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The Correlation of Lab Data, Hormone Peptides, Quality of Life, and Different Traditional Chinese Medicine Syndrome Groups in Type 2 Diabetes Patients

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ABSTRACT

The aim of this study is to explore the correlation of laboratory data, hormone peptides, and quality of life with different traditional Chinese medicine (TCM) syndrome groups in type 2 diabetes patients. Of 513 registered patients, 179 subjects aged between 20 and 65 years and having type 2 diabetes mellitus (T2DM) for more than 1 year were enrolled in the study. All the participants were asked to fill out a questionnaire on diabetic TCM syndrome groups, which was designed by professional TCM doctors, and two questionnaires on the quality of life (QOL), WHOQOL-BREF Taiwan version and Medical Outcomes Study (MOS) Short Form-12 (SF-12). The biochemical characteristics and hormone peptide levels were collected at the same time. The patients in any one of the six TCM syndrome groups had the trend to have worse QOL. Especially, patients with qi deficiency had worse life quality on every aspect compared to those without qi deficiency and were fatter than others. We also found that the subjects who had qi deficiency, qi stagnation, and yin deficiency at the same time had worsened condition. We consider that patients with qi deficiency may also be at a higher risk of developing other complications. They need more advanced health care than others. This self-reported questionnaire will be a reference for health care workers screening those T2DM patients who have a higher possibility of developing other complications. Especially in remote areas, where there is a lack of medical resources, an easy-to-use tool such as the one in the present study for detecting and evaluating disease conditions is needed.

Key words: Qi deficiency, Quality of life, Traditional Chinese medicine, Type 2 diabetes

INTRODUCTION

Diabetes mellitus is one of the most common chronic diseases in the world, and type 2 diabetes mellitus (T2DM) accounts for about 90% of all diabetes worldwide. Diabetes also has become one of the major causes of premature illness and death in most countries.[1] Given the large population, Chinese bear a higher diabetes-related burden than any other country.[2-4] Further, the high usage rate of traditional Chinese medicine (TCM) in Chinese population means TCM plays an important role in diabetes treatment in the Chinese population.

To improve long-term diabetic syndromes, patients and health care professionals seek TCM as an adjuvant treatment for T2DM.[5,6] According to TCM theory, the physicians look at pat-

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terns of disharmony, which include all presenting signs of illness and symptoms as well as patients' emotional and psychological responses.[7] The physicians can classify the diabetic patients with different symptoms into different syndrome groups.

Many studies have shown the quality of life (QOL) of T2DM patients significantly decreases.[7-10] The variation in syndrome groups could significantly influence some domains of QOL.[9] In our previous study, we developed a self-reported questionnaire on symptoms to facilitate the classification of different syndrome groups for different diseases.[11-13] Hence, we also want to examine the relationship among the diabetic TCM syndrome groups, QOL, and biochemical characteristics in T2DM patients. The aim of this study is to explore the correlation of lab data, hormone peptides, and QOL with different TCM syndrome groups in type 2 diabetes patients.

MATERIALS AND METHODS

Study design and participants

This was a cross-sectional study conducted from January 2012 through June 2012 in a Taipei City Hospital, Taiwan. Among the 501 registered type 2 diabetes patients screened at our outpatient clinic, a total of 179 were enrolled. The inclusion criteria and exclusion criteria are shown in Table 1. The protocol was approved by the Human Ethics Committee of the Taipei City Hospital. Informed consent was obtained from all the enrolled patients.

Diabetic TCM syndrome groups

The enrolled subjects were examined by TCM practitioners, and diagnoses were made on the basis of the examination, symptoms reported by the patients, and the practitioner's experience. We developed a self-reported questionnaire on patient symptoms as a diagnostic tool according to TCM concepts, our clinical experiences, and related studies,[11-13] and the six most common TCM syndrome groups of T2DM patients were defined. These groups were respectively characterized by Stomach Heat syndrome (胃熱 Wèi Rè, SHS), Yin Deficiency syndrome (陰虛 Yīn Xū, YDS), Qi Deficiency syndrome (氣虛 Qì Xū, QDS), Kidney Deficiency syndrome (腎虛 Shèn Xū, KDS), Qi Stagnation syndrome (氣滯 Qì Zhì, QSS), and Spleen Deficiency syndrome (脾虛 Pí Xū, SDS). Nine TCM doctors with clinical experience met and came up with three yes–no questions under each syndrome group for diagnosing T2DM patients. The questionnaire designed is shown in Table 2. All patients were categorized into these six diabetic TCM syndrome groups if they met the diagnosed criteria having more than two out of three of the symptoms of the corresponding TCM syndrome. Validation test results showed an alpha coefficient of 0.85 and Cronbach's alpha coefficient of 0.78, indicating that the questionnaire has good reliability.

Quality of life

To measure the QOL among our subjects, we used the self-administered questionnaire of brief version of World Health Organization Quality of Life (WHOQOL-BREF), Taiwan version, which was well validated with consistency coefficients ranging from 0.70 to 0.77.[14] The WHOQOL-BREF questionnaire evaluated the QOL in physical, psychological, social, and environmental domains, with scores ranging from 0 to 100. We also used another self-administered questionnaire, Medical Outcomes Study (MOS) Short Form-12 (SF-12), which has 12 items. These 12 items measure eight concepts: Physical functioning, role limitations due to physical health problems, role limitations due to emotional health problems, bodily pain, general health, vitality, social functioning, and mental health. The responses of these questions are transformed into two scores, physical and mental composite score (PCS-12 and MCS-12), respectively. The general population has a mean of 50 and a standard deviation of 10.[15,16] Higher scores represent a better health condition.

Table 1. Inclusion and exclusion criteria

Inclusion criteria
Aged between 20 and 65 years
Having type 2 diabetes for more than 1 year
Willing to participate in this study
Exclusion criteria
Glutamate pyruvate transaminase≥80 mg/dl
Serum creatinine≥1.8 mg/dl
Prolactin or pregnant women and planned-to-pregnant women
Heart failure, acute myocardial infarction, stroke, and heavy injuries in 6 months
Any other conditions not suitable for trial as evaluated by the physician

Table 2. Classification criteria for the diagnosis of TCM deficiency syndrome groups

In the past week, did you often have the following symptoms? (Often means more than 8 h/day and more than 4 days/week)
Stomach Heat syndrome (胃熱 Wèi Rè)
Sore gums or bad breath
Swift digestion with frequent hunger
Like to drink cold beverages
Yin Deficiency syndrome (陰虛 Yīn Xū)
Dry throat or mouth
Night sweats
Palm or face flushing sensation
Qi Deficiency syndrome (氣虛 Qì Xū)
Felt exhausted or lack of energy
Did not feel like talking or talked in a low and weak voice
Did not feel like moving about or did not have the strength to walk
Kidney Deficiency syndrome (腎虛 Shèn Xū)
Felt backache easily
Tinnitus and hard of hearing
Frequent urination (more than two times in the night)
Qi Stagnation syndrome (氣滯 Qì Zhì)
Chest tightness
Palpitation
Agitation and irritability
Spleen Deficiency syndrome (脾虛 Pí Xū)
Leg pitting edema
Felt thirsty and like to drink water easily
Anorexia

Definition: Patients who have two of three or more of the criteria in the Stomach Heat; Yin Deficiency; Qi Deficiency; Kidney Deficiency; Qi Stagnation; and Spleen Deficiency syndrome groups are compatible with that TCM syndrome; TCM: Traditional Chinese medicine

Analysis of hormone peptides

The levels of hormone peptides, including leptin, insulin, ghrelin, and adiponectin, were measured in the morning after 8-9 h of fasting. The entire blood sample was drawn and centrifuged at 4°C, with 1 ml of the sample rapidly frozen at −80°C for the subsequent radioimmunoassay concentration analysis. Leptin was detected by the Human Leptin assay (Millipore, St. Charles, MO, USA) using I^{125}-labled human leptin antiserum with a sensitivity of 0.5 ng/ml for a 100-µl sample. Ghrelin and adiponectin were detected by Ghrelin RIA Kit (Millipore) and Adiponectin RIA kit (Millipore) with a sensitivity of 93 pg/ml and 1 ng/ml, respectively. We used the same process as that for leptin detection only with different I^{125}-labled antibodies specific for ghrelin or adiponectin. BioSource INS-IRMA Kits (BioSource Europe S.A., Nivelles, Belgium) were employed to determine the level of insulin in the serum as previously reported.[17,18] Sampling would be reported if a difference exceeding 10% coefficient of variation was found between duplicated results of the sample. Following the approach of Matthews, *et al*., we used the homeostasis model assessment for insulin resistance (HOMA-IR) for measuring the insulin resistance of our subjects.[19]

Outcome measurements

The major outcome is the difference in lab data and QOL scores of T2DM patients in different diabetic TCM syndrome groups. We included the mean scores of WHOQOL-BREF and SF-12 questionnaire, body mass index (BMI), and biochemical characteristics in the six TCM syndrome groups at the same time.

The biochemical characteristics of the blood sample included fasting blood sugar, triglyceride, total cholesterol levels, and hormone peptides also. The other outcomes were evaluated in terms of weight, waist circumference, hip circumference, and blood pressure.

All patients were asked to answer the TCM syndrome group questionnaire to classify them into six diabetic TCM syndrome groups. All biochemical measurements were made after 8-9 h of fasting using a standardized method, as detailed in our previous research.[20] The physicians who participated in the study received prior training before the study and they also knew how to interview the patients and assist them in completing the questionnaires.

Statistical analysis

The data were analyzed by SPSS software (version 17.0, Chicago, IL, USA). Student's *t*-test was employed to examine the demographic data, basic data, biochemical data, hormone peptide data, and QOL scores. Multiple linear regression analysis with the stepwise method was applied to adjust the QOL scores. All *P* values were two-tailed and the α level of significance was set at 0.05.

RESULTS

Demographics and clinical features of subjects

Of 501 registered patients with diabetes screened at our outpatient clinic, 179 subjects met the inclusion and exclusion criteria. All of these 179 subjects completed both questionnaires. As shown in Figure 1, QDS is the most common syndrome group in this study. There were 44% subjects with QDS. The mean age, BMI, systolic/diastolic blood pressure, and triglyceride level of all the subjects in the study were 54.3 ± 7.1 years, 26.5 ± 4.4 kg/m^2, 133.8 ± 17.5/80.2 ± 11.6 mmHg, and 179.0 ± 83.3 mg/dl, respectively [Table 3].

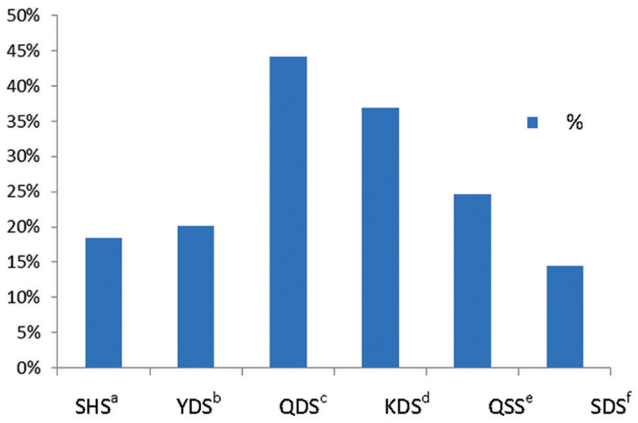

Figure 1. Distribution of different diabetic syndrome groups (a, Stomach Heat syndrome [胃熱 Wèi Rè, SHS]; b, Yin Deficiency syndrome [陰虛 Yīn Xū, YDS]; c, Qi Deficiency syndrome [氣虛 Qì Xū, QDS]; d, Kidney Deficiency syndrome [腎虛 Shèn Xū, KDS]; e, Qi Stagnation syndrome [氣滯 Qì Zhì, QSS]; f, Spleen Deficiency syndrome[脾虛 Pí Xū, SDS])

Table 3: Demographic characteristics of the participants

Variables	All (*N*=179)
Basic data	
Age, years	54.3 (7.1)
Body mass index, kg/m^2	26.5 (4.4)
Waist circumference, cm	86.6 (10.5)
Hip circumference, cm	98.0 (9.3)
Waist/hip	0.9 (0.1)
Heart rate, times/min	77.7 (12.8)
Systolic blood pressure, mmHg	133.8 (17.5)
Diastolic blood pressure, mmHg	80.2 (11.6)
Biochemical data	
Fasting blood sugar, mg/dl	147.0 (51.7)
HbA1c, %	7.7 (1.7)
Triglyceride, mg/dl	179.0 (83.3)
Total cholesterol, mg/dl	203.3 (44.6)
High density lipoprotein, mg/dl	49.3 (13.1)
Low density lipoprotein, mg/dl	112.7 (32.5)
Glutamate pyruvate transaminase, IU/L	32.4 (20.0)
Creatinine, mg/dl	0.7 (0.2)
Uric acid, mg/d	5.4 (1.3)
HOMA-IR index	5.1 (3.6)
Hormone peptide	
Leptin, ng/ml	8.0 (6.1)
Adiponectin, µg/ml	20.1 (4.9)
Ghrelin, pg/ml	515.5 (225.3)
Insulin, IU/ml	14.2 (10.1)

The data are presented as mean (SD), HbA1c: Hemoglobin A1c; HOMA-IR: Homeostasis model assessment for insulin resistance

Basic data

Table 4 shows the difference in basic data among the six diabetic TCM syndrome groups. As shown in the table, there was significant difference in BMI, waist circumference, hip circumference, and systolic blood pressure between the patients with and without QDS; that is, type 2 diabetes patients with QDS were fatter than those patients without QDS. The patients with KDS also had higher BMI than those without KDS, and the patients with SDS were significant older than others.

Biochemical characteristics and hormone peptides

As seen in Table 5, the subjects with YDS, QDS, and QSS had significantly higher triglyceride levels than those without syndromes.

Table 4: Difference in basis data among the different diabetic traditional Chinese medicine syndrome groups

Variables	SHS		YDS		QDS		KDS		QSS		SDS	
	Yes (*n*=33)	No (*n*=146)	Yes (*n*=36)	No (*n*=143)	Yes (*n*=79)	No (*n*=100)	Yes (*n*=66)	No (*n*=113)	Yes (*n*=44)	No (*n*=135)	Yes (*n*=26)	No (*n*=153)
Basic data												
Age, years	52.2 (8.3)	54.7 (6.7)	54.1 (7.6)	54.3 (7.0)	54.9 (7.8)	53.8 (6.5)	55.0 (7.1)	53.9 (7.1)	54.3 (6.1)	54.3 (7.4)	57.7 (7.2)*	53.7 (6.9)*
BMI, kg/m^2	25.6 (4.1)	26.7 (4.5)	27.2 (4.6)	26.3 (4.4)	28.3 (4.3)**	25.1 (4.1)**	27.5 (4.7)*	25.9 (4.2)*	27.4 (4.5)	26.2 (4.4)	27.0 (4.0)	26.4 (4.5)
Waist, cm	87.2 (10.8)	86.4 (10.5)	86.5 (9.9)	86.6 (10.7)	89.9 (10.5)**	83.9 (9.7)**	88.1 (10.4)	85.7 (10.5)	86.6 (10.9)	86.6 (10.4)	87.0 (10.6)	86.5 (10.5)
Hip, cm	96.9 (7.6)	98.2 (9.6)	99.0 (9.4)	97.7 (9.3)	100.9 (9.9)**	95.6 (8.0)**	99.5 (9.6)	97.1 (9.0)	99.9 (10.3)	97.4 (8.9)	97.2 (6.9)	98.1 (9.6)
Waist/hip	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)	0.9 (0.1)
HR, times/min	79.8 (12.9)	77.2 (12.7)	80.2 (14.8)	77.0 (12.2)	77.4 (13.9)	77.9 (11.8)	76.5 (12.5)	78.4 (12.9)	74.3 (11.3)*	78.8 (13.1)*	70.0 (13.1)*	79.0 (12.3)*
SBP, mmHg	134.2 (16.0)	133.8 (17.9)	135.5 (18.8)	133.4 (17.2)	137.6 (18.1)*	130.9 (16.5)*	135.8 (17.0)	132.7 (17.8)	135.0 (18.3)	133.5 (17.3)	136.9 (18.3)	133.3 (17.4)
DBP, mmHg	80.1 (10.3)	80.3 (11.9)	82.0 (13.1)	79.8 (11.2)	82.0 (12.5)	78.8 (10.7)	80.6 (12.8)	80.0 (10.9)	81.7 (14.3)	79.7 (10.6)	80.8 (14.5)	80.1 (11.1)

The data are presented as mean (SD), SHS: Stomach Heat syndrome (胃熱 Wèi Rè); YDS: Yin Deficiency syndrome (陰虛 Yīn Xū); QDS: Qi Deficiency syndrome (氣虛 Qì Xū); KDS: Kidney Deficiency syndrome (腎虛 Shèn Xū); QDS: Qi Stagnation syndrome (氣滯 Qì Zhì); SDS: Spleen Deficiency syndrome (脾虛 Pí Xū); HR: Hart rate; SBP: Systolic blood pressure; DBP: Diastolic blood pressure, BMI: Body mass index, *P<0.05, **P<0.001

Table 5: Difference in biochemical data among the different diabetic traditional Chinese medicine syndrome groups

Variables	SHS		YDS		QDS		KDS		QSS		SDS	
	Yes (*n*=33)	No (*n*=146)	Yes (*n*=36)	No (*n*=143)	Yes (*n*=79)	No (*n*=100)	Yes (*n*=66)	No (*n*=113)	Yes (*n*=44)	No (*n*=135)	Yes (*n*=26)	No (*n*=153)
Biochemical data												
Glucose, mg/dl	159.0 (43.2)	144.3 (53.1)	151.9 (53.5)	145.7 (51.3)	148.6 (50.9)	145.7 (52.5)	141.2 (44.2)	150.4 (55.5)	138.6 (48.1)	149.7 (52.7)	133.8 (46.4)	149.2 (52.3)
HbA1c, %	8.1 (1.7)	7.5 (1.7)	7.8 (1.8)	7.6 (1.6)	7.8 (1.8)	7.5 (1.5)	7.5 (1.4)	7.8 (1.8)	7.4 (1.8)	7.7 (1.6)	7.7 (1.8)	7.6 (1.7)
Triglyceride, mg/dL	197.1 (83.8)	174.9 (83.0)	222.4 (70.2)**	168.1 (83.0)**	198.5 (80.1)*	163.6 (83.0)*	194.0 (81.7)	170.3 (83.4)	203.3 (75.1)*	171.1 (84.6)*	188.7 (81.0)	177.4 (83.9)
T. chol., mg/dl	216.1 (44.9)	200.5 (44.2)	212.3 (47.0)	201.1 (43.9)	207.3 (44.1)	200.2 (45.0)	204.7 (47.6)	202.5 (43.0)	207.0 (36.6)	202.1 (47.0)	224.8 (61.2)	199.7 (40.3)
HDL-C, mg/dl	48.6 (12.9)	49.5 (13.2)	46.4 (11.4)	50.0 (13.4)	48.4 (11.0)	50.1 (14.5)	47.7 (10.2)	50.2 (14.5)	48.6 (11.9)	49.5 (13.5)	53.6 (18.0)	48.6 (12.0)
LDL-C, mg/dl	118.0 (26.5)	111.5 (33.7)	108.8 (28.2)	113.6 (33.5)	112.3 (31.3)	113.0 (33.6)	110.1 (32.3)	114.2 (32.7)	114.0 (32.9)	112.2 (32.5)	114.5 (31.0)	112.4 (32.8)
GPT, IU/L	35.0 (25.5)	31.8 (18.6)	33.9 (17.2)	32.0 (20.6)	36.3 (22.9)*	29.4 (16.8)*	34.3 (21.6)	31.3 (19.0)	32.2 (17.5)	32.5 (20.8)	29.9 (19.1)	32.8 (20.1)
Creatinine, mg/dl	0.7 (0.1)	0.7 (0.2)	0.8 (0.2)	0.7 (0.2)	0.7 (0.2)	0.8 (0.2)	0.7 (0.1)	0.7 (0.2)	0.8 (0.2)	0.7 (0.2)	0.8 (0.1)	0.7 (0.2)
Uric acid, mg/dl	5.2 (1.1)	5.5 (1.3)	5.1 (1.1)	5.5 (1.3)	5.5 (1.2)	5.4 (1.4)	5.4 (1.2)	5.5 (1.3)	5.5 (1.3)	5.4 (1.3)	5.3 (1.6)	5.5 (1.3)

The data are presented as mean (SD), SHS: Stomach Heat syndrome (胃熱 Wèi Rè); YDS: Yin Deficiency syndrome (陰虛 Yīn Xū); QDS: Qi Deficiency syndrome (氣虛 Qì Xū); KDS: Kidney Deficiency syndrome (腎虛 Shèn Xū); QSS: Qi Stagnation syndrome (氣滯 Qì Zhì); SDS: Spleen Deficiency syndrome (脾虛 Pí Xū); HbA1c: Hemoglobin A1c; T. chol.: Total cholesterol; HDL-C: High density lipoprotein cholesterol; LDL-C: Low density lipoprotein cholesterol; GPT: Glutamate pyruvate transaminase, *P<0.05, **P<0.001

As for hormone peptides [Table 6], the leptin, insulin, and HOMA-IR index levels were markedly higher in subjects with QDS. The leptin and ghrelin levels were also significantly higher in KDS group, while the adiponectin level of the subjects with QSS was significantly lower but leptin level was higher than those without QSS.

QOL scores

Table 7 displays the intergroup analysis among the subjects with/without the six TCM diabetic syndromes. We observe that the subjects with QDS had significantly lower QOL scores on every aspect of the WHOQOL-BREF survey and the same was found in the SF-12 survey. It is evident that QDS significantly affected the QOL in the WHO-BREF physical, psychological ($P < 0.001$), social relations ($P < 0.05$), environment domain ($P < 0.001$), and both physical and mental aspects in SF-12 ($P < 0.001$). The subjects with KDS also had significantly lower QOL scores on every aspect of both WHOQOL-BREF survey and SF-12 survey, except MCS-12 in SF-12 survey. With respect to with/without QSS groups, there was significant difference in MCS-12 score and the subjects with QSS had a lower score.

Table 8 shows the coefficients of linear multiple regressions on QDS's QOL scores of the WHOQOL-BREF and SF-12 survey by the stepwise method. We adjusted the basic data including age, gender, family history of type 2 diabetes, and blood pressure, and also adjusted the biochemical data such as glycosylated hemoglobin (HbA1c), triglyceride, total cholesterol, high density lipoprotein (HDL), and low density lipoprotein (LDL). We also adjusted the hormone peptides like leptin, adiponectin, ghrelin, and HOMA-IR. In Table 8, it is found that females showed a significant correlation with a better score in the social domain of the WHOQOL-BREF survey, but poor PCS-12 in

Table 6: Difference in hormone peptides among the different diabetic traditional Chinese medicine syndrome groups

Variables	SHS		YDS		QDS		KDS		QSS		SDS	
	Yes (*n*=33)	No (*n*=146)	Yes (*n*=36)	No (*n*=143)	Yes (*n*=79)	No (*n*=100)	Yes (*n*=66)	No (*n*=113)	Yes (*n*=44)	No (*n*=135)	Yes (*n*=26)	No (*n*=153)
Hormone peptide												
Leptin, ng/ml	6.9 (4.1)	8.2 (6.4)	9.1 (7.7)	7.8 (5.6)	10.2 (7.3)**	6.3 (4.2)**	9.7 (7.4)*	7.1 (4.9)*	9.9 (7.3)*	7.4 (5.5)*	9.8 (7.9)	7.7 (5.7)
Adiponectin, µg/ml	19.2 (3.7)	20.2 (5.1)	18.7 (2.6)*	20.4 (5.3)*	19.6 (4.8)	20.4 (4.9)	20.2 (5.7)	19.9 (4.4)	18.2 (1.4)*	20.6 (5.4)*	21.4 (8.5)	19.8 (3.9)
Ghrelin, pg/ml	479.4 (236.1)	522.6 (223.3)	525.2 (193.7)	513.1 (233.1)	532.7 (235.8)	502.4 (217.2)	564.0 (232.9)*	487.2 (216.8)*	519.5 (194.0)	514.3 (235.0)	592.7 (255.8)	502.3 (217.9)
Insulin, IU/ml	14.2 (6.4)	14.2 (10.7)	15.8 (9.6)	13.8 (10.2)	16.1 (11.9)*	12.7 (8.3)*	15.1 (11.9)	13.7 (8.9)	17.0 (11.3)	13.3 (9.6)	16.1 (11.6)	13.9 (9.8)
HOMA-IR index	5.7 (2.7)	5.0 (3.8)	5.8 (3.4)	4.9 (3.7)	5.8 (3.9)*	4.6 (3.4)*	5.2 (4.0)	5.0 (3.4)	5.8 (3.7)	4.9 (3.6)	5.2 (3.3)	5.1 (3.7)

The data are presented as mean (SD), SHS: Stomach Heat syndrome (胃熱 Wèi Rè); YDS: Yin Deficiency syndrome (陰虛 Yīn Xū); QDS: Qi Deficiency syndrome (氣虛 Qì Xū); KDS: Kidney Deficiency syndrome (腎虛 Shèn Xū); QSS: Qi Stagnation syndrome (氣滯 Qì Zhì); SDS: Spleen Deficiency syndrome (脾虛 Pí Xū); HOMA-IR: Homeostasis model assessment for insulin resistance, *P<0.05, **P<0.001

Table 7: Comparison of life quality in yes/no TCM syndrome group

Variables	SHS		YDS		QDS		KDS		QDS		SDS	
	Yes (*n*=33)	No (*n*=146)	Yes (*n*=36)	No (*n*=143)	Yes (*n*=79)	No (*n*=100)	Yes (*n*=66)	No (*n*=113)	Yes (*n*=44)	No (*n*=135)	Yes (*n*=26)	No (*n*=153)
WHOQOL-BREF												
Physical	58.8 (14.4)*	64.9 (12.4)*	61.7 (14.2)	64.3 (12.7)	57.4 (12.2)**	69.0 (11.3)**	59.4 (12.6)**	66.4 (12.5)**	58.5 (15.2)*	65.6 (11.7)*	61.2 (10.5)	64.3 (13.3)
Psychological	70.0 (14.8)	72.1 (15.2)	68.6 (14.2)	72.5 (15.3)	66.8 (15.0)**	75.7 (14.0)**	68.1 (16.9)*	73.9 (13.6)*	64.3 (16.8)*	74.2 (13.7)*	68.3 (16.8)	72.3 (14.8)
Social	70.2 (14.2)	74.5 (17.2)	71.1 (17.5)	74.3 (16.5)	70.9 (17.2)*	75.9 (16.0)*	69.2 (20.6)*	76.4 (13.3)*	71.6 (18.0)	74.4 (16.2)	71.2 (15.6)	74.1 (16.9)
Environment	70.0 (12.5)	74.9 (13.9)	73.3 (11.5)	74.2 (14.3)	69.7 (14.1)**	77.5 (12.6)**	71.3 (14.5)*	75.6 (13.1)*	71.6 (12.6)	74.8 (14.1)	71.0 (12.9)	74.5 (13.9)
SF-12												
PCS-12	44.3 (10.4)	47.5 (7.6)	44.7 (9.5)	47.6 (7.8)	43.4 (8.3)**	49.9 (6.9)**	43.1 (9.5)**	49.3 (6.3)**	43.5 (10.2)*	48.2 (7.1)*	43.3 (8.5)*	47.7 (8.0)*
MCS-12	46.6 (10.9)	50.2 (9.5)	45.6 (9.6)*	50.6 (9.6)*	46.5 (10.0)**	52.1 (8.9)**	47.8 (10.9)	50.7 (9.0)	43.7 (10.6)**	51.5 (8.7)**	48.7 (8.4)	49.8 (10.0)

The data are presented as mean (SD), SHS: Stomach Heat syndrome (胃熱 Wèi Rè); YDS: Yin Deficiency syndrome (陰虛 Yīn Xū); QDS: Qi Deficiency syndrome (氣虛 Qì Xū); KDS: Kidney Deficiency syndrome (腎虛 Shèn Xū); QDS: Qi Deficiency syndrome (氣滯 Qì Zhì); SDS: Spleen Deficiency syndrome (脾虛 Pí Xū); PCS: Physical condition score; MCS: Mental condition score; *P<0.05, **P<0.001, SF: Short form; TCM: Traditional Chinese medicine; WHOQOL-BREF: Brief version of World Health Organization Quality of Life

the SF-12 survey. As seen in the WHOQOL-BREF survey in Table 8, aging people showed a marked correlation with a higher score in every domain, but only showed significant correlation with MCS in the SF-12 survey. The subjects with QDS showed a markedly significant correlation with poor scores in every domain, except the social domain, on both the WHOQOL-BREF and SF-12 surveys.

Correlation among six diabetic TCM syndrome groups

Table 9 shows the coexisting correlation among the six diabetic TCM syndrome groups. QDS had significantly high co-exiting correlation with every other syndrome group, except SHS group. QSS group had the same condition with QDS group. YDS group had high co-exiting correlation with QDS, QSS, and KDS groups. The condition of SDS group was the same as YDS group. SHS group had no significant co-exiting correlation with any other syndrome group.

DISCUSSION

The initial findings of our study showed T2DM patients with QDS had worse QOL scores. Among all T2DM patients in our study, the group with QDS accounted for about 44% of the total. They had lower QOL scores over the physical, psychological, social relations, and environment aspects than the group without QDS in the WHO-BREF survey, as well as lower scores on every aspect of the SF-12 survey [Table 7].

In terms of basic data, we found there were significant differences in BMI and waist and hip circumferences between the groups with/without QDS. The patients with QDS had higher BMI and larger waist and hip circumferences. As seen in Table 4, the triglyceride and the leptin levels of patients with QDS were higher than those without QDS. To prove that QDS is a really important factor in poor QOL, we adjusted many factors as seen in Table 8. According to TCM theory, QDS might cause patients to feel exhausted or lack energy. Patients with chronic symptoms of diabetes, such as tiredness and lethargy, leading to a decrease in work performance in adults and increased falls in the elderly. Obviously, the QOL of T2DM patients will be adversely affected.[5] We found that QDS affected the QOL deeply and adversely, even when adjusted by other related factors.

In the past, the study of TCM encountered serious challenges due to the almost irreconcilable differences with conventional western medicine. However, we found patients with QDS had higher BMI.[21] This matched the concept of TCM theory that patients with QDS are usually obese. Previous studies showed impaired biochemical data and hormone peptide level, such as insulin resistance, impaired adiponectin or leptin level and higher triglyceride level, not only adversely affected the health of the T2DM patients, but also badly affected their QOL.[22-25] We obtained similar results. Fatty acids not only provide an important

Table 9: Intergroup correlation analysis of different diabetic traditional Chinese medicine syndrome groups

	SHS (%)	YDS (%)	QDS (%)	KDS (%)	QSS (%)	SDS (%)
SHS						
With						
Without						
P						
YDS						
With	27.8					
Without	16.1					
P	0.11					
QSS						
With	24.1	31.6				
Without	14.0	11.0				
P	0.09	<0.05				
KDS						
With	22.7	34.8	69.7			
Without	15.9	11.5	29.2			
P	0.26	<0.001	<0.001			
QSS						
With	25.0	43.2	70.5	52.3		
Without	16.3	12.6	35.6	31.9		
P	0.20	<0.001	<0.001	<0.05		
SDS						
With	23.1	30.8	65.4	65.4	46.2	
Without	17.6	18.3	40.5	32.0	20.9	
P	0.51	0.14	<0.05	<0.05	<0.05	

SHS: Stomach Heat syndrome (胃熱 Wèi Rè); YDS: Yin Deficiency syndrome (陰虛 Yīn Xū); QDS: Qi Deficiency syndrome (氣虛 Qì Xū); KDS: Kidney Deficiency syndrome (腎虛 Shèn Xū); QSS: Qi Stagnation syndrome (氣滯 Qì Zhì); SDS: Spleen Deficiency syndrome (脾虛 Pí Xū); PCS: Physical condition score; MCS: Mental condition score

Table 8: Multiple linear regression analysis of the scores of quality of life using stepwise method

Factor	WHOQOL-BREF								SF-12			
	Physical		Psychological		Social		Environmental		PCS-12		MCS-12	
	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*	β	*P*
Sex (male=1/female=0)	−0.01	0.87	−0.31	<0.05	−0.36	<0.001	−0.11	0.29	0.23	<0.05	−0.15	0.14
Family history of type 2 diabetes (yes=1/no=0)	0.09	0.21	0.08	0.29	0.10	0.19	0.03	0.69	0.15	<0.05	0.01	0.91
Age	0.28	<0.001	0.16	0.06	0.15	0.08	0.14	0.12	0.12	0.14	0.22	<0.05
BMI	0.14	0.17	0.24	<0.05	0.29	<0.05	0.12	0.29	0.10	0.31	0.30	<0.05
With/without Qi deficiency	−0.46	<0.001	−0.28	0.001	−0.11	0.17	−0.27	<0.05	−0.34	<0.001	−0.39	<0.001

Adjusting: Systolic blood pressure, diastolic blood pressure, hemoglobin A1c (HbA1c), triglyceride, total cholesterol, high density lipoprotein cholesterol, low density lipoprotein cholesterol, leptin, adiponectin, ghrelin, homeostasis model assessment for insulin resistance (HOMA-IR), BMI: Body mass index; PCS: Physical condition score; MCS: Mental condition score; SF: Short form; WHOQOL-BREF: Brief version of World Health Organization Quality of Life

energy source as nutrients but also act as signaling molecules in various cellular processes.[26,27] It was also reported that the plasma fatty acid concentration in subjects with diabetes and pre-diabetes was higher than that in healthy controls. The higher triglyceride level might be the reason for the development of metabolic syndrome among T2DM patients and is also an important biomarker of QDS.[26,28] According to the previous study and the lab data of this study, patients with QDS might be predicted to develop metabolic syndrome and poor QOL.

According to the data of Table 5, Table 6, and the original data of the subjects' TCM syndrome record, we found that the subjects who had QDS, QSS, and YDS at the same time had worsened conditions, like higher BMI, HOMA-IR index, etc., The obese patients usually have bad blood circulation system. This may be the cause of qi and yin deficiency. YDS means abnormal body fluid secretion or deficiency. Hence, we considered YDS group in this study may have correlation with abnormal secretion of hormone.

The yes–no questions of the different specific syndromes in this questionnaire came up from common intersection of nine TCM doctors with clinical experience diagnosing six traditional Chinese syndromes. Overlapping symptoms might exist among the six syndrome groups due to the complexity of the TCM concept, thus two or three mutually conclusive symptoms in the questionnaire should be satisfied when diagnosing the different traditional Chinese syndromes. However, mutual existence of the different syndromes could be found in the same subject, which might influence the specificity of the syndrome group. A large-scale study is needed to further validate this questionnaire and improve its sensitivity and specificity.

CONCLUSION

The three yes–no questions for diagnosing the six diabetic TCM syndrome groups in this study which showed high coefficient on the validation test may be used as a screen tool for the health care workers evaluating the condition of T2DM patients. These three yes–no questions for diagnosing diabetic syndrome groups will be a reference for the health care workers screening those T2DM patients who have a higher possibility of developing other complications and poor QOL. Especially in remote areas, where there is lack of medical resources, an easy-to-use tool for detecting and evaluating disease conditions is needed.

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