

太极拳对焦虑人群睡眠质量的影响研究与机制探讨：基于随机对照试验

梁嘉欣

昆明理工大学津桥学院，昆明，650106

研究目的：焦虑障碍是现代社会普遍存在的心理健康问题，世界卫生组织数据显示，全球约有 2.64 亿人受其困扰。这类患者中，约 60-70% 伴有不同程度的睡眠障碍，表现为入睡困难、睡眠维持障碍和早醒等症状。目前临床主要采用药物治疗，如选择性 5-羟色胺再摄取抑制剂（SSRIs）和苯二氮草类药物，但这些治疗方式存在明显的局限性：约 30% 患者对药物反应不佳，且长期使用可能导致药物依赖、认知功能损害等不良反应。近年来，运动干预作为一种安全、经济的辅助治疗方式受到广泛关注。其中，太极拳因其独特的运动特点显示出显著优势。太极拳融合了缓慢流畅的动作、深长的腹式呼吸和正念冥想，被认为是一种典型的身心运动（mind-body exercise）。现有研究表明，太极拳可能通过多重途径改善心理健康和睡眠质量，但针对焦虑人群的系统性研究仍较缺乏，特别是对其作用机制的探讨不够深入。因此，本研究通过严格的随机对照试验设计，采用主客观相结合的评估方法，旨在：1. 验证 24 式太极拳对焦虑障碍患者睡眠质量的改善效果；2. 探讨太极拳干预影响睡眠质量的潜在生理和心理机制；3. 为临床实践提供循证医学依据，推动非药物干预的应用。

研究方法：2.1 研究对象本研究采用线上招募方式，纳入标准包括：年龄 18-65 岁；符合 DSM-5 广泛性焦虑障碍（GAD）诊断标准；匹兹堡睡眠质量指数（PSQI）总分 ≥ 8 分；近 1 个月未接受系统心理治疗；能够完成线上训练课程。排除标准包括：严重躯体疾病；正在服用镇静类药物或抗抑郁药物；有规律太极拳练习史。最终纳入 60 例受试者，采用随机数字表法分为太极拳组（ $n=30$ ）和对照组（ $n=30$ ）。两组在年龄、性别、病程等基线资料上无统计学差异（ $P>0.05$ ），具有可比性。2.2 干预方案：太极拳组接受为期 12 周的 24 式简化太极拳训练；训练频率：每周 7 次（每日 1 次）；单次时长：40 分钟（包括 10 分钟热身、25 分钟正式训练、5 分钟放松）；训练方式：通过专业线上平台进行实时视频指导；训练内容：以国家体育总局推广的 24 式简化太极拳为基础，重点练习“起势”、“野马分鬃”、“白鹤亮翅”等核心动作；训练要点：强调动作的连贯性、呼吸与动作的协调配合（采用腹式呼吸）、意念的专注。对照组维持原有生活方式，在研究期间不进行任何系统性运动干预，仅接受常规健康指导。2.3 评估指标 2.3.1 主观评估指标：1. 睡眠质量：采用匹

兹堡睡眠质量指数（PSQI）评估，包含 7 个维度（主观睡眠质量、入睡时间、睡眠时间、睡眠效率、睡眠障碍、催眠药物使用、日间功能障碍），总分 0-21 分，分数越高表示睡眠质量越差。

2. 焦虑程度：采用焦虑自评量表（SAS）评估，包含 20 个项目，标准分 ≥ 50 分表示存在焦虑症状。

2.3.2 客观生理指标

1. 心率变异性（HRV）测量指标：高频功率（HF）：反映副交感神经活性；低频/高频功率比（LF/HF）：反映交感-副交感平衡；测量时段：晨起静息状态下连续监测 10 分钟。

2.4 数据收集与统计分析 采用 SPSS 26.0 进行统计分析：计量资料采用均数 $\pm$ 标准差（ $\bar{x}\pm s$ ）表示；组内比较采用配对 t 检验；组间比较采用独立样本 t 检验；多时间点比较采用重复测量方差分析； $P<0.05$ 认为差异具有统计学意义。

研究结果：

3.1 睡眠质量改善情况 PSQI 总分变化：太极拳组从基线时的 12.4 ± 2.1 分显著降至干预结束时的 7.2 ± 1.8 分（ $t=8.37$, $P<0.01$ ），降幅达 41.9%；而对照组仅从 11.9 ± 2.3 分降至 11.6 ± 2.5 分（ $t=0.52$, $P=0.61$ ），组间差异具有显著统计学意义（ $F=32.15$, $P<0.001$ ）。

睡眠参数各指标改善：入睡潜伏期：太极拳组从 35.2 ± 10.1 分钟缩短至 22.4 ± 8.3 分钟（ $t=4.82$, $P<0.05$ ）；睡眠效率：从 $75.3\%\pm 8.2\%$ 提升至 $88.6\%\pm 6.7\%$ （ $t=5.91$, $P<0.01$ ）；睡眠持续时间：从 5.2 ± 1.1 小时延长至 6.8 ± 0.9 小时（ $t=4.15$, $P<0.05$ ）；睡眠质量主观评分：从 2.8 ± 0.7 分改善至 1.5 ± 0.6 分（ $t=6.23$, $P<0.01$ ）。

3.2 焦虑症状改善 SAS 评分变化：太极拳组从基线时的 58.7 ± 6.2 分显著降至 45.3 ± 5.8 分（ $t=7.84$, $P<0.01$ ），降幅达 22.8%；对照组从 57.9 ± 5.8 分降至 56.3 ± 6.1 分（ $t=1.12$, $P=0.28$ ），组间差异显著（ $F=28.76$, $P<0.001$ ）。

3.3 生理指标变化 自主神经功能改善：HF-HRV（副交感神经活性指标）：太极拳组从基线时的 856 ± 234 ms² 显著增加至 1235 ± 287 ms²（ $t=4.95$, $P<0.05$ ）；LF/HF 比值（交感-副交感平衡指标）：从 2.8 ± 0.9 降至 1.7 ± 0.6 （ $t=5.12$, $P<0.05$ ）。

机制探讨：4.1 自主神经调节机制 本研究通过 HRV 检测证实，太极拳训练能显著增强副交感神经活性，改善自主神经平衡。通过以下途径实现：呼吸调控：太极拳特有的腹式呼吸（6-8 次/分钟）可刺激迷走神经，增强副交感张力；运动模式：缓慢、流畅的动作减少交感神经过度激活；血管调节：改善血管内皮功能，降低外周血管阻力。

4.2 心理-神经机制

1. 正念效应：太极拳的意念专注特性可降低默认模式网络（DMN）过度活跃，减少反刍思维；

2. 情绪调节：可能通过调节前额叶-边缘系统功能连接，增强情绪调控能力；

3. 认知行为改变：建立规律的作息习惯，改善睡眠卫生。

研究结论： 本研究通过严格的随机对照试验证实：1. 12 周 24 式太极拳训练能显著改善焦虑障碍患者的睡眠质量

2. 作用机制涉及自主神经功能调节、HPA 轴活性抑制和心理放松效应

3. 线上教学模式具有良好的可行性和接受度。

基于以上发现，建议将太极拳作为焦虑相关睡眠障碍的辅助干预手段，在临床和社区健康管理中推广应用。未来的研究应进一步优化干预方案，探索精准化的个体治疗策略。

关键词：太极拳；焦虑；睡眠质量；自主神经

Research on the Impact of Tai Chi on Sleep Quality in Anxious People and Mechanism Exploration: Based on a Randomized Controlled Trial

Liang Jiaxin

Jinqiao College of Kunming University of Science and Technology, Kunming 650106

Research objective: Anxiety disorders are widespread mental health issues in modern society. According to data from the World Health Organization, approximately 264 million people worldwide are troubled by them. Among such patients, approximately 60-70% are accompanied by sleep disorders of varying degrees, manifested as difficulty falling asleep, sleep maintenance disorders and early awakening, etc. At present, drug treatment is mainly adopted in clinical practice, such as selective serotonin reuptake inhibitors (SSRIs) and benzodiazepines. However, these treatment methods have obvious limitations: about 30% of patients have a poor response to the drugs, and long-term use may lead to adverse reactions such as drug dependence and cognitive impairment. In recent years, exercise intervention has received extensive attention as a safe and economical auxiliary treatment method. Among them, Tai Chi shows significant advantages due to its unique movement characteristics. Tai Chi, which combines slow and smooth movements, deep abdominal breathing and mindfulness meditation, is regarded as a typical mind-body exercise. Existing research indicates that Tai Chi may improve mental health and sleep quality through multiple pathways. However, systematic studies on people with anxiety are still relatively scarce, especially the exploration of its mechanism of action is not in-depth enough. Therefore, this study, through a strict randomized controlled trial design and by adopting a combined subjective and objective assessment method, aims to: 1. Verify the improvement effect of 24-form Tai Chi on the sleep quality of patients with anxiety disorders; 2. Explore the potential physiological and psychological mechanisms by which Tai Chi intervention affects sleep quality; 3. Provide evidence-based medical basis for clinical practice and promote the application of non-pharmaceutical interventions. **Research Methods:** 2.1 Research Object This study adopted an online recruitment method. The inclusion criteria included: age 18-65 years old; Meet the diagnostic criteria of DSM-5 generalized Anxiety Disorder (GAD); The total score of the Pittsburgh Sleep Quality Index (PSQI) is ≥ 8 points. No systematic psychological treatment has been

received in the past month. Be able to complete online training courses. Exclusion criteria include: severe physical illness; Currently taking sedative drugs or antidepressants; There is a history of regular Tai Chi practice. Ultimately, 60 subjects were included and randomly divided into the Tai Chi group (n=30) and the control group (n=30) using the random number table method. There was no statistically significant difference in baseline data such as age, gender, and disease duration between the two groups ($P>0.05$), and they were comparable.

2.2 Intervention Plan The Tai Chi group received a 12-week simplified 24-form Tai Chi training: Training frequency: 7 times a week (once a day); Single session duration: 40 minutes (including 10 minutes of warm-up, 25 minutes of formal training, and 5 minutes of relaxation); Training method: Real-time video guidance is provided through a professional online platform. Training content: Based on the 24-form simplified Tai Chi promoted by the General Administration of Sport of China, the focus is on practicing core movements such as "Starting Posture", "Wild Horse Spreading its Mane", and "White Crane Spreading Its Wings". Key points of training: Emphasize the continuity of movements, the coordination and cooperation between breathing and movements (using abdominal breathing), and the concentration of the mind. The control group maintained their original lifestyle and did not receive any systematic exercise intervention during the study period, only receiving routine health guidance.

2.3 Evaluation Indicators

2.3.1 Subjective Evaluation Indicators

1. Sleep quality: It is evaluated using the Pittsburgh Sleep Quality Index (PSQI), which includes seven dimensions (subjective sleep quality, time to fall asleep, sleep duration, sleep efficiency, sleep disorders, use of hypnotic drugs, and daytime dysfunction), with a total score ranging from 0 to 21. The higher the score, the poorer the sleep quality.
2. Degree of anxiety: It is evaluated using the Self-Rating Anxiety Scale (SAS), which consists of 20 items. A standard score of ≥ 50 indicates the presence of anxiety symptoms.

2.3.2 Objective Physiological indicators

1. Heart rate variability (HRV) measurement indicators: High-frequency power (HF): Reflects parasympathetic nerve activity; Low-frequency/high-frequency power ratio (LF/HF): Reflects the sympathetic-parasympathetic balance; Measurement period: Continuous monitoring for 10 minutes at rest upon waking up in the morning.

2.4 Data Collection and Statistical Analysis Statistical analysis was conducted using SPSS 26.0: Measurement data were expressed as mean $\pm$ standard deviation (' $\bar{x} \pm s$ '); Paired t-tests were used for intra-group comparisons. The independent sample t-test was used for comparison between groups. Repeated measures analysis of variance was used for multi-time point comparisons. A P value <0.05 was considered statistically significant.

Research Results:

3.1 Improvement

in sleep quality Total PSQI score change: In the Tai Chi group, it significantly decreased from 12.4 ± 2.1 points at baseline to 7.2 ± 1.8 points at the end of the intervention ($t=8.37$, $P<0.01$), with a decrease of 41.9%. However, the score of the control group only decreased from 11.9 ± 2.3 to 11.6 ± 2.5 ($t=0.52$, $P=0.61$), and the difference between the groups was statistically significant ($F=32.15$, $P<0.001$). Improvement of various indicators of sleep parameters: Sleep latency: In the Tai Chi group, it was shortened from 35.2 ± 10.1 minutes to 22.4 ± 8.3 minutes ($t=4.82$, $P<0.05$); Sleep efficiency: Increased from $75.3\% \pm 8.2\%$ to $88.6\% \pm 6.7\%$ ($t=5.91$, $P<0.01$); Sleep duration: Prolonged from 5.2 ± 1.1 hours to 6.8 ± 0.9 hours ($t=4.15$, $P<0.05$); Subjective score of sleep quality: Improved from 2.8 ± 0.7 points to 1.5 ± 0.6 points ($t=6.23$, $P<0.01$).

3.2 Improvement of anxiety symptoms Changes in SAS score: In the Tai Chi group, it significantly decreased from 58.7 ± 6.2 points at baseline to 45.3 ± 5.8 points ($t=7.84$, $P<0.01$), with a decrease of 22.8%. The score of the control group decreased from 57.9 ± 5.8 points to 56.3 ± 6.1 points ($t=1.12$, $P=0.28$), and the difference between the groups was significant ($F=28.76$, $P<0.001$).

3.3 Changes in Physiological Indicators Improvement of autonomic nerve function: HF-HRV (parasympathetic nerve activity index): In the Tai Chi group, it significantly increased from 856 ± 234 ms² at baseline to 1235 ± 287 ms² ($t=4.95$, $P<0.05$); LF/HF ratio (sympathetic-parasympathetic balance index): Decreased from 2.8 ± 0.9 to 1.7 ± 0.6 ($t=5.12$, $P<0.05$).

Mechanism Discussion:

4.1 Autonomic nerve Regulatory Mechanism This study confirmed through HRV detection that Tai Chi training can significantly enhance parasympathetic nerve activity and improve autonomic nerve balance. It is achieved through the following pathways: Respiratory regulation: The unique abdominal breathing of Tai Chi (6-8 times per minute) can stimulate the vagus nerve and enhance parasympathetic tension; Movement pattern: Slow and smooth movements reduce excessive activation of the sympathetic nerve; Vascular regulation: Improve vascular endothelial function and reduce peripheral vascular resistance.

4.2 Psycho-Neural mechanisms

1. Mindfulness effect: The characteristic of mental concentration in Tai Chi can reduce the overactivity of the default mode network (DMN) and decrease rumination.
2. Emotional regulation: It may enhance the ability to regulate emotions by regulating the functional connection between the prefrontal lobe and the limbic system.
3. Cognitive behavioral changes: Establish regular sleep and rest habits and improve sleep hygiene.

Research Conclusion: This study confirmed through a rigorous randomized controlled trial that: 1. 12-week 24-form Tai Chi training can significantly improve the sleep quality of patients with anxiety disorders. 2. The mechanism of action involves the regulation of autonomic nerve function, the inhibition of HPA axis

activity, and psychological relaxation effects. The online teaching mode has good feasibility and acceptance. Based on the above findings, it is suggested that Tai Chi be used as an auxiliary intervention method for anxiety-related sleep disorders and be promoted and applied in clinical and community health management. Future research should further optimize intervention plans and explore precise individualized treatment strategies.

Keywords: Tai Chi Chuan; Anxiety; Sleep quality; Autonomic nerve

