ORIGINAL ARTICLE

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The original scores of traditional Chinese medicine constitutions are risk and diagnostic factors in middle-aged and older adults with sarcopenia

Xin Nie[1,2,3] | Chi Wang[1,2,3] | He Zhang[1,2,3] | Qianhui Liu[1,2,3] | Lisha Hou[4] |
Yiping Deng[4] | Wenbin Ye[5] | Jirong Yue[4] | Yong He[1,2,3] (iD)

[1]Department of Laboratory Medicine, West China Hospital, Sichuan University, Chengdu, Sichuan, China

[2]Sichuan Clinical Research Center for Laboratory Medicine, Chengdu, Sichuan, China

[3]Clinical Laboratory Medicine Research Center of West China Hospital, Chengdu, Sichuan, China

[4]Department of Geriatrics and National Clinical Research Center for Geriatrics, West China Hospital, Sichuan University, Chengdu, Sichuan, China

[5]Xiamen Hospital of Traditional Chinese Medicine, Beijing University of Chinese Medicine, Xiamen, Fujian, China

Correspondence
Wenbin Ye, Department of Geriatrics, Xiamen Hospital of Traditional Chinese Medicine, Beijing University of Chinese Medicine, Xiamen, Fujian, China.
Email: wby848@163.com

Jirong Yue, Department of Geriatrics and National Clinical Research Center for Geriatrics, West China Hospital, Sichuan University, Chengdu 610041, Sichuan, China.
Email: yuejirong11@hotmail.com

Yong He, Department of Laboratory Medicine, West China Hospital, Sichuan University, Chengdu, Sichuan Province, China.
Email: heyong1011@163.com

Abstract

Objective: Sarcopenia is a geriatric syndrome that occurs with age and is characterized by a gradual decline in muscle mass, power, and functionality. It serves as a prominent contributor to frailty, disability, and mortality among older individuals. Currently, no standardized global guidelines exist for the diagnosis of sarcopenia. This study aimed to establish the correlation between sarcopenia and the constitutions of traditional Chinese medicine (TCM), considering the connection between physical functioning and sarcopenia.

Methods: A total of 1441 participants in this study were diagnosed with sarcopenia. The Asian Working Group for Sarcopenia (AWGS) proposed a sarcopenia definition algorithm. To determine the constitution of each participant, classification and determination standards were used in traditional Chinese medicine. This study evaluated the demographics, lifestyles, and self-reported medical history of individuals diagnosed with sarcopenia through a self-administered questionnaire. The constitution of the participants was determined using TCM classification and determination standards. Subsequently, we analyzed the results of univariate analysis and multivariate regression and constructed a receiver operating characteristic (ROC) curve.

Results: Participants who were diagnosed with sarcopenia had substantially lower original Neutral constitution scores ($P < 0.050$). In comparison to those without sarcopenia, individuals with sarcopenia exhibited notably elevated original Qi-deficiency, Yang-deficiency, Yin-deficiency, Blood-stagnation, and Qi-stagnation scores in contrast to those in the healthy group ($P < 0.050$). The identified risk factors associated with sarcopenia included the following: Neutral (OR = 0.903), Qi-deficiency (in males, OR = 1.126), Yang-deficiency (OR = 1.062), Phlegm-dampness (in males, OR = 0.833), and Blood-stagnation (in females, OR = 1.089). The highest area under the curve (AUC) was observed for the original neutral constitution score, followed by the Yang-deficiency and blood-stagnation scores (0.644, 0.613, and 0.611, respectively).

Xin Nie and Chi Wang contributed equally to this work.

Additionally, the AUC for the combined original scores of all nine constitutions among males reached 0.778.

Conclusions: In this cross-sectional study of older people with higher original Qi-deficiency, Yin deficiency, Yang-deficiency, Blood-stagnation, and Qi-stagnation were associated with sarcopenia. Notably, various TCM constitutions are significantly linked to sarcopenia. There was a significant occurrence of various body constitution types among individuals diagnosed with sarcopenia. The mixture of the nine original constitution scores exhibited good diagnostic performance for sarcopenia in males.

KEYWORDS

body constitution, middle-aged and older, original score, sarcopenia, traditional Chinese medicine (TCM)

1 | INTRODUCTION

Sarcopenia is an aging syndrome characterized by decreased muscle mass, strength, and function with increasing age.[1,2] Sarcopenia increases the risk of falls and fractures, is accompanied by disability and a decreased ability to perform activities of daily living, and is closely associated with impaired mobility, falls, low bone mass and metabolic disorders.[3,4] At present, numerous institutions have proposed diagnostic standards that rely on muscle size and muscle performance, employing different thresholds and diverse assessment instruments.[5] In the assessment of sarcopenia, dual-energy X-ray absorptiometry (DXA) is presently the primary option for quantitative evaluations, although magnetic resonance imaging (MRI), computed tomography (CT), or bioimpedance analysis (BIA) may be utilized depending on the specific circumstances.[6] Internationally, there are different diagnostic criteria for sarcopenia. DXA measures the appendicular skeletal muscle mass index (ASMI), which represents muscle mass, while grip strength serves as the muscle strength index, and daily gait speed indicates the physical fitness index.[7] Sarcopenia can be diagnosed when the corresponding measurements are lower than the above values.

Over the past few years, there has been a proposal and enhancement of systematic constitutional theory in traditional Chinese medicine (TCM).[8] TCM constitutions have been extensively studied in a variety of diseases.[9–11] According to Chinese medicine, the constitution of the body is a relatively stable characteristic inherent in the morphological structure and functional activities of human individuals, formed by congenital inheritance and acquisition.[11] The differences in individual physique are reflected in certain differences in response and adaptation to external stimuli in the physiological state, as well as in susceptibility to certain pathogenic factors in the pathogenesis process and in the tendency for disease development.[12,13] Hence, investigating body constitutions aids in scrutinizing the emergence and progression of illnesses, thereby establishing a foundation for diagnosing and treating ailments.[14,15] In recent years, it has been reported that eight kinds of biased TCM constitutions are closely related to the

occurrence and development of diseases in the elderly population and can be used to guide individual prevention and treatment.[16,17] This cross-sectional study revealed that Qi-deficiency and Yin-deficiency are related to a decrease in neurocognitive function in elderly people and that Yang-deficiency is closely related to osteoporosis and knee joint disease.[16,18] The China Association for Traditional Chinese Medicine issued standards for determining constitutions in TCM.[19] The standard questionnaire can be used to evaluate one's constitution based on the symptoms presented. Therefore, our investigation focused on examining the associations between nine constitutional factors and skeletal muscle mass in the sarcopenia group.

2 | METHODS

2.1 | Study sample

The data for the Xiamen Aging Trend (XMAT) study were collected during the baseline period, which was conducted between March and April 2022. The study included a total of 1874 individuals aged 50 years or older residing in Xiamen city. A total of 1441 people met the requirements based on specific exclusion criteria. The exclusion criteria for these individuals were (1) cognitive impairment; (2) recent malignancy; (3) missing laboratory measurements; and (4) a medical history of plate, pacemaker, or cardiac stent implantation. The research was carried out following the guidelines of the Helsinki Declaration, and all participants willingly participated and provided signed informed consent.

2.2 | Assessment of sarcopenia

The AWGS 2019, widely employed in Asia for sarcopenia diagnosis, was utilized as the diagnostic criterion, taking into account the decline in muscle mass, muscle strength, and physical performance.[20] A dynamometer (EH101; Camry, Zhongshan, China) was used to evaluate muscle strength in the dominant hand, and the

highest measurement out of two trials was selected for analysis. Bioimpedance analysis considers a low muscle mass as an appendicular skeletal muscle mass index (ASMI) of <7.0 kg/m^2 for males and <5.7 kg/m^2 for females. According to the AWGS, individuals with a handgrip strength less than 28 kg for men and less than 18 kg for women are considered to have low muscle strength. A gait speed of less than 0.8 m/s during the 4 m walking test is classified as slow.[21]

2.3 | Specimen collection

The interviewers were individuals from XMAT who gathered data from questionnaires by personally conducting one-on-one interviews in person. We recruited more than 1441 participants from communities between March and April 2022. The study did not include pregnant women or participants with significant renal and hepatic function abnormalities. The TCM constitution was evaluated utilizing a prescribed questionnaire endorsed by the China Association for Traditional Chinese Medicine (Supplementary Document accessible in Supporting Information).

2.4 | Statistical analyses

The ROC curve analysis was performed using MedCalc v19.0.7. The mean ± SD was used for continuous variables, and frequencies with percentages were used for categorical variables. The *t* test was used for normally distributed data, and the Mann–Whitney *U*-test was used for abnormally distributed data. The chi-square test was used for categorical variables. Binary regression analysis to identify significant risk factors for sarcopenia. A *p* value <0.050 was considered statistically significant.

3 | RESULTS

3.1 | Characteristics of the study cohorts stratified by the sarcopenia status

Among the 1441 elderly people, sarcopenia was present in 147 individuals, with 41 men and 106 women. On the other hand, sarcopenia was absent in 1294 participants, including 314 men and 980 women. The characteristics of the elderly participants, categorized by sarcopenia status, are displayed in Table 1. Our analysis revealed a significant difference in age between the sarcopenia and nonsarcopenia groups. The group without sarcopenia exhibited a decrease in the number of sit-to-stand tests performed five times, the skeletal muscle index (SMI), and the maximum grip strength. However, they demonstrated greater performance in the 6-m walk test than did the group with sarcopenia. Table 1 also summarizes the TCM body constitutions of the participants, categorized based on sarcopenia status. The body constitution of patients with sarcopenia was found to be inferior to that of healthy

TABLE 1 Characteristics of the study cohorts.

	No sarcopenia (n=1294)	Sarcopenia (n=147)	P-Value
Gender [n (%)]			
Male	314 (24.3)	41 (27.9)	0.334
Female	980 (75.7)	106 (72.1)	
Age(years)	64.22 ± 7.02	69.67 ± 7.50	<0.001*
Sit-to-stand five times/s	9.22 ± 1.70	12.2 ± 3.43	<0.001*
6 m walking test/(m/s)	1.2 ± 0.22	0.99 ± 0.21	<0.001*
SMI	6.5 ± 0.82	5.58 ± 0.60	<0.001*
Maximum grip strength/kg	26.86 ± 9.70	21.34 ± 7.89	<0.001*
Neutral constitution/original score	28.76 ± 3.67	26.78 ± 4.03	<0.001*
Qi-deficiency constitution/original score	12.98 ± 3.92	14.03 ± 4.48	0.003*
Yang-deficiency constitution/original score	11.5 ± 4.63	13.96 ± 5.97	<0.001*
Yin-deficiency constitution/original score	12.49 ± 3.78	13.67 ± 4.37	<0.001*
Phlegm-damp constitution/original score	11.68 ± 3.40	12.1 ± 3.53	0.160
Damp-heat constitution/original score	9.76 ± 2.76	10.12 ± 3.34	0.147
Blood-stagnation constitution/original score	11.93 ± 3.33	13.25 ± 3.61	<0.001*
Qi-stagnation constitution/original score	9.54 ± 3.46	10.17 ± 3.82	0.025*
Special diathesis constitution/original score	9.21 ± 2.61	9.66 ± 2.70	0.048

Note: Mean skeletal muscle mass index, SMI, *p < 0.050.

individuals. According to the Constitution in Chinese Medicine Questionnaire (CCMQ), individuals with sarcopenia had a significantly lower original score for Neutral-constitution than did those without sarcopenia ($P < 0.050$). Compared to individuals in the healthy group, individuals in the sarcopenia group exhibited significantly greater original scores in Qi-deficiency, Yin-deficiency, Qi-stagnation, Yang-deficiency, and blood-stagnation constitution ($P < 0.050$). Moreover, there were no distinctions observed between the groups that had sarcopenia and those that did not regarding the original Phlegm- damp, Damp-heat, or Special diathesis constitution scores.

3.2 | Multivariate regression of TCM constitutions and muscle mass

Table 2 displays the findings of binary logistic regression analysis, utilizing multivariate analysis, aiming to elucidate the risk factors associated with TCM constitutions for sarcopenia across all participants, male participants, and female participants. Table 2 also shows that the original body condition scores for Neutral (OR = 0.903), Yang-deficiency (OR = 1.062), Phlegm-damp (in males, OR = 0.833), and Blood-stagnation (in females, OR = 1.089) were risk factors for reduced skeletal muscle mass in sarcopenia patients ($P < 0.050$).

3.3 | The predictive value of indicators for sarcopenia

By calculating the AUC, we evaluated the diagnostic accuracy of TCM for detecting low muscle mass among individuals in the sarcopenia cohort. Furthermore, we constructed an ROC curve to analyze TCM performance (Table 3). We found that in all participants, the original body condition score of Neutral AUC = 0.644 [95% CI: 0.596–0.691] and Yang-deficiency AUC = 0.613 [95% CI: 0.560–0.666] had better predictive value than the other parameters (Figure 1). In male participants, the original body condition scores for Qi-deficiency and Yin-deficiency also showed diagnostic potential, with AUCs of 0.642 and 0.634, respectively, and a cut-off value of 10.5, but these values were not significant in female participants. Then, we aggregated the parameters of all the AUCs and discovered that the AUC of the nine original body condition score mixtures in male participants reached 0.778, while that in female participants reached 0.676 (Figure 2).

4 | DISCUSSION

Sarcopenia is a progressive and systemic skeletal muscle disorder associated with an increased likelihood of adverse outcomes, including falls, fractures, physical disability, and death, and is

TABLE 2 Risk factors for sarcopenia.

	All participants (n=1441) OR (95% CI)	P-Value	Male participants (n=355) OR (95% CI)	P-Value	Female participants (n=1086) OR (95% CI)	P-Value
Neutral constitution/original score	0.903 (0.850, 0.960)	<0.001*	0.873 (0.774, 0.985)	0.028*	0.909 (0.846, 0.975)	0.008*
Qi-deficiency constitution/original score	0.976 (0.919, 1.036)	0.420	1.126 (1.000, 1.269)	0.051	0.942 (0.878, 1.011)	0.096
Yang-deficiency constitution/original score	1.062 (1.022, 1.104)	0.002*	1.089 (1.004, 1.181)	0.041*	1.064 (1.018, 1.114)	0.007*
Yin-deficiency constitution/original score	1.046 (0.988, 1.108)	0.119	1.066 (0.942, 1.206)	0.314	1.042 (0.974, 1.114)	0.229
Phlegm-damp constitution/original score	0.944 (0.881, 1.011)	0.101	0.833 (0.719, 0.964)	0.014*	0.976 (0.899, 1.059)	0.562
Damp-heat constitution/original score	0.972 (0.903, 1.046)	0.449	0.952 (0.819, 1.106)	0.517	0.973 (0.892, 1.062)	0.539
Blood-stagnation constitution/original score	1.069 (1.004, 1.138)	0.037	1.069 (0.936, 1.221)	0.327	1.089 (1.012, 1.172)	0.023*
Qi-stagnation constitution/original score	0.966 (0.904, 1.032)	0.303	0.918 (0.796, 1.059)	0.239	0.979 (0.908, 1.057)	0.593
Special diathesis constitution/original score	0.994 (0.926, 1.068)	0.876	1.083 (0.954, 1.230)	0.847	0.948 (0.867, 1.035)	0.223

*$p < 0.050$.

TABLE 3 The results of ROC analysis of various TCM constitutions for the diagnosis of sarcopenia.

TCM constitution	All participants (n=1441) AUC (95% CI)	Cut-off values	Sensitivity	Specificity	Male participants (n=355) AUC (95% CI)	Cut-off values	Sensitivity	Specificity	Female participants (n=1086) AUC (95% CI)	Cut-off values	Sensitivity	Specificity
Neutral constitution/original score	0.644 (0.596, 0.691)	27.5	55.8	66.2	0.682 (0.587, 0.776)	29.5	70.7	58.4	0.634 (0.578, 0.689)	27.5	60.4	62.3
Qi-deficiency constitution/original score	0.568 (0.517, 0.62)	12.5	59.2	53.2	0.642 (0.551, 0.734)	10.5	78	42.9	0.549 (0.488, 0.611)	12.5	63.2	48.4
Yang-deficiency constitution/original score	0.613 (0.56, 0.666)	13.5	48.3	72.2	0.647 (0.548, 0.745)	11.5	51.2	74.4	0.607 (0.545, 0.67)	17.5	34	87
Yin-deficiency constitution/original score	0.577 (0.526, 0.628)	12.5	57.8	57	0.634 (0.547, 0.72)	10.5	80.5	47.7	0.563 (0.501, 0.625)	12.5	59.4	54.7
Phlegm-damp constitution/original score	0.535 (0.485, 0.584)	12.5	40.8	66.5	0.516 (0.425, 0.606)	9.5	80.5	31.2	0.543 (0.484, 0.602)	12.5	43.4	65.7
Damp-heat constitution/original score	0.514 (0.462, 0.566)	12.5	23.1	84.3	0.52 (0.423, 0.618)	11.5	34.1	74	0.51 (0.448, 0.571)	12.5	22.6	85.3
Blood-stagnation constitution/original score	0.611 (0.562, 0.66)	12.5	54.4	61.6	0.617 (0.523, 0.711)	10.5	73.2	47.7	0.616 (0.559, 0.673)	15.5	32.1	84.6
Qi-stagnation constitution/original score	0.546 (0.520, 0.572)	7.5	69.4	38.0	0.547 (0.454, 0.640)	8.5	48.8	56.5	0.551 (0.492, 0.610)	10.5	38.7	68.9
Special diathesis constitution/original score	0.554 (0.528, 0.580)	10.5	34.7	75.1	0.619 (0.521, 0.717)	9.5	53.7	68.5	0.530 (0.473, 0.586)	7.5	69.8	37.9

preventable and treatable in its early stages.[22,23] In TCM, health maintenance and disease treatment are guided by a complex conceptual framework.[24] According to the TCM theory, both innate and acquired factors can influence individual body constitutions, which determine disease susceptibility and development. Previous research has investigated the associations between TCM body constitutions and various diseases and conditions, including systemic lupus erythematosus, sleep disorders, hypertension, diabetes, dysmenorrhea, stroke, neoplasm of the breast, and fatty liver disease.[16,25,26] A large body of research has explored a wide range of diseases, but little has been done on patients with sarcopenia.[17,27]

In this investigation, we initially identified certain TCM constitutions connected to sarcopenia among elderly Chinese participants with XMAT. Participants with sarcopenia had noticeably lower original Neutral constitution scores ($p < 0.050$). Compared with individuals without sarcopenia, those with sarcopenia exhibited notably higher original Qi-deficiency, Yang-deficiency, Blood-stagnation, Yin-deficiency, and Qi-stagnation scores ($p < 0.050$). Based on the principles of TCM theory, an individual may have either a single or a blend of body constitutions.[28] Within TCM, Neutral is the only healthy constitution, and it is more important to balance a disharmonious condition to a gentleness constitution than to treat a particular illness.[29] Our results showed that sarcopenia participants tended to receive a lower original score in the Neutral TCM constitution group than in the other eight constitutions group.

Based on the multivariate logistic regression analysis, we included different indicators in the multivariate model and established ROC curves to identify the best diagnostic indicators in the sarcopenia cohort. Neutral (OR=0.903), Qi-deficiency (in males, OR=1.126), Yang-deficiency (OR=1.062), Phlegm-damp (in males, OR=0.833), and Blood-stagnation (in females, OR=1.089) were identified as risk factors for low skeletal muscle mass in sarcopenia patients. The AUC of the original Neutral constitution score was the highest, followed by those of the Qi-deficiency and Phlegm-damp scores (0.644, 0.613, and 0.611, respectively), and the AUC of the mixture of the nine constitution original scores in males reached 0.778.

This study has many limitations. First, this was a cross-sectional study with inherent limitations. Second, in this study, we only found a correlation between TCM constitutions and sarcopenia, not a causal relationship. Third, due to ethical limitations, the investigation of sarcopenia patients in this paper did not involve patients with serious physical and mental diseases or a loss of self-care ability and focused only on local patients with independent mobility in Xiamen. It was difficult to obtain data from patients who were severely ill or bedridden, which resulted in some bias in the results of the TCM syndrome analysis. The sample in this study was mainly concentrated in Xiamen, which may limit the generalizability of the findings, so it is necessary to conduct comprehensive and in-depth multicenter studies with larger samples and longer time spans in the future.
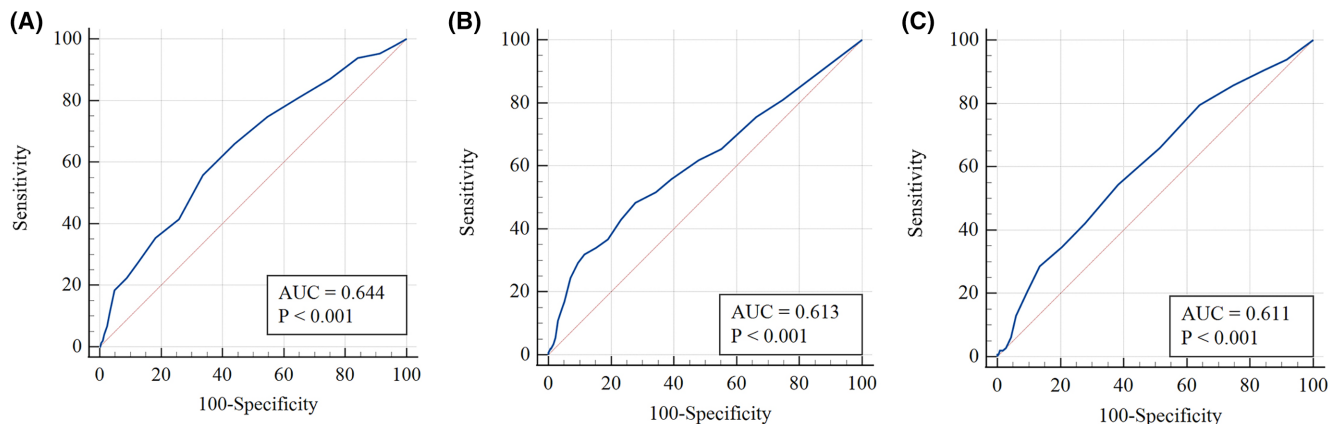
FIGURE 1 Receiver operating characteristic curves of different TCM constitution indicators in Sarcopenia (A) ROC curve analysis of Neutral original body condition score with AUC. (B) ROC curve analysis of Yang-deficiency original body condition score with AUC. (C) ROC curve analysis of blood-stagnation original body condition score with AUC.

FIGURE 2 Receiver operating characteristic curves of the predictive performance of multiple factors in Sarcopenia. (A) ROC curve analysis of nine original body conditions scores with AUC in males. (B) ROC curve analysis of comprehensive diagnosis in all subjects with AUC in females.
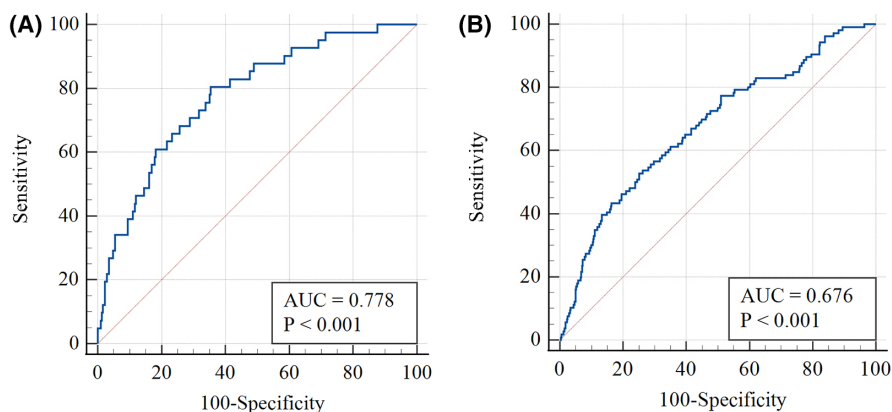
5 | CONCLUSIONS

In this cross-sectional study of Chinese elderly people aged over 50 years from the XMAT, a mixture of nine original constitution scores was associated with sarcopenia in males and risk factors for low muscle mass.

AUTHOR CONTRIBUTIONS

This work was substantially, directly, and intellectually contributed by all the authors, and their final approval was obtained.

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CONFLICT OF INTEREST STATEMENT

The authors affirm that the study was carried out without any potential conflicts of interest, either commercial or financial.

DATA AVAILABILITY STATEMENT

The corresponding author/s will provide the original data that support the conclusions of this article without any unnecessary withholding.

ETHICAL APPROVAL

This research was approved by the Medical Ethics Committee of West China Hospital of Sichuan University (ethics approval No. 2017445), and the registration number is ChiCTR 1800018895. Prior to their inclusion, all participants consented to participate in the study and provided written informed consent.

ORCID

Yong He https://orcid.org/0000-0002-1791-4680

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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