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SYSTEMATIC REVIEW ON THE EFFECTS OF TAI CHI ON EXECUTIVE FUNCTION IN COLLEGE STUDENTS

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Abstract:
This review investigates the efficacy of Tai Chi in enhancing executive functions, drawing on a compilation of diverse studies. Findings consistently highlight improvements in inhibition control, executive function, and overall mental well-being, positioning Tai Chi as an accessible intervention supportive of the cognitive health of college students. Notably, benefits are observed in both older and younger populations, as well as individuals with differing health conditions, underscoring its universal applicability. It equally identifies new research domain for the investigation of the interplay between Tai Chi and executive function, particularly regarding its influence on academic performance/achievement.

Keywords: Tai Chi; executive function; inhibition, college students; academic achievement

1. Introduction

Tai Chi is a martial art with profound roots in ancient Chinese philosophy and has attracted attention not only for its physical benefits but also for its potential implications in enhancing cognitive functions. Research indicates that practicing Tai Chi can improve memory, attention, and executive functions, making it an appealing exercise for various populations, particularly older adults. The slow deliberate movements promote mindfulness, which can help reduce stress and anxiety, leading to improved cognitive clarity. Studies suggest that practicing Tai Chi can improve memory, attention, and executive functions. Additionally, the integration of breath control with movement fosters a greater sense of mental well-being. Research indicates that regular practice may lead to neuroplasticity—helping the brain form new connections and improve overall cognitive resilience. Participants in Tai Chi programs often report enhanced mood and

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greater focus, benefiting both older adults and younger practitioners. Moreover, the rhythmic nature of Tai Chi encourages a meditative state, which can spur creativity and problem-solving skills.

However, despite the emerging body of literature, significant research gaps remain. Most studies focus primarily on older adults [1-4], leaving a lack of understanding regarding the cognitive effects of Tai Chi in younger populations. This review analyzes recent publications on young adults, particularly university students, to examine the impact of Tai Chi on executive function and related academic performance. By focusing on this demographic, the review aims to provide a critical perspective on the role of Tai Chi in enhancing cognitive abilities among young adults. Equally, it has been shown to have positive effects on both the physical and mental health of students [5, 6]. Engaging in regular Tai Chi practice promotes better physical fitness, enhances flexibility, and reduces stress, contributing to overall well-being [7, 8]. Additionally, it supports mental clarity and focus, which are essential for academic success. By integrating Tai Chi into students' routines, universities can foster a healthier environment that promotes not only physical activity but also mental resilience, ultimately benefiting students in their studies and personal lives.

Despite the growing body of literature, notable research gaps persist. Most studies concentrate on older adults, leaving the cognitive effects of Tai Chi in younger populations largely unexplored. This review analyzes recent publications specifically concerning young adults, particularly university or college students. By emphasizing this demographic, the review seeks to critically evaluate the potential of Tai Chi as a tool for enhancing cognitive abilities among young adults. The aim is to bridge the knowledge gap and highlight the relevance of Tai Chi not just as a physical discipline but also as a means to improve mental capacities.

2. Method

A thorough computerized search was performed across the following databases: PubMed, Medline, and Web of Science, covering the years 2020 to 2024. Additionally, Google Scholar was utilized specifically for English-language articles relevant to this study. The search terms encompassed various iterations and related phrases of Tai Chi, formulated as follows: (Tai Ji OR Tai Chi OR Tai Ji Quan OR Tai Chi Chuan OR Tai Chi Quan) AND (university student OR college student) AND (academic achievement OR academic performance OR curriculum). Studies eligible for this meta-analysis needed to meet two criteria: 1) they must examine executive function in the context of Tai Chi, and 2) they must consider a factor influencing executive function alongside Tai Chi exercise training for the experimental group.

2.1 Screening process

The screening process and data extraction were conducted in four stages. The first step involved basic screening based on the title and abstract. In the second stage, papers

unrelated to the topic were excluded. Third, studies that included Tai Chi with other forms of exercise, such as yoga or qigong, were also eliminated. Finally, full-text eligibility was assessed. Data from the selected studies were collected using a pre-piloted form, capturing details such as study design, sample size, and results.

2.2 Data extraction

Potential papers were screened for inclusion, with relevant studies retrieved and assessed for eligibility. Any discrepancies were resolved by consensus. The extracted information was organized into the following categories: 1) Publication details, including the first author's last name and publication year; 2) Study participant characteristics, such as sample size; 3) Intervention details, including the type of intervention and its effects on executive function.

2.3 Quality assessment

The quality assessment was conducted using the PRISMA technique [9]. The papers included in this study underwent critical analysis, resulting in classifications assigned to areas perceived as low value, ambiguous, or at increased risk of bias. These areas included: randomness of sequence generation, allocation concealment, blinding methods, incomplete outcome data, potential selective reporting of outcomes, and other sources of bias.

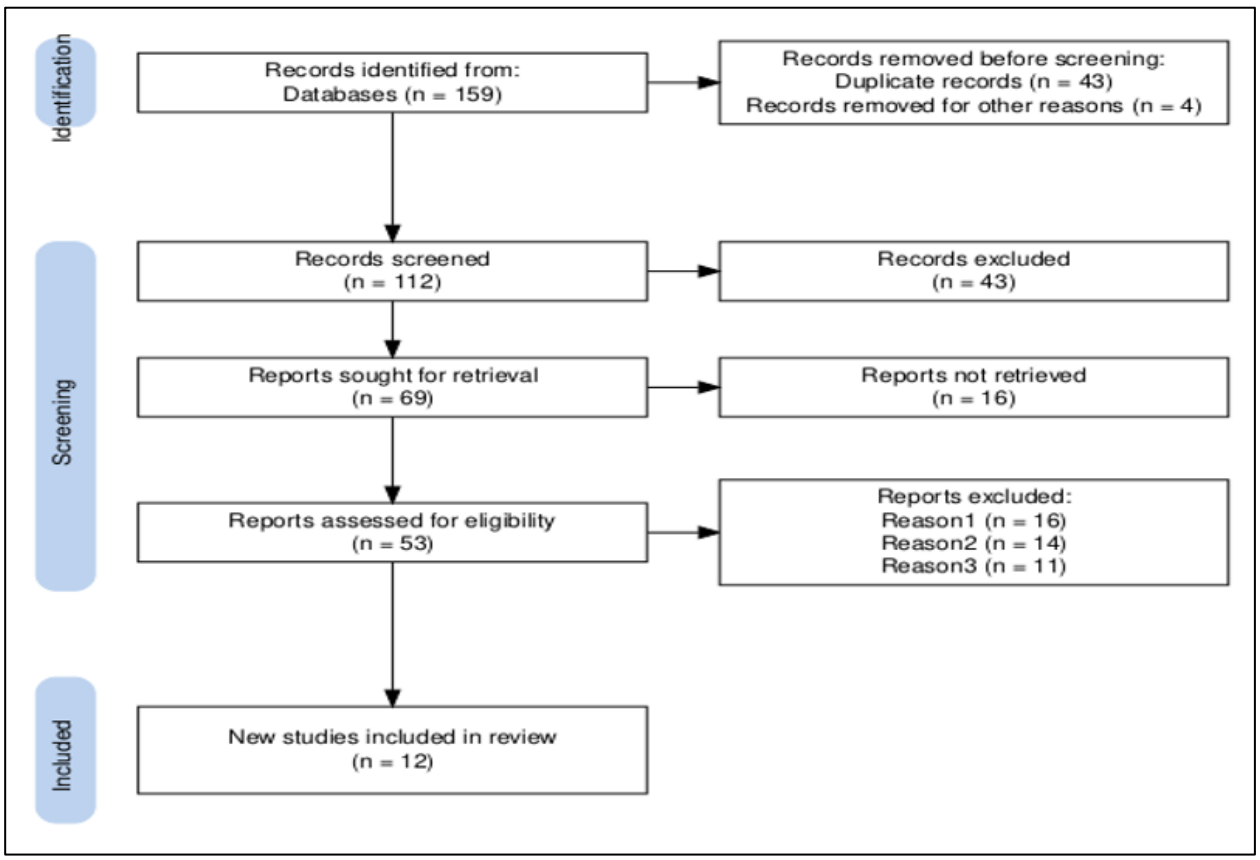

Figure 1: Prisma diagram of the review

3. Result and Discussion

Table 1: The effect of Tai Chi on executive function

Author	Student Number	Age	Training Duration	Tai Chi Style	Research Objectives	Procedure	Result and Conclusion
Hao, (2022) [10]	60	18- 24	15-weeks; 45 min		Inhibition Control	Stroop task and fNIRS	Tai Chi has positive impact on Inhibition Control
Shen et al., (2021) [11]	12		8-week; 60 min	24-form Tai Chi	Inhibitory Control	Flanker and fNIRS	Tai Chi has positive impact on Inhibition Control
Converse [12] et al., (2020)	19		7-week		Attention Deficit Hyperactivity Disorder	Clinical test and Suevi of student	Tai Chi is effective for ADHD and Inhibition control
Chuan, (2022) [13]	31			Yang-styled Tai Chi	Attentional Inhibition and Response Inhibition	Blindness Test and Physical Activity Readiness Questionnaire (PAR-Q).	Tai Chi has positive impact on Respond and Attention Inhibition
Cui, L. (2023) [14]			8-week	Bafa Wubu	Executive Function	physical, psychological and multimodal imaging measurement	Promote the Executive function and may be increasing of white matter integrity.
Wang, et al., (2024) [15]	98	18-22	12-weeks; 45 min	24-form	Executive Inhibitory Control	Randomized controlled trial	TAI CHI training not only improves executive inhibitory control but may also enhance localized brain activity
Zhu et al., (2021) [16]	76		12-weeks		Exercise Improves the Health and Mental Status of Drug Dependents.	Inhibitory control (IC, go/no-go task), working memory (3-back task) and cognitive flexibility (switching task)	TAI CHI training can improve the IC and maintain the working memory and cognitive flexibility of MA dependents
Guo & Yang, (2022) [17]	18		8-week		Inhibitory Function	Flanker task	Tai Chi intervention has a positive impact on the inhibition function
Li et al., (2023) [18]	66	18-21	8-week; 30min	Eight-style Tai Chi	Addiction Behavior and Inhibiting Function of College Students	Flanker task (suppression function), 2-back task (refresh function) and More-odd shifting task	Mindful Taijiquan intervention can improve the mobile phone addiction as well as the inhibition function
Shen et al., (2021) [19]	36		8 weeks	Bafa Wubu	Enhancement on Inhibition	Individuals were assessed with a Rs-fMRI scan	Processing efficiency of inhibition and stronger effects on brain plasticity the aerobic exercise
Hou et al., (2023) [20]			16-weeks	Bafa Wubu	Influence of Tai Chi on The Inhibition Function and Autonomic Nerve Function	Flanker and EEG	Improve inhibitory function and Autonomic nerve function of the Tai Chi group
Wang et al., (2023) [21]	55		12-weeks; 60 min	24-form Tai Chi	Working Memory Capacity and Emotion Regulation	2-back	Tai Chi training can improve individuals' working memory capacity and emotion regulation ability

Various scholars have explored the intersections of Tai Chi practice and cognitive functions, providing a rich reservoir of data. Notably, Hao (2022) [10], Shen et al. (2021) [11], Converse et al. (2020) [12], Chuan (2022) [13], and several others have conducted studies examining the effects of different Tai Chi styles on cognitive inhibition and executive functions. These studies typically target diverse demographics, emphasizing the universal applicability of Tai Chi, particularly among young adults and those affected by attention-related disorders. The studies reflect diverse participant groups, with samples ranging from 12 to 98 students with a total of 471, primarily within the age bracket of 18 to 24 years. This demographic focus highlights the relevance of Tai Chi as an intervention strategy for young adults and its implications for enhancing cognitive performance, particularly in academic settings.

The primary research objective across the studies is the exploration of Tai Chi's effects on cognitive inhibition and executive functions. Procedures commonly included cognitive tasks like the Flanker task and neuroimaging methods such as fNIRS and EEG to assess participants' performance and brain activity. For example, Li et al. (2023) [18] used several cognitive tests to evaluate the impact of mindful Taijiquan on mobile phone addiction and inhibiting functions among college students, demonstrating the rigorous approach taken by researchers to quantify outcomes effectively. Equally, Hao (2022) [10] aimed to assess the influence of Tai Chi on inhibition control through the Stroop task, while Shen et al. (2021) [11] focused on inhibitory control using the Flanker task. The breadth of studies encapsulates various cognitive areas, including executive function, working memory capacity, and emotional regulation, demonstrating the multifaceted nature of tai chi's cognitive benefits.

Most studies implemented standardized cognitive tasks to measure cognitive functions pre- and post-intervention. Techniques such as functional Near-Infrared Spectroscopy (fNIRS), both behavioral tests like the Flanker and Stroop tasks, and neuroimaging methods were employed to provide robust assessments. For example, Wang et al. (2024) [15] conducted a randomized controlled trial over 12 weeks with participants engaging in 45-minute sessions of 24-form Tai Chi. Other studies, such as Guo & Yang (2022) [17], used single assessments like the Flanker task to focus specifically on inhibition function.

The results gathered from these investigations uniformly indicate that Tai Chi positively influences cognitive functions. Hao, (2022) [10] and Shen et al. (2021) [11, 19] both reported marked improvements in inhibition control as a product of Tai Chi practice. Similarly, Wang et al. (2023) [21] discovered that participants exhibited enhanced working memory capacity and better emotional regulation. Conversely, Zhu et al. (2021) [16] highlighted improvements in cognitive flexibility and working memory in drug-dependent individuals following an extensive Tai Chi regimen, suggesting that Tai Chi can be a rehabilitative tool for diverse populations.

4. Discussion

Based on the results presented, the compiled findings from various studies offer a compelling case for the efficacy of Tai Chi in enhancing cognitive functions across diverse demographics. The consistent observations regarding inhibition control, executive function, and overall mental well-being indicate that Tai Chi is an accessible and advantageous intervention for promoting cognitive health. Furthermore, these benefits are seen not only in older adults [22, 23] but also in younger populations and individuals with varying health conditions, highlighting its universal appeal [21].

To deepen our understanding, Future research could explore the nuanced relationship between Tai Chi and executive function, particularly how these improved cognitive processes influence academic performance. Additionally, researchers can investigate how durations of Tai Chi practice impact executive function, assessing variations in student populations, such as age, academic discipline, or baseline cognitive abilities. Longitudinal studies could provide insights into the long-term benefits of Tai Chi on academic achievement, while experimental designs incorporating control groups, could establish causality. Finally, qualitative research could add depth by exploring students' perceptions of Tai Chi's impact on their cognitive function and academic performance. This multifaceted approach could provide a comprehensive understanding of Tai Chi's potential as a beneficial practice for enhancing executive function and, ultimately, academic success.

5. Conclusion

This review outlines the benefits of Tai Chi in fostering cognitive functions, particularly inhibitory control and executive functioning. Tai Chi emerges not only as a physical practice but also as a cognitive enhancer. Its unique combination of movement, mindfulness, and breathing exercises contributes to improved mental clarity and focus, making it an effective tool for cognitive enhancement. Incorporating Tai Chi into therapeutic settings or educational curricula could yield significant benefits, particularly for individuals seeking to improve their cognitive abilities or manage stress. Moreover, introducing Tai Chi in schools may serve to bolster students' executive functioning skills, allowing for better academic performance and social interactions. The practice can also offer a constructive outlet for energy and anxiety, contributing to a more balanced educational environment.

Authors' Contribution
We thank our group members for their technical support and thank the Wushu College of Henan University. Sime Nkemeni Darrin, Duangchit Chanthavone Hong Hao wrote and designed the research.

Availability of Data and Materials
All data will be made available on requested.

Ethics Approval Statement
Ethical approval was not sought for the present study because it is a qualitative paper.

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The authors declare no conflicts of interest.

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References

[1] L. Wei, Q. Chai, J. Chen, Q. Wang, Y. Bao, W. Xu, E. Ma, The impact of Tai Chi on cognitive rehabilitation of elder adults with mild cognitive impairment: a systematic review and meta-analysis, Disabil. Rehabil. 44(11) (2022) 2197-2206. https://doi.org/10.1080/09638288.2020.1830311

[2] M. Lin, C. Ma, J. Zhu, J. Gao, L. Huang, J. Huang, Z. Liu, J. Tao, L. Chen, Effects of exercise interventions on executive function in old adults with mild cognitive impairment: A systematic review and meta-analysis of randomized controlled trials, Ageing Res. Rev. 82 (2022). https://doi.org/10.1016/j.arr.2022.101776

[3] X.-L. Zhou, L.-N. Wang, J. Wang, X.-H. Shen, X. Zhao, Effects of exercise interventions for specific cognitive domains in old adults with mild cognitive impairment A protocol of subgroup meta-analysis of randomized controlled trials, Medicine 99(31) (2020). https://doi.org/10.1097/MD.0000000000020105

[4] Q. Wang, Y. Sheng, Effect of Tai Ji Quan on Cognitive Function in Old Adults with Mild Cognitive Impairment, Chinese Journal of Rehabilitation Theory and Practice 22(6) (2016) 645-649. https://doi.org/10.1155/2020/6683302

[5] Y. Wang, Tai Chi exercise and the improvement of mental and physical health among college students, Medicine and Sport Science 52:135-45 (2008). http://dx.doi.org/10.1159/000134294

[6] Y.T. Wang, L. Taylor, M. Pearl, L.-S. Chang, Effects of Tai Chi exercise on physical and mental health of college students, The American Journal of Chinese Medicine 32(03) (2004) 453-459. https://doi.org/10.1142/s0192415x04002107

[7] K. Caldwell, L. Emery, M. Harrison, J. Greeson, Changes in mindfulness, well-being, and sleep quality in college students through taijiquan courses: a cohort control study, The journal of alternative and complementary medicine 17(10) (2011) 931-938. https://doi.org/10.1089/acm.2010.0645

[8] G. Zheng, X. Lan, M. Li, K. Ling, H. Lin, L. Chen, J. Tao, J. Li, X. Zheng, B. Chen, The effectiveness of Tai Chi on the physical and psychological well-being of college students: a study protocol for a randomized controlled trial, Trials 15 (2014) 1-9. https://doi.org/10.1186/1745-6215-15-129

[9] N.R. Haddaway, M.J. Page, C.C. Pritchard, L.A. McGuinness, PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis, Campbell Syst. Rev. 18(2) (2022) e1230. https://doi.org/10.1002/cl2.1230

[10] T. Hao, Research on the Influence of Taijiquan on College Students' Inhibition Control Based on fNIRS Technology, Med. Sci. Forum, MDPI, 2022, p. 1. http://dx.doi.org/10.3390/IECH2022-12297

[11] X. Li, L. Cui, Y. Wang, L. Zhu, Y. Li, J. Li, Q. Shen, J. Zhang, H. Yin, Acute Tai Chi (Bafa Wubu) on inhibitory function under negative emotional stimulation in college students: an ERP study, J. Beijing Normal Univ. (Nat. Sci.) 56(1) (2020) 141-147. https://doi.org/10.3389/fnbeh.2024.1520508

[12] A.K. Converse, B.P. Barrett, B.A. Chewning, P.M. Wayne, Tai Chi training for attention deficit hyperactivity disorder: A feasibility trial in college students, Complement. Ther. Med. 53 (2020) https://doi.org/10.1016/j.ctim.2020.102538

[13] C.S. Chuan, Effects of Tai Chi practice through virtual training on attentional inhibition and response inhibition among students of USM, Kelantan, Malaysia, 2022. Retrieved from http://eprints.usm.my/57149/

[14] L. Cui, S. Tao, H.C. Yin, Q.Q. Shen, Y. Wang, L.N. Zhu, X.J. Li, Tai Chi Chuan Alters Brain Functional Network Plasticity and Promotes Cognitive Flexibility, Front. Psychol. 12 (2021) https://doi.org/10.3389/fpsyg.2021.665419

[15] M. Wang, B. Lyu, Effect of 24-form simplified Tai Chi on executive inhibitory control of college students: a randomized controlled trial of EEG, Front. Psychol. 15 (2024) 1344989. https://doi.org/10.3389/fpsyg.2024.1344989

[16] L. Zhu, A. He, D. Chen, X. Dong, X. Xiong, A. Chen, Cardiorespiratory fitness as a mediator between body fat rate and executive function in college students, Front. Endocrinol. (Lausanne) 14 (2023). Retrieved from https://doi.org/10.3389/fendo.2023.1293388

[17] B. Guo, Y. Song, L. Zhao, X. Cheng, H. Ma, X. Qiu, X. Yang, Z. Qiao, E. Zhao, T. Bu, J. Yang, R. Mishra, Y. Yang, J. Zhou, Sleep quality and creativity in Chinese college student during the COVID-19 pandemic: The mediating role of executive function, Public Health Front. 10 (2022). https://doi.org/10.3389/fpubh.2022.987372

[18] J. Li, W. Yang, F. Zheng, Study on the effect of mindfulness Taijiquan on improving mobile phone addiction behavior and inhibiting function of college students, The Journal of the International Society of Chinese Health Practices 3(1) (2023). Retrieved from http://www.ischp.org/journal/index.php/jischp/article/view/291

[19] Q. Shen, H. Yin, L. Cui, The brain mechanisms of Bafa Wubu of Tai Chi exercise enhancement on inhibition of college students, The Journal of the International Society of Chinese Health Practices 2(1) (2021). Retrieved from http://www.ischp.org/journal/index.php/jischp/article/view/93

[20] J. Hou, H. Yin, L. Cui, Q. Shen, T. Xia, J. Zhang, Effects of tai chi on inhibitory function in college students' evidence from heart rate variability, The Journal of the International Society of Chinese Health Practices 3(1) (2023). Retrieved from http://www.ischp.org/journal/index.php/jischp/article/view/247

[21] Y. Wang, J. Tian, Q. Yang, Tai Chi exercise improves working memory capacity and emotion regulation ability, Front. Psychol. 14 (2023) 1047544. https://doi.org/10.3389/fpsyg.2023.1047544

[22] X. Lv, X. Ren, C. Guo, L. Tang, Tai Chi exercise training enhances executive function and fluid intelligence of healthy older adults: Cross-sectional and longitudinal evidence, Psychol. Sport Exerc. 58 (2022) 102105. https://doi.org/10.1016/j.psychsport.2021.102105

[23] F.-T. Chen, J.L. Etnier, K.-H. Chan, P.-K. Chiu, T.-M. Hung, Y.-K. Chang, Effects of exercise training interventions on executive function in older adults: a systematic review and meta-analysis, Sports Med. 50(8) (2020) 1451-1467. https://doi.org/10.1007/s40279-020-01292-x