

Review

Health benefits of traditional Chinese sports and physical activity for older adults: A systematic review of evidence

Yucheng Guo ^{*}, Haiyang Shi, Dinghai Yu, Pixiang Qiu

School of Martial Arts, Shanghai University of Sport, Shanghai 200438, China

Received 21 February 2016; revised 20 March 2016; accepted 19 April 2016

Available online 9 July 2016

Abstract

Background: Traditional Chinese sports and physical activities (PAs) have a long history and are practiced by millions of Chinese. However, relatively few systematic reviews of the scientific evidence for their health benefits, especially for older Chinese adults, have been undertaken.

Evidence acquisition: Between January and March 2016, a systematic search was conducted using the CNKI and PubMed databases to identify studies published between 2000 and 2015. Studies were selected for review if they were designed specifically to evaluate the health benefits of traditional Chinese sports and PAs in adults aged 50 years and older in the Mainland of China. The studies included observational, uncontrolled, and randomized and controlled designs. Papers published without an English title or abstract were excluded.

Evidence synthesis: The initial search identified a total of 229 studies. After removing duplicates and studies that did not meet the inclusion/exclusion criteria, 95 studies were selected for review. Special attention was given to studies of the most commonly practiced activities: Tai Ji Quan, Qigong, and Yangko exercises. A positive association between these types of exercise and health benefits was noted for healthy older adults and those with chronic diseases. Evidence on other types of activities was less clear due to the limited number of studies conducted.

Conclusion: There is promising evidence that traditional Chinese sports and PAs provide many health benefits for older Chinese adults. While additional scientifically rigorous research is warranted, promoting these traditional and culturally-based sports and PAs as forms of behavioral medicine in primary and secondary prevention of diseases among the aging Chinese population will help fulfill an urgent public health need.

© 2016 Production and hosting by Elsevier B.V. on behalf of Shanghai University of Sport. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: Chinese culture; Chinese martial arts; Elderly; Health; Physical activity; Sports

1. Introduction

For more than 5000 years, many forms of traditional sports and exercise activities have been widely practiced in China.¹ For centuries, older Chinese adults have used these activities to help enhance their fitness, promote their health, and prevent disease. Many of these activities are culturally rooted, with their social and spiritual health values being important among different ethnic populations. Despite this rich and varied history, a systematic review of the health benefits of many traditional sports and physical activities (PAs) for an older Chinese adult population has not been conducted.

Increased longevity and low fertility rates in China have led to the aging of the Chinese population,² which has increased the burden of disease and disability on the country's healthcare

system.³ Therefore, from a health and disease prevention perspective, promoting lifestyle changes, including an increase in levels of PA, is urgently needed for older adults. Despite the fact that the Chinese have a long history of using traditional sports and fitness-oriented PAs to improve health, the benefits of these activities have been both under-documented and under-studied. This has created a significant knowledge gap in the area of health promotion for China's aging population. The purpose of this article is to narrow this gap by providing a systematic review of contemporary research on the health benefits of traditional forms of exercise and PA among older Chinese adults.

2. Traditional forms of exercise and PA

More than 900 forms of traditional Chinese sports and PAs (hereafter referred to as "traditional PAs") are practiced by China's 56 ethnic populations.^{1,4} Many of these activities fall into the general category of Wushu,⁴ also known as martial arts, which comprise more than 120 variations of self-defense techniques⁵ developed under the influence of Chinese

Peer review under responsibility of Shanghai University of Sport.

* Corresponding author.

E-mail address: wushuxue@126.com (Y. Guo).

Confucianism, Buddhism, and Taoism. Historically, the practice of these martial arts has been credited with improving fitness, cultivating morality, and strengthening self-defense capabilities. In our contemporary era, these activities also function as forms of cultural exchange, entertainment, and commercialized sports performances.

During the past 3 decades, traditional Chinese PAs such as Tai Ji Quan and Qigong^{4,6} have gained significant international recognition as a means of promoting cultural, educational, and health values.⁷ There is growing research evidence that supports the claims for the health benefits of these 2 types of traditional Chinese activities.^{8–16} However, the health benefits of other culturally-based traditional PAs being practiced in China, such as Yangko dance, diabolo, kicking shuttlecocks, Mulan Quan, dragon-boat racing, Tibetan Guozhuang dance, rope skipping, and drum beating,⁴ have not been well documented. Of these activities, Yangko dance is the most popular one practiced by older adults in the northern part of China. In the following sections, we provide a general description of these 3 most common PAs (Tai Ji Quan, Qigong, Yangko dance) practiced by older Chinese adult populations.

2.1. Tai Ji Quan

Tai Ji Quan, as part of Wushu, consists of various techniques established on the basis of the rudimentary premise of yin-yang (as represented by Tai Ji) that gives rise to mind-driven interactive combative actions or exercise movements (as represented by the word “Quan”). Tai Ji Quan has different schools or styles, including classic Chen, Yang, Wǔ, Wú, and Sun styles, and are often practiced with variations in performance routines (e.g., solo or with weapons) and complexity of the forms.⁵ Tai Ji Quan has traditionally been practiced for multiple purposes, including self-defense, mindful nurturing of well-being, and fitness enhancement.⁶ As a traditional PA, it is one of the most popular activities practiced by older Chinese adults and people around the world.⁷ Several Chinese scholars have provided comprehensive reviews on the health benefits of Tai Ji Quan in China.^{17–21}

2.2. Qigong

Qigong involves either a static (stationary) or dynamic set of meditative exercises that are carried out, like Tai Ji Quan, with the intention of integrating one’s mental energy, coordinated breathing, and physical movements. In theory, Qigong shares many similarities with Tai Ji Quan in that it is deeply rooted in the ancient Chinese culture and traditional Chinese medicine. In practice, Qigong exercises have been viewed for centuries as a means of cultivating internal energy, invigorating internal organs, and aiding in the healing of the human body.²² Various types of Qigong form or exercise exist, but some of the most common types are Wu Qin Xi (Wuqinxi, also known as “frolics of 5 animals”), Ba Duan Jin (Baduanjin, also known as “8 Strands of Silk Brocade”),²³ Yi Jin Jing, Liu Zi Jue, Ma Wang Dui Dao Yin Shu (Mawangdui Daoyin exercises). Most Qigong exercises are performed slowly and gently, making them particularly suitable and appealing to older adults.

2.3. Yangko dance

Having a much shorter history than Tai Ji Quan or Qigong, Yangko dance, a form of dance with variations in style, originated in rural areas of northern China. The word “Yangko” literally means “dance and chant in synchronization with folk music”. Movements in Yangko dance involve vigorous and quick aerobic dancing with many variations in styles and forms. It is one of the most popular community-based PAs and is performed in streets, open spaces, and at cultural festivals. Although there is limited formal documentation about Yangko, it is evident from anecdotal sources that it is intended as a PA that promotes health.

3. Evidence acquisition

3.1. Literature search

Between January and March 2016, a comprehensive search of the literature on traditional PAs in the Mainland of China was conducted by a panel consisting of the first 2 authors of this article and an international scholar who is an expert in PA and aging. To identify relevant studies, the Chinese National Knowledge Infrastructure (CNKI), a major, high-yielding Chinese literature database, was used to search for studies published in Chinese or English between 2000 and 2015. To ensure inclusion of papers published in international English-language journals, an additional search was conducted in PubMed (U.S. National Library of Medicine). Primary search terms included “traditional Chinese sports”, “traditional PAs”, “Wushu”, “Tai Chi”, “Tai Ji Quan”, and “Qigong”. These terms were coupled with “older adults”, “physical activity”, “exercise”, and “mass sports”. These phrases were used to search both the text and subject headings wherever possible.

3.2. Inclusion and exclusion criteria

The inclusion criteria for research studies reviewed in this article required that they focus on examining the health benefits derived from the practice of traditional PAs by older Chinese adults and that they have clearly described and operationalized target outcome measures. To better understand the scope of research conducted in China, both observational (i.e., observations made without any interventions (e.g., cohort studies, case-control studies, or cross-sectional studies)) and experimental (uncontrolled (e.g., single-group pre-post design studies) or controlled (non-randomized studies or randomized controlled trials; non-RCTs/RCTs)) studies were considered. Studies that involved individuals aged 50 years and older were included. This minimum age limit was established because a significant number of studies included this age cohort as part of the health outcome evaluations of traditional PAs for older adults.

Papers published without an English title or abstract were excluded. In addition, studies that did not have a specific focus on traditional PAs in China were excluded. Randomized studies in which there was not a minimal attention control condition were not included.

3.3. Selection and identification of studies

All titles and abstracts retrieved through the search were independently scanned and reviewed by the panel for relevance. Potential studies that met the eligibility criteria were further retrieved with the full text of the article and reviewed in detail by the panel members. This involved an appraisal of activity types, study designs (observational, non-RCTs, RCTs), study measures and outcomes, and type of prevention (primary vs. secondary). Identified studies were entered into a coding frame using Microsoft Office Excel 2007 (Microsoft Corp., Redmond, WA, USA) and the data extracted from each study were subsequently synthesized and tabulated. Where there was uncertainty in content, a third reviewer was consulted and a decision was then made, upon consensus, regarding inclusion.

3.4. Data extraction

The initial search of the 2 databases yielded a total of 229 published studies. After removing duplicates and those that failed to meet the inclusion criteria, a total of 95 studies were thoroughly appraised and included in this review. Of these studies, 42 were observational or uncontrolled/non-RCTs and 53 were RCTs. A total of 10 studies (11%) included in this review were published in English-language journals and 85 (89%) were published in Chinese academic journals. Fig. 1 displays the data extraction process and the number of studies, shown by exercise type, sorted by study design—RCTs vs. other (i.e., observational or non-RCTs)—that were included in this review. The traditional PAs that received the most extensive research attention were Tai Ji Quan ($n = 54$) and Qigong ($n = 27$). These 2 exercise types were followed by Yangko dance ($n = 8$) and other activities ($n = 6$).

3.5. Quality assessment

Due to inclusion of studies with various designs (i.e., observational, uncontrolled, and controlled non-randomized and

randomized studies), a formal quality assessment was not conducted. All studies that met the inclusion/exclusion criteria were included in the systematic review.

4. Results

All studies included in this review are identified in the reference list at the end of the article. Of the 95 studies reviewed, there was a great deal of overlap and similarity in study topics, study objectives, and health outcomes. In what follows, we summarize the evidence from research studies on the 3 most commonly practiced traditional PAs—Tai Ji Quan, Qigong, and Yangko dance—for their respective levels of primary and secondary prevention of chronic diseases such as hypertension, cardiovascular diseases, diabetes, cancer, obesity, and osteoporosis.

4.1. Tai Ji Quan

4.1.1. Primary prevention

Of the 54 studies identified on Tai Ji Quan, 25 (46%) used cross-sectional, non-randomized designs and 29 (54%) used an RCT design. Health outcomes measured in these studies varied significantly and included psychosocial, quality of life, mental, physical, physiological, and biological outcomes.

4.1.1.1. Health risk. In a large-scale, cross-sectional study conducted in the city of Shiyan in Hubei province, healthy individuals aged 50–70 years ($n = 15,514$) who practiced Tai Ji Quan were compared to those who did not practice it.²² The results showed that practicing Tai Ji Quan was associated with a reduced risk of having metabolic syndrome (odds ratio = 0.72, 95% confidence interval: 0.60–0.88). The study also indicated a dose–response relationship, suggesting that each 1 h/week increment in Tai Ji Quan practice was associated with a 5% lower risk of metabolic syndrome.

Tai Ji Quan exercise was also associated with lowering high lipid profiles in older adults. For example, studies showed that

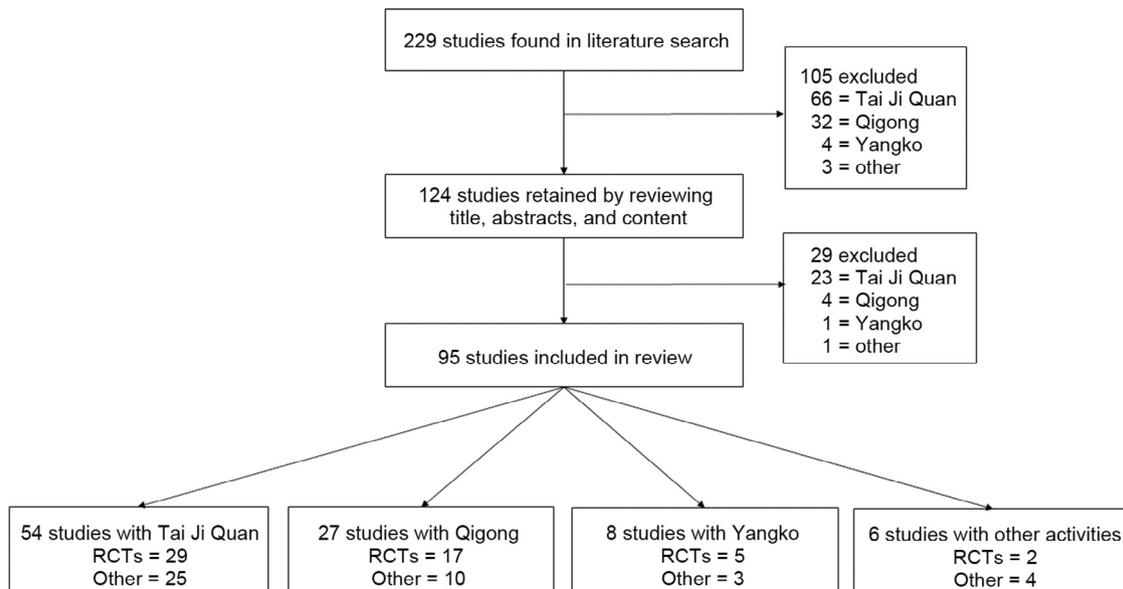


Fig. 1. Data extraction process. RCTs = randomized controlled trials.

long-term Tai Ji Quan exercisers, compared to those who did not exercise, tended to have reductions in blood cholesterol, low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG),²⁴ as well as improvements in high-density lipoprotein cholesterol (HDL-C) levels.^{24–26} These observations were confirmed in both non-RCTs and RCTs.^{27,28}

4.1.1.2. Physical and mental health. Several cross-sectional studies indicated that older adults who practiced Tai Ji Quan regularly reported better mental and physical health,^{29,30} mental well-being,³¹ flexibility,^{30–32} reaction time,³² walking speed,³³ and mobility³⁴ compared to people who did not practice Tai Ji Quan. One RCT demonstrated that Tai Ji Quan training significantly improved times for 10 m walking at a normal pace³⁵ and another RCT showed improvement in mental health and quality of life among older adults.³⁶

4.1.1.3. Global cognitive function. Regular or long-term practice of Tai Ji Quan was associated with improved global cognitive function.³³ This result was confirmed in an RCT that showed that a 6-month intervention significantly improved older adults' global cognitive function.³⁵

4.1.1.4. Sleep quality. In an uncontrolled, single-group study, investigators showed that a 48-week Tai Ji Quan intervention administered to college retirees significantly improved their quality of sleep in terms of sleep latency, duration, and efficiency.³⁷

4.1.1.5. Balance and strength. A number of cross-sectional studies showed that Tai Ji Quan was associated with better balance, stronger hand grip, and increased limb strength.^{29–33,38,39} Two non-RCTs showed improved vestibular function in older women⁴⁰ and better static postural balance in older adults.⁴¹ Six RCTs that involved a Tai Ji Quan intervention showed a significant improvement in strength and balance^{35,42–44} and joint proprioception⁴⁵ among older adults.

4.1.1.6. Cardiovascular fitness, cardiopulmonary function, and lung function. Cross-sectional studies demonstrated that long-term Tai Ji Quan practice was associated with better oxygen consumption, lung function,³⁹ and cardiopulmonary and cardiovascular functions.^{46,47} One prospective study with long-term follow-up showed that Tai Ji Quan participants benefited from improved cardio output.⁴⁸ Both non-RCTs and RCTs showed that Tai Ji Quan significantly improved older adults' cardiovascular^{49–51} and lung functions.⁵²

4.1.1.7. Bone mineral density (BMD) and bone metabolism. Studies indicated that Tai Ji Quan may be beneficial for bone health. For example, studies showed that frequent and long-term Tai Ji Quan exercisers tended to have a higher level of BMD and better bone metabolism than those who did not practice Tai Ji Quan.²⁴ Bone density can also be improved through Tai Ji Quan training. In 1 RCT, investigators showed that a 12-month intervention resulted in significantly improved calcaneus BMD among elderly women.⁴⁴

4.1.1.8. Immune system. Both uncontrolled and controlled studies showed that Tai Ji Quan was associated with improve-

ment in various immunological outcomes in older adults.^{52–55} For example, 1 uncontrolled study showed improvement in Th1/Th2 cell balance after 6 months of Tai Ji Quan intervention.⁵⁴ In addition, 3 RCTs showed that Tai Ji Quan interventions yielded positive results in terms of increases in the number of natural killer cells,⁵⁶ improved immunoglobulins (i.e., IgA, IgG, IgM),⁵² and enhanced Th1 immune response.⁵⁶

4.1.1.9. Gene expression of muscle. In a single-group, uncontrolled study, investigators found that gene expression patterns in the skeletal muscle were altered after a 12-week Tai Ji Quan intervention in a group of healthy older adults,⁵⁷ indicating that Tai Ji Quan training, like other exercises, may regulate genes in the skeletal muscle.

4.1.1.10. Other. In a comparative RCT, investigators evaluated the health benefits across 3 traditional activities involving Tai Ji Quan, Mulan Quan, and Qigong.⁵⁸ Although no between-group comparisons were made, the results of the study showed that participants across all 3 exercise groups had significant improvement in blood pressure, lung capacity, flexibility, balance, and hand grip strength.

4.1.2. Secondary prevention

Tai Ji Quan has long been promoted as a means to maintain health and prevent disease. This traditional view of Tai Ji Quan practice, however, has expanded over the past 2 decades, thanks to research. An increasing number of studies have evaluated the therapeutic value of Tai Ji Quan training in attenuating symptoms or improving conditions in patients with chronic diseases. To date, studies on secondary prevention, most of which involve RCTs, suggest that practicing Tai Ji Quan can help improve the health of older Chinese adults who have chronic medical or disease conditions.

4.1.2.1. Hypertension. Two non-RCTs evaluated the effect of Tai Ji Quan practice in older adult patients with essential hypertension. The results of these studies showed that Tai Ji Quan significantly lowered patients' systolic and diastolic blood pressure.^{59,60} Similarly, 2 RCTs involving patients with chronically elevated blood pressure (hypertension) showed that patients who participated in a Tai Ji Quan intervention, when compared to those assigned to a control condition, significantly improved their systolic and diastolic blood pressure⁶¹ and the biomarker of C-reactive protein.⁶²

4.1.2.2. Hyperlipidemia. Tai Ji Quan exercise has also been shown to be effective in altering the lipid profile in older adult patients with hyperlipidemia. In 1 study, investigators showed that after a 28-week intervention, participants reduced their LDL-C, total cholesterol (TC), and TG, and improved HDL-C.⁶² In another study, the practice of Tai Ji Quan alone was shown to be effective in reducing body mass index and fat, but a combined intervention of Tai Ji Quan and an auricular plaster therapy appeared to be more effective in improving the lipid profile in patients with secondary hyperlipidemia.⁶³

4.1.2.3. Chronic heart failure. One RCT showed that patients with chronic heart failure who practiced Tai Ji Quan had

improved cardiac function (as indexed in left ventricular ejection fraction, left ventricular end-diastolic dimension), walking speed, and quality of life when compared to a control group.⁶⁴

4.1.2.4. Chronic obstructive pulmonary disease. Tai Ji Quan exercise appeared to be beneficial to patients with chronic obstructive pulmonary disease (COPD). For example, 1 RCT showed that after a 12-week Yang-style Tai Ji Quan intervention, patients with COPD significantly improved in multi-dimensional health outcome measures, including forced expiratory volume, overall health, daily life, and well-being, when compared to other 2 active control conditions.⁶⁵ Another study, however, reported improvement in dyspnea only, after a 3-month intervention.⁶⁶ Finally, for this clinical population, Tai Ji Quan was also shown to be effective in terms of improving mental health and BMD (lumbar vertebrae L1–L4, neck, trochanter, total BMD).⁶⁷

4.1.2.5. Chronic kidney and cardiovascular diseases. A long-term (18-month) Tai Ji Quan training was shown to improve HDL-C and reduce TG in patients with atherosclerosis.⁶⁸ In another study, a 12-week Tai Ji Quan intervention was shown to improve glomerular filtration rate, left ventricular ejection fraction, lipid profile (lowered LDL-C, TG, TC, improved HDL-C), and blood pressure in patients with chronic kidney disease and cardiovascular disease.⁶⁹

4.1.2.6. Menopausal women or osteoporosis. RCTs have shown that Tai Ji Quan practice can help slow down the loss of BMD (L2–L4)⁷⁰ and reduce stepping reaction time⁷¹ in menopausal women. It has also been shown to improve BMD (L1–L4, greater trochanter of femur) in postmenopausal women⁷² and both BMD (L2, femoral neck) and bone metabolism (serum bone calcium vegetable, alkaline phosphatase) in older adults with primary osteoporosis.⁷³

4.1.2.7. Other disease conditions. Tai Ji Quan intervention was shown to improve plasma neuropeptide Y in older adult patients with type 2 diabetes,⁷⁴ increase peripheral blood mononuclear cell activities in patients with non-small cell lung cancer,⁷⁵ improve physical and mental health in patients with anxiety disorders,⁷⁶ and ameliorate gastrointestinal function among older adult patients with chronic constipation.⁷⁷

4.2. Qigong

4.2.1. Primary prevention

Of the 27 studies on Qigong, 10 (37%) used cross-sectional, non-randomized designs and 17 (63%) used an RCT design. Although there are fewer Qigong studies than Tai Ji Quan studies, an increased research effort has taken place in evaluating the health benefits of various types of Qigong exercises, including Ba Duan Jin, Yi Jin Jing, and Wu Qin Xi.

4.2.1.1. Health risk. Qigong exercises have been shown to be effective in modifying the lipid profile. Evidence to date indicates that popular types of Qigong exercises, such as Ba Duan Jin, Yi Jin Jing, and Wu Qin Xi, show promise in lowering LDL-C and TG and increasing HDL-C.^{78–80} One RCT, however,

showed favorable responses in LDL-C and HDL-C among elderly women as a result of Yi Jin Jing exercise, but no significant change in TG or TC.⁸¹

4.2.1.2. Physical and mental health. Among older adults, regular Qigong exercisers were found to have lower levels of anxiety and depression than non-exercisers.⁸² A single-group study showed that an 8-week Ma Wang Dui Dao Yin Shu intervention improved older adults' self-reported health and well-being.⁸³ Two studies demonstrated improvement in older adults' flexibility after Ba Duan Jin⁸⁴ or Yi Jin Jing interventions.⁷⁹ However, these positive results were not always consistent. For example, in a non-randomized study, it was reported that older adults who participated in a 30-min daily Qigong exercise program for 6 months experienced no change in mobility (Timed Up and Go test) or balance (Romberg test) compared to participants in a control group.⁸⁵

4.2.1.3. Balance and strength. A number of studies have shown that some types of Qigong exercises, such as Ba Duan Jin and Yi Jin Jing, consistently help older adults improve their strength and balance.^{79,80,84,86}

4.2.1.4. Cognitive function. In a non-randomized study, investigators found that a 6-month Yi Jin Jing intervention resulted in improvements in cognitive tasks among older adults, including mental arithmetic calculations and remembering numbers.⁸⁷

4.2.1.5. Cardiovascular fitness, cardiopulmonary function, and lung function. Both non-RCT and RCT studies showed that common Qigong exercises, such as Ba Duan Jin, Yi Jin Jing, or Wu Qin Xi, were effective in reducing blood pressure,^{78–80,84,86} improving lung function^{78,84,86,88} and improving cardiovascular function (i.e., improving blood flow and velocity, increasing blood volume and concentration, and enhancing myocardial contractile force).⁸⁹ One study that used a combined Yi Jin Jing and Wu Qin Xi exercise intervention showed that participants had reduced blood pressure, positive changes in cerebrovascular resistance, and improved cerebral blood flow and cardiac output.⁹⁰

4.2.1.6. Immune system. A single-group study showed that a 4-month Wu Qin Xi exercise intervention improved older adults' plasma antioxidant capacity.⁹¹ One RCT showed that 6 months of Wu Qin Xi practice resulted in a significant increase in natural killer cell activity in older adults.⁹² Two Yi Jin Jing RCTs also showed improvement in older adults' immunoglobulins and other immunological markers.^{93,94} An RCT study that used a non-specified Qigong exercise showed that older adults who participated in a 12-week Qigong practice had favorable alterations in natural killer cell number and activity.⁹⁵ Finally, 1 non-randomized study showed that, compared to those who did not exercise, older adults who participated in a 24-week Ba Duan Jin intervention significantly increased their circulation of red blood cells.⁹⁶

4.2.2. Secondary prevention

Only a few studies were reported on the benefits of Qigong exercises for secondary prevention in patients with chronic diseases.

4.2.2.1. Hypertension and hyperlipidemia. Three RCTs reported a significant reduction in blood pressure through Ba Duan Jin exercise interventions.^{97–99} In other studies, Ba Duan Jin exercises also helped to positively alter the lipid profile, including reductions in LDL-C, TG, and TC, and increases in HDL-C^{97,98} and serum nitric oxide concentration.⁹⁹ One study showed that Ba Duan Jin exercises lowered blood lipid and improved lipid metabolism among older adults with hyperlipidemia.¹⁰⁰ These results suggest that Ba Duan Jin exercises may have a cardiovascular protective effect in people with hypertension or hyperlipidemia.

4.2.2.2. Other chronic diseases. A few studies showed that Qigong exercises improved vascular endothelial function in older adults with type 2 diabetes¹⁰¹ and global cognitive function and activities of daily living in patients with type 2 diabetes complicated by mild cognitive impairment.¹⁰² One RCT showed that patients with coronary artery bypass grafting who underwent a 23-week Ba Duan Jin exercise intervention reported significant improvements in their physical limitations, treatment satisfaction, and disease symptoms.¹⁰³

4.2.2.3. BMD. In a comparative RCT, the researchers evaluated the effects of 3 types of Qigong exercises (Ba Duan Jin, Yi Jin Jing, and Wu Qin Xi) on BMD and bone metabolism in menopausal women.¹⁰⁴ The results indicated that after 12 months of training, women in all 3 groups improved their BMD (i.e., L2) and bone metabolism (e.g., alkaline phosphatase).

4.3. Yangko dance

4.3.1. Primary prevention

As a traditional dance activity, the practice of Yangko has been shown to have multiple health benefits for older adults.

4.3.1.1. Physical and mental health. One survey study of community-dwelling older adults showed that, compared to non-exercisers, Yangko exercisers tended to report higher levels of self-esteem and life satisfaction, and fewer negative mood states.¹⁰⁵ One RCT showed that a 6-month Fan Dance exercise intervention (an exercise that mingles dance, Wushu, and a hand-held fan) significantly improved older adults' physical and mental health. These benefits were shown to be stronger for Fan Dance participants than for individuals who participated in either Tai Ji Quan or brisk walking exercises.^{106,107}

4.3.1.2. Strength and balance. Using a single-group study design, investigators showed that a 24-week intervention of Yangko dance resulted in significant improvement in tests related to simple reaction time and single-leg standing with eyes closed¹⁰⁷ but failed to show a positive change in grip strength. However, an RCT involving a 24-week Fan Dance intervention for older adults did show an improvement in grip strength along with improvements in flexibility and balance.¹⁰⁸

4.3.1.3. Lung function. One study showed improved lung capacity among older women after a 24-week Yangko intervention.¹⁰⁷

4.3.2. Secondary prevention

Yangko exercise has been shown to reduce weight, body fat percentage, and body mass index among obese women¹⁰⁹ and has improved lipid profiles in people with type 2 diabetes¹¹⁰ and balance in postmenopausal women.¹¹¹ In a study of a special type of dance called “drum dance”, researchers showed that older adults with type 2 diabetes who participated in a 12-week drum dance intervention had favorable changes in their blood lipid profiles, including glucose, cholesterol, and LDL-C.¹¹²

4.4. Other exercise activities

Of the 6 studies identified in the “other” category, 5 of them evaluated diabolo, a type of Chinese Yo-Yo exercise. Two of these studies showed that, for older retirees, a 48-week training intervention resulted in an increase in HDL-C¹¹³ and a reduction in LDL-C and TG.^{113,114} In another study, a 48-week diabolo training regimen showed a positive effect in improving quality of sleep¹¹⁵ and antioxidant capacity.¹¹⁶ Finally, an RCT showed that, compared to those in the control group, older adults who participated in a 6-month diabolo training program showed significant improvements in balance, grip strength, and lung capacity.¹¹⁷

In an RCT study, investigators evaluated the long-term effects of a shuttlecock kicking exercise intervention on BMD and bone metabolism among postmenopausal women.¹¹⁸ The results showed that those who participated in a 12-month intervention enjoyed greater beneficial effects than those who either did regular exercises for 6 months or did not exercise at all (control). For those in the 12-month intervention, a significant improvement in BMD at the femoral neck and an increase in the level of serum osteocalcin were observed.

5. Discussion

5.1. Summary of evidence

A significant number of studies conducted in China have evaluated the health benefits of traditional Chinese PAs. The review of the evidence derived from observational studies, uncontrolled studies, and RCTs suggests that older Chinese adults can gain significant health benefits, including physical, psychological, physiological, biological, and cognitive, from participating in Tai Ji Quan and Qigong exercise interventions. Clinically, many of these activities have shown potential therapeutic value for reducing the impact of chronic disease. However, the evidence is less compelling for other popular traditional activities, such as Yangko, diabolo, or shuttlecock.

Although the number of studies on traditional Chinese PAs has increased over the past 2 decades, very few of them have had well-articulated study purposes. RCTs focusing on these activities rarely have sound research designs or rigorous methodologies.¹¹⁹ Many conceptual and methodological issues are evident in the published studies as they relate to both primary and secondary prevention, ranging from the lack of a conceptual theoretical framework to a weakly established therapeutic basis for demonstrating multiple health outcomes; from weaknesses in design, randomization, and outcome assessment to poorly executed statistical analyses.

Despite the many conceptual and methodological issues that exist in the empirical studies reviewed in this article, the findings are generally congruent with those reported from other regions or countries.^{8,9,11,12,14,15} In fact, information on many of the health benefits identified in this review, including those in the areas of hyperlipidemia, lung function, immune systems, and BMD, has not been widely disseminated to the international research community or public health systems because the studies were not published in English-language journals. Therefore, this review fills a knowledge gap by updating and disseminating new knowledge about the many health benefits derived from traditional Chinese PAs.

5.2. Practical implications

In China, the activities reviewed in this article are traditionally performed in outdoor settings and have no special equipment or space requirements. They are also essentially cost-free. Furthermore, they are community-based and can be easily organized at either the community or neighborhood level. From a disease prevention perspective, however, these activities are most attractive because they can be implemented on a large scale at the population level. Disseminating these activities to local community-dwelling older adults can have a far-reaching public health implication because they address the needs of an increasingly large aging population that has expanding health-care costs.¹²⁰ From a clinical perspective, results from some of the secondary prevention studies suggest that activities such as Tai Ji Quan and Qigong have promising therapeutic value in addressing some of the important chronic disease conditions common among older Chinese adults, including stroke, malignant neoplasms, heart disease, COPD, and diabetes.²

Despite the public health potential of these traditional PAs, the extent to which they can be used as a frontline strategy to prevent chronic diseases, improve health outcomes, reduce health risks, and limit premature death remains to be determined. Similarly, it is unclear how effective these activities are in the secondary prevention of chronic diseases and in reducing the frequency of premature death among older Chinese adults with chronic diseases. Unfortunately, these limitations hinder the development of prevention guidelines in clinical practice and health initiatives aimed at promoting traditional PAs in an effort to ameliorate the effects of chronic diseases in older Chinese populations.^{2,3}

5.3. Limitations and future research

There are a number of significant limitations in the study of traditional Chinese PAs in older adult populations. First and foremost, the studies we have reviewed in this article are limited in scope, representation, and generalizability.

Our review shows that the focus of most Chinese research is on activities such as Tai Ji Quan and Qigong, the most popular activities currently being practiced in China. However, very little is known about the types and levels of other traditional Chinese PAs being practiced in the general community. For example, with more than 900 types of activities in existence,⁴ research efforts have focused mostly on mainstream activities

rather than exploring and evaluating the many other types of traditional activities often practiced by older adults living in rural or underdeveloped regions in China. Similarly, there are about 50 styles of Quan exercises in Wushu,⁵ a significant number of which have not been studied in relation to their health benefits.

Studies of traditional PAs have rarely involved older adults from different minority ethnic groups. In fact, little is known about facilitating factors and barriers that influence the increasingly diverse older Chinese population's participation in regular PA. There has been little exploration of why and how traditional activities, either sports- or fitness-oriented, improve health outcomes; and there is a dearth of vigorously designed RCT studies addressing important non-communicable (chronic) diseases that the aging population in China faces, including stroke, cardiovascular disease, cancers, and diabetes.²

Overall, the studies conducted to date have been preliminary and descriptive in nature and have lacked scientific rigor in their designs and methodologies. Observational and uncontrolled experimental studies using conveniently recruited, often non-representative and underpowered samples are the most common type of research design paradigms used. Most studies do not use any control strategies in the design of the study to minimize confounding or analytically adjust for confounding in the analysis. Collectively these weaknesses raise questions regarding both the representativeness of the study samples and generalizability of study results presented.

In light of these substantive and methodological limitations, the following research related to older adult populations is recommended:

- (1) Large-scale population-based epidemiological studies with long-term prospective follow-ups should be conducted. These studies should document and track the prevalence and patterns of various types of traditional Chinese PAs among older Chinese adults from different ethnic minorities over time.
- (2) Many activities (e.g., Tai Ji Quan) have been promoted as a life-long practice. Epidemiological studies are needed to understand the extent to which long-term participation is associated with reductions in the risk of death from any cause and from diseases such as cardiovascular illnesses, cancer, and diabetes.
- (3) Studies should be conducted that aim at uncovering and understanding the theoretical underpinnings of traditional activities so that appropriately tailored interventions for older adults can be developed.
- (4) Primary and secondary prevention interventions should be developed to systematically document the impact of each traditional Chinese activity on the most prevalent chronic diseases (e.g., stroke, cancer, hypertension, cognitive function, diabetes). Interventions should also focus on musculoskeletal fitness outcomes (e.g., strength, balance, flexibility, mobility, cardiac output, body composition, and metabolism) across the general population and sub-populations (e.g., ethnic groups, old-oldest age cohorts, and "empty nest" older adults).

- (5) Studies should be conducted to help us understand how certain activities such as Tai Ji Quan, Qigong, or Yangko dance can be modified or adapted to individuals with different mental and physical capacities.
- (6) Studies should be encouraged that promote an understanding of social factors (community bonding, participation in social activities) and built environmental factors (community accessibility, walkability, safety, land use patterns, rural vs. urban residence settings) that facilitate or impede broad participation in traditional PAs.
- (7) Studies should be designed that use the RCT gold standard to ensure both internal and external validity. Sample sizes should be sufficiently powered to reject a false null hypothesis. Adequate exercise dosage and follow-ups should also be included to allow inferences to be drawn about proper exercise intensity, frequency, and duration.
- (8) The biological, physiological, psychological, and biomechanical mechanisms of activities should be evaluated to determine which of them are responsible for improvements in health outcomes or reductions in the risks associated with chronic diseases.

5.4. Strengths and limitations of this study

A major strength of this review is that it is the first to provide a comprehensive review and synthesis of research studies conducted in the Mainland of China that focus on traditional Chinese PAs among older adults. Although the review was thorough in identifying pertinent studies, a significant weakness is that it did not include a formal quality evaluation of the studies reviewed. Therefore, many methodological issues such as participant selection bias, measurement bias, blinding, and controlling for confounding variables were not addressed. As a result of this inherent limitation, caution needs to be exercised when interpreting the summarized results presented. Three additional weaknesses are that (1) the studies included in the review were published in Chinese, which may make them subject to language bias, (2) electronic databases were used to search for articles, which may have led to the unintentional omission of relevant “gray” literature in some instances, and (3) only 2 major electronic databases were used in the search for articles.

6. Conclusion

In this systematic review, a positive association between some common types of traditional Chinese PAs and health benefits was noted for healthy older adults or those with chronic diseases. Evidence on other types of activities was less clear due to the limited number of studies conducted. With the anticipated increase in the number of older Chinese adults and the resulting burden of chronic diseases, there is an urgent need for the development of evidence-based prevention interventions and for epidemiological research that analyzes and evaluates the benefits that older adult populations gain from participating in various traditional PAs.

Acknowledgment

The work presented in this article was supported by a grant from the General Administration of Sport of China (No. 2015B079). The authors thank Dr. Fuzhong Li for his help with the search strategy, data synthesis, and helpful advice and constructive comments during the various stages of writing of this manuscript.

Authors' contributions

YG drafted the literature review; HS helped to collect, organize, and analyze data; DY and PQ participated in the study design and made comments to the manuscript. All authors have read and approved the final version of the manuscript, and agree with the order of presentation of the authors.

Competing interests

None of the authors declare competing financial interests.

References

1. General Administration of Sport of China, China Sports Museum. *Traditional sports annals of the Chinese nationalities*. Nanning: Guangxi People's Publishing House; 1990. [in Chinese].
2. World Health Organization. China country assessment report on ageing and health. Available at: http://apps.who.int/iris/bitstream/10665/194271/1/9789241509312_eng.pdf; 2015 [accessed 24.02.2016].
3. The World Bank. *Toward a healthy and harmonious life in China: stemming the rising tide of non-communicable diseases*. Washington, DC: World Bank. Available at: http://www.worldbank.org/content/dam/Worldbank/document/NCD_report_en.pdf; 2011 [accessed 24.02.2016].
4. Qiu P. *Concepts of traditional Chinese sports*. Beijing: China Higher Education Press; 2008. [in Chinese].
5. Committee of Chinese Wushu Encyclopedia. *Chinese Wushu encyclopedia*. Beijing: Encyclopedia of China Publishing House; 1998. [in Chinese].
6. Martial Arts Institute. *A history of Chinese Wushu*. Beijing: People's Sports Publishing House of China. 1996. [in Chinese].
7. Guo Y, Qiu P, Liu T. Tai Ji Quan: an overview of its history, health benefits, and culture value. *J Sport Health Sci* 2014;**3**:3–8.
8. Chang YK, Nien YH, Chen G, Yan J. Tai Ji Quan, the brain, and cognition in older adults. *J Sport Health Sci* 2014;**3**:36–42.
9. Jahnke R, Larkey L, Rogers C, Etnier J, Lin F. A comprehensive review of health benefits of Qigong and Tai Chi. *Am J Health Promot* 2010;**24**:e1–25.
10. Mei L, Chen Q, Ge L, Zheng G, Chen J. Systematic review of Chinese traditional exercise Baduanjin modulating the blood lipid metabolism. *Evid Based Complement Alternat Med* 2012;**2012**:282131. doi:10.1155/2012/282131
11. Rogers C, Larkey LK, Keller C. A review of clinical trials of Tai Chi and Qigong in older adults. *West J Nurs Res* 2009;**31**:245–79.
12. Taylor-Piliae RE. Tai Ji Quan as an exercise to prevent and manage cardiovascular disease: a review. *J Sport Health Sci* 2014;**3**:43–51.
13. Wang XQ, Pi YL, Chen PJ, Liu Y, Wang R, Li X, et al. Traditional Chinese exercise for cardiovascular disease: systematic review and meta-analysis of randomized controlled trials. *J Am Heart Assoc* 2016;**5**:e002562. doi:10.1161/JAHA.115.002562
14. Wayne PM, Kiel DP, Krebs DE, Davis RB, Savetsky-German J, Connelly M, et al. The effects of Tai Chi on bone mineral density in postmenopausal women: a systematic review. *Arch Phys Med Rehabil* 2007;**88**:673–80.
15. Wayne PM, Walsh JN, Taylor-Piliae RE, Wells RE, Papp KV, Donovan NJ, et al. The impact of Tai Chi on cognitive performance in older adults: systematic review and meta-analysis. *J Am Geriatr Soc* 2014;**62**:25–39.

16. Xiong X, Wang P, Li S, Zhang Y, Li X. Effect of Baduanjin exercise for hypertension: a systematic review and meta-analysis of randomized controlled trials. *Maturitas* 2015;**80**:370–8.
17. Li FG, Li SF. Scientific research progress of Taijiquan since 30-year reform and opening up in China. *Chin Sport Sci Technol* 2010;**46**:126–33. [in Chinese].
18. Li LC, Chen LY, Hu YX. Research on bodybuilding and disease prevention mechanism of shadowboxing on aged people. *J Sport Adults Educ* 2005;**21**:39–41. [in Chinese].
19. Liang DM, Tang WQ, Luo C, Zhang MQ. An overview of researches on Taijiquan exercising promoting the elderly's cognitive function. *J Phys Educ* 2014;**21**:62–5. [in Chinese].
20. Yuan JB, Li Y. Current state of and future expectation for researches on the effects of Taijichuan on the fitness of middle-aged and elderly people. *J Phys Educ* 2010;**17**:99–103. [in Chinese].
21. Xiao R, Liu MX, He YZ. Taijiquan in Wudang and health preservation of senior citizens. *Liaoning Sport Sci Technol* 2006;**28**:76–7. [in Chinese].
22. Chen M, He M, Min X, Pan A, Zhang X, Yao P, et al. Different physical activity subtypes and risk of metabolic syndrome in middle-aged and older Chinese people. *PLoS One* 2012;**8**:e53258. doi:10.1371/journal.pone.0053258
23. Xin Z. Research on the historical development of Baduanjin of health Qigong and its choice of value realization path. *J Shenyang Sport Univ* 2015;**4**:135–40. [in Chinese].
24. Liu CJ, Liu G. About the effect of the regular tai chi exercise to the blood lipid, leptin levels of bone mineral density of retired intellectual women. *Liaoning Sport Sci Technol* 2014;**36**:55–8. [in Chinese].
25. Liu TM, Zhang Y. Study on effects of taichichuan on lipoprotein cholesterol and low-density lipoprotein cholesterol in older adults. *Mod Rehabil* 2001;**5**:117–8. [in Chinese].
26. Zhang XY. Influence of Taijiquan exercise on health condition of elderly people. *Bull Sport Sci Technol* 2009;**17**:86–7. [in Chinese].
27. Li CW, Zeng Y, Peng FL. Effect of Taijiquan on endothelial diastolic function in the elderly. *J Clin Rehabil Tissue Eng Res* 2007;**27**:5414–6. [in Chinese].
28. Mao Y, Ma LJ, Lv YA, Han XY. The influence of Taijiquan and comprehensive exercises on blood lipid metabolism of senile women. *Chin J Woman Child Health Res* 2007;**18**:374–6. [in Chinese].
29. Li G, Fang Y, Zhang Y, Duan G. Effect of Tai Chi intervention on physical and mental health of middle-aged and elderly population. *J Nurs Sci* 2010;**25**:5–7. [in Chinese].
30. Zhu J. Research on the influence of Taijiquan on senior citizen's mental health. *J Hubei Sports Sci* 2007;**26**:354–7. [in Chinese].
31. Li G, Zhang Y, Duan G. Investigation of the effect of Taijiquan on the mood state of the elderly. *Chin J Geriatr Care* 2009;**7**:19–21. [in Chinese].
32. Wang J, Song Q. An investigation and analysis of the health effects of Taijiquan exercise to the elderly in Henan province. *Chin Health Stand Manag* 2015;**18**:21–2. [in Chinese].
33. Sun J, Wang L, Li W, An L. Influence of Tai Chi exercise on physical and mental function of the elderly in community. *Chin Nurs Res* 2013;**27**:3990–1. [in Chinese].
34. Yan TB, Xie RH, Guo YH, Jin DM, Cao YL. Comparison of the effects of shadowboxing on equilibrium function of healthy elderly women. *Chin J Clin Rehabil* 2005;**9**:159–61. [in Chinese].
35. Sun J, Kanagawa K, Sasaki J, Ooki S, Xu H, Wang L. Tai chi improves cognitive and physical function in the elderly: a randomized controlled trial. *J Phys Ther Sci* 2015;**27**:1467–71.
36. Luo XH, Chen KM, Tan XM. Study of the effect of health of aged female for the shadowboxing—research of different exercise periods on mental health and life quality. *J Guangzhou Sport Univ* 2008;**28**:68–71. [in Chinese].
37. Li F, Han S, Zhang C. Influence of Tai Chi on emotion, sleeping health of elderly people. *J Qufu Norm Univ* 2009;**35**:121–3. [in Chinese].
38. Chen XB. The effects of Tai Chi and fitness walking on the static balance ability in women over the age of 70. *J Bengbu Med Coll* 2015;**40**:773–80. [in Chinese].
39. Ni HY, Zheng XX, Wang HZ, Chen XC. Taijiquan: health promotion on physical fitness of elderly women. *Chin Sport Sci Technol* 2013;**49**:99–102. [in Chinese].
40. Ma LJ, Ren QJ, Zhang X, Wang QJ, He R. Effects of taijiquan exercise on balance ability of senile women. *Chin J Woman Child Health Res* 2007;**18**:484–5. [in Chinese].
41. Yu D, Wang S, Yang H, Ban Y. Effects of 24-week Tai Chi exercise on the static postural balance of the elderly persons. *Clin J Sports Med* 2011;**30**:1115–9. [in Chinese].
42. Liu C, Yan F, Li Y, Du J, Zhao H. Comparison research on improving aged women's static balance by Taijiquan and vigorous walk. *Chin J Rehabil Med* 2009;**24**:445–7. [in Chinese].
43. Qiu Y, Cui Y. A study on mechanism of Taijiquan exercises in senile people to prevent falls. *Chin Nurs Res* 2008;**22**:490–1. [in Chinese].
44. Song QH, Zhang QH, Xu RM, Ma M, Zhao XP, Shen GQ, et al. Effect of Tai-chi exercise on lower limb muscle strength, bone mineral density and balance function of elderly women. *Int J Clin Exp Med* 2014;**7**:1569–76.
45. Liu J, Wang XQ, Zheng JJ, Pan YJ, Hua YH, Zhao SM, et al. Effects of Tai Chi versus proprioception exercise program on neuromuscular function of the ankle in elderly people: a randomized controlled trial. *Evid Based Complement Alternat Med* 2012;**265486**:doi:10.1155/2012/265486
46. Li J. Taijiquan exercise can improve the cardiovascular function in senile people and resistant the senilism. *J High Alt Med Prac Geriatr* 2005;**15**:20–2. [in Chinese].
47. Sha KH, Liu TG, Liu KK, Luan SR. Investigation of the effect of Taijiquan exercise on the heart of the elderly. *Pract Geriatr Med* 2006;**20**:192–4. [in Chinese].
48. Ren LJ. Influences of Taijiquan on the health care of elderly people. *Chin J Clin Rehabil* 2006;**47**:25–8. [in Chinese].
49. Pan Q. Research on physique improvement of Taijiquan on the elderly. *Clin J Chin Med* 2014;**6**:142–4. [in Chinese].
50. Wang XJ. Influence of Taijiquan on blood viscosity in the elderly. *Shandong Sports Sci Technol* 2003;**25**:34–7. [in Chinese].
51. Zhao XM, Wu GS, Li GL. Effects of Tai Chi exercise on somatic function of middle-aged females. *Clin J Rehabil Theory Pract* 2006;**12**:167–8. [in Chinese].
52. Yang ZH, Zhou XW. Research on the effects of Chenshi Taichichuan Gongfa's on lung and immunity function of middle-aged and aged people. *J Beijing Sport Univ* 2005;**28**:1212–23. [in Chinese].
53. Liu Q, Zhao Y, Yu D. Effect of Taijiquan practice on the dendritic cell subsets in peripheral blood. *Chin J Sports Med* 2013;**32**:596–600. [in Chinese].
54. Yang EH, Wei Y. Effects of Tai-chi on Th1/Th2 type cytokine mRNA expression in white blood cell. *J Shandong Inst Phys Educ Sports* 2013;**29**:55–78. [in Chinese].
55. Zheng CF. On the influences of shadowboxing exercise to immune system on middle-aged people. *Liaoning Sport Sci Technol* 2012;**34**:46–58. [in Chinese].
56. Liu J, Chen P, Wang R, Yuan Y, Li C. Effect of Tai Chi exercise on immune function in middle-aged and elderly women. *J Sports Med Doping Stud* 2012;**2**:119. doi:10.4172/2161-0673.1000119
57. Ke J, Ma W, Zhong M, Ji L, Lin J, Zheng W. Global gene expression in human skeletal muscle of the elderly person influenced by Tai Chi Chuan training. *Chin J Rehabil Med* 2007;**22**:306–22. [in Chinese].
58. Tang QH. Effects of traditional sports on physical function and fitness of elder intellectuals. *Chin Sport Sci Technol* 2006;**42**:108–11. [in Chinese].
59. Pan XG, Cheng PL. Effects of Tai Ji Quan on endothelial function in essential hypertension patients with high frequency ultrasound. *Zhejiang Sport Sci* 2014;**36**:101–10. [in Chinese].
60. Xie HJ, Bai CQ. Gaseous signal molecular mechanism of Taijiquan's intervention in aged essential hypertension. *J Wuhan Inst Phys Educ* 2014;**48**:51–63. [in Chinese].
61. Wang XJ, Li YJ, Liu NN. Empirical study of Taijiquan interventions on the prevention and cure of hypertension. *J Beijing Sport Univ* 2011;**34**:76–7. [in Chinese].

62. Xie YL, Cheng JY, Zhou ZH, Wang JY. Effect of Taijiquan exercise on hyperlipidemia in middle aged and older people. *Chin J Gen Pract* 2011;**9**:245–6. [in Chinese].
63. Song Q, Yuan Y, Jiao C, Zhu X. Curative effect of Tai Chi exercise in combination with auricular plaster therapy on improving obesity patient with secondary hyperlipidemia. *Int J Clin Exp Med* 2015;**8**:21386–92. [in Chinese].
64. Yao CD, Li F, Ma YB. Effects of shadow boxing on rehabilitation in patients with chronic heart failure. *Chin J Cardiovasc Rehabil* 2010;**19**:364–6. [in Chinese].
65. Du S, Xing B, Wang C, Ding L, Yang F, Liu Z, et al. The effects of Taijiquan practice on the BODE and SGRQ patients. *Chin J Sports Med* 2013;**32**:403–19. [in Chinese].
66. Yao YP. Effect of tai chi chuan on chronic obstructive pulmonary disease. *Clin J Rehabil Theory Pract* 2004;**10**:439–40. [in Chinese].
67. Li Q, Fang W, Liu C. The effect of taijiquan combined with respiratory exercise training on rehabilitation of patients with stable chronic obstructive pulmonary disease (COPD). *J Rehabil Med* 2012;**27**:825–8. [in Chinese].
68. Sa P. Effect of Taijiquan exercise on the nitrogen monoxide and blood lipid of elder patients with atherosclerosis. *J Clin Rehabil Tissue Eng Res* 2007;**11**:6832–4. [in Chinese].
69. Shi ZM, Wen HP, Liu FR, Yao CX. The effects of Tai Chi on the renal and cardiac functions of patients with chronic kidney and cardiovascular diseases. *J Phys Ther Sci* 2014;**26**:1733–6.
70. Wang H, Yu B, Chen W, Lu Y, Yu D. Simplified Tai Chi resistance training versus traditional Tai Chi in slowing bone loss in postmenopausal women. *Evid Based Complement Alternat Med* 2015;**2015**:379451. doi:10.1155/2015/379451
71. Wang H, Yu B, Lu Y. Effects of different kinds of Taijiquan on choice stepping reaction time in postmenopausal women. *Chin J Rehabil Med* 2015;**30**:1135–9. [in Chinese].
72. Yu D, Wang H, Xie Y, Chen W, Yu B, Lu Y. Tai Chi bone-building exercise effect on bone mineral density of postmenopausal women. *J Shanghai Univ Sport* 2014;**38**:101–4. [in Chinese].
73. Song H. Effects of Taijiquan exercise on bone density and bone metabolism of primary osteoporosis sufferers. *J Phys Educ* 2008;**15**:106–8. [in Chinese].
74. Wang J, Cao Y. Effect of Tai Chi exercise on plasma neuropeptide Y of old obese type 2 diabetes mellitus. *J Sports Sci* 2003;**24**:67–72. [in Chinese].
75. Liu J, Chen P, Wang R, Yuan Y, Wang X, Li C. Effect of Tai Chi on mononuclear cell functions in patients with non-small cell lung cancer. *BMC Complement Altern Med* 2015;**15**:1–8.
76. Song QH, Shen GQ, Xu RM, Zhang QH, Ma M, Guo YH, et al. Effect of Tai Chi exercise on the physical and mental health of the elder patients suffered from anxiety disorder. *Int J Physiol Pathophysiol Pharmacol* 2014;**6**:55–60.
77. Zhou Y, Liang L, Hong L, Li J. About the convalescent influence of 24-pattern shadowboxing to the patients with chronic functional constipation. *Liaoning Sport Sci Technol* 2015;**37**:52–8. [in Chinese].
78. Ru L, Zhang B. Study of the influence of the fitness Qigong-wuqinxu for the blood lipid and physiology of the elder. *J Gansu Lianhe Univ* 2013;**27**:75–8. [in Chinese].
79. Su YF, Liu XD. Effect of fitness Qigong, Yijinjing on physical function and blood lipid of the elder people. *J Nanjing Inst Phys Educ* 2012;**11**:27–9. [in Chinese].
80. Sun G, Chao F, Wang AL. Influence of fitness Qigong (Baduanjin) on blood lipid and physiological function of the elder male people. *Chin Sport Sci Technol* 2008;**44**:81–4. [in Chinese].
81. Liu XD, Jin HZ. Effect of fitness Qigong (Yijinjing) on blood lipid and free radical metabolism of the elderly women. *Chin J Tradit Complement Med Pharm* 2010;**25**:1480–2. [in Chinese].
82. Zhang CH, Ma HY. The influence of four fitness Qigongs' exercise on emotional health of senior citizens. *Chin J Clin Psychol* 2011;**19**:407–10. [in Chinese].
83. Liu XP, Wang Z, Wang ZY. Experimental study of mood improvement of middle aged women for health Qigong Mawangdui guided exercise. *Chin Sport Sci Technol* 2010;**46**:118–21. [in Chinese].
84. Tang QH, Xie XR. Research of the physical function and fitness of elder intellectuals by health Qigong Baduanjin. *J Phys Educ Inst Shanxi Norm Univ* 2008;**23**:142–4. [in Chinese].
85. Lv YL. Research on impacts of Qigong Baduanjin on balance ability of old people. *J Luoyang Inst Sci Technol* 2013;**28**:91–6. [in Chinese].
86. Hu G, Gu KO. Effects of Qigong eight section brocade exercise on quality of life of the elderly in distract. *Med Soc* 2014;**27**:74–6. [in Chinese].
87. Zhang W, Zhong ZB, Wu QH, Chen XF, Wang SY, Zhang Y. A research on health Qigong Yi Jin Jing for slowing down intelligence decline of the aged. *Chin J Behav Med Sci* 2006;**15**:827–8. [in Chinese].
88. Xue WS. The effect of health Qigong Ba Duan Jin on cardiopulmonary function of aged people. *J Bohai Univ* 2013;**34**:431–4. [in Chinese].
89. Bian B, Pan H, Feng Y. Impacts of Qigong-Wuqinxu exercise on cardiovascular function of middle aged and elder person. *J Guangzhou Univ Tradit Chin Med* 2013;**30**:26–9. [in Chinese].
90. Zhang Y, Li C, Zhou L, He Y, Zhang G, Bai H. Research of health care Qigong on cardiac and cerebral vessel of middle and elder people. *Chin Sport Sci Technol* 2006;**2**:98–101. [in Chinese].
91. Duan L. Correlational research on the effect of Wuqinxu exercise on antioxidant capacity and intestine lactobacillus of old people. *Chin Sport Sci Technol* 2012;**2**:112–6. [in Chinese].
92. Yu D, Wu J. Effects of exercising building up Qigong-Wuqinxu on middle aged and old peoples NK cell activity. *J Shanghai Univ Sport* 2008;**32**:56–8. [in Chinese].
93. Feng Y, Zhong G, Qui W, Wei J, Zhao Z, Jing C, et al. The effect of fitness Qigong Yijinjing on immunity function of the elder. *J Jilin Inst Phys Educ* 2013;**29**:68–70. [in Chinese].
94. Miao FS, Li Y, Liu XY. Research on effects of fitness qigong yijinjing on serum immunoglobulin (Ig) and complement activities. *J Liaoning Norm Univ* 2009;**32**:258–60. [in Chinese].
95. Wang F, Yang Y, Joon Y. Effects of aerobic exercise and qigong on immune function of elderly females. *J Wuhan Inst Phys Educ* 2006;**7**:47–50. [in Chinese].
96. Jiao RY, Zhong GL, Pan HS, Feng YC, Xu JY, Zhao ZM, et al. The influence of fitness Qigong Baduanjin on erythrocyte function of the elderly. *Fujian Sports Sci Technol* 2013;**32**:25–7. [in Chinese].
97. Pan HS, Feng YC. Clinical observation of rehabilitation therapy with health Qigong Ba Duan Jin on grade 1 hypertension of old patients. *J Nanjing Inst Phys Educ* 2010;**9**:4–6. [in Chinese].
98. Yang M, Huang LS, Yang XD, Zhuang JY, Lu YM. Research on the intervention effect on people with borderline hypotension in community by Baduanjin and health education. *Chin Manipul Rehabil Med* 2013;**4**:130–3. [in Chinese].
99. Zheng L, Chen QY, Chen F, Mei LJ, Zheng JX. The influence of ba duan jin exercise on vascular endothelium function in old patients with hypertension grade 1. *Chin J Rehabil Med* 2014;**29**:223–7. [in Chinese].
100. Miao FS, Liu XY, Li Y, Wang XC. Effect of fitness Qigong Baduanjin on plasma lipid and lipoprotein metabolism of patients with hyperlipidemia. *J Shandong Inst Phys Educ Sports* 2009;**25**:46–8. [in Chinese].
101. Li XH. Effect of Qigong, Baduanjin on endothelium-dependent arterial dilation of Type 2 diabetes. *J Shenyang Sport Univ* 2009;**28**:50–5. [in Chinese].
102. Zhu H, Zhang N, Ji C. Influence of Baduanjin on mild cognitive impairment in elderly diabetic patients. *Chin J Pract Nurs* 2009;**31**:1202–4. [in Chinese].
103. Lin XL, Chen JW, Zhang GQ, Zhao JY, Tang C. Effects of eight sections brocade Ba Duan Jin on quality of life for patients after coronary artery bypass grafting. *J Nurs* 2012;**19**:63–7. [in Chinese].
104. Miao F, Wang M. Research of fitness Qigong on menopause female's bone mineral density and bone metabolism. *J Jilin Inst Phys Educ* 2012;**28**:107–9. [in Chinese].
105. Xu T, Mao Z. Relationships between Chinese northeast Yangge exercise and self-esteem, life satisfaction, and mood states of senior citizens. *J Beijing Sport Univ* 2013;**10**:82–7. [in Chinese].
106. Luo D, Li L, Li YH, Zhou T, Tao ZH, Xie W, et al. The impact of different sports on the physical and mental health of elderly. *Mod Nurse* 2012;**8**:1–4. [in Chinese].

107. Zhang TM, Tan YM. Research on functions of Yang-ge dance for aged women's keeping fit. *J Wuhan Inst Phys Educ* 2006;**40**:49–52. [in Chinese].
108. Chen ZQ. Effects of exercise on physical and mental health of the elderly in a community. *Chin Rural Health Serv Adm* 2015;**35**:1444–6. [in Chinese].
109. Li N, Lin Q. Effects of the fourth Yangko on the obesity older women body composition. *Shandong Sports Sci Technol* 2011;**33**:46–9. [in Chinese].
110. Teng YS, Liu LJ. Study the effect of Yangge on blood rheology and blood sugar of type II diabetes. *J Liaoning Norm Univ* 2008;**31**:243–5. [in Chinese].
111. Feng N, Han X, Zhang Y. Effects of Yangge dancing on static balance ability of postmenopausal women. *J Shenyang Sport Univ* 2014;**6**:99–102. [in Chinese].
112. Fei JM, Liu ZM. Effect of “Drum Dance” on elderly patients with type 2 diabetes. *J Bengbu Med* 2015;**40**:723–6. [in Chinese].
113. Chen C. Effects of “diabolo” exercise on senior citizens HDL function. *J Wuhan Inst Phys Educ* 2008;**8**:67–70. [in Chinese].
114. Li J. The effects of “the diabolo” exercise on older people's LDL function. *Fujian Sports Sci Technol* 2006;**25**:25–7. [in Chinese].
115. Li J. Influence of diabolo exercise on emotion, sleeping health of elder people. *Chin Sport Sci Technol* 2005;**41**:37–9. [in Chinese].
116. Li J. Effect of diabolo exercise on anti-aged ability of elder people. *Chin Sport Sci Technol* 2006;**42**:96–8. [in Chinese].
117. Gao XW, Wang XB. An analysis on the impact of diabolo to the physiques of middle-aged women. *Liaoning Sport Sci Technol* 2009;**31**:61–2. [in Chinese].
118. Wu D, Li S, Tang H. Effects of shuttlecock on postmenopausal women's bone mineral density and metabolism. *J Beijing Sport Univ* 2011;**7**:60–2. [in Chinese].
119. Li F. The public health benefits of Tai Ji Quan—addressing the unmet needs of aging populations in the 21st century. *J Sport Health Sci* 2016;**5**:304–7.
120. Wu X, Luo X. Healthy aging as the core concept of the medical and health services for the elderly. In: Wu YS, Dang JW, editors. *China report of the development on aging cause*. Beijing: Social Sciences Academic Press; 2013.p.94–116. [in Chinese].