, body numbness or pain, insomnia, dry and stiff skin	Wiry, deep, choppy or intermittent pulse

HbA1c measurement: Blood samples were collected from the median cubital vein and analyzed using high-performance liquid chromatography (HPLC) with a D-10 Hemoglobin Analyzer (Bio-Rad). Glycemic control was defined as HbA1c < 7%.[10]

3. Research ethics

All participants were informed about the study and provided verbal consent before enrollment. Data were collected honestly and processed with accuracy. All patient information was kept strictly confidential and used solely for scientific purposes

III. RESULTS

1. Clinical characteristics of the study population

Table 2. Clinical characteristics of participants (n = 197)

Characteristic		Number (n)	Percentage (%)
Age	≥ 40 and < 60 years	26	.20
	≥ 60 years	171	.80
Gender	Male	85	.15
	Female	112	.85
Duration of diabetes	≥ 10 years	73	.06
	< 10 years	124	.94
Physical activity	Insufficient	122	.93
	Sufficient	75	.07
Dietary adherence	Poor	140	.07
	Good	57	.93

Characteristic		Number (n)	Percentage (%)
BMI classification	≥ 23 kg/m²	96	.73
	< 23 kg/m²	101	.27
Waist circumference	Above standard	114	.87
	Within standard	83	.13
TM pattern	Heat injuring fluids	35	.77
	Yin essence deficiency	45	.84
	Qi-Yin deficiency	61	.96
	Yin-Yang deficiency	31	.74
	Blood stasis	25	.69

The majority of patients in this study were aged 60 years or older (86.8%) and were female (56.85%). Most participants had been diagnosed with diabetes for less than 10 years (62.94%). A large proportion did not meet recommended levels of physical activity (61.93%) and did not adhere to dietary guidelines (71.07%). Nearly half of the patients had a BMI ≥ 23 kg/m² (48.73%), while 57.87% had waist circumference values above the standard threshold, indicating a high prevalence of central obesity. Regarding TM classification, the most common syndrome was Qi-Yin deficiency (30.96%), followed by Yin essence deficiency (22.84%) and Heat injuring fluids (17.77%).

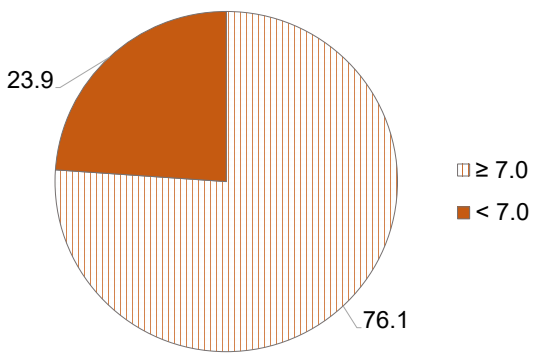

Chart 1. Proportion of patients achieving HbA1c control

The majority of patients had HbA1c levels ≥ 7.0%, accounting for 76.1% of the study population.

2. Association Between HbA1c Levels and Clinical Characteristics

Table 3. Association between HbA1c levels and selected clinical characteristics

Characteristic		HbA1c(%)		OR [95%CI]	p-value
		≥ 7.0 (n,%)	< 7.0 (n,%)		
Age	< 60 years	22 (11.68)	4 (2.03)	1.85 [0.603; 5.663]	0.333
	≥ 60 years	128 (64.97)	43 (21.83)		

Characteristic		HbA1c(%)		OR [95%CI]	p-value
		≥ 7.0 (n,%)	< 7.0 (n,%)		
Gender	Male	66 (33.5)	19 (9.64)	1.16 [0.595; 2.253]	0.666
	Female	84 (42.64)	28 (14.21)		
Duration of diabetes	≥ 10 years	67 (34.01)	6 (3.05)	5.516 [2.209; 13.775]	0.000
	< 10 years	83 (42.13)	41 (20.81)		
Physical activity	Insufficient	110 (55.84)	12 (6.09)	8.021 [3.793; 16.961]	0.000
	Sufficient	40 (20.30)	35 (17.77)		
Dietary adherence	Poor	124 (62.94)	16 (8.12)	9.24 [4.423; 19.304]	.000
	Good	26 (13.20)	31 (15.74)		
BMI classification	≥ 23 kg/m²	75 (38.07)	21 (10.66)	1.238 [0.641; 2.391]	0.524
	< 23 kg/m²	75 (38.07)	26 (13.20)		
Waist circumference	Above standard	93 (47.21)	21 (10.66)	2.020 [1.041; 3.920]	0.036
	Within standard	57 (28.93)	26 (13.20)		

The proportion of patients with HbA1c ≥ 7.0% was 84.6% in the group aged under 60 years (22/26) and 74.8% in those aged 60 years and above (128/171). Similarly, the proportion was higher in male patients (77.6%; 66/85) compared to female patients (75.0%; 84/112). However, these differences were not statistically significant (p > 0.05).

Lack of adequate physical activity was significantly associated with poor glycemic control (OR = 8.02; 95% CI: 3.793 – 16.961; p < 0.001). Similarly, patients with poor dietary adherence had a markedly higher rate of HbA1c ≥ 7.0% compared to those with good adherence (OR = 9.24; 95% CI: 4.423 – 19.304; p < 0.001).

A statistically significant association was also observed between elevated waist circumference and poor glycemic control (OR = 2.02; 95% CI: 1.041 – 3.920; p = 0.036). In contrast, BMI ≥ 23 kg/m² was not significantly associated with HbA1c status (OR = 1.24; 95% CI: 0.641 – 2.391; p = 0.524).

Table 4. Association between HbA1c levels and Traditional Medicine syndrome types (n = 197)

TM Syndrome Type	HbA1c (%)		p-value
	≥ 7.0 (n,%)	< 7.0 (n,%)	
Heat injuring fluids	30 (15.23)	5 (2.54)	0.179
Yin essence deficiency	34 (17.26)	11 (5.58)	
Qi-Yin deficiency	40 (20.30)	21 (10.66)	
Yin-Yang deficiency	25 (12.69)	6 (3.05)	
Blood stasis	21 (10.66)	4 (2.03)	

The proportion of patients with HbA1c ≥ 7.0% was 75.6% in the Yin essence deficiency group (34/45) and 65.6% in the Qi-Yin deficiency group (40/61). The highest proportion was observed in the Blood stasis group (84.0%; 21/25), followed by the Yin-Yang deficiency group (80.6%; 25/31). In the Heat injuring fluids group (reference), the proportion was 85.7% (30/35). Despite these variations, the differences in HbA1c control among TM syndrome types were not statistically significant (p = 0.179).

Table 5. Multivariate logistic regression analysis of factors associated with good HbA1c control

Independent variable	B	p-value	OR	95% CI
Age < 60	1.749	0.038	5.748	1.099 - 30.062
Male sex	-0.971	0.082	0.379	0.127 - 1.130
Duration > 10 years	1.067	0.048	2.907	1.008 - 8.385
Good dietary adherence	2.702	0.000	14.911	4.951 - 44.906
Regular physical activity	2.310	0.000	10.071	3.502 - 28.957
Waist circumference above standard	-0.707	0.296	2.027	0.539 - 7.626
BMI ≥ 23	-0.201	0.773	0.818	0.208 - 3.214
TM pattern*		0.009		
Yin essence deficiency	-2.208	0.013	0.110	0.019 - 0.622
Qi-Yin deficiency	-2.893	0.002	0.055	0.009 - 0.339
Yin-Yang deficiency	-1.226	0.21	0.294	0.043 - 1.996
Blood stasis	-0.428	0.648	0.652	0.104 - 4.099

**Reference group for TM pattern: Heat injuring fluids.*

B: Logistic regression coefficient

Logistic regression analysis identified several factors significantly associated with increased odds of poor glycemic control (HbA1c ≥ 7.0%). These included age under 60 years (OR = 5.748; p = 0.038). duration of diabetes over 10 years (OR = 2.907; p = 0.048). poor dietary adherence (OR = 14.911; p < 0.001). and lack of regular physical activity (OR = 10.071; p < 0.001).

TM syndrome classification was also significantly associated with HbA1c control (p = 0.009). Compared with the heat injuring fluids pattern (reference group). patients with the Yin essence deficiency pattern (OR = 0.110; 95% CI: 0.019 – 0.622; p = 0.013) and the Qi-Yin deficiency pattern (OR = 0.055; 95% CI: 0.009 – 0.339; p = 0.002) had significantly lower odds of achieving good glycemic control. even after adjusting for clinical covariates. Other factors such as gender. BMI. and waist circumference were not significantly associated with HbA1c outcomes.

IV. DISCUSSION

The results of this study showed that only 23.9% of patients achieved the target HbA1c level of less than 7%. This means that nearly three-quarters of the study

population did not reach adequate glycemic control. as recommended by the American Diabetes Association (ADA), which advocates maintaining HbA1c below 7% to reduce the risk of chronic complications.[13] This is a noteworthy finding, reflecting the suboptimal glycemic control status among hospitalized patients with T2DM in this setting. This observation is consistent with previous studies in Vietnam. For example, a study by Nguyen Le Dieu Hien at Da Nang Hospital reported a control rate of only 20.6%,[7] while research by Bui Thi Minh Phuong in Thai Binh showed a slightly higher rate of 32.1%, although still below the recommended target.[6] The low rate of HbA1c control may be attributed to several factors, such as a high proportion of patients with long-standing disease, existing complications, and metabolic disturbances. Additionally, poor adherence to dietary recommendations, lack of physical activity, and irregular follow-up visits may also play a role. It is also important to note that this study was conducted in an inpatient setting within a densely populated urban area, where patients often present with more complex or advanced disease compared to outpatient populations. This could have contributed to the high proportion of patients with HbA1c levels ≥ 7%.

The proportion of patients with HbA1c ≥ 7.0% was higher in the group aged under 60 years (84.6%) compared to those aged 60 years and above (74.8%), although this difference was not statistically significant (OR = 1.85; p = 0.333). Similarly, male patients tended to have poorer glycemic control than females, but this trend also did not reach statistical significance (OR = 1.16; p = 0.666). These findings suggest that younger patients and males may have lower treatment adherence, possibly due to irregular routines or prolonged work-related stress, which can interfere with the consistent and structured management required in diabetes care. In contrast, behavioral factors such as poor dietary adherence (OR = 9.24; p < 0.001) and insufficient physical activity (OR = 8.02; p < 0.001) were strongly associated with failure to achieve target HbA1c levels. These two lifestyle factors remained significant in the multivariate analysis. Our findings are consistent with the study by Bui Thi Minh Phuong, which also showed that patients with poor dietary habits had significantly worse glycemic control.[6] Importantly, a meta-analysis by Jansson, et al. (2022), which evaluated the effect of resistance training on HbA1c levels in adults with T2DM, reported that physical exercise significantly reduced HbA1c compared to control groups. The pooled analysis of 20 randomized controlled trials (n = 1172) found a weighted mean difference of –0.39% (95% CI: –0.60 to –0.18; p < 0.001).[14] In addition, poor eating and exercise habits are known to contribute to increased waist circumference. In our study, elevated waist circumference was also positively associated with HbA1c ≥ 7.0%, supporting the notion that visceral fat and central obesity may serve as stronger indicators of metabolic dysfunction than overall BMI.

Over time, the ability of the pancreatic islets to secrete insulin progressively declines in patients with T2DM mellitus, making glycemic control increasingly difficult. In addition, patients with longer disease duration often present with more complications and cumulative metabolic disturbances, which negatively affect blood glucose management and exacerbate associated risk factors. Prolonged disease duration contributes to both impaired β-cell function and increased insulin resistance, both of which make achieving target HbA1c levels more challenging. In our study, we observed

a positive association between longer disease duration and higher HbA1c levels. Patients with a longer duration of diabetes were less likely to achieve adequate glycemic control. This association remained significant in the multivariate regression analysis, reinforcing its clinical importance. Our findings are consistent with those reported by Nguyen Le Dieu Hien (2024), who found that patients with a diabetes duration of more than 10 years had a significantly higher risk of HbA1c ≥ 7% (OR = 3.42; p = 0.014).[7]

In addition, when examining the relationship between TM syndrome types and HbA1c control, we found that patients classified under the Yin essence deficiency pattern had significantly lower odds of achieving HbA1c < 7%. compared to those with the Heat injuring fluids pattern (reference group) (OR = 0.110; p = 0.013). Similarly, the Qi-Yin deficiency pattern was also negatively associated with glycemic control (OR = 0.055; p = 0.002).

These findings are consistent with the theoretical foundation of TM, particularly the concept of *"Xiaoke"* (wasting and thirsting syndrome), which describes the pathogenesis of diabetes as "deficiency in origin and excess in manifestation" (*ben xu, biao shi*), with Yin deficiency and internal heat being predominant in the early stages. As the disease progresses, especially in elderly individuals or those with a long disease duration, Yin deficiency worsens and may evolve into Qi-Yin deficiency or Yin-Yang deficiency, both of which are associated with more severe depletion and poorer glycemic control. Traditionally, syndrome differentiation of T2DM in clinical TM was based on the *"Sanxiao"* model (upper, middle, and lower jiao), reflecting progressive involvement of the lung, spleen/stomach, and kidney, respectively. In modern clinical practice, syndrome classification is often guided by the stage of disease progression. Dry-Heat and Yin deficiency syndromes are more common in early stages, Qi-Yin deficiency in the intermediate phase, and Yin-Yang deficiency in the late stage,where complications such as atherosclerosis, neuropathy, retinopathy, and nephropathy tend to be more prevalent.[8] This staging model aligns with our results, in which syndromes characterized by prolonged internal deficiency (e.g., Qi-Yin deficiency and Yin essence deficiency) were significantly associated with poor glycemic control. These insights highlight the potential clinical relevance of TM syndrome differentiation in predicting glycemic outcomes and guiding personalized treatment strategies.

One limitation of this study is the use of convenience sampling, which may introduce selection bias. To reduce this risk, we consecutively recruited all eligible inpatients during the study period to ensure consistency in participant selection.

These findings emphasize the importance of lifestyle interventions (particularly diet and physical activity) in T2DM care, especially for patients under 60 or with long disease duration. Waist circumference may be a more sensitive marker of metabolic risk than BMI. In addition, the classification of TM syndromes may help doctors better understand which patients are more likely to have poor glycemic control. For example, patients with Yin essence deficiency or Qi-Yin deficiency may need closer monitoring and more personalized care. Combining TM with modern medical treatment may lead to better outcomes and help prevent diabetes-related complications. Using TM syndrome patterns alongside modern clinical factors could support more personalized and effective diabetes care.

V. CONCLUSION

This study involving 197 patients with T2DM at the Traditional Medicine Hospital – Ministry of

Public Security found that only 23.9% achieved the target HbA1c level of < 7%, indicating a high rate of suboptimal glycemic control. Key factors significantly associated with poor control included younger age (< 60 years), disease duration of 10 years or more, poor dietary adherence, and insufficient physical activity. Importantly, TM syndrome types also showed a strong association with HbA1c control. Specifically, patients with the Qi-Yin deficiency and Yin essence deficiency patterns had significantly lower odds of achieving good glycemic control. These findings suggest the need to integrate TM syndrome differentiation into personalized treatment strategies and to strengthen lifestyle interventions for patients with T2DM.

To improve glycemic outcomes in patients with T2DM, it is important to strengthen lifestyle interventions with a focus on dietary counseling and physical activity, particularly among individuals under 60 years of age and those with a longer duration of disease. In parallel, incorporating TM syndrome classification into routine clinical assessments may help identify high-risk patients and support the development of individualized treatment strategies. Finally, encouraging the combined application of TM and modern medical approaches may enhance overall treatment effectiveness and help prevent long-term complications associated with diabetes.

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