

Effects of Baduanjin on balance and walking function in stroke survivors

Pu Dong*

School of Public Health, Wannan Medical College, Wuhu, China

*Corresponding author: 20109010039@stu.wnmc.edu.cn

Abstract. OBJECTIVE: This study was designed to systematically assess the impacts of the Baduanjin exercise on the balance and walking ability of stroke survivors. **METHODS:** A search for relevant randomized controlled trials was carried out in three Chinese and English electronic databases. **RESULTS:** Eight randomized controlled trials were included in this study. By analyzing the results of the eight trials, it was found that Baduanjin exercise could significantly help stroke survivors balance in later rehabilitation. Additionally, Baduanjin exercise can effectively improve the ability of daily living and cognitive function, thus improving living quality. **CONCLUSION:** The findings suggest that Baduanjin may be a beneficial rehabilitation technique for improving balance, motor, trunk and neurological function, activities of daily living and overall living quality in stroke survivors. However, the results pertaining to improvements in walking function associated with Baduanjin remain inconclusive. Further high quality RCTs are needed to validate these findings.

Keywords: Baduanjin, stroke, balance, walking function.

1. Introduction

Stroke has a high incidence worldwide, with approximately 7.05 million deaths from cerebrovascular disease globally since the onset of the COVID-19 pandemic ^[1]. A substantial proportion of these survivors have motor disorders, and balance and walking dysfunction are common sequelae of stroke recovery, which seriously affect the quality of life and physical and mental health of survivors ^[2,3]. The cause of motor dysfunction is that the ipsilateral cerebral nerve damage in hemiplegic survivors with stroke affects lower limb muscle strength on the non-hemiplegic side, which in turn limits the walking ability and balance of the survivors ^[4]. The more severe the cerebral nerve function damage, the more pronounced is the decline in the survivors' capacity for daily living, work, and social skills, resulting in a worsening quality of life ^[5]. Simultaneously, these conditions impose significant caregiving and economic burdens on survivors, their families, and society at large ^[6]. Given the chronic nature of stroke, survivors are better served by simple to learn and accessible exercise programs that can be performed at home or in a community setting to improve or maintain balance in a sustainable way ^[7,8].

Rehabilitation training is an important intervention during the recovery period after a stroke, and in the last few years, Baduanjin has been used to treat and cure many illnesses, which can promote the improvement of survivors' body functions, improve the strength of lower limbs and waist and abdominal muscles, and improve the body balance and gait stability ^[9,10]. Baduanjin is a traditional gong method in China, which is practiced without instruments, not subject to site limitations, easy to learn, time-saving, and can dredge the meridians and increase muscle strength while exercising ^[11]. Fitness Qigong - Baduanjin is summarized by the ancient guide to create and develop, composed of eight sections of action, with a refined and perfect choreography and good health care function ^[12]. Modern research has concluded that this set of gong methods can soften the muscles and bones, promote blood circulation, improve neuromodulation, regulate internal organs, and stimulate the function of various body systems ^[12].

Fitness Qigong eight pieces of brocade is able to strengthen the body, prevention and treatment of disease, is its technical characteristics and medical principles. The Baduanjin is based on the ancient Chinese doctrine of yin and yang and five elements as its philosophical guiding ideology, emphasizing the harmonization of yin and yang, the human body and nature, the beauty of the inner world with the outer body, and the human body's activity and stasis ^[13]. Therefore, this fitness gong

method through "adjusting the heart", "adjusting the breath", "mobilization" of the three combined with each other, to guide the qi, to promote the human body, qi and blood running through the meridians, moistening the limbs and bones, to maintain normal physiological functions of the human body, thus playing a preventive role in the normal physiological functions of the body. Normal physiological function, so as to play the role of disease prevention and treatment, and physical fitness^[14].

According to the retrieved literature, most of the studies on the impacts of Baduanjin on stroke survivors have focused on other aspects, such as the results of the study by Li Rongwei et al ^[15], which showed that Baduanjin is an efficient method to enhance the ability and living quality of stroke survivors, and Zheng Guohua et al, who conducted a study ^[16], which concluded that regular training of Baduanjin can enhance the cognitive function of post-stroke survivors. However, a systematic evaluation of the impact of Baduanjin on improving balance and walking ability of stroke survivors is inconclusive. Therefore, the goal of this systematic evaluation was to investigate the effects of fitness qigong Baduanjin on balance and walking ability of stroke survivors. We included papers using Baduanjin as a primary intervention, which observed balance and walking ability to evaluate training effectiveness.

2. Materials and Methods

2.1. Search strategy

The following databases were used for the literature search: Google scholar, PubMed and CNKI. To ensure that all relevant studies were included, relevant search terms were used in conjunction with OR/AND combinations, restricting the search language to English and Chinese, and were used according to three search levels: (i) Baduanjin or Qigong; (ii) stroke; It was possible to manually identify relevant studies.

2.2. Eligibility criteria

The RCTs were published in English and Chinese. Stroke survivors who had been discharged from the hospital were being treated in a rehabilitation center Those who applied Qigong with conventional medication were the intervention group. People who did other forms of physical activity were included in the control group. Pre- and post-test data was included.

The criteria for inclusion in the study were as follows: (1) articles reporting the effects of Baduanjin (Qigong) on balance and walking function in stroke survivors; (2) randomized controlled trials; and (3) British and Chinese literature.

The criteria for exclusion in the study were as follows: (1) not related to the research field; (2) duplicate participants; (3) duplicate literature; (4) unpublished papers; and (5) conference papers.

2.3. Data extraction

Eight trials were included overall. The following information was collected: published authors, published period, clinical Setting, language, survivors, intervention, control group and outcome measure.

3. Result

3.1. Study Selection

As can be seen in Figure 1. Literature review identified 461 potentially relevant articles, 258 from Google scholar, 19 from PubMed, and 184 from CNKI. Manual search identified two additional citations. Titles and abstracts were reviewed according to the inclusion criteria and duplicate citations were removed. After initial examination, the full text of 38 articles was reviewed, excluding articles without randomized controlled trials (n=13), articles with duplicate participants (n=4), unpublished

papers (n=3), and dissertations as well as conference paper articles (n=10) removed. Finally, a sum of eight randomized control trials (RCTs) were part of the systematic review.

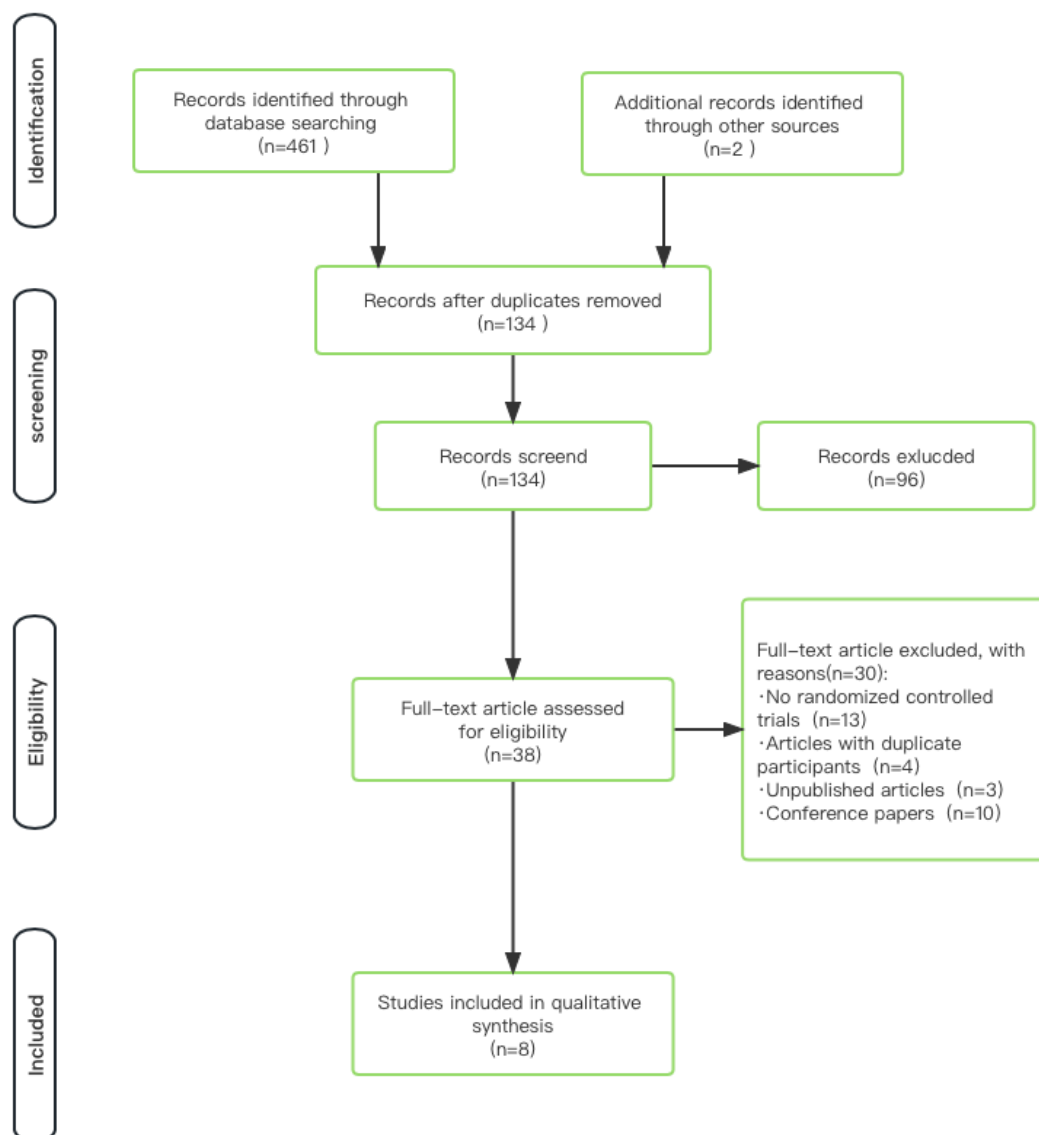


Fig. 1 Literature search and screening process

3.2. Study characteristic

The main characteristics of the 8 randomized controlled trials are presented in Table 1. These studies were carried out in China and included both English (k=4) and Chinese (k=4) literature. Stroke survivor intervention settings were hospital-based (n=6) and community-based (n=2). Sample sizes ranged from 30 to 113 participants (418 stroke survivors in total), and the mean age range was 54 to 63 years. Approximately 56% of the participants were male and 44% were female.

Table 1. Study characteristics

Study, year	Clinical Setting	Language	Survivors		Intervention			Comparison	Outcome measure
			E (M:F)	C (M:F)	Mean age	Type	Duration (weeks)		
Ding et al, 2019	Hospital	Chinese	57 (33:24)	56 (31:25)	55.37±4.71	The Third Form of the Baduanjin	3	Balance training	BBS FMB Rehabilitative ultrasound imaging
Bai et al, 2011	Hospital	Chinese	30 (20:10)	30 (22:8)	53.7 ± 4.5	Baduanjin	6	Balance training	BBS
Liu Et al, 2022	Hospital	Chinese	21 (14:7)	22 (13:9)	57.73 ±5.55	Baduanjin	4	Traditional and Modern Rehabilitation Therapy	BBS TUGT WBL
Cai Et al, 2011	Community	Chinese	30 (20:10)	30 (23:7)	60.27±10.48	Sitting Baduanjin	13	Health guidance	BI
Yuen Et al, 2021	Hospital	English	29 (15:14)	29 (14:15)	63.1 ± 10.6	Baduanjin	8	Upper and Lower Extremity Stretching, Strength, Weight Shifting and Breathing Exercises	Mini-BESTest FTSTT TUGT
Zheng Et al, 2020	Hospital	English	30 (24:16)	30 (19:11)	63.50±10.36	Liuzijue (Qigong)	3	General Rehabilitation	TIS
Zheng Et al, 2020	Community	English	24 (19:5)	24 (22:2)	61.63 ± 9.21	Baduanjin	24	No treatment	MoCA
Yang Et al, 2023	Hospital	English	15 (11:4)	15 (10:5)	54.02 ± 38.41	Baduanjin	8	No treatment	sEMG Pk254P WHOQOL-BREF

*Data are mean±standard deviation or range values.

Abbreviations: M, male; F, female; BBS, Berg Balance Scale; FMB, Fugl- Meyer Balance Scale; TUGT, Timed Departure; WBL, weight-body weight distribution ratio of both lower extremities; BI, Basel Index; Mini-BESTest, Mini-Balance Evaluation System Test; FTSTT, 5-times sit-to-stand test; TIS, Trunk Impairment Scale; sEMG, surface electromyography; PK254P, Balance Function Testing System; WHOQOL-BREF, World Health Organization Quality of Life Brief Version .

3.3. Synthesis of results

The first study considered in this review was a RCTs conducted by [17], which randomised 120 people with post-stroke balance problems to a control group and a treatment group of 60 people, and the BBS and FMB were used to assess the balance of the survivors before and after the treatment, and rehabilitation ultrasound was used to probe the transversus abdominis and multifidus of the survivor's core muscle groups to transversus abdominis thickness and multifidus muscles in the core muscle groups of the survivors were probed by rehabilitation ultrasound to evaluate the improvement of the muscles.

The study by [18] randomly and equally divided 60 stroke survivors who met the inclusion criteria will be divided into a treatment group and a control group. The control group was trained in balance function, and the treatment group practiced Baduanjin on the basis the treatment of the control. Before and after the treatment, the balance ability of the survivors in the two groups was assessed by three-level balance ability assessment and Berg score (BBS), respectively.

Retrieved [19] literature selected 46 cases of stroke recovery survivors. Randomized into two observation group (21 cases) and the control group (22 cases); The comparison group was given conventional internal medicine and rehabilitation treatment, while the observation group was added to the Baduanjin exercise prescription. The two groups of survivors were treated continuously for 4 weeks, and the survivors' BBS dynamic balance test scores and "standing up - walking" timing test (TUGT) were recorded at the end of the enrollment and treatment, The control group's dynamic balance scores were not as high as the observation group's, but the scores of the monitored groups were significantly higher than those of the controls.

In the study by [20], 60 survivors with post-stroke sequelae were selected for the study. 30 survivors were given health guidance in the comparison group. 30 survivors in the trial group were given regular health guidance, while 30 survivors in the seated Baduanjin exercise program were given 3 months of exercise. The survivors' capacity to carry out the activities of daily living before and after the exercise was evaluated using the Barthel Index. The research found that the survivors in the trial group were better than those in the comparison group in daily life activities.

The study included in this review [21] was a single-blind, randomised controlled trial in which only the assessor was blinded. The group received 8 weeks of training in the Baduanjin. The same exercises were carried out at home, 3 days a week, for a period of 8 weeks. The comparison group received 2 monitored regular exercise sessions in the 1th week, followed by exercising at home 3 days a week until the end of the 16th week. All consequences were measured over the course of 16 weeks. The Mini-Balance Evaluation System Test was used to make the assessments. After 8 weeks of training, the trial group showed a substantial increase in Mini-BESTest score, Comprehensive Balance Score, FTSTT and TUG compared to the comparison group.

[22] was a single-blind, randomized controlled trial with 60 participants. Conventional rehabilitation combined with six-word exercises was given to the experimental group, and the control group was given conventional rehabilitation training in combination with breathing exercises. The Berg Balance Scale and the MBI were the main concerns. MBI changes improved markedly for both groups, and the scores of the experimental group were relatively higher, and the Six Character Technique (Qigong) exercise significantly enhanced the daily living ability of survivors in the beginning stage of stroke recovery.

The study by [23] was a randomized, two-armed, parallel-controlled trial. Forty-eight stroke survivors were randomly assigned to either the Baduanjin exercise intervention group or the control group. The original medication was maintained by the control group. The trail group performed Baduanjin training at a rate of three days per week and 40 minutes per day for 24 weeks. The activities of daily living were included in the observation indicators.

In the study [24], 30 stroke survivors were randomized into a comparison group and a Qigong group. The 8-week Qigong Baduanjin intervention was required of participants in the Qigong group. The surface area and co-contraction ratio were used to obtain muscle coordination data. The balance function testing system was used to obtain balance data. The results of the Qigong group showed a significant difference. The Y- axis trajectory deviation and Y- axis velocity were significantly decreased in the Qigong group.

4. Discussion

The objective of this review was to collate and synthesize evidence pertaining to the efficacy of the Baduanjin (Qigong) intervention in enhancing balance and ambulatory function among stroke survivors. Upon exhaustive examination of eight randomized controlled trials (RCTs) comprising 418

participants, it was discerned that Baduanjin exercise potentially presents a promising modality for augmenting balance and walking capacity in stroke survivors. Concurrently, the review posits the prospective utility of Baduanjin in enhancing cognitive function and overall quality of life among this survivor demographic.

Stroke is a common and frequent disease in middle-aged and elderly people. Stroke survivors have impairments in somatosensory and motor conduction pathways due to central nervous system damage, which are mainly characterized by low muscle strength and endurance, and loss of joint flexibility and inter-muscle coordination^[25], and the vast majority of survivors have varying degrees of motor deficits after treatment. Most of the stroke survivors hope to obtain walking function as soon as possible, but independent walking requires an organic combination of weight bearing, striding, and balance, and the prerequisite for restoring the ability to walk is to have a good balance function^[18]. Therefore, in the rehabilitation process of hemiplegic survivors, it is very important to pay attention to the recovery of balance function in order to develop scientific and reasonable rehabilitation training^[18]. Ba Duan Jin is one of the traditional fitness methods in China, and Ba Duan Jin belongs to low and moderate intensity aerobic activity, which can improve the strength of upper limbs and lower limbs of middle-aged and elderly people, significantly improve respiratory system function, improve joint flexibility, balance and nervous system flexibility of middle-aged and older people, and can improve cardiovascular function of middle-aged and elderly people^[26].

Several studies in this review have shown that Baduanjin is an effective and easy-to-use intervention for stroke survivors and can improve the balance function of survivors [17,18,19,20,21,22,23]. Meanwhile, the results of study [24] showed that Baduanjin had an improvement in cognitive function of stroke survivors. The studies in [17,21,22], in addition to using relevant balance scales, also assessed the muscle status of stroke survivors, thus providing a more objective response to the improvement effect of the intervention on muscle groups. The study in [17] used rehabilitation ultrasound techniques to probe the thickness of the transversus abdominis and multifidus muscles on the affected side in both groups thereby evaluating the stability of the core muscle groups of the lumbar and abdominal region in stroke survivors. A clinical study by [21] used a pressure biofeedback device to assess changes in intra-abdominal pressure (IAP) for evaluation of transversus abdominis muscle activity. Indirect responses responded to trunk control. The study by [22] used sEMG and Ag/AgCl electrodes to assess muscle activity in the biceps and triceps brachii.

Although this review found promising results, certain limitations still exist. First, due to the fact that our search language was only set to English and Chinese, we cannot exclude a very small number of relevant clinical studies published in other languages (e.g., Korean, Japanese). Second, there is no systematic evaluation of the adverse clinical manifestations caused by Baduanjin during the intervention process, and the exercise impairment test was not used in the studies in this review. Third, there are some limitations of the studies in China; all the trials were performed in China, and all the stroke survivors were Chinese, and it is ambiguous whether this improvement measure of Baduanjin is applicable to non-Chinese. Fourth, only 8 articles were included in this review, and it is considered that there may be other research articles (e.g., clinical studies that are not randomized controlled trials) that may also be able to explain the complex association between Baduanjin and stroke survivors' recovery. Fifth, most of the clinical trials included in this review evaluated short-term interventions and did not do long-term monitoring and follow-up observational studies; therefore, the existing literature focuses only on the immediate effects of the Baduanjin, and there are no long-term differences in efficacy. Sixth, stroke survivors have mixed characteristics (e.g., different degrees of impairment), which makes generalizations from the results difficult.

In conclusion, further high-quality RCTs are needed to with further determine the rehabilitative effects of Baduanjin on stroke survivors. Future studies should incorporate follow-up surveys to ascertain long-term effects of this intervention. These studies should incorporate longitudinal assessments to evaluate the enduring impact of Baduanjin on rehabilitation outcomes. It would be beneficial to design future trials to strictly control for additional therapies or interventions, ensuring a clearer assessment of Baduanjin's standalone efficacy. Lastly, extending research to encompass

stroke survivors from diverse ethnic backgrounds will ascertain the broader applicability of Baduanjin in post-stroke exercise rehabilitation.

References

- [1] American Heart Association. My Life Check–Life’s Simple 7. Accessed July 28, 2021. <https://www.heart.org/en/healthy-living/healthy-lifestyle/my-life-check--lifes-simple-7>Google Scholar
- [2] Van Criekinge T, Truijen S, Schröder J, Maebe Z, Blanckaert K, van der Waal C, Vink M, Saeys W. The effectiveness of trunk training on trunk control, sitting and standing balance and mobility post-stroke: a systematic review and meta-analysis. *Clin Rehabil.* 2019 Jun;33(6):992-1002. doi: 10.1177/0269215519830159. Epub 2019 Feb 22. PMID: 30791703.
- [3] Nindorera F, Nduwimana I, Thonnard JL, Kossi O. Effectiveness of walking training on balance, motor functions, activity, participation and quality of life in people with chronic stroke: a systematic review with meta-analysis and meta-regression of recent randomized controlled trials. *Disabil Rehabil.* 2022 Jul;44(15):3760-3771. doi: 10.1080/09638288.2021.1894247. Epub 2021 Mar 14. PMID: 33715555.
- [4] Kim CM, Eng JJ. The relationship of lower-extremity muscle torque to locomotor performance in people with stroke. *Phys Ther.* 2003 Jan;83(1):49-57. PMID: 12495412.
- [5] Kernan WN, Ovbiagele B, Black HR, Bravata DM, Chimowitz MI, Ezekowitz MD, Fang MC, Fisher M, Furie KL, Heck DV, Johnston SC, Kasner SE, Kittner SJ, Mitchell PH, Rich MW, Richardson D, Schwamm LH, Wilson JA; American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Peripheral Vascular Disease. Guidelines for the prevention of stroke in survivors with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2014 Jul;45(7):2160-236. doi: 10.1161/STR.0000000000000024. Epub 2014 May 1. Erratum in: *Stroke.* 2015 Feb;46(2):e54. PMID: 24788967.
- [6] Lawrence M, Kerr S, McVey C, Godwin J. The effectiveness of secondary prevention lifestyle interventions designed to change lifestyle behavior following stroke: summary of a systematic review. *Int J Stroke.* 2012 Apr;7(3):243-7. doi: 10.1111/j.1747-4949.2012.00771.x. PMID: 22405279.
- [7] van Duijnhoven HJ, Heeren A, Peters MA, et al. Effects of exercise therapy on balance capacity in chronic stroke: systematic review and meta-analysis. *Stroke.* 2016;47:2603-2610.
- [8] Laver KE, George S, Thomas S, Deutsch JE, Crotty M. Virtual reality for stroke rehabilitation. *Cochrane Database Syst Rev.* 2017;(11):CD008349.
- [9] YAO Zhi-Ping, WANG Declining sun, NI Ying. Effects of intensive balance training combined with Ba Duan Jin on balance function, lower limb function and fall risk in elderly stroke survivors[J]. *International Journal of Nursing*,2020,39(16):2967-2970.
- [10] YANG Huixin,LIU Xiaolei. Effects of taijiquan and eight-duanjin on motor function and surface electromyography of hemiplegic lower limbs in stroke survivors[J]. *Chinese Rehabilitation Theory and Practice*,2019,25(01):101-106.
- [11] Wang Jisheng. Traditional Fitness Methods from the Perspective of Traditional Chinese Medicine--Baduanjin[J]. *Henan Traditional Chinese Medicine*, 2006, 26(1): 81-81.
- [12] ZHOU Xiaoqing,ZHANG Dongqin. Exploration of the method of practicing fitness Qigong-baduanjin safely[J]. *Exercise*,2014(06):150+124.
- [13] Kudjeti Ablimiti. *Ethnic Sports in Xinjiang* [M]. Urumqi: Xinjiang Science, Technology and Health Press, 1998.
- [14] Xin Zhe. Review of the historical development of fitness Qigong eight-duanjin and its value realization path selection[J]. *Journal of Shenyang Sports Institute*, 2015, 34(4): 135-140,144.
- [15] Wei, Lirong et al. “The effects of Baduanjin on physical function, daily living activities and quality of life in survivors with stroke: a systematic review and meta-analysis.” *Topics in stroke rehabilitation*, 1-21. 9 Aug. 2023, doi:10.1080/10749357.2023.2238433
- [16] Zheng G, Zheng Y, Xiong Z, Ye B. Effect of Baduanjin exercise on cognitive function in survivors with post-stroke cognitive impairment: a randomized controlled trial. *Clin Rehabil.* 2020 Aug;34(8):1028-1039. doi: 10.1177/0269215520930256. Epub 2020 Jun 10. PMID: 32517490.

- [17] DING Yi, GUO Sam-chen, WANG Ning, et al. Effects of the third style of Baduanjin combined with conventional balance training on balance function of stroke survivors[J]. Shandong Journal of Traditional Chinese Medicine, 2019, 7.
- [18] Bai Yanjie, Mao Haiyan, Guo Jian, et al. Study on the improvement of balance function of stroke survivors by combining functional training with Ba Duan Jin[J]. Journal of Chinese Medicine, 2011, 26(10): 1231-1232.
- [19] LIU Wan,ZHAO Yan,YANG Dan et al. Effects of eight-duanjin exercise prescription on the self-dynamic balance of survivors recovering from stroke[J]. Shizhen Guomian Guomian,2022,33(08):1936-1939.
- [20] Cai Wei,Liang Cuiyun. Effects of seated eight-duanjin on daily living activities of post-stroke survivors in the community[J]. Journal of Nursing Management,2011,11(11):810-811.
- [21] Yuen M, Ouyang H X, Miller T, et al. Baduanjin Qigong improves balance, leg strength, and mobility in individuals with chronic stroke: a randomized controlled study[J]. Neurorehabilitation and Neural Repair, 2021, 35(5): 444-456.
- [22] Zheng Y, Zhang Y, Li H, et al. Comparative effect of Liuzijue Qigong and conventional respiratory training on trunk control ability and respiratory muscle function in survivors at an early recovery stage from stroke: a randomized controlled trial[J]. Archives of physical medicine and rehabilitation, 2021, 102(3): 423-430.
- [23] Zheng G, Zheng Y, Xiong Z, et al. Effect of Baduanjin exercise on cognitive function in survivors with post-stroke cognitive impairment: a randomized controlled trial[J]. Clinical rehabilitation, 2020, 34(8): 1028-1039.
- [24] Yang H, Li B, Feng L, et al. Effects of health Qigong exercise on upper extremity muscle activity, balance function, and quality of life in stroke survivors[J]. Frontiers in Neuroscience, 2023, 17.
- [25] Le Lin, Guo Ganghua, Li Zhe. Effects of balance training on walking ability of hemiplegic stroke survivors[J]. Chinese Journal of Practical Neurological Diseases, 2012, 15(5): 23-25.
- [26] Zeng Yungui. Effects of fitness Qigong-baduanjin exercise on body shape and physiological functions of middle-aged and elderly people[J]. Sports Science and Technology Literature Bulletin, 2005 (12): 14-14.