

Exploring Traditional Chinese Medicine Body Constitutions in Understanding Mechanobiology of Depression among Young Adults

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Abstract: Depression is a prevalent mental health disorder among young adults and remains challenging to detect at an early stage. Increasing evidence suggests that mechanobiological processes play a significant role in the development and progression of depression. This study explores the relationship between traditional Chinese medicine (TCM) body constitutions (balanced constitution and unbalanced constitutions: qi-stagnation, blood-stasis, qi-deficiency, yang-deficiency, yin-deficiency, phlegm-dampness, damp-heat, and inherited-special) and depression among young adults. A cross-sectional pilot study was conducted at Universiti Tunku Abdul Rahman among 30 Malaysian university students aged 18 to 30 years using the Patient Health Questionnaire-9 (PHQ-9) and the Constitution in Chinese Medicine Questionnaire. Overall, 33.3% of participants met criteria for depression (PHQ-9 $\geq$ 10), and 73.3% demonstrated unbalanced TCM body constitutions. Multiple linear regression analysis showed that balanced constitution ($B = -0.196$, 95% CI: -0.288 to -0.103), qi-stagnation ($B = 0.169$, 95% CI: 0.057 to 0.282) and yang-deficiency ($B = -0.11$, 95% CI: -0.209 to -0.011) were significantly related to depression severity. This pilot study highlights the potential of integrating TCM constitutions assessment with mechanobiological perspectives to develop future early detection frameworks for depression.

1 Introduction

Depression represents a pervasive global health challenge, characterized by persistent emotional distress, loneliness, anhedonia, and the loss of interest in daily activities [1]. These symptoms significantly affecting a person health and overall well-being. Furthermore, the etiology of depressive disorders is heavily influenced by environmental factors, with traumatic life events, abuse, and prolonged exposure to stress serving as primary catalysts [1]. In Malaysia, about 10 thousand young adults (4.6%) are suffering from depression [2].

The *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) [3] is the standard tool for diagnosing depression, but its reliance on reported emotional symptoms may limit early detection, particularly in multicultural settings where depression often presents through physical or somatic complaints [4]. To overcome these limitations and improve early detection, an

integrative approach that incorporates the underlying biological mechanisms of depression is needed.

In recent years, mechanobiology has emerged in understanding disease pathogenesis. It refers to how mechanical forces and cellular physical properties regulate biological processes [5]. Mechanical cues such as extracellular matrix stiffness, cytoskeletal tension, and transduction signalling pathways are now recognized as key modulators of inflammation, cellular metabolism, gene expression and tissue homeostasis. Dysregulation of these processes may lead to depression [6].

Mechanobiological processes play a significant role in the development and progression of depression. Chronic psychosocial stress can induce sustained activation of the hypothalamic pituitary adrenal (HPA) axis, leading to neuroinflammation, microglial activation, and remodelling of neural extracellular matrices [5]. These changes affect neuronal plasticity, synaptic connectivity, and brain tissue mechanics, thereby contributing to depressive symptomatology [5].

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The emerging of mechanobiological shares conceptual understanding with traditional Chinese medicine (TCM). In TCM theory, depression is commonly classified under “**Yù Zhèng**”, a condition attributed to impaired qi movement, emotional constraint, and dysfunction of the zang-fu organs, particularly the liver. Prolonged qi-stagnation is believed to result in pathological accumulations, internal tension and disrupted systemic harmony which descriptions that metaphorically parallel modern concepts of mechanical stress, impaired signal transduction and inflammatory burden within biological systems [7]. Furthermore, TCM constitution theory emphasizes individual susceptibility to disease based on inherent functional and regulatory imbalances, aligning with contemporary notions of mechanobiological [7].

Therefore, exploring TCM body constitutions in understanding mechanobiology of depression among young adults contributing to a more holistic and culturally informed model of depression.

2 Literature review

2.1 Pathogenesis of “**Yù Zhèng**” in TCM

In TCM theory, the pathogenesis of “**Yù Zhèng**” is fundamentally rooted in two interrelated dynamics: emotional distress (情志内伤) and an inherent deficiency of organ Qi (藏气素弱) [8]. Emotional distress especially when prolonged or intense (e.g. chronic sadness, anger, fear, overthinking or excessive joy) will disrupts the harmony of the internal organs, particularly the heart, liver, spleen, lung and kidneys [9]. Each emotion corresponds to a specific organ system and the disturbances impede the smooth flow of qi, weaken organ function and ultimately impair the regulation of emotion and spirit (Shen) [9].

Over time, the emotional distress can lead to pathological changes: stagnation of qi and blood, accumulation of phlegm, yin-yang imbalance, and a deficiency or disturbance of the “**Shen**” [10]. Qi-stagnation can lead to irritability, tension, and disrupted digestion, disturbing the flow of qi and blood, which can result in complex patterns involving phlegm accumulation, blood stasis, Yin-Yang imbalance, and deficient “**Shen**” (spirit). These imbalances not only affect physical health but also significantly influence mood, memory, and cognitive function [10].

Inherent organ qi-deficiency, which refers to a constitutional weakness in the body's zang organ systems [8]. Individuals born with or who develop weak organ qi (藏气素弱) are less able to buffer emotional shocks or environmental stressors. Consequently, weak heart qi may manifest as insomnia, poor mental clarity or palpitations; Liver qi-deficiency may predispose one to mood swings, frustration or emotional reactivity; Weaken kidney qi can result in fearfulness, reduced willpower and poor stress resilience. It is due to the “**Shen**” (spirit/mind) that relies on adequately nourished organ systems and stable qi. Deficiencies in these elements increase vulnerability to

emotional distress and contribute to the development of “**Yù Zhèng**” [8].

2.1.1 TCM body constitutions and depression

In Traditional Chinese Medicine (TCM), body constitution (体质, *tǐ zhì*) is considered a fundamental determinant of individual susceptibility to disease, including depression [10]. From a mechanobiological perspective, TCM body constitutions can be conceptualized as a macro-level manifestation of underlying cellular and tissue-level regulatory states. Mechanobiology research demonstrates that mechanical forces, cytoskeletal organization and extracellular matrix (ECM) signalling play critical roles in regulating cellular metabolism, inflammation and neuroendocrine function which are implicated in stress-related mental disorders [11].

The relationship between TCM body constitutions, depression and mechanobiology lies in their shared emphasis on balance, adaptability and regulation. Mechanobiology highlights the role of mechanical forces, cellular dynamics and tissue-level homeostasis in maintaining long-term physiological and psychological health. By addressing constitution-based vulnerabilities, TCM not only contributes to the prevention and management of depression but also aligns with mechanobiological principles by emphasizing the restoration of dynamic balance, resilience to stress and functional integration across biological systems [10].

3 Methodology

A cross-sectional pilot study was conducted at the University Tunku Abdul Rahman (UTAR) Sungai Long campus with 30 Malaysian university students aged between 18 to 30 years. Exclusion criteria are pre-existing psychological issues or decline to provide written informed consent. Reliable and validated self-administered questionnaires (Patient Health Questionnaire-9 (PHQ-9) [12] and Constitution in Chinese Medicine questionnaire) [13] was used. A written and signed informed consent was obtained before the data collection. This study was approved by the UTAR Ethics Committee (U/SERC/56(B)-26/2024).

Chi-square test was performed to investigate the associations between demographic characteristics, TCM body constitutions, and depression. Relationship between TCM body constitutions and depression was then analysed using multiple linear regressions (enter method). The significance level (α) was set at a p -value of <0.05 .

4 Results

In Table 1, the mean age of the participants was 20.56 years (SD = 3.64). Of the participants, 12 (40%) were male and 18 (60%) were female. Based on PHQ-9 scores (0-27), 33.3% ($n = 10$) are depressed (PHQ-9 ≥ 10). The overall mean PHQ-9 score was 7.20 (SD = 4.44).

Most participants were classified as having unbalanced body constitutions (73.3%). All participants in the depressed group were categorized as unbalanced constitution. Gender ($p = 0.018$), body constitutions ($p = 0.020$), and herbal supplement use ($p < 0.001$) showed

significant associations with depression. Age, body mass index (BMI), education level, and alcohol consumption showed no significant associations with depression ($p > 0.05$).

Table 1. Associations of traditional Chinese medicine body constitutions and demographic characteristics with depression

Characteristics	All (n=30) n	Percentage (%)	Depressed (n=10) n	Percentage (%)	Non-depressed (n=20) n	Percentage (%)	p Value
Depression (PHQ-9) (Mean $\pm$ SD) (0–27)	(7.20 $\pm$ 4.44)						
Yes (≥ 10)	10	33.30					
No (<10)	20	66.70					
Gender							
Male	12	40.00	1	3.30	11	36.70	0.018
Female	18	60.00	9	30.00	9	30.00	
Age (Mean $\pm$ SD)	(20.56 $\pm$ 3.64)						
≤ 24 years old	23	76.70	9	30	14	46.70	
> 24 years old	7	23.30	1	3.3	6	20.00	0.222
Body constitutions (0–100) (Mean $\pm$ SD)	(55.94 $\pm$ 16.87)						
Balanced	8	26.70	0	0	8	26.70	0.02
Unbalanced	22	73.30	10	33.30	12	40.00	
Body Mass Index (kg/m ²) (Mean $\pm$ SD)	(21.32 $\pm$ 3.34)						
Underweight (≤ 18.4)	13	43.3	4	13.33	4	13.33	0.203
Normal (18.5–22.9)	8	26.7	1	3.33	7	23.33	
Overweight (23.0–27.4)	1	3.3	1	3.33	0	0	
Obese (≥ 27.5)							
Education level (current)							
Foundation	16	53.33	7	23.3	9	30	0.415
Undergraduate	7	23.33	2	6.7	5	16.7	
Master's	4	13.33	0	0	4	13.3	
Ph.D	3	10.00	1	3.3	2	6.7	
Alcohol consumption							
Never	14	46.70	6	20.00	8	26.70	0.585
Monthly or Less	12	40.00	3	10.00	9	30.00	
2-4 times per month	4	13.30	1	3.30	3	10.00	
Herbal supplement use							
Yes	16	53.3	1	3.30	15	50.00	<0.001
No	14	46.7	9	30.00	5	16.70	

Balanced constitution with a score > 60 in the balanced constitution and scores < 30 in all unbalanced constitutions; Unbalanced constitutions (qi-stagnation, blood-stasis, qi-deficiency, yang-deficiency, yin-deficiency, phlegm-dampness, damp-heat and inherited-special) were identified based on higher scores in the corresponding constitution (cut-off score of 30)

In Table 2, results of multiple linear regression showed that balanced constitution ($B = -0.196$, 95% CI: -0.288 to -0.103 , $p < 0.001$), qi- stagnation ($B = 0.169$, 95% CI: 0.057 to 0.282 , $p = 0.005$) and yang-deficiency ($B = -0.11$, 95% CI: -0.209 to -0.011 , $p = 0.031$) were

significantly related to depression severity. Other TCM constitutions (blood-stasis, qi-deficiency, yin-deficiency, phlegm-dampness, damp-heat and inherited special) types were not significantly related to depression.

Table 2. Relationship between TCM body constitutions and depression

Body constitutions	Simple Linear Regression				Multiple Linear Regression			
	B	95% CI		p Value	B	95% CI		p Value
Balanced	-0.212	-0.272	-0.151	<0.001	-0.196	-0.288	-0.103	<0.001
Qi-stagnation	0.182	0.108	0.256	<0.001	0.169	0.057	0.282	0.005
Blood-stasis	0.161	0.062	0.261	0.002	0.033	-0.067	0.132	0.502
Qi-deficiency	0.171	0.088	0.255	<0.001	-0.018	-0.134	0.099	0.756
Yang-deficiency	0.115	0.038	0.191	0.005	-0.110	-0.209	-0.011	0.031
Yin-deficiency	0.139	0.044	0.235	0.006	0.017	-0.100	0.134	0.765
Phlegm-dampness	0.106	0.0258	0.185	0.011	-0.046	-0.144	0.052	0.340
Damp-heat	0.090	0.001	0.179	0.049	0.003	-0.079	0.084	0.944
Inherited-special	0.097	0.016	0.177	0.020	0.020	-0.056	0.095	0.588

5 Discussion

The results demonstrated that balanced constitution and yang-deficiency constitution are protective factor while qi-stagnation constitution known as predictive factor of depression.

From TCM theoretical, the primary etiological factor for “Yù Zhèng” is qi-stagnation constitution [8]. Qi-stagnation constitution is a central position linking emotional stress to dysregulated biological processes. The positive association between qi-stagnation constitution and depression severity observed in this study is consistent with TCM theory, which identifies impaired qi movement as a core mechanism underlying “Yù Zhèng” [14]. In mechanobiological, qi-stagnation may be interpreted as a functional analogue of chronic mechanical stress loading, impaired mechanotransduction, and persistent inflammatory signalling. Prolonged psychosocial stress is known to induce neuroendocrine and inflammatory changes that alter tissue and cellular responsiveness, thereby reducing adaptive capacity [15]. Qi-stagnation may alter mechanotransduction efficiency, impair mitochondrial energy regulation, and reduce cellular resilience to sustained psychosocial or mechanical stressors [15]. For instance, constrained or impaired qi flow may disrupt Yes-associated protein (YAP) and transcriptional co-activator with PDZ-binding motif (TAZ) signaling, thereby compromising intercellular communication under chronic stress conditions [15]. This reduces the ability to maintain homeostasis in response to inflammatory, mechanical, or emotional challenges.

The inverse relationship between balanced constitution and PHQ-9 scores suggests a protective role against depression. In TCM, a balanced constitution reflects harmonious regulation of qi, blood, yin and yang, which can adapt to internal and external stressors. Within the mechanobiological framework, this state corresponds to preserved biomechanical homeostasis, characterized by flexible cellular signalling, intact tissue dynamics, and resilient stress-response systems [16]. These perspectives reinforce the framework’s emphasis on balance and adaptability as central determinants of mental health and support the use of constitution assessment as a proxy indicator of regulatory resilience.

In TCM theory, yang-deficiency mainly reflects functional hypoactivity and somatic cold syndromes. As such, yang-deficiency may act as a predisposing or modifying factor rather than a direct determinant of depression [17], which may explain the results of yang-deficiency as protective factor. Thus, a larger sample size to determine the indirect and modulatory role of yang-deficiency in depression is needed.

Integrating TCM body constitutions with mechanobiological concepts may support the development of a framework that conceptualises depression as a disorder of dynamic regulatory imbalance rather than a purely neurochemical condition. TCM body constitutions assessment may serve as a clinically accessible means of identifying individuals with reduced

biomechanical and functional resilience, thereby informing early preventive and personalized intervention strategies.

Although mechanobiological parameters were not directly measured, the observed associations between body constitutions and depression support future interdisciplinary research incorporating mechanobiological biomarkers; however, the cross-sectional pilot study design limits the generalizability of these findings.

6 Conclusion

This study supports exploring TCM constitution theory with mechanobiological principles towards depression as a disorder of disrupted regulatory balance.

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