

太极拳对大学生睡眠质量的影响—压力的中介效应

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研究目的: 太极拳作为中国传统的身心健康运动, 其独特的动作、呼吸节奏和意念调控有助于放松身心, 具有改善睡眠质量的效果。当前大学生正面临学业竞争、就业压力及社交适应等多重心理应激源, 导致神经系统长期处于高唤醒状态, 易引发睡眠质量下降和压力增加, 影响其身心健康发展。睡眠质量是大学生身心健康的重要评价指标, 优质的睡眠质量可消除疲劳、恢复精力, 缺乏睡眠直接影响其学习效率与生活质量。2025 年《中国睡眠健康研究白皮书》数据显示, 仅 21% 的大学生能够在午夜前入睡, 高达 25% 的大学生在凌晨 2 点后才入睡, 同时有 32% 的大学生在早上 9 点后醒来, 表明大学生群体睡眠紊乱现象突出。此外, 全球流行病学数据显示, 大学生群体压力检出率也呈现出逐年上升态势。基于此, 本研究旨在全面评估太极拳对大学生主观睡眠质量和客观睡眠参数的干预效果, 并以压力指标为中介变量, 深入探讨太极拳作为传统身心干预方式, 调节压力进而改善睡眠的深层机制, 旨在为构建可持续的校园身心健康促进模式提供理论支撑和实践参考。

研究方法: 本研究采用 3(太极拳组、健步走组、对照组)×2(干预前、干预后)的混合实验设计, 招募 90 名在校大学生, 按照区组随机化原则分配至三组。实验组进行干预周期为 8 周, 每周 3 次, 每次 60 分钟的运动干预, 对照组在相同时间内正常生活。8 周干预期间, 太极拳组和健步走组共 7 名被试因个人原因脱落, 最终太极拳组 (28 人)、健步走组 (25 人) 和对照组 (30 人) 共 83 人纳入研究。客观睡眠评估采用 ActiGraph GT9X 三轴加速度计进行 7 天连续监测, 获取睡眠效率(SE)、入睡潜伏期(SOL)、夜间觉醒时长(WASO)和觉醒次数(NA)等核心参数; 主观睡眠质量采用匹兹堡睡眠质量指数量表(PSQI)评估; 压力测量使用大学生压力反应测评问卷和中文版知觉压力量表(PSS)。运用 SPSS 27.0 进行重复测量方差分析检验组间差异, 采用 Hayes 开发的 PROCESS 宏程序(Model 4)进行中介效应分析, 通过 5000 次 Bootstrap 重采样获得偏差校正置信区间, 显著性水平设定为 $\alpha=0.05$ 。

研究结果: (1) 大学生睡眠参数得到显著改善。8 周太极拳干预显著提升了大学生群体的睡眠效率(SE), 缩短了入睡潜伏期(SOL), 减少了夜间觉醒时长(WASO)和次数(NA)。具体而言, 太极拳组的睡眠效率提升了 $9.32\pm5.77\%$ ($F=20.49, P<0.001$), 入睡潜伏期缩短了 6.33 ± 4.54

分钟，夜间觉醒时长减少了 35.65 ± 28.31 分钟，觉醒次数降低了 6.88 ± 6.95 次。在主观睡眠质量方面，太极拳组的 PSQI 总分下降了 2.21 ± 1.52 分，表明受试者对睡眠质量的自我评价获得全面提升。相较之下，健步走组虽有改善但效果较弱，对照组无明显变化。（2）大学生压力水平显著降低。8 周太极拳干预显著降低了压力知觉（CPSS）和压力反应（CSSRQ）得分，特别在情绪反应维度上更为显著。具体表现为压力知觉总分下降了 6.89 ± 4.86 分（ $t=7.12, P<0.01$ ），压力反应总分降低 10.32 ± 14.13 分。健步走组在压力知觉和压力反应方面也有一定改善，但效应量显著小于太极拳组。对照组各项压力指标基本保持稳定，未呈现显著变化趋势。（3）压力反应的中介效应明确。基于 Bootstrap 法的中介效应模型显示，压力反应在太极拳改善睡眠质量的过程中发挥了部分中介作用（间接效应 $= -0.14$, 95% CI $= -0.34 \sim -0.01$ ）。尽管压力知觉的中介效应未达统计显著，但其潜在作用表明可能需要更细致的测量或延长干预周期来进一步验证。相关分析进一步揭示，压力知觉变化与 PSQI 变化呈显著正相关（ $r=0.28, P=0.010$ ），压力反应变化与 PSQI 变化的相关性更高（ $r=0.31, P=0.004$ ）。**研究结论：**（1）8 周太极拳干预改善了大学生睡眠质量和压力调节水平。具体表现为太极拳干预不仅提升了客观睡眠参数，同时提升了其主观睡眠体验，且效果优于健步走。（2）中介效应模型进一步揭示了 8 周太极拳干预通过调节压力反应系统，间接优化了大学生群体的睡眠质量，强调了太极拳在心理—生理层面的综合调节作用。（3）太极拳作为一种有效改善大学生睡眠质量和压力管理的系统性身心干预策略，通过调节大学生压力水平，可能为大学生群体带来多系统整合效应，可有效改善睡眠质量，且效果优于健步走。（4）未来研究应着重于扩大样本规模、延长随访时间，以及利用多导睡眠图（PSG）等精密设备深入分析睡眠结构变化，同时探讨神经内分泌指标，以揭示太极拳影响睡眠的生物学机制，构建更加完善的太极拳健康促进理论体系，推动其在学校健康管理中的广泛应用，为大学生身心健康促进体系的一体化建设提供理论支撑与实践路径。

关键词：太极拳；大学生；睡眠质量；压力；身心健康

The Impact of Tai Chi on College Students' Sleep Quality - The Mediating Effect of Stress

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Abstract: Objective: This study aims to explore the impact of Tai Chi intervention on the sleep quality of college students, and further analyze the mediating role of stress in this process. **Methods:** A

quasi-randomized controlled trial design was adopted. 90 college students were divided into three groups: Tai Chi group, brisk walking group, and control group. The intervention program lasted for 8 weeks, with 3 sessions per week, each lasting 1 hour. Heart rate monitoring ensured that the exercise intensity reached moderate or above levels. Before and after the intervention, total sleep time, sleep efficiency, sleep latency, nocturnal awakening duration, and the number of awakenings were recorded using ActiGraph GT9X. The Pittsburgh Sleep Quality Index (PSQI), the Chinese version of the Stress Perception Scale (CPSS), and the College Students' Stress Response Questionnaire were used to assess sleep quality and stress status. Results: Compared with the control group, the sleep efficiency of the Tai Chi group significantly increased ($\Delta=9.32\pm5.77\%$, $P<0.001$), sleep latency significantly shortened ($\Delta=-6.33\pm4.54$ min, $P<0.001$), nocturnal awakening duration and the number of awakenings significantly decreased ($\Delta=-35.65\pm28.31$ min, -6.88 ± 6.95 times, $P<0.001$), and the total PSQI score decreased by 2.21 ± 1.52 points ($P<0.001$). The sleep indicators of the brisk walking group also improved, but the improvement was smaller than that of the Tai Chi group. In terms of stress indicators, the total scores of stress perception and stress response in the Tai Chi group significantly decreased ($\Delta=-6.89\pm4.86$; $\Delta=-10.32\pm14.13$, $P<0.01$). Correlation analysis showed that the change in stress was positively correlated with the change in sleep quality ($r=0.42$, $P<0.001$). Bootstrap mediation analysis showed that the total effect of the group on the change in PSQI was -1.22 points, and the indirect effects of stress perception and stress response were -0.08 (95% CI = $-0.44\sim0.33$) and -0.14 (95% CI = $-0.34\sim0.01$), respectively. Conclusion: A 8-week moderate-intensity Tai Chi intervention can significantly improve the objective and subjective sleep quality of college students. Its effect is partially achieved by reducing stress, indicating that Tai Chi is an effective non-drug intervention method with a comprehensive physical and mental advantage. **Research Objective:** Tai Chi, as a traditional Chinese mind-body exercise, features unique movements, breathing rhythms, and mental focus techniques that help relax the mind and body, thereby improving sleep quality. Currently, college students face multiple psychological stressors such as academic competition, employment pressure, and social adaptation, leading to prolonged high arousal states in the nervous system. This can result in decreased sleep quality and increased stress, thereby impacting their physical and mental health development. Sleep quality is a crucial indicator of college students' physical and mental health. High-quality sleep helps eliminate fatigue and restore energy, while insufficient sleep directly impacts their learning efficiency and quality of life. According to data from the

2025 “China Sleep Health Research White Paper,” only 21% of college students can fall asleep before midnight, 25% fall asleep after 2 a.m., and 32% wake up after 9 a.m., indicating that sleep disorders are prevalent among college students. Furthermore, global epidemiological data show that the prevalence of stress among college students has been increasing year by year. Based on this, this study aims to comprehensively assess the intervention effects of Tai Chi on college students' subjective sleep quality and objective sleep parameters, using stress indicators as mediating variables. It further explores the underlying mechanisms through which Tai Chi, as a traditional mind-body intervention method, regulates stress and improves sleep, with the goal of providing theoretical support and practical references for establishing a sustainable campus mental and physical health promotion model. **Research Methods:** This study employed a 3 (Tai Chi group, brisk walking group, control group) $\times$ 2 (pre-intervention, post-intervention) mixed experimental design, recruiting 90 college students who were randomly assigned to the three groups according to the principle of stratified randomization. The intervention period for the experimental groups was 8 weeks, with three sessions per week, each lasting 60 minutes. The control group maintained their normal lifestyle during the same period. During the 8-week intervention period, 7 participants from the Tai Chi group and brisk walking group dropped out due to personal reasons. Ultimately, 83 participants were included in the study: 28 from the Tai Chi group, 25 from the brisk walking group, and 30 from the control group. Objective sleep assessment was conducted using the ActiGraph GT9X three-axis accelerometer for 7 days of continuous monitoring, yielding core parameters such as sleep efficiency (SE), sleep onset latency (SOL), wake after sleep onset (WASO), and number of awakenings (NA); Subjective sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Stress measurement utilized the College Student Stress Response Questionnaire and the Chinese version of the Perceived Stress Scale (PSS). Repeated measures analysis of variance (ANOVA) was performed using SPSS 27.0 to test for between-group differences. Mediation effects were analyzed using the PROCESS macro program (Model 4) developed by Hayes, with bias-corrected confidence intervals obtained through 5,000 bootstrap resampling. The significance level was set at $\alpha = 0.05$. **Research findings:** (1) College students' sleep parameters showed significant improvement. The 8-week Tai Chi intervention significantly improved sleep efficiency (SE), reduced sleep onset latency (SOL), and decreased nighttime awakenings in duration (WASO) and frequency (NA) among the college student group. Specifically, the Tai Chi group's sleep efficiency improved by $9.32 \pm 5.77\%$ ($F = 20.49$, $P < 0.001$),

sleep onset latency decreased by 6.33 ± 4.54 minutes, nighttime awakening duration decreased by 35.65 ± 28.31 minutes, and the number of awakenings decreased by 6.88 ± 6.95 times. In terms of subjective sleep quality, the Tai Chi group's PSQI total score decreased by 2.21 ± 1.52 points, indicating a comprehensive improvement in participants' self-assessment of sleep quality. In contrast, the brisk walking group showed improvement but with weaker effects, while the control group showed no significant changes. (2) Stress levels among college students were significantly reduced. The 8-week Tai Chi intervention significantly reduced scores on stress perception (CPSS) and stress response (CSSRQ), particularly in the emotional response dimension. Specifically, the total score for stress perception decreased by 6.89 ± 4.86 points ($t = 7.12$, $P < 0.01$), and the total score for stress response decreased by 10.32 ± 14.13 points. The brisk walking group also showed some improvement in stress perception and stress response, but the effect size was significantly smaller than that of the Tai Chi group. The control group maintained stable stress indicators with no significant changes. (3) The mediating effect of stress response was clearly established. The mediation effect model based on the Bootstrap method showed that stress response played a partial mediating role in the improvement of sleep quality through Tai Chi (indirect effect = -0.14 , 95% CI = -0.34 to -0.01). Although the mediating effect of stress perception did not reach statistical significance, its potential role suggests that more detailed measurements or extended intervention periods may be needed for further validation. Correlation analysis further revealed that changes in perceived stress were significantly positively correlated with changes in the PSQI ($r = 0.28$, $P = 0.010$), while changes in stress response were even more strongly correlated with changes in the PSQI ($r = 0.31$, $P = 0.004$). **Study conclusions:** (1) An 8-week Tai Chi intervention improved college students' sleep quality and stress regulation levels. Specifically, the Tai Chi intervention not only improved objective sleep parameters but also enhanced subjective sleep experiences, with effects superior to those of brisk walking. (2) The mediation effect model further revealed that the 8-week Tai Chi intervention indirectly optimized sleep quality in college students by regulating the stress response system, emphasizing the comprehensive regulatory role of Tai Chi at the psychophysiological level. (3) As an effective systemic mind-body intervention strategy for improving sleep quality and stress management in college students, Tai Chi may bring about multi-system integration effects by regulating stress levels, thereby effectively improving sleep quality, with effects superior to those of brisk walking. (4) Future research should focus on expanding sample size, extending follow-up periods, and utilizing precise

equipment such as polysomnography (PSG) to deeply analyze changes in sleep structure. Additionally, neuroendocrine indicators should be explored to uncover the biological mechanisms through which Tai Chi influences sleep, thereby constructing a more comprehensive theoretical framework for Tai Chi-based health promotion. This will facilitate its widespread application in school health management and provide theoretical support and practical pathways for the integrated development of a mental and physical health promotion system for college students.

Keywords: taijiquan; College student; Sleep quality; Pressure; Physical and mental health