Original Article

Associations between traditional Chinese medicine body constitution and obesity risk among US adults

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Background: Traditional Chinese medicine (TCM) body constitution (BC), primarily determined by physiological and clinical characteristics, is an important process for clinical diagnosis and treatment and play a critical role in precision medicine in TCM. The purpose of the study was to explore whether the distributions of BC types differed by obesity status.

Methods: We conducted a study to evaluate BC type in US population during 2012–2016. A total of 191 White participants from Personalized Prevention of Colorectal Cancer Trial (PPCCT) completed a self-administered Traditional Chinese Medicine Questionnaire (TCMQ, English version). In this study, we further compared the distribution of major types of TCM BC in the PPCCT to those Chinese populations stratified by obesity status.

Results: We found the Blood-stasis frequency was higher in US White adults, 22.6% for individuals with BMI <30 and 11.2% for obese individuals, compared to 1.4% and 1.8%, respectively, in Chinese populations. We also found the percentages Inherited-special and Qi-stagnation were higher in US White adults than those in Chinese populations regardless of obesity status. However, the proportions of Yang-deficiency were higher in Chinese populations than those in our study conducted in US White adults regardless of obesity status.

Conclusions: These new findings indicate the difference in distribution of BC types we observed between US and Chinese populations cannot be explained by the differences in prevalence of obesity. Further studies are needed to confirm our findings and understand the potential mechanism including genetic background and/or environmental factors.

Keywords: Traditional Chinese medicine (TCM); body constitution (BC); overweight; obesity

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Introduction

In recent decades, obesity has surged to epidemic proportions and has been a major contributor to the global burden of chronic noncommunicable diseases and the associated disability. According to the World Health Organization (WHO) in 2016, over 1.9 billion aged 18 years and older were overweight and 650 million adults were obese. Obesity is not only a condition of increased body weight but also a complex disorder that affects glucose, lipid, and protein metabolism. Furthermore, it is closely related to metabolic disorders such as insulin resistance (IR), type 2 diabetes mellitus (T2DM), and liver steatosis, leading to significant morbidity, mortality, and societal burden (1).

Body constitution (BC), the foundational concept of traditional Chinese medicine (TCM), classifies individuals into nine types: Balanced constitution, Qi-deficiency constitution, Yang-deficiency constitution, Yin-deficiency constitution, Phlegm-dampness constitution, Damp-heat constitution, Blood-stasis constitution, Qi-stagnation constitution and Inherited-special constitution (2). This classification is based on physical, psychological, and physiological characteristics, as well as susceptibility to illnesses and adaptability to the environment. These constitutions are dynamic and can be influenced by acquired factors including lifestyles and environment (3). BC is an important process for clinical diagnosis and treatment and play a critical role in precision medicine and precision prevention.

However, TCM plays a very limited role in Western medical practice. Almost all these previous studies using TCM BC have been conducted in Chinese populations except for one study of 400 White college students attending three Beijing universities in China (4).

Highlight box

Key findings

- Blood-stasis, Inherited-special and Qi-stagnation proportions were higher in US White adults compared to Chinese populations despite obesity status.

What is known and what is new?

- This is first study to compare the distribution of Traditional Chinese medicine body constitution in White population to that in Chinese population stratified by obesity status.

What is the implication, and what should change now?

- Further large studies are needed to confirm the findings.

Very recently, in the first conducted in an American population (5), we found the distribution of TCM BC types in a US White population were different from the distribution among Chinese individuals in China. TCM BC has been previously associated with obesity in China (6) and the US population has higher prevalence of obesity than the Chinese populations (7). Thus, it is possible that the difference in distribution of major types of TCM BC may be due to higher obesity prevalence in our study population. In this study, we compared the distribution of major types of TCM BC between our study population and Chinese populations according to obesity status.

Methods

Study population

The participants in this study were from the Personalized Prevention of Colorectal Cancer Trial (PPCCT, NCT01105169 at ClinicalTrials.gov) which was a double-blind, placebo-controlled, randomized precision-based magnesium trial conducted between March 2011 and January 2016. Aged 40 to 85 years with history of colorectal polyp or high risk of colorectal cancer (CRC) participants were enrolled from Vanderbilt University Medical Center. Detailed inclusion and exclusion criteria have been reported (8,9). In the parent study, 250 participants enrolled and 239 completed the study with 11 participants finishing part of the study before withdrawal. One participant completed questionnaires and provided samples at baseline and at the end of the trial after withdrawal. In total, 240 participants were included (shown in *Table 1*). Traditional Chinese Medicine Questionnaire (TCMQ, English version: Health Questionnaire) as a component of the study was approved by IRB on May 31, 2012, which was a year after the trial started. A total of 191 participants (80% of 240) completed the self-administered TCMQ from May 31, 2012 to Jan 30, 2016 (5). The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Vanderbilt Institutional Review Board (IRB) (No. 100106) and informed consent was obtained from all individual participants.

Constitution in TCMQ

TCMQ is an English version of the standardized Constitution in Chinese Medicine Questionnaire (CCMQ)

Table 1 Baseline characteristics of participants with or without TCMQ, results from PPCCT

Characteristic	Overall (n=240)	With TCMQ (n=191)	Without TCMQ (n=49)	P value
BMI (kg/m^2)	30.3±6.3	30.3±6.7	30.1±5.0	0.95
<25	47 (19.6)	40 (20.9)	7 (14.4)	
25–29.9	78 (32.5)	62 (32.5)	16 (32.6)	0.93
≥30	115 (47.9)	89 (46.6)	26 (53.0)	
Waist circumference (cm)	106.9±15.7	106.8±16.7	107.4±11.1	0.92
Age (year)	60.8±8.0	60.0±7.8	63.8±7.8	0.33
Gender male	127 (52.9)	100 (52.4)	27 (55.1)	0.93
Education college or beyond	216 (90.0)	173 (90.6)	43 (87.8)	0.84
Smoking status				0.87
Never	131 (54.6)	102 (53.4)	29 (59.2)	
Ever	91 (37.9)	72 (46.6)	19 (38.8)	
Current	18 (7.5)	17 (8.9)	1 (2.0)	
Drinking status				0.92
Never	90 (37.5)	70 (36.7)	20 (40.8)	
Ever	49 (20.4)	42 (21.9)	7 (14.3)	
Current	101 (42.1)	79 (41.4)	22 (44.9)	
Physically active ≥2 days/week	195 (81.2)	162 (84.8)	33 (67.3)	0.33
SBP (mmHg)	127.3±14.8	127.5±15.3	126.8±13.1	0.92
DBP (mmHg)	7.05±8.7	75.3±8.8	73.7±8.2	0.71
Total cholesterol (mg/dL)	202.9±56.1	204.7±57.7	195.9±49.4	0.74
Triglycerides (mg/dL)	130.1±73.7	124.8±65.6	151.0±97.2	0.43
LDL (mg/dL)	117.5±41.2	118.5±41.9	113.5±38.4	0.80
HDL (mg/dL)	59.4±20.4	61.2±21.3	52.2±14.8	0.36
C-reactive protein (mg/dL)	3.1±4.3	3.1±3.9	3.1±5.1	0.97
Antihypertensive medication use	106 (44.1)	78 (40.8)	28 (57.1)	0.48
Lipid control medication use	88 (36.7)	68 (35.6)	20 (40.8)	0.82
Glycemic control medication use	22 (9.2)	22 (11.5)	0 (0.0)	0.42

Continuous variables were presented as mean ± SD, P values (the comparison between overall and participants who completed TCMQ) were calculated using GLM model; categorical variables presented as n (%), P values were calculated using chi-square test or fisher's exactly test. TCMQ, Traditional Chinese Medicine Questionnaire; PPCCT, Personalized Prevention of Colorectal Cancer Trial; BMI, body mass index; SBP, systolic blood pressure; DBP, diastolic blood pressure; HDL, high-density lipoproteins; LDL, low-density lipoproteins.

was developed by Wang *et al.* in China (10). As reported in our study (5), the construct validity of TCMQ was confirmed with scaling success rates that ranged from 75.0% to 100%, and confirmatory factor analysis indicate an acceptable model fit. The results of reliability for test-retest reliability (intra-class correlation coefficients) were 0.7–0.8, the Cronbach's alphas ranged from 0.44 to 0.72 during three-month period. The TCMQ consists of 60 questions and each item (question) was graded on a 5-point Likert scale, ranging from 1 (not at all) to 5 (very much). Each of the nine subscales within the TCMQ assessed one type of the TCM BC individually. A total score

Table 2 Comparison of distribution of different body mass index among the TCMQ constitution groups, results from PPCCT

TCM constitution types	BMI (kg/m^2)			P value
	<25 (n=40)	25–29.9 (n=62)	≥30 (n=89)	
Balanced	16	18	23	0.27
Qi-deficiency	3	8	15	
Yang-deficiency	1	4	4	
Yin-deficiency	2	1	9	
Phlegm-dampness	1	4	11	
Damp-heat	2	1	3	
Blood-stasis	8	15	10	
Qi-stagnation	2	3	7	
Inherited-special	5	8	7	

Categorical variables presented as n (%), P values were calculated using chi-square test. TCM, traditional Chinese medicine; TCMQ, Traditional Chinese Medicine Questionnaire; PPCCT, Personalized Prevention of Colorectal Cancer Trial.

of each subscale was obtained by summing relevant item scores and the transformed score was created for each type by using the following equation.

$$Transform\ score = 100\% \times \frac{\text{Original score} - \text{Num. of item}}{\text{Num. of item} \times 4} \quad [1]$$

Following the criteria, a higher score in a specific TCMQ BC subscale indicates a higher likelihood of the corresponding BC type, with a score of 30 being a "threshold" for case definition. The following rule was applied to ultimately classify a participant within a specific TCM BC: when (I) the score for the Balanced subscale was greater than or equal to 60 and other BC type scores were less than 30, the study participant was diagnosed as "Balanced" which was considered the balanced BC; when (II) the score for an imbalanced BC type (all other BCs) was greater than or equal to 40, then the participant was regarded as one or more of eight imbalanced BC types; and when (III) a BC type score was between 30–40, the diagnosis was made by a well-trained Chinese Medicine Practitioner.

Anthropometric measurements

Anthropometry or body measures for the participants were conducted during their clinic visits by trained personnel. Weight was taken on a digital scale and measured in kilograms. When the participant was properly positioned and the digital readout was stable, the study nurse recorded the number on the screen. Standing height was measured in centimeter with a fixed stadiometer with a vertical backboard and a moveable headboard. They were asked to stand on the floor with the heels of both feet together and the toes pointed slightly outward at approximately a 60° angle. When the participant was properly positioned, the study nurse recorded the height. At least two measurements were required, the 3rd measurement was made only if the difference between the first two was greater than the difference threshold (0.1 kg for weigh and 1 cm for height). The means of two or three measurements (including weight, height, waist circumference, hip circumference) separated by 30 seconds were used for the analysis. BMI values are calculated for participants using measured height and weight values as follows: weight (kilograms)/height (meters squared). BMI criteria are used to for weight categories: normal or desirable weight (BMI values <25.0), overweight (BMI values 25.0–29.9), obese (BMI values ≥30.0).

Statistical analyses

Mean ± standard deviation for continuous demographic variables and percentage for categorical demographic variables were presented in *Table 1*. We performed general linear model for continuous variables or Pearson chi-squared tests, and Fisher's exactly tests for categorial variables. We compared the distribution of nine TCM BC types by obesity status and population. All P values are two sided and statistical significance was determined using an alpha level of 0.05. The data analyses used software SAS Enterprise Guide 7.1.

Results

We compared baseline demographic characteristics between 191 participants who completed TCMQ and all participants (n=240) in the parent study (*Table 1*). No significant difference was found for baseline characteristics between these two groups. *Table 2* showed the distributions of the nine-body constitution by body weight and no difference was found between normal, overweight, and obese participants.

We found that the Blood-stasis proportion was higher in US White adults, 22.6% for individuals with BMI <30

Table 3 Comparison of distribution of different body mass index among the TCMQ constitution groups

TCM constitution types	BMI (kg/m^2)				P_1	P_2
	PPCCT		China (Li *et al.* 2017) (11)			
	<30 (n=102)	≥30 (n=89)	<30 (n=4,513)	≥30 (n=510)		
Balanced	34 (33.3)	23 (25.8)	1,776 (39.4)	224 (44.4)	<0.0001	<0.0001
Qi-deficiency	11 (10.8)	15 (16.8)	1,050 (23.3)	103 (20.2)		
Yang-deficiency	5 (4.9)	4 (4.5)	848 (18.8)	54 (10.6)		
Yin-deficiency	3 (2.9)	9 (10.1)	298 (6.6)	32 (6.3)		
Phlegm-dampness	5 (4.9)	11 (12.4)	247 (5.5)	55 (10.8)		
Damp-heat	3 (2.9)	3 (3.4)	107 (2.4)	17 (3.3)		
Blood-stasis	23 (22.6)	10 (11.2)	65 (1.4)	9 (1.8)		
Qi-stagnation	5 (4.9)	7 (7.9)	45 (1.0)	8 (1.6)		
Inherited-special	13 (12.8)	7 (7.9)	77 (1.7)	8 (1.6)		

Categorical variables presented as n (%). P_1: the comparison of US and Chinese population among BMI <30; P_2: the comparison of US and Chinese population among BMI ≥30. TCMQ, Traditional Chinese Medicine Questionnaire; PPCCT, Personalized Prevention of Colorectal Cancer Trial.

and 11.2% for obese individuals, compared to 1.4% and 1.8%, respectively, in Chinese populations (*Table 3*). Also, the percentages of Inherited-special were higher in US White adults, 12.8% for individuals with BMI <30 and 7.9% for obese individuals, than 1.7% and 1.6%, respectively, in Chinese populations (11). Likewise, we observed that the proportions of Qi-stagnation were higher in US White adults, 4.9% for individuals with BMI <30 and 7.9% for obese individuals, than 1.0% and 1.6%, respectively, in Chinese populations. Conversely, the proportions of Yang-deficiency were higher in Chinese populations, 18.8% for individuals with BMI <30 and 10.6% for obese individuals, than 4.9% and 4.5%, respectively in our study conducted in US White adults. (P_1<0.0001 among BMI <30 and P_2<0.0001 among obesity adults).

In our recent report (5), the distribution of BC types varied greatly between our study conducted in US White adults and those conducted in Chinese populations. Balanced (29.8%) was the predominant BC type in our study, while the three most common pathologic BC types were Blood-stasis (17.3%), Qi-deficiency (13.6%), and Inherited-special (10.5%). In contrast, the most common pathologic BC types found in Chinese populations were Qi-deficiency, Yang-deficiency, Yin-deficiency, and Phlegm-Dampness. In this study, the differences of the three BC proportions between US population and Chinese population remained after considering obesity status.

Discussion

These new findings indicate the difference in distribution of BC types we observed between populations cannot be explained by the differences in prevalence of obesity. However, our finding was not conclusive. The different distribution between our study population in US and that conducted in previous studies may be caused by selection biases. In our study, over 46% of the study participants were obese whereas only 10.1% of participants in studies conducted in China were obese. Thus, the difference could be due to the different prevalence rates in obesity. In addition, our study participants had a personal history of colorectal polyp or were at high risk of CRC. Another possibility is that individuals diagnosed with colorectal polyp or at high risk of CRC had different BC types. Tao *et al.* recently reported that the observed differences in the distribution of Blood-Stasis cannot be attributable to this selection bias, as well as different distributions in sex and age (12). Thus, it is possible that the observed differences are due to the different genetic background or environmental factors, including different dietary patterns.

Conclusions

The dissimilarity in distribution of BC types between US population and Chinese population cannot be solely

attributed to the variations in obesity prevalence. Additional research is necessary to validate and comprehend the potential reasons for the observed disparity.

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Footnote

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