

RESEARCH ARTICLE

Correlation analysis between traditional Chinese medicine constitutions and blood lipid metabolism indicators

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Dyslipidemia is a major risk factor of cardiovascular disease and is highly prevalent in China. Existing research on the correlation between traditional Chinese medicine (TCM) constitutions and dyslipidemia has mainly focused on Eastern and Southern China with limited data from multi-ethnic Yunnan province with high humidity and salt- and fat-rich diet. Currently, there are no interventions based on TCM, and research targeting mixed constitutions and special populations remains insufficient. This research conducted a cross-sectional investigation on 200 patients from a hospital in Yunnan to analyze 4 core TCM constitutions and 4 lipid parameters. By taking balanced constitution as the reference, the obtained data were analyzed using multivariable logistic regression and Pearson's chi-square test. The results showed that abnormal lipids were observed in 78.5% of the participants. Balanced constitution was protective with the lowest rates. "Qi" deficiency increased the risks of triglycerides (TG), low density lipoprotein cholesterol (LDL-C), and high density lipoprotein cholesterol (HDL-C). "Yang" deficiency raised LDL-C most, while "Yin" deficiency raised TG most. TCM constitution was found to be linked with dyslipidemia. A balanced constitution had a protective effect, whereas constitutional imbalance was a risk factor. Total cholesterol (TC) abnormality was not related to constitution. This study filled research gap in Yunnan province and aided precise prevention.

Keywords: traditional Chinese medicine (TCM) constitution; lipid metabolism; blood indicators; dyslipidemia; blood lipid levels.

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Introduction

Identification of traditional Chinese medicine (TCM) constitution is a key component of preventive TCM, providing fundamental support for personalized health management, disease prevention, and standardization of constitution-related research. In line with Healthy China Initiative, identification of TCM constitution is closely related with dyslipidemia, which is a major sub-health manifestation and a key risk factor for cerebrovascular and cardiovascular

diseases. According to the 2023 report, dyslipidemia prevalence among Chinese adults is 40.4%, and dyslipidemia-related deaths account for more than 40% of total mortality, imposing a substantial medical and social burden. Yunnan province, China inhabited by 25 ethnic minorities and has a distinct three-dimensional climate with annual average humidity of 60 – 80%. Local dietary patterns include consumption of high amounts of fat and salt and excessive alcohol consumption combined with sedentary lifestyles are prevalent among residents in mountainous

areas. These regional factors give rise to a unique distribution of TCM constitutions as that high environmental humidity may induce a phlegm dampness constitution. Meanwhile, high-salt diets can exacerbate “Qi” deficiency and “Yang” deficiency constitutions. Therefore, Yunnan province provides ideal research setting to explore the correlation between dyslipidemia and TCM constitution in multi-ethnic regions of Southwest China.

In TCM, “body constitution” refers to the inherent and acquired traits of an individual that determine responses to stimuli and disease susceptibility. Originating from the Yellow Emperor’s Inner Classic, it was systematized as “TCM constitution theory” in the 1970s. Based on the 2009 classification of China Association of Chinese Medicine, nine constitution types exist including one balanced and eight unbalanced “Qi” stagnation, “Qi” deficiency, “Yin” deficiency, “Yang” deficiency, phlegm dampness, damp heat, blood stasis, and special diathesis. “Qi”, “Yin”, and “Yang” are the core concepts. “Qi” is the vital energy flowing through the body, governing functions such as warmth, metabolism, movement, and protection. “Yin” and “Yang” are complementary forces with “Yin” representing material, cooling aspects, and “Yang” representing active, warming aspects. Health is a balance between “Yin” and “Yang”. Imbalances between these two aspects can cause disease, as presented in constitution types such as “Yin” deficiency or “Yang” deficiency. Global research has advanced the understanding of lipid metabolism and TCM, as well as the correlation of dyslipidemia. Domestic research on 1,996 health check-up participants in Beijing, China found that damp heat and phlegm dampness were the predominant TCM constitutions with significant gender related differences observed [1]. However, another research on 2,633 hospital based health examination attendees in Nanning, Guangxi, China identified phlegm dampness with blood stasis as the most common combined type. Unbalanced constitutions have been found to positively correlate with triglycerides (TG), total cholesterol (TC), and body mass index (BMI) [2].

Lipid metabolism was also investigated among US college students [3]. Research on Brazilian adolescents reported a 44.9% prevalence of suboptimal high density lipoprotein cholesterol (HDL-C) and found no correlation between dyslipidemia and diet [4]. Research on Nigerian adolescents presented a 33.3% prevalence of dyslipidemia and identified visceral adiposity index (VAI) as a metabolic syndrome predictor [5]. Phlegmatic temperament has been accounted for 57% and linked to abnormal TC [6]. Physiological and lifestyle factors also matter. Turkish research correlated moderate activity to life quality in dyslipidemia patients [7], while Iranian research identified key dyslipidemia predictors [8]. A Japanese cohort study found that increase in data envelopment analysis (DEA) efficiency score was related to reduced dyslipidemia risk [9]. In populations with specific diseases, a Shanghai based study identified TCM constitutions as cardiovascular disease predictors in elderly diabetic patients [10]. A global survey on type 1 diabetes (T1D) and type 2 diabetes (T2D) covered 24 developing countries. The results presented poor control over dyslipidemia and hypertension with less than 5% of the participants achieving glucose, blood pressure, and lipid triple targets. Community diabetic patients with dyslipidemia had primary phlegm dampness, “Qi” deficiency, and “Yin” deficiency constitutions. Patients with phlegm dampness and “Yang” deficiency had higher TG and low-density lipoprotein cholesterol (LDL-C) [11]. Gestational diabetes patients had a predominant phlegm dampness constitution with elevated LDL-C and TC [12]. Effective TCM interventions using a six-month health management program effectively reduced TC, TG, LDL-C, and improved Short Form 36 (SF-36) scores [13]. A TCM lipid-lowering prescription achieved a compliance rate of 78.6% [14]. Despite these advances, critical gaps still exist, which include geographic imbalance with no research on multi-ethnic Yunnan province [15], dominant cross-sectional designs that fail to capture dynamic changes and causal relationships, over-reliance on specific populations and small sample sizes, lack of a

regional "TCM-lipid metabolism characteristic map", and TCM interventions without mechanism elaboration. This leaves Yunnan, China without TCM based individualized prevention programs for dyslipidemia.

This research used quantitative methods on the hospital seeking population of Yunnan, China to explore TCM and lipid distribution patterns including TC, TG, LDL-C, and HDL-C, analyze the effects of TCM on lipids, evaluate correlations between TCM and dyslipidemia, verify balanced TCM as a protective factor against dyslipidemia, and identify high-risk combinations. The findings of this study could be applied to establish a Yunnan-specific "TCM-lipid metabolism characteristic map" and localized TCM based programs, which would decrease the prevalence of dyslipidemia and cardiovascular disease, alleviating local burdens. This study enriched the global evidence based on traditional medicine and modern metabolic diseases, offering a reference for similar regions.

Materials and methods

Recruitment of participants

A total of 200 participants consisting of 48% males and 52% females were enrolled in this research. The participants aged from 18 to 75 years old with 46.35 ± 12.68 years for male and 45.82 ± 13.15 years for females. Participants were consecutively recruited between September and December 2024 from individuals undergoing routine physical examinations at Kunming Traditional Chinese Medicine Hospital (Kunming, Yunnan, China) with the inclusion criteria of 18 to 75 years of age, voluntary provision of signed informed consent, normal cognitive function, and full cooperation and ability to provide complete datasets. The exclusion criteria were major systemic diseases, use of hormonal or lipid-lowering medications within the past three months, major surgery or trauma within the past six months, pregnancy or lactation, incomplete data or loss to follow-up, and psychiatric disorders.

Grouping and data collection

Participants were classified into the following four TCM constitution types based on standardized TCM constitution identification criteria including balanced, "Qi" deficiency, "Yang" deficiency, and "Yin" deficiency. Standard screening, constitution identification, fasting blood collection, biochemical testing, and dual data entry by two independent operators using separate computer systems with exclusion of missing and anomalous values were performed in this research. All procedures of this research were approved by the Ethics Committee of Kunming Medical University (Kunming, Yunnan, China), and written informed consents were obtained from all participants.

Blood sample collection and biochemical analysis

Prior to sample collection, participants underwent an 8 – 12 hour fasting period and abstained from strenuous exercise, alcohol consumption, and high-fat meals. Five milliliters of venous blood sample were drawn from the antecubital vein. Following serum separation, samples were aliquoted and stored at -80°C . Biochemical analyses were performed at the Department of Laboratory Medicine, Kunming Municipal Hospital of Traditional Chinese Medicine, Kunming, Yunnan, China using a AU5800 biochemical analyzer (Beckman Coulter, Brea, CA, USA) to quantify TC, TG, HDL-C, and LDL-C with the implementation of appropriate controls and quality assurance procedures. Normal reference ranges were defined as $\text{TC} < 5.2 \text{ mmol/L}$, TG between $0.56 - 0.70 \text{ mmol/L}$, $\text{HDL-C} \leq 3.4 \text{ mmol/L}$, and LDL-C between $1.03 - 1.70 \text{ mmol/L}$.

Statistical analysis

SPSS version 27.0 (IBM, Armonk, NY, USA) was employed for statistical analyses of this research. Initially, chi-square test was performed to compare dyslipidemia detection rates across different constitution groups. Subsequently, a binary logistic regression analysis using a backward stepwise method was conducted to evaluate the influence of each constitution type

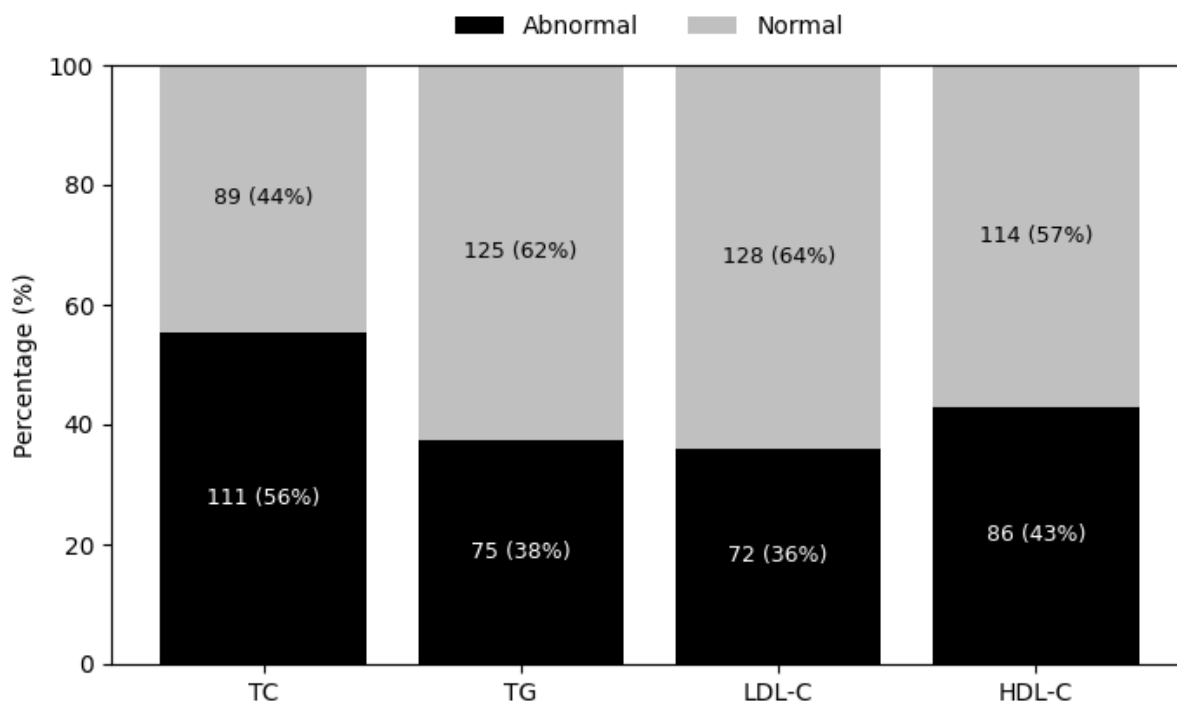


Figure 1. Distribution of blood lipid status among different blood lipid indicators.

on dyslipidemia by evaluation of parameter estimates (B), Wald test statistics, significance levels (P value), odds ratio (OR), and 95% confidence interval (CI).

Results

Association between blood lipid abnormalities and TCM constitutions

The results showed that TC had the highest abnormal detection rate of 111 cases, which accounted for 55.5% of the total population. TG abnormality was observed in 75 cases accounting for 37.5% of total population, indicating a significantly higher proportion of normal TG levels in the population. The lowest abnormal detection rates among the four indicators were observed with LDL-C of 72 cases (36.0%), HDL-C of 86 cases (43.0%) (Figure 1). The correlation between individual blood lipid indicator abnormalities and TCM constitution types demonstrated that, for TC abnormality, Pearson chi-square value was 21.793 ($P < 0.01$), indicating a highly significant statistical correlation between

TC abnormality and TCM constitution types and confirming the non-independence of the two variables. For TG abnormality, Pearson chi-square value was 17.147 ($P < 0.01$), indicating a significant statistical correlation between TG abnormality and TCM constitution types. Inherent differences were observed in the probability of TG abnormality across different constitutional populations, and no result bias was witnessed due to extremely small of expected frequencies. For HDL-C abnormality, Pearson chi-square value was 9.012 ($P < 0.05$), suggesting a statistically significant correlation between TCM constitution types and HDL-C abnormality with the minimum expected count of 14.62. Balanced constitution had a relatively low probability of HDL-C abnormality. However, “Yang” deficiency and “Qi” deficiency constitutions were identified as key target types for the prevention and control of HDL-C abnormality. For LDL-C abnormality, Pearson chi-square value was 18.980 ($P < 0.01$), revealing a statistically significant association between LDL-C abnormality and TCM constitution types. The observed differences were non-fortuitous and non-random with the

Table 1. Combined Univariate Analysis of TCM Constitution and Four Blood Lipid Abnormalities.

TCM Constitution	Index	“Qi” deficiency	Balanced	“Yang” deficiency	“Yin” deficiency
Total cholesterol (TC) abnormality	Yes	53	15	17	26
	No	29	34	18	8
	χ^2			21.793	
	<i>P</i>			< 0.01	
Triglyceride (TG) abnormality	Yes	34	7	15	19
	No	48	42	20	15
	χ^2			17.147	
	<i>P</i>			< 0.01	
HDL-cholesterol (HDL-C) abnormality	Yes	42	13	18	13
	No	42	36	17	21
	χ^2			9.012	
	<i>P</i>			< 0.05	
LDL-cholesterol (LDL-C) abnormality	Yes	35	5	16	16
	No	47	44	19	18
	χ^2			18.98	
	<i>P</i>			< 0.05	

minimum expected count of 12.24, meeting the preconditions of chi-square test and eliminating potential bias in the obtained results (Table 1).

Logistic regression of TCM types on lipid abnormalities

A multiple Logistics regression model was adopted for the quantification of association strength and statistical reliability among three non-balanced TCM constitutions and abnormalities of four blood lipid indicators with the normal blood lipid indicators and balanced constitution as the reference group. The results showed that “Qi” deficiency constitution demonstrated significant positive associations with TG, LDL-C, and HDL-C abnormalities, but no statistical association with TC abnormality. Compared with the balanced constitution, the odds ratios of TG, HDL-C, and LDL-C abnormalities were increased by 4.925 folds with OR of 5.925, 4.076 folds with OR of 5.076, and 9.532 folds with OR of 10.532, respectively. However, the odds ratio of TC abnormality presented no significant difference with OR of 1.291 and *P* value of 0.590. The “Yang” deficiency constitution was consistent with “Qi” deficiency constitution and showed significant positive associations with TG, LDL-C, and HDL-C abnormalities, but no

association was found with TC abnormality. The odds ratios of TG, HDL-C, and LDL-C abnormalities were 6.174 folds with OR of 7.174, 5.576 folds with OR of 6.576, and 15.567 folds with OR of 16.567, respectively, compared with the balanced constitution. The association between “Yang” deficiency constitution and LDL-C abnormality was the strongest one across all constitutional indicator combinations, and no significant difference was witnessed in the odds ratio of TC abnormality with OR of 0.571 and *P* value of 0.314. The “Yin” deficiency constitution was significantly positive associated with TG and LDL-C abnormalities. Marginal significance was found in HDL-C abnormality with *P* value of 0.051. No statistical association was demonstrated with TC abnormality. Compared with the balanced constitution, the odds ratios of TG and LDL-C abnormalities significantly increased by 8.318 folds with OR of 9.318 and 9.274 folds with OR of 10.274, respectively, while that of TC abnormality was not significantly different with OR of 2.326 and *P* value of 0.152. Although the odds ratio of HDL-C abnormality showed an increasing trend with OR of 3.073, the result was not statistically significant (Table 2).

Table 2. Logistic Regression Analysis of TCM Constitution Types and Blood Lipid Indicators.

TCM constitution	Variable	B	β	P	OR (95% CI)
“Qi” deficiency	Abnormal TC	0.256	0.475	> 0.05	1.291 (0.509 - 3.274)
	Abnormal TG	1.779	0.531	< 0.01	5.925 (2.092 - 16.781)
	Abnormal LDL-C	2.354	0.607	< 0.01	10.532 (3.205 - 34.609)
	Abnormal HDL-C	1.625	0.475	< 0.01	5.076 (2.000 - 12.885)
“Yang” deficiency	Abnormal TC	0.561	0.557	> 0.05	0.571 (0.192 - 1.699)
	Abnormal TG	1.97	0.6	< 0.01	7.174 (2.212 - 23.263)
	Abnormal LDL-C	2.807	0.682	< 0.01	16.567 (4.350 - 63.090)
	Abnormal HDL-C	1.883	0.558	< 0.01	6.576 (2.201 - 19.645)
“Yin” deficiency	Abnormal TC	0.844	0.589	> 0.05	2.326 (0.733 - 7.377)
	Abnormal TG	2.232	0.607	< 0.01	9.318 (2.833 - 30.650)
	Abnormal LDL-C	2.33	0.683	< 0.01	10.274 (2.696 - 39.160)
	Abnormal HDL-C	1.123	0.576	> 0.05	3.073 (0.993 - 9.508)

Discussion

This research systematically explored the distribution characteristics of TCM constitutions among 200 participants as well as their correlations with blood lipid abnormalities, providing theoretical and experimental evidence for TCM-oriented prevention and intervention guidelines for dyslipidemia. The key findings of this study were consistent with the holistic perspective of TCM and further supplemented the existing academic understanding of the associations among metabolic disorders and constitutional medicine. The prevalence of blood lipid abnormalities in study cohort was 78.5%, which was higher than the reported average value in the general population, which might be attributed to selection bias in research subjects. Among the four main blood lipid indicators, TC presented the highest abnormal detection rate, while LDL-C exhibited the lowest value. This distribution pattern was slightly different from the national epidemiological data in China, where elevated TG levels were more prevalent, probably due to the specific demographic features of the research population. Among different TCM constitution types, “Qi” deficiency constitution was the most predominant followed by “Yin” deficiency, “Yang” deficiency, and the balanced constitutions. Notably, the balanced constitution was correlated with the lowest

incidence of blood lipid abnormalities. It was the only constitution type with a normal blood lipid proportion exceeding 50%, corroborating the core tenets of TCM constitutional theory that the balanced constitution represented an optimal state of human health, characterized by a lower risk of metabolic disorders. Chi-square test results revealed significant correlations among abnormalities of all four blood lipid indicators and TCM constitution types, indicating inherent variations in dyslipidemia risk across different constitution types and providing a theoretical basis for targeted constitutional interventions. Multiple regression analyses revealed that “Qi” deficiency, “Yin” deficiency, and “Yang” deficiency constitutions were positively correlated with TG and LDL-C abnormalities with “Yang” deficiency constitution presenting the strongest association with LDL-C abnormalities. “Qi” deficiency and “Yang” deficiency constitutions were significantly correlated with HDL-C abnormalities, while “Yin” deficiency constitution demonstrated a marginal association with HDL-C abnormalities. It was noteworthy that none of the three non-balanced constitution types exhibited significant correlations with TC abnormalities, which might be because dietary patterns and genetic factors more strongly influenced TC levels. The findings of this research were generally consistent with previous relevant research, which also revealed

associations among “Qi” deficiency, “Yang” deficiency, “Yin” deficiency constitutions and dyslipidemia, while confirming the protective influence of the balanced constitution against dyslipidemia. Prior research emphasized the association between dyslipidemia and phlegm dampness constitution, which was not included in this research due to differences in constitutional type selection. In addition, this research quantitatively analyzed the strength of the association among each constitution type and blood lipid indicators, thereby supplementing existing results by clarifying specific correlations among individual blood lipid abnormalities and TCM constitution types.

Conclusion

Balanced constitution was found to be a protective factor against dyslipidemia with consistently low abnormality rates across all lipid indicators. Among non-balanced types, “Yang” deficiency showed the strongest LDL-C risk and also synergistically affected TG and HDL-C, warranting multi-indicator monitoring. “Yin” deficiency primarily elevated TG with secondary LDL-C effects, while its associations with HDL-C and TC were not significant. “Qi” deficiency involved concurrent abnormalities in TG, LDL-C, and HDL-C, requiring comprehensive surveillance. TC abnormality was unrelated to any non-balanced constitution, indicating that genetic and dietary factors predominated over constitutional influence. Environmental factors such as high-humidity and high-salt diet in Yunnan province might exacerbate LDL-C elevation in “Yang” deficiency individuals *via* dampness related mechanisms, supporting a regional pathway model from environment to constitution to lipid disorder. These findings might enable targeted interventions including TG regulation for “Yin” deficiency, LDL-C control for “Yang” deficiency, dietary cholesterol restriction for TC, and community based screening for “Qi” deficiency given its high prevalence. Consistence with prior studies confirmed reproducibility,

while Yunnan-specific parameters enhanced regional applicability.

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