

**Robert W. McGee\*****Tai Chi and Qigong: Promoting Neurogenesis and Cognitive Health Through BDNF Upregulation in Older Adults: An AI-Assisted Review****Robert W. McGee\***

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**ABSTRACT**

This manuscript investigates the potential of Tai Chi and Qigong, traditional Chinese exercises, to promote neurogenesis and cognitive health in older adults. Prompted by an inquiry to the AI assistant Grok 4, the article synthesizes evidence from randomized controlled trials (RCTs), meta-analyses, and reviews. These studies show that the practices elevate brain-derived neurotrophic factor (BDNF) levels, supporting neuron growth, survival, and neuroplasticity. Key protocols include 8-form Tai Chi (60-minute sessions, twice weekly for 10 weeks) and home-based Tai Chi (50 minutes, three times weekly for 6 months). Outcomes feature improved plasma BDNF, cognitive functions like memory and executive control, and reduced depressive symptoms via mechanisms such as BDNF demethylation and cortisol modulation. Direct neurogenesis measurement in humans is challenging due to ethical and technical constraints, so indirect biomarkers like BDNF serve as proxies for neuroprotective benefits against mild cognitive impairment (MCI) and dementia precursors. Additional PubMed-sourced studies on Qigong reinforce BDNF elevation in depression management, with optimal exercise doses around 610 METs-min/week. This review highlights the novelty of AI-assisted methodologies in synthesizing research, enhancing efficiency and breadth. It underscores the accessibility of these interventions for brain health and calls for further studies to refine protocols and confirm long-term effects.

**KEYWORDS:**

Tai Chi, Qigong, BDNF, neurogenesis, mild cognitive impairment, dementia, cognitive decline, depression, older adults, traditional chinese exercises, neuroplasticity, brain health

**INTRODUCTION:**

After reading an article on neurogenesis, I wondered about studies on Tai Chi—a traditional Chinese medicine practice and martial art—for creating new brain neurons. I queried the AI assistant Grok 4: "Have any studies been done on the practicing of Tai Chi on neurogenesis?" Grok 4 provided this response:

Yes, several studies have investigated Tai Chi's effects on neurogenesis. They often use indirect measures like increased BDNF levels, a protein promoting neuron growth and survival. Studies also note changes in brain volume and structure linked to neuroplasticity and neuron generation.

For example, a 2018 RCT with older adults having MCI found that 12 weeks of Tai Chi raised plasma BDNF

levels. This correlated with cognitive improvements. Researchers noted BDNF enhances neurogenesis and protects against decline [1]. Another 2018 study showed Tai Chi improved brain metabolism in areas like the posterior cingulate gyrus. It also enhanced muscle energetics, suggesting neuroplasticity support, including potential neurogenesis in aging [2].

A 2023 review on Tai Chi for brain health highlighted raised brain chemicals boosting new cell growth and connections. It strengthened the hippocampus, a key neurogenesis area, and improved brain blood flow. This was based on older adults with Type 2 diabetes and MCI practicing Tai Chi for 24 weeks [3-4]. A 2025 meta-analysis of 11 RCTs on traditional

Chinese exercises like Tai Chi and Qigong found regular practice elevates BDNF in middle-aged and older adults. This aids neuron growth, repairs existing ones, maintains cognition, and reduces inflammation [5-8].

Other research, like a 2012 RCT with Chinese elderly, showed Tai Chi three times weekly for eight months increased brain volume and cognition versus controls. This aligns with neurogenesis mechanisms, though focused on preventing age-related shrinkage [9-10]. A 2024 scoping review of neuroimaging studies supported this. Tai Chi increased grey matter volume and neural activity in brain regions, potentially linked to neuron generation and connectivity [11-12]. While direct human neurogenesis measurement is difficult—relying on animal models or biomarkers—these studies indicate Tai Chi fosters favorable conditions via BDNF upregulation and brain changes, especially in older adults.

## AUTHOR COMMENTS

Grok 4 delivered an excellent response with citations. For full disclosure, it provided some references; I expanded by reviewing them and adding related studies. Grok 4 guided effectively. This highlights the novelty of AI-assisted research: Grok 4 enabled rapid synthesis, query refinement, and summarization, blending human curiosity with computational efficiency for interdisciplinary insights.

To build on this, I searched PubMed on August 15, 2025, using terms "BDNF" AND "Tai Chi" (yielding [13-15]) and "BDNF" AND "Qigong" (yielding [16-17]). Inclusion criteria: English-language RCTs, meta-analyses, or reviews from 2010-2025 focusing on older adults ( $\geq 60$  years), BDNF modulation, and cognitive or depressive outcomes. Exclusion: Non-human studies, non-peer-reviewed articles, or those lacking BDNF data. This covered 2010 onward to capture recent evidence, excluding earlier works for recency.

## SUMMARY OF KEY STUDIES

To enhance clarity, Table 1 summarizes protocols, biomarkers, and outcomes from selected studies.

Study	Intervention	Protocol (Frequency/Duration)	Key Biomarkers	Cognitive/Emotional Outcomes
Sungkarat et al. (2018) [13]	Tai Chi	50 min, 3x/week, 6 months (home-based after instructor-led)	↑ Plasma BDNF	↑ Memory (Logical Memory delayed recall), ↑ Executive function (Trail Making Test B-A)
Liao et al. (2022) [14]	Tai Chi	Not detailed in abstract (pre-post study)	↓ BDNF methylation	↓ Depressive symptoms (PHQ-9)
Solianik et al. (2021) [15]	8-form Tai Chi	60 min, 2x/week, 10 weeks	↑ BDNF	↑ Mental switching, trend ↑ Inhibitory control; ↓ Stress, ↓ Depressive symptoms
Lu et al. (2020) [16]	Qigong	Not detailed (focused on depressive symptoms)	↑ BDNF, ↑ Serotonin, ↓ Cortisol	↓ Depressive symptoms (cortisol-mediated)
Yuping et al. (2024) [17]	Qigong (meta-analysis)	Optimal ~610 METs-min/week	↑ BDNF	Not quantified beyond BDNF; implications for depression management
Chen et al. (2023) [4]	Tai Chi Chuan	Not specified (24 weeks)	Implied ↑ BDNF-related factors	↑ Cognitive function in Type 2 diabetes/MCI
Gan et al. (2025) [6]	Traditional Chinese exercises (meta-analysis)	Varied across 11 RCTs	↑ BDNF	Maintained cognition, ↓ Inflammation
Mortimer et al. (2012) [10]	Tai Chi	3x/week, 8 months	Not measured (brain volume proxy)	↑ Brain volume, ↑ Cognition

**Table 1: Summary of interventions, protocols, biomarkers, and outcomes. ↑ = increase; ↓ = decrease.**

## SOME ADDITIONAL STUDIES

### Sungkarat et al. (2018): Tai Chi Improves Cognition and Plasma BDNF in Older Adults With Mild Cognitive Impairment [13]

This RCT involved 66 older adults (mean age 67.9) with amnesic MCI. They were divided into Tai Chi (n=33) and control (n=33) groups. The Tai Chi group learned

with an instructor, then did home sessions. Findings: Significant BDNF increases in Tai Chi group ( $P < .05$ ). This implies neuron growth support. Cognition improved in memory and executive function ( $P < .05$ ). No changes in other biomarkers.

**Liao et al. (2022): Tai Chi Improves Depressive Symptoms Among Community-Dwelling Older Persons by Mediating BDNF Methylation [14]**

This pre-post study had 18 older adults in Tai Chi. It reduced depressive symptoms and BDNF methylation. Methylation correlated with depression. Demethylation may enhance BDNF expression, aiding neuron growth indirectly. Calls for larger trials.

**Solianik et al. (2021): Tai Chi Improves Psychoemotional State, Cognition, and Motor Learning in Older Adults During the COVID-19 Pandemic [15]**

This RCT with 30 older adults (Tai Chi  $n=15$ , control  $n=15$ ) used 8-form Tai Chi. BDNF increased, correlating with mental switching ( $P < .05$ ). Cognition and emotions improved: better switching, control, processing; less stress and depression.

**Lu et al. (2020): Qigong for the Treatment of Depressive Symptoms: Preliminary Evidence of Neurobiological Mechanisms [16]**

This RCT with 30 older adults (Qigong  $n=14$ , control  $n=16$ ) showed Qigong raised BDNF and serotonin, lowered cortisol. Depressive symptoms decreased, mediated by cortisol. Suggests neuroplasticity support.

**Yuping et al. (2024): The Optimal Type and Dose of Exercise for Elevating Brain-Derived Neurotrophic Factor Levels in Patients With Depression [17]**

This meta-analysis of 36 RCTs (2,515 participants) compared exercises. All raised BDNF; optimal dose  $\sim 610$

## Neurology and Neurological Research

METs-min/week. Qigong ranked moderately. Implies neuron growth support for depression.

### AUTHOR COMMENTS

Grok 4 provided excellent summaries. Many studies exist on Tai Chi/Qigong for cognitive decline, depression, dementia, and Alzheimer's. This review focuses on BDNF and neurogenesis effects. It offers food for thought and may inspire further research.

### LIMITATIONS AND FUTURE DIRECTIONS

This review has limitations. Many studies use small samples (e.g.,  $n=18-66$ ), limiting generalizability. Neurogenesis is measured indirectly via BDNF, as direct human assessment is challenging. Confounding factors like lifestyle variations (diet, activity) may influence results. Future research should use larger, diverse populations to address biases. Longitudinal studies could confirm long-term effects. Refined protocols, controlling confounders, would strengthen evidence.

### CONCLUDING COMMENTS

Evidence from AI-assisted summaries and studies shows Tai Chi and Qigong promote neurogenesis via BDNF. They enhance cognitive resilience and well-being in older adults. These practices counter brain atrophy and decline. They suit home/community use for MCI, depression, and early dementia. Limitations like small samples and indirect measures call for larger, longitudinal research on causality, dosing, and demographics. Integrating these arts may reduce neurodegenerative burdens. This AI-novel exploration encourages readers to explore further or adopt for mental vitality.

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## Neurology and Neurological Research

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