

Cupping mark color and its association with TCM constitution and health status: findings from a cross-sectional study

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ABSTRACT

Introduction Cupping mark color is believed to be related to the mechanism and efficacy of cupping therapy, but exploration of the factors influencing its depth has so far been limited. **Methods** We recruited 100 patients with fibromyalgia and 100 healthy volunteers (aged 18–75 years) from Dongfang Hospital Beijing University of Chinese Medicine (Beijing, China), and nearby communities. A survey was conducted to collect demographic data and the Traditional Chinese Medicine (TCM) constitution of participants. Cupping was then performed at six acupoints (bilateral *Feishu* [BL 13], *Xinshu* [BL 15], and *Ganshu* [BL 18]) for 10 min, and the resulting color of each cupping mark was rated according to a cupping color rating chart. Statistical multiple linear regression analysis was carried out using SPSS 22.0 to determine the correlation between cupping mark color and possible influencing factors including health status, TCM constitution type, sex, age, and body mass index (BMI). **Results** A total of 33 males (16.5%) and 167 females (83.5%), with an average age of 42.08 years, completed the survey. Forty-four participants (22%) were classified as yang-deficiency constitution, 38 (19%) as balanced constitution, and 26 (13%) as phlegm-dampness constitution. The average score of cupping mark color was 4.38. Sex ($\beta = -1.025$, $P = 0.001$) and health status ($\beta = -0.678$, $P = 0.003$) were significant factors influencing cupping mark color: female participants had lighter marks than males, and fibromyalgia patients had lighter marks than healthy volunteers. TCM constitution type, age, and BMI were not associated with cupping mark color. **Conclusions** This cross-sectional study of 200 participants did not reveal any correlation between TCM constitution type and cupping mark color. However, given the limited sample size, future studies with larger cohorts are warranted.

KEYWORDS

cupping therapy, cupping mark color, traditional Chinese medicine constitution, fibromyalgia, cross-sectional study

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1. Introduction

Cupping therapy has gained global recognition for its efficacy in pain management,^{1–4} with evidence supporting its use for conditions such as low back pain, ankylosing spondylitis, knee osteoarthritis, neck pain, herpes zoster, migraine, plaque psoriasis, and chronic urticarial.⁵ While the physical effects of cupping—such as local capillary congestion, microtrauma, and increased blood flow—are well documented,^{6,7} These phenomena are interpreted in traditional Chinese medicine (TCM) not merely as physiological responses, but as manifestations of underlying the healthy qi and TCM constitution.^{8–11}

In TCM theory, constitution refers to individualized biopsychosocial traits that influence disease susceptibility and treatment response. Constitutional types such as qi deficiency constitution (QDC), yin-deficiency constitution (YIDC), and damp-heat constitution are thought to modulate physiological reactivity, including dermal responses to external stimuli like cupping.^{12–17} Clinicians often observe that individuals with different constitutions exhibit distinct cupping mark characteristics (e.g., intensity, color, duration), suggesting a potential link between constitution and tissue response. However, despite the widespread use of cupping mark for diagnostic inference, empirical evidence supporting this association is limited.

Cupping mark color is considered visible reflections of the body's func-

tional status, with color variations traditionally interpreted as indicators of qi and blood stagnation, dampness, or heat.^{6,7} However, mark appearance may also be influenced by procedural factors (e.g., pressure, duration) and individual variability. To date, no standardized framework exists for interpreting cupping marks, and it remains unclear whether variations are attributable to constitutional differences or to technical/physiological factors.

This study therefore aims to investigate the association between TCM constitution and cupping mark color, particularly in comparing individuals with functional somatic syndromes and healthy volunteers, in order to advance objectivity and personalization in TCM practice.

2. Methods

2.1. Ethical approval

This study was conducted in accordance with the Helsinki Declaration. The study protocol was approved by the Ethics Committee of BUCM (#2020BZYL1002) and registered with the Chinese Clinical Trial Registry (No. ChiCTR2100045219). All participants provided written informed consent after receiving a detailed explanation of the procedure, potential risks (e.g., bruising, temporary discomfort), and benefits.

2.2. Setting and design

This cross-sectional observational study with a prospective interventional component was conducted at Dongfang Hospital Beijing University of Chi-

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nese Medicine (BUCM, Beijing, China) between April 6, 2021 and May 31, 2022 (delayed due to COVID-19). Based on our previous systematic review¹⁶ and another survey,¹⁷ cupping mark color may be influenced by negative pressure inside the cup, treatment duration, participant health status, TCM constitution, or TCM symptoms and signs. Thus, we included both healthy volunteers and patients with fibromyalgia syndrome (FS).

2.3. Participants

Patients with FS were recruited from the Department of Acupuncture and Moxibustion at Dongfang Hospital. They were eligible to participate if they were 18–75 years old, had moderate chronic pain ≥ 30 mm (measured by the Visual Analog Scale, VAS), and met the diagnostic criteria for FS according to the American College of Rheumatology (2010).^{18,19} Healthy volunteers were recruited through convenience sampling from local communities around Dongfang Hospital and among university staff via posters and online announcements.

Participants were excluded if they had mental illness or severe diseases such as tumors, hematological disorders, or organ failure. Pregnant and lactating women were also excluded. Healthy volunteers were eligible if they were 18–75 years old and free from any diagnosed disease. All participants confirmed that they understood the content of the survey and signed an informed consent form.

2.4. Data collection

A questionnaire was designed to collect participants' demographic data, TCM constitution type, and cupping mark color. Demographic data included sex, age, height, weight, body mass index (BMI), blood pressure, ethnicity, marital status, and disease history. The TCM constitution type was determined based on the "Classification and Determination of Constitution in Traditional Chinese Medicine" issued by the China Association of Chinese Medicine in 2009,^{20,21} which describes nine types: balanced constitution (BC), qi deficiency constitution (QDC), yang-deficiency constitution (YADC), yin-deficiency constitution (YIDC), phlegm-dampness constitution (PDC), damp-heat constitution (DHC), blood stasis constitution (BSC), qi stagnation constitution (QSC), and inherited special constitution (ISC). Two authors (GDL and JL) were responsible for these evaluations. All questionnaires were completed by the participants. For those unable to fill out the form, answers were provided verbally and transcribed by the researchers. One author (YYW) verified the data for the TCM constitution scores, and two others (YYW and MH) entered and analyzed the data using Microsoft Excel 2019 (Microsoft Corp., Redmond, WA).

As mentioned above, negative pressure, cupping duration, health status, TCM constitution, and TCM constitution in different patterns may influence cupping mark color. Therefore, a standardized procedure was used to generate cupping marks for all participants. The cupping instruments (Beijing Kangzhu Medicine Equipment, Beijing, China) were applied bilaterally on *Feishu* (BL 13), *Xinshu* (BL 15), and *Ganshu* (BL 18) for 10 min with a negative pressure of -0.05 MPa (Figure 1). Each participant underwent the cupping procedure once. Photographs of each site were taken after 5 min of cupping. All procedures and photographic documentation were conducted in a dedicated clinical room with standardized lighting.

The cupping mark color was assessed using tools developed by the Third Affiliated Hospital of Henan University of Traditional Chinese Medicine (Figure 2).²² There were eight color grades, scored from 1 to 8. Scores of 1–2 indicated weak stimulation with inconspicuous marks; scores of 3–4 indicated moderate irritation with skin redness and slight bruising; scores of 5–6 indicated strong stimulation, with the marks filling the cup and appearing bright red; and scores of 7–8 indicated very strong stimulation, with dark red, purple, or black skin, or blisters at the cupping site.

Four evaluators assessed the cupping mark colors, and the average score was calculated for each participant. Each participant had six scores, corresponding to the six cupping sites, and the mean of these scores was used to represent the cupping mark color. Any adverse events during or after cupping were recorded immediately.



Figure 1 The cupping procedure (left) and the cupping environment (right)



Figure 2 Color reference chart for cupping marks

Notes: This figure was adapted from reference 22.

2.5. Statistical analysis

It was difficult to calculate the minimum sample size for this cross-sectional study due to the lack of previous studies on the correlation between cupping mark color and TCM constitution. Therefore, we aimed to recruit 200 subjects, including 100 healthy volunteers and 100 patients with FS, to explore the potential relationship.

One author (YYW) recorded the data using Epidata 3.1 (Chinese version, Danish Epidata Association Odense, Odense, Denmark). The data were double-checked by two other authors (GDL and JL). SPSS 22.0 (IBM Corp., Armonk, NY) software was used for analysis. Quantitative data were expressed as mean (standard deviation), while qualitative data were described as rates or composition ratios. Correlations between influencing factors (TCM constitution, sex, age, BMI) and cupping mark color were determined using multiple linear regression.

3. Results

3.1. Characteristics of the participants

This survey included 200 participants, all of whom completed the survey (100% response rate). The participants' ages ranged from 18 to 73 years, with a median of 41.50 years. There were 33 males (16.5%) and 167 females (83.5%). Other characteristics of the 200 participants are shown in Table 1. The five most common TCM constitution types were YADC (22%), BC (19%), DHC (13%), QDC (12%), and PDC (10%).

3.2. TCM constitution types

Among the 200 participants, 44 (22%) were YADC. The other most com-

Table 1 Analysis of basic participant characteristics

Variable	FS (<i>n</i> = 100)	HV (<i>n</i> = 100)
Age (years, <i>n</i> [%])		
18-35	24 (12.0)	50 (25.0)
36-59	59 (29.5)	47 (23.5)
≥ 60	17 (8.5)	3 (1.5)
Height (cm, mean [SD])	162.3 (6.2)	163.6 (7.3)
Weight (kg, mean [SD])	62.3 (7.9)	69.2 (67.1)
Systolic pressure (mmHg, mean [SD])	120.1 (13.2)	113.5 (11.6)
Diastolic pressure (mmHg, mean [SD])	77.5 (9.0)	76.4 (8.2)
Ethnicity (<i>n</i> [%])		
Han	96 (48.0)	95 (47.5)
Minority	4 (2.0)	5 (2.5)
Sex (<i>n</i> [%])		
Male	15 (7.5)	18 (9.0)
Female	85 (42.5)	82 (41.0)
TCM constitution (<i>n</i> [%])		
Yang-deficiency constitution	27 (13.5)	17 (8.5)
Yin-deficiency constitution	4 (2.0)	9 (4.5)
Qi deficiency constitution	15 (7.5)	4 (2.0)
Phlegm-dampness constitution	12 (6.0)	8 (4.0)
Damp-heat constitution	9(4.5)	17 (8.5)
Blood stasis constitution	9 (4.5)	5 (2.5)
Inherited special constitution	1 (0.5)	1 (0.5)
Qi stagnation constitution	12 (6.0)	12 (6.0)
Balanced constitution	11 (5.5)	27 (13.5)
Body mass index (<i>n</i> [%])		
< 18.5	2 (1.0)	2 (1.0)
18.5-23.9	52 (26.0)	56 (28.0)
≥ 24	46 (23.0)	42 (21.0)
Marital status (<i>n</i> [%])		
Married	84 (42.0)	69 (34.5)
Unmarried	16 (8.0)	31 (15.5)
Constitution classification [*] (<i>n</i> [%])		
Deficiency	47 (23.5)	31 (15.5)
Excess	42 (21.0)	42 (21.0)
Normal	11 (5.5)	27 (13.5)

Notes: FS: fibromyalgia syndrome; HV: healthy volunteers; SD: standard deviation; TCM: traditional Chinese medicine. ^{*} Yang-deficiency, yin-deficiency, qi-deficiency, and inherited special constitutions are classified as deficient types, whereas damp-heat, phlegm-dampness, qi stagnation, and blood stasis are excess types. The balanced constitution is considered normal.

mon types were BC (38 participants, 19%), DHC (26 participants, 13%), QSC (24 participants, 12%), and PDC (20 participants, 10%). YADC, YIDC, QDC, and ISC were classified as deficiency constitutions, while DHC, PDC, QSC, and BSC were classified as excess constitutions. Using this classification, deficiency constitutions were observed in 39% of participants (78 people), and excess constitutions in 42% (84 people) (Table 1).

3.3. Cupping mark colors

Overall, the darkest cupping marks appeared at *Feishu* (BL 13, left 1 [L1] and right 2 [R2]), followed by *Xinshu* (BL 15, L3 and R4), while the lightest marks were observed at *Ganshu* (BL 18, L5 and R6) (Table 2, Figure 3).

Table 2 Cupping mark colors

Acupoints	Location	Score (mean [SD])
<i>Feishu</i> (BL 13)	L1	4.70 (2.00)
	R2	4.77 (2.03)
<i>Xinshu</i> (BL 15)	L3	4.41 (1.85)
	R4	4.38 (1.90)
<i>Ganshu</i> (BL 18)	L5	4.04 (1.70)
	R6	3.99 (1.76)
Average	–	4.38 (1.58)

Notes: L: left; R: right; SD: standard deviation. “–” indicates not applicable.

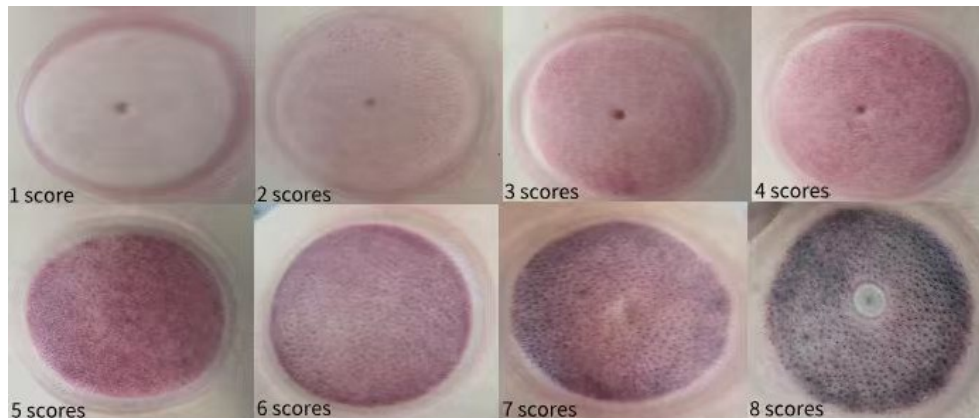


Figure 3 Schematic diagram of observed cupping mark colors

3.4. Analysis of relevant factors affecting cupping mark color

We examined whether health status (healthy volunteers = 0, patients with FS = 1), age, sex (male = 1, female = 2), TCM constitution type, or BMI were independent predictors of cupping mark color using multiple linear regression. Results are shown in Table 3.

The results in Table 3 indicate statistically significant differences in cupping mark color between participants with different health statuses ($t = -3.031$, $P = 0.003$). Participants with FS had lighter cupping mark colors than healthy volunteers (MD = -0.71 , 95% CI -1.14 to -0.34 , $n = 200$) (Appendix 1). Sex differences were also significant ($t = -3.503$, $P = 0.001$), with males showing darker cupping mark colors than females (MD = 1.07 , 95% CI 0.58 to 1.56 , $n = 200$). No statistically significant differences were observed in cupping mark color across age, TCM constitution types, or BMI.

To further explore influencing factors, we categorized health status (FS vs. HV), sex, age group (18–35, 36–59, ≥ 60 years), and TCM constitution classification (deficiency, excess, normal) as independent variables. The findings were consistent with the original regression analysis: cupping mark color was

associated with health status ($P = 0.002$) and sex ($P < 0.001$) (Table 4). Patients with FS tended to have lighter cupping mark colors than healthy volunteers, and females had lighter mark colors compared to males. No associations were found between cupping mark color and other variables, including TCM constitution type.

4. Discussion

In this cross-sectional study of 200 participants (100 with FS and 100 healthy volunteers), we found no statistically significant association between cupping mark color and TCM constitution type. However, cupping mark color was significantly associated with both sex and health status. Specifically, males exhibited darker cupping marks than females (MD: 1.0 point lower in females), and patients with FS displayed lighter marks than healthy volunteers (MD: 0.7 points lower). These findings suggest that health status and sex-related factors may be stronger determinants of cupping response than constitution type alone.

Women accounted for a much larger proportion of patients with FS, and

Table 3 Multiple linear regression analysis of factors affecting cupping mark color

Model	Unstandardized coefficient		SC	β 95% CI		t	P
	β	Standard error	β	Lower limit	Upper limit		
Constant	6.399	0.952	–	4.521	8.276	6.721	< 0.001
HS	–0.678	0.224	–0.215	–1.119	–0.237	–3.031	0.003
Sex	–1.025	0.292	–0.241	–1.601	–0.448	–3.503	0.001
Age	–0.009	0.009	–0.071	–0.027	0.010	–0.908	0.365
TCMC	–0.042	0.037	–0.078	–0.114	0.031	–1.138	0.257
BMI	0.033	0.037	0.066	–0.041	0.106	0.875	0.383

Notes: BMI: body mass index; CI: confidence interval; HS: health status (participants with fibromyalgia or healthy volunteers); SC: standardized coefficient; TCMC: traditional Chinese medicine constitution. “–” indicates not applicable.

Table 4 Multiple linear regression analysis of factors affecting cupping mark color

Model	Unstandardized coefficient		SC	t	P
	β	Standard error	β		
Constant	6.817	0.607	–	11.232	< 0.001
HS	–0.704	0.229	–0.223	–3.070	0.002
Sex	–1.053	0.294	–0.248	–3.581	< 0.001
Age group	–0.031	0.181	–0.013	–0.173	0.863
DETCMC	–0.119	0.149	–0.055	–0.794	0.428

Notes: HS: health status (participants with fibromyalgia or healthy volunteers); DETCMC: deficiency or excess of traditional Chinese medicine constitution; SC: standardized coefficient. “–” indicates not applicable.

overall the majority of participants were middle-aged. The incidence rate of FS in our study was consistent with previously reported.^{23–25} The observed sex difference—darker cupping marks in males—aligns with classical TCM principles, which describe males as generally possessing more robust qi and blood circulation and a tendency toward excess or heat pattern.^{26–29} In clinical practice, darker cupping mark is often interpreted as indicating blood stasis, cold coagulation, or damp-heat,²⁷ whereas lighter mark suggests deficiency or cold pattern. Thus, our findings may reflect underlying physiological differences in vascular reactivity, dermal perfusion, or inflammatory response between sexes.²⁸

Similarly, the lighter cupping marks in patients with FS—despite their higher prevalence of constitution types in deficiency (e.g., YADC and QDC, together 42%)—are consistent with the hypothesis of reduced qi and blood circulation in these individuals.³⁰ Impaired microcirculation and autonomic dysregulation, commonly reported in functional somatic disorders, may lead to diminished local capillary recruitment and hemolysis under negative pressure, resulting in less intense discoloration. By contrast, healthy volunteers were more likely to exhibit BC or DHC (together 44%), and associated with stronger physiological reactivity and metabolic activity, potentially explaining their darker marks. These results imply that systemic functional status particularly circulation and metabolic activity may outweigh constitutional predisposition in determining the local tissue response to cupping.

Although we found no direct correlation between TCM constitution and cupping mark color, this does not definitively rule out such a relationship. Several factors may have obscured an association:

(I) Imbalanced distribution of TCM constitutions across health states: Patients with FS predominantly exhibited deficiency-type constitutions, while healthy volunteers were more likely to have BC or excess-type constitutions (e.g., DHC). This confounding by health status may have masked constitution-specific effects.

(II) Limited sample size per constitution type: With only 20–30 participants per constitution on average, statistical power was insufficient to detect subtle but clinically meaningful differences, especially given the polythetic nature of TCM pattern diagnosis.

(III) Heterogeneity within constitution categories: Current classification systems (e.g., *Classification and Determination of Constitution in TCM*) may not fully capture subtypes or transitional states, potentially diluting associations. Therefore, constitution-stratified studies in large-size samples are needed to clarify this relationship.

Several limitations must be acknowledged. First, healthy volunteers were recruited via convenience sampling, which may introduce selection bias, as participants may have higher health awareness or greater openness to traditional therapies. Second, the sample was predominantly female, limiting generalizability to males. Although sex was adjusted for in analyses, residual confounding from sex-related biological (e.g., hormonal fluctuations, skin thickness) or behavioral factors cannot be excluded. Third, cupping mark color was assessed using standardized color charts—a practical but semi-quantitative method subject to inter-observer variability. Although machine-based colorimetry was considered, its accuracy in this context remains limited. Finally, the prolonged recruitment period may have introduced seasonal or temporal variability in skin reactivity, though this has not been systematically studied.

Despite these limitations, this study has several strengths. To our knowledge, this is the first study to systematically evaluate individual-level factors, including TCM constitution, health status, and sex, while controlling for procedural variables. This design enhances internal validity and advances the methodological rigor of cupping research.

Future studies should employ population-based or randomized recruitment strategies to improve external validity. Nevertheless, our findings provide preliminary evidence of differential cupping responses between healthy individuals and patients with functional somatic syndromes.

Our results indicate that sex and health status are correlated with cupping mark color and should be controlled for in future research on cupping mark color interpretation and therapeutic efficacy. Current reliance on cupping mark for diagnostic inference lacks standardization and may be confounded

by non-constitutional factors. Moreover, this study only compared patients with FS and healthy volunteers. Future studies should include other disease populations to explore broader clinical applications.

Research should also aim to overcome methodological limitations by adopting population-based sampling and enrolling larger sample sizes (estimated at approximately 400 participants,³¹ based on an observed standard deviation of 1.55 and an allowable error of 0.17) to ensure sufficient statistical power for subgroup analyses across the nine TCM constitutions. Longitudinal or experimental designs should also be considered to capture dynamic changes in cupping mark formation and regression. Expanding investigations beyond functional somatic syndromes will help clarify the generalizability of these findings and contribute to a more comprehensive understanding of individual variability in response to cupping therapy.

5. Conclusion

This cross-sectional study of 200 participants found no correlation between TCM constitution type and cupping mark color. However, sex and health status were identified as influencing factors. We recommend future studies with larger sample sizes (at least 400 participants), stratified by sex and health status, to further explore the relationship between TCM constitution types and cupping mark color.

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Author Contribution Statement

Yi-ying Wang: Data curation, formal analysis, methodology, software, visualization, and writing – original draft. **Mei Han:** Methodology, formal analysis, and writing – review and editing. **Guo-dong Li:** Data curation, investigation, and writing – review and editing. **Jie Lian:** Data curation, investigation, and writing – review and editing. **Zhan-guo Xie:** Methodology, supervision, and writing – review and editing. **Li Zhou:** Methodology, supervision, and writing – review and editing. **Jian-ping Liu:** Conceptualization, supervision, and writing – review and editing. **Hui-juan Cao:** Conceptualization, supervision, funding acquisition, project administration, and writing – review and editing.

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. Prof. Jian-ping Liu is the Editor-in-Chief of *Evidence-Based Chinese Medicine and Technology Assessment*, and he was not involved in the peer review or any decisions regarding this article.

Electronic Supplementary Material

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