

太极拳对高血压患者的心血管健康效益及潜在机制

李凤仪，张靓*

北京师范大学体育与运动学院，北京 100875

摘要：研究目的：我国高血压患者数量约占心血管疾病现患人数的 74.2%，整体呈上升趋势，已成为影响国民健康的重大公共卫生问题。目前，药物治疗虽可在一定程度上控制血压，却常伴随肝肾损伤等副作用，限制其长期应用的安全性与依从性。大量临床与基础研究表明，运动训练直接或间接有益于心血管健康，而身体活动不足一直被认为是高血压的关键致病风险因素。太极拳作为中国传统运动疗法的典范，属于中低强度有氧运动，能够全面增强肌肉、关节和韧带功能，改善微循环，促进身心健康。其动作柔缓均匀、连贯圆活，强调“以意引气、阴阳平衡、经络疏通、情绪平和”，有助于维持血管神经调节的稳定性，提高血管顺应性，在高血压的非药物干预中展现出显著潜力。然而，目前对太极拳心血管保护效应的认识仍处于初步阶段，其改善高血压的具体分子机制尚未完全阐明。本研究通过综述太极拳对高血压患者心血管健康的综合效益，并深入挖掘其潜在分子生物学机制，旨在揭示太极拳介导心血管保护作用的调控网络，为高血压防治提供新的研究视角和策略方向。**研究方法：**本文主要采用文献资料法，通过中国知网、Web of science (WOS)、PubMed 等数据库以不同形式组合的检索词检索太极拳改善高血压相关的核心文献，检索词包括：太极拳、高血压、血压、心血管疾病、血管功能、Tai-ji、Tai Chi、Chi Tai、Taijiquan、hypertension、cardiovascular diseases 等。在此基础上运用逻辑分析法对所纳文献进行归纳总结，阐述太极拳对高血压患者的心血管健康效益并解析其潜在作用机制。根据其应用状况和研究现状对未来研究方向做出展望，并尝试为后续研究开拓新思路。**研究结果：**1) 在心血管健康效益方面，太极拳能显著降低高血压患者的收缩压 (systolic pressure, SBP) 和舒张压 (diastolic pressure, DBP)。一次急性太极拳运动后原发性高血压患者 SBP 和 DBP 都呈下降趋势，DBP 下降的程度更加明显且更为持久。这种降压效应可持续 18h 以上 24h 后基本恢复到运动前水平；长期太极拳运动，尤其是中老年人群，每次练习时间不超过 60min、频率每周 3-5 次、持续 8 周以上时，降压效果更为显著。其次，太极拳能有效改善血管功能。高血压患者坚持 16 周太极拳运动后，血清一氧化氮 (NO) 和内皮素 (endothelin, ET) 水平显著降低，从而促进血管舒张，增强血管弹性，保护血管内皮功能，延缓动脉硬化进程。12 周太极拳干预后可显著提高微血管反应性和血流灌注量。此外，太极拳能够改善自主神经平衡。太极

拳能够降低交感神经活性，增强迷走神经张力，优化心率变异性，表现为低频分量（low frequency, LF）功率下降、高频分量（high frequency, HF）功率上升、LF/HF 比值降低。这一调节作用有助于稳定血压，降低心血管事件风险。太极拳还可以降低心血管事件风险。太极拳能显著降低总胆固醇、甘油三酯、低密度脂蛋白胆固醇，升高高密度脂蛋白胆固醇，改善糖脂代谢。2）在潜在作用机制方面，太极拳通过以下多维机制发挥心血管保护作用。其一，调节神经内分泌系统，太极拳通过牵拉、挤拧、推按等动作调节脏腑经络功能，宁心安神。从中枢层面抑制交感神经兴奋，降低儿茶酚胺、肾上腺素、去甲肾上腺素等升压物质，同时增加多巴胺、牛磺酸等降压物质，维持血压稳态。其二，抗炎与抗氧化，太极拳可能通过减少巨噬细胞向血管壁迁移，抑制 NF- κ B 炎症信号通路，下调干扰素、肿瘤坏死因子、白细胞介素等促炎因子水平；同时增强抗氧化能力，增强血清超氧化物歧化酶和谷胱甘肽过氧化物酶活性，通过清除过量活性氧减少血管内皮氧化损伤。其三，优化血液流变学特性，太极拳通过意气相随、神定气行的锻炼方式，推动气血循行，降低全血粘度、改善红细胞变形能力、促进微循环灌注，减轻心脏后负荷，增强心脏泵血功能，从而整体改善血流动力学状态。其四，心理与社会支持效应，太极拳通过“调身、调息、调心”促进身心和谐，缓解焦虑与抑郁情绪；其“社交属性”也有助于增强社会支持，形成“心理改善-血压控制”良性循环，间接促进心血管健康。**研究结论：**太极拳与健康促进的关联，始终是运动健康领域的前沿研究方向与核心热点，更是中国式现代化背景下推进具有中国特色的全民健身与全民健康深度融合的标志性实践内容之一。作为一种兼具安全性、经济性与普适性的运动干预手段，太极拳对高血压患者具有明确且多维度的心血管健康效益：不仅能有效调控血压、优化血管内皮功能，还可以平衡自主神经状态，改善糖脂代谢，进而降低心血管不良事件的发生风险。其作用机制并非单一途径，而是涉及神经内分泌调控、抗炎抗氧化、血液流变学特性优化，以及心理干预与社会支持效应等多层面的协同综合调节。基于现有研究，未来可从三方面深化探索。其一，进一步明确太极拳干预高血压的“最佳运动处方”，包括适宜的运动强度、频率与持续时长等关键参数；其二，加强多中心、大样本量的随机对照试验设计，推动太极拳在高血压临床康复实践中的标准化应用与个性化适配；其三，结合现代生物技术手段（如分子生物学、组学技术等），深入解析其作用的分子机制，为传统运动项目在现代慢性疾病管理中的推广应用，提供更扎实、充分的科学依据。

关键词：太极拳；高血压；心血管健康；生物学机制

The cardiovascular health benefits of Tai Chi for hypertensive patients and potential mechanisms

Fengyi Li, Jing Zhang*

College of PE and Sports, Beijing Normal University, Beijing 100875, China

Abstract: Research Objective: Hypertension affects approximately 74.2% of individuals with cardiovascular disease in China, exhibiting an overall upward trend and emerging as a major public health issue impacting national health. Currently, while medication can control blood pressure to some extent, it is often accompanied by side effects such as liver and kidney damage, limiting its long-term safety and patient compliance. Extensive clinical and basic research indicates that exercise training directly or indirectly benefits cardiovascular health, and insufficient physical activity has long been recognized as a key risk factor for hypertension. Tai Chi, a quintessential example of traditional Chinese exercise therapy, is a low-to-moderate intensity aerobic activity. It comprehensively enhances muscle, joint, and ligament function, improves microcirculation, and promotes physical and mental well-being. Its movements are gentle, smooth, and continuous, emphasizing “guiding energy with intention, balancing yin and yang, unblocking meridians, and maintaining emotional equilibrium.” This approach helps stabilize vascular neuro-regulation, improve vascular compliance, and demonstrates significant potential in non-pharmacological interventions for hypertension. However, current understanding of Tai Chi's cardiovascular protective effects remains preliminary, and its specific molecular mechanisms for improving hypertension have not been fully elucidated. This study reviews the comprehensive benefits of Tai Chi for cardiovascular health in hypertensive patients and delves into its potential molecular biological mechanisms. It aims to reveal the regulatory network mediating Tai Chi's cardiovascular protective effects, offering new research perspectives and strategic directions for hypertension prevention and treatment.

Research Methodology: This study primarily employed a literature review approach. Core literature on the effects of Tai Chi on hypertension was retrieved from databases including China National Knowledge Infrastructure (CNKI), Web of Science (WOS), and PubMed using various combinations of search terms. Key search terms included: Tai Chi, hypertension, blood pressure, vascular function, Tai-ji, Chi Tai, Taijiquan, cardiovascular diseases, etc. Based on this, logical analysis was applied to synthesize the included literature, elucidating the cardiovascular health benefits of Tai Chi for hypertensive patients and

analyzing its potential mechanisms of action. Future research directions were projected based on current application status and research landscape, while attempting to pioneer new avenues for subsequent studies.

Research Findings: 1) Regarding cardiovascular health benefits, Tai Chi significantly reduces systolic blood pressure (SBP) and diastolic blood pressure (DBP) in hypertensive patients. Following an acute Tai Chi session, both SBP and DBP decreased in patients with primary hypertension, with DBP showing a more pronounced and sustained reduction. This blood pressure-lowering effect persisted for over 18 hours, returning to pre-exercise levels by 24 hours. Long-term Tai Chi practice, particularly among middle-aged and elderly individuals, yielded more significant blood pressure reductions when sessions lasted no longer than 60 minutes, occurred 3-5 times weekly, and continued for over 8 weeks. Second, Tai Chi effectively improves vascular function. After 16 weeks of consistent Tai Chi practice, hypertensive patients exhibited significantly reduced serum nitric oxide (NO) and endothelin (ET) levels. This promotes vasodilation, enhances vascular elasticity, protects endothelial function, and delays the progression of atherosclerosis. A 12-week Tai Chi intervention significantly improved microvascular reactivity and blood perfusion. Additionally, Tai Chi enhances autonomic nervous system balance by reducing sympathetic activity, increasing vagal tone, and optimizing heart rate variability (HRV). This is reflected in decreased low-frequency (LF) power, increased high-frequency (HF) power, and a reduced LF/HF ratio. This regulatory effect contributes to blood pressure stabilization and reduced cardiovascular event risk. Tai Chi also lowers cardiovascular event risk. It significantly reduces total cholesterol, triglycerides, and low-density lipoprotein cholesterol while increasing high-density lipoprotein cholesterol and improving glucose and lipid metabolism. 2) Regarding potential mechanisms, Tai Chi exerts cardiovascular protective effects through the following multidimensional pathways. First, it regulates the neuroendocrine system. Through movements like stretching, squeezing, twisting, and pressing, Tai Chi modulates the functions of internal organs and meridians, calming the mind and soothing the spirit. At the central level, it inhibits sympathetic nervous system excitation, reducing pressor substances like catecholamines, epinephrine, and norepinephrine while increasing vasodilatory substances such as dopamine and taurine to maintain blood pressure homeostasis. Second, anti-inflammatory and antioxidant effects. Tai Chi may reduce macrophage migration to vascular walls, inhibit the NF- κ B inflammatory signaling pathway, and downregulate pro-inflammatory factors like interferon, tumor necrosis factor, and interleukins. Simultaneously, it enhances antioxidant capacity by increasing serum superoxide dismutase and glutathione peroxidase

activity, thereby reducing oxidative damage to vascular endothelium through scavenging excess reactive oxygen species. Third, optimizing blood rheological properties. Through its practice of “mind-breath coordination” and “calm-spirit-flow,” Tai Chi promotes qi and blood circulation, reduces whole blood viscosity, improves red blood cell deformability, enhances microcirculatory perfusion, reduces afterload on the heart, and strengthens cardiac pumping function—thereby comprehensively improving hemodynamic status. Fourth, psychological and social support effects. Tai Chi promotes mind-body harmony through “regulating posture, breath, and mind,” alleviating anxiety and depression. Its “social nature” also enhances social support, creating a virtuous cycle of “psychological improvement-blood pressure control” that indirectly promotes cardiovascular health. **Research Conclusions:** The association between Tai Chi and health promotion remains a cutting-edge research direction and core focus in the field of exercise and health. It stands as one of the landmark practices advancing the deep integration of national fitness and public health with Chinese characteristics under the context of Chinese modernization. As a safe, economical, and universally accessible exercise intervention, Tai Chi offers clear and multidimensional cardiovascular health benefits for hypertensive patients: it effectively regulates blood pressure, optimizes vascular endothelial function, balances autonomic nervous system activity, improves glucose and lipid metabolism, and consequently reduces the risk of adverse cardiovascular events. Its mechanism of action is multifaceted, involving synergistic regulation across multiple pathways including neuroendocrine control, anti-inflammatory and antioxidant effects, optimization of blood rheological properties, as well as psychological intervention and social support effects. Based on existing research, future exploration can be deepened in three key areas. First, further defining the “optimal exercise prescription” for Tai Chi intervention in hypertension, including key parameters such as appropriate exercise intensity, frequency, and duration; Second, strengthen the design of multicenter, large-sample randomized controlled trials to advance the standardized application and personalized adaptation of Tai Chi in clinical hypertension rehabilitation practices. Third, integrate modern biotechnological methods (such as molecular biology and omics technologies) to deeply analyze its molecular mechanisms, providing more robust and comprehensive scientific evidence for the promotion and application of traditional exercise programs in modern chronic disease management.

Keywords: Tai Chi; hypertension; cardiovascular health; biological mechanisms