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Review Article

The Effect of Tai Chi Exercise on Reduction the Risk of Falls in the Elderly: A Literature Review

Novya Ashlahatul Mar'ah[1] | Aprilina Sartika[2] | Eka Sindi Miftahul Jannah[3] | Neni Suryani[4] | Dheni Wahyudi[5] | Rodiah Pulungan[6] | Rhury Nia Permata[7] | Syamsul Anwar[8*]

[1]Department of nursing, Sekolah Tinggi Ilmu Keperawatan PPNI Jawa Barat, Bandung, West Java – Indonesia

[2]Departement of Nursing, Universitas Medika Suherman, Bekasi, Indonesia

[3]Departement of Nursing, Politeknik Hangtuah Jakarta, Jakarta, Indonesia

[4]Departement of Nursing, Politeknik Kesehatan Hermina, Jakarta, Indonesia

[5]Emergency Departement, Rumah Sakit Khusus Daerah Duren Sawit, Jakarta, Indonesia

[6]Public Health Center Rawasari, Jakarta, Indonesia

[7]Departement of Nursing, Universitas Muhammadiyah Jakarta, Jakarta, Indonesia

***contact**
syamsul_nisa@yahoo.com

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Abstract

The risk of falls in the elderly increases with age. Even though there are many complications that occur if the elderly fall, Tai Chi exercise is one of the best fall prevention exercises, compared to other exercise programs that focus on muscle strength.
Aims: This study aims to summarize studies on the effectiveness of Tai Chi Exercises to reduce falls in the elderly.
Methods: a literature review using three databases (Pubmed, Google Scholar, and Sciendirect) for previous studies published from 2017 to 2022. The CASP format PRISMA guidelines and the PICOT framework were used to assess study quality assist in article selection, and define criteria—research inclusion.
Results: A total of 5 articles from 65 studies were included in the review process. The results showed that Tai Chi exercise significantly reduced the risk and fear of falling in the elderly. The gentle and coordinated Tai Chi movements can increase the flexibility of the lower extremities. Conclusion: Tai Chi exercise can be ascertained as an activity for healthy elderly has many benefits, mainly to prevent the risk of falling.

Keywords
Tai Chi, Risk of Falls, Older

INTRODUCTION

The Elderly is someone who experiences physical changes. These material changes cause a decrease in dynamic balance which eventually increases falls and threatens their health(1). The prevalence of the risk of falls in the elderly increases with age, namely the elderly with age over 65 years, the risk of falling reaches 30%, and at the age of 80 years, it increases by 50% every year(2). Various complications that can occur in the elderly, including anxiety syndrome after a fall, both soft tissue injury or fractures, in the hospital, disability (decreased mobility), isolation,

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decreased functional status / decreased independence, increased use of health care facilities, increased costs health care and can even occur in patients who die (3)(4). Therefore, falls should not be repeated by knowing risk factors, assessing balance and gait, and managing/ overcoming situational factors(5).

Numerous causes contribute to falls, including intrinsic variables that cause gait disturbances, lower extremity muscular weakness, short steps, joint stiffness, inability to tread firmly, slow movement, and vision abnormalities. Extrinsic variables, on the other hand, such as slippery flooring and uneven distribution, tripping over things, unfastened wheelchairs, poor vision, and inadequate lighting, cause the elderly to slip or stumble, increasing their risk of falling. While certain risk variables, such as age and gender, cannot be altered, others can (6).

Exercise is one of the essential non-pharmacological interventions in preventing falls in the elderly (7). Although exercise is recommended to reduce the risk of falls in the elderly, it can lead to negative consequences and injury (4). It has been reported that tai chi exercises are practical for improving balance control and flexibility in older adults, suggesting a protective role against falls. The physical and cognitive coordination in Tai Chi exercises demonstrates the value of this exercise in fall prevention, compared to other exercise programs that focus on muscle strength. In addition, Tai Chi practice also increases the individual's awareness of his balance and can reduce the fear of falling (8).

Tai-Chi has a soft tempo, slow and coordinated movements. The exercise is especially appropriate for older adults because it involves minimal strain on the joints and cardiovascular system. Previous studies have shown that Tai-Chi can increase muscle strength in the lower extremities, and improve balance control, proprioception, and postural adaptation, thereby reducing the risk of falls in older adults. However, because aging is an individual process, exercises such as Tai-Chi must be adapted based on the health status and physical functioning of each individual (9)(10)(11). Tai Chi has been extensively studied by some randomized controlled trials (RCTs), which can vary with Tai Chi style, exercise dose, exercise duration, and follow-up time. So researchers are interested in conducting a review of articles related to the effectiveness of Tai chi on preventing the risk of falls in the elderly. This review aims to provide an overview of Tai Chi exercises that can be done by the elderly, along with their advantages and disadvantages.

METHODS

The type of research used is a literature review of previous research articles. In this study, a review of the article was conducted to determine the effectiveness of Tai Chi Exercises to reduce the risk of falling in the elderly. The literature search was carried out by analyzing keywords contained in the Pubmed, Google Scholar, and ScienceDirect databases. The three databases were chosen to consider that they are the largest databases in the health sector. Search articles in the database using the boolean operators "AND" and "OR," which are used to broaden or specify searches with the keywords "tai chi," "fall risk," and "older." The strategy for determining

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the inclusion and exclusion criteria used to search for articles uses the PICOT framework. Inclusion criteria in this literature review include: Experimental design, published articles from 2016 to 2021, English articles, Full text, research conducted on elderly patients, interventions carried out, namely Tai Chi exercise and, results-focused on reducing the risk of falls. The search for articles is carried out in January for one week. Assessment of the quality of each article is carried out using the format of the Critical Appraisal Skills Program (CASP) and PRISMA guidelines (Leite et al., 2019). We used the PRISMA guidelines for protocol review and study selection.

RESULTS

The process of selecting and eliminating articles is illustrated in the form of a PRISMA flowchart (Figure 1). Literature search resulted in studies through database searches identified by keywords. Of the 15,530 articles, the researchers issued 15,465 articles which were screened by title, leaving 65 articles. Of the total 65 articles, 60 of them were excluded based on the abstract and did not meet the inclusion criteria, leaving 5 articles that met all the inclusion criteria and were included in the analysis.

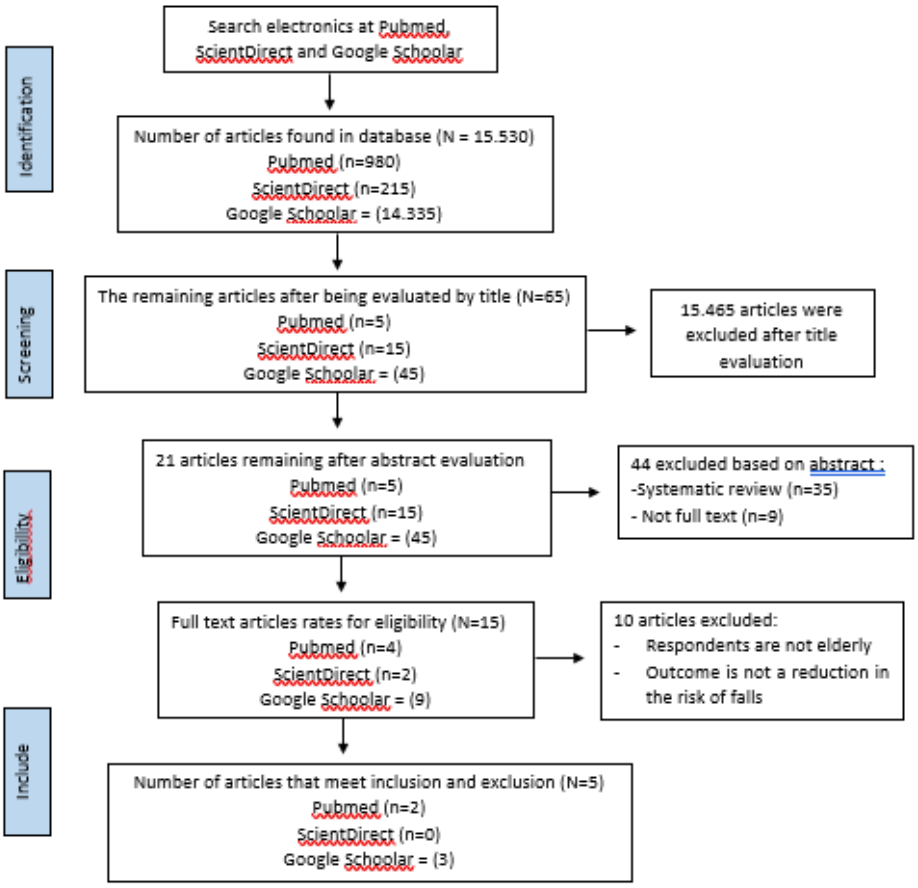

Figure 1.
PRISMA Flowchart Explaining the Process of Articles being reviewed and Selected

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Tabel 1. Articles Entering the Analysis Stage

Journal	Author	Title
1	A Mary P. Gallant, Meaghan Tartaglia, Susan Hardman, and Kara Burke (2017), USA	Using Tai Chi to Reduce Fall Risk Factors Among Older Adults: An Evaluation of a Community-Based Implementation
2.	Lida Hosseini, Elham Kargozar, Farshad Sharifi, Reza Negarandeh, Amir-Hossein Memari, Elham Navab (2018), Iran	Tai Chi Chuan can improve balance and reduce fear of falling in community dwelling older adults: a randomized control trial
3	Canan Birimoglu Okuyan PhD and Ebru Deveci MSc (2020), Turkey	The effectiveness of Tai Chi Chuan on fear of movement, prevention of falls, physical activity, and cognitive status in older adults with mild cognitive impairment: A randomized controlled trial
4	Somporn Sungkarat, PhD, Sirinun Boripuntakul, PhD, Nipon Chattipakorn, MD, PhD, Kanokwan Watcharasaksilp, MD, and Stephen R Lord, PhD (2016), Thailand	Effects of Tai Chi on Cognition and Fall Risk in Older Adults with Mild Cognitive Impairment: A Randomized Controlled Trial
5	Hamed Mortazavi, Mahbubeh Tabatabaeichehr, Ali Golestani, Mohammad Reza Armat, and Mohammad Reza Yousefi (2018), Iran	The Effect of Tai Chi Exercise on the Risk and Fear of Falling in Older Adults: a Randomized Clinical Trial

Tabel 2. Article Characteristics

Author (year), Place	Sample	Method	Instrument	Intervention	Result
A Mary P. Gallant, Meaghan Tartaglia, Susan Hardman, and Kara Burke (2017), USA	131 older adults	Experimental one group pretest posttest design	Self-report and functional performance assessments included demographics, health and fall history, the functional Reach test, the Activities Specific Balance Scale and the Timed Up and Go test, and	The respondents are separated into numerous classes, each containing 10-15 people. Warm-up exercises last 5 to 10 minutes, Tai Chi exercises last 35 minutes and cooling down exercises last 5 to 10 minutes with respite as needed. The eight Tai Chi motions should be learned twice a week on average, with the eight acts being practiced in order during each class consultation. This application runs for 12 weeks, with 1-hour classes scheduled every week. Participants were also instructed to practice at home for 45 minutes.	On average, the majority of female individuals were 73 years old. At baseline, 18% reported being fearful or extremely afraid of falling, and 18% had fallen within six months. At follow-up, Timed Up and Go ($p<0.001$), functional reach ($p<0.01$), and activities-specific balance Scale scores all improved significantly ($p<001$).

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Lida Hosseini, Elham Kargozar, Farshad Sharifi, Reza Negarandeh, Amir-Hossein Memari, Elham Navab (2018), Iran	Sixty older adults were randomly allocated into two groups.	A randomised controlled trial	Timed Up and Go (TUG) test, Tinetti test and Falls Efficacy Scale International	For eight weeks, twice a week, and for 55 minutes per session, participants in the intervention group practiced the Yang style of Tai Chi Chuan. Each session began with a 5-minute warm-up, followed by a 35-minute Tai Chi Chuan exercise and a 5-minute cool-down. The complete program was conducted in an outdoor venue at a community park by an excellent Tai Chi Chuan coach accompanying a researcher (LH). No intervention was given to the control group.	The study compares the intervention and control groups' TUG, Tinetti, and FES-I scores. There was no significant difference in TUG, Tinetti, or FES-1 values between the pretest and post-test readings in the control group. After the intervention period, participants in the intervention group significantly improved TUG, Tinetti (balance and total scores), and FES-1. Only Tinetti scores for the gait part were not significantly different between pre- and post-test in the intervention group.
Canan Birimoglu Okuyan PhD and | Ebru Deveci MSc (2020), Turkey	The interventi on group (n = 20) and control group (n = 22).	A randomized control trial wth pretest, posttesti, and control-group .	The Tinetti assessment tool (TAT), the Tampa scale of kinesiophobia (TSK), the physical activity scale for the elderly (PASE), and the falls behavioral (FaB) scale	After completing such forms, patients in the intervention group began performing TCC exercises with the researcher's assistance. As previously indicated, they completed the TCC exercise program twice a week on Wednesdays and Thursdays, consisting of like sessions and 35 and 40 minute periods.	Posttest scores indicated that scores on cognitive adaptations, being observant, and changes in level subscales of the fall behavioral scale improved considerably ($p<.01$) in older persons who participated in Tai Chi training within the intervention group.
Somporn Sungkarat, PhD, Sirinun Boripuntakul, PhD, Nipon Chattipakorn, MD, PhD, Kanokwan Watcharasaksilp, MD, and Stephen R Lord, PhD (2016), Thailand	66 older adults	Randomized controlled trial	Cognitive tests, including Logical Memory (LM) delayed recall, Block Design, Digit Span forward and backward, and Trail-Making Test Part B–A (TMT B–A), and fall risk index using the Physiological Profile Assessment (PPA)	Three weeks of Tai Chi in a center and twelve weeks at home (50 mins consistent with session, three times according to week)	After correcting baseline test performance, the Tai Chi group performed much better on the LM, Block design, and TMT B–A than the control group. Additionally, the Tai Chi group had a significantly higher composite PPA score and rankings for the following PPA parameters: knee extension energy, reaction time, postural sway, and lower limb proprioception.
Hamed Mortazavi, Mahbubeh Tabatabaeichehr, Ali Golestani, Mohammad Reza	A total of 60 male and female elderly	Randomized controlled trial	Berg's Balance Scale and Fall Efficacy Scale-International (FES-I)	The intervention group participated in a 30-session sports program (three sessions per week for ten weeks)	Age, gender, education, and body mass index have been matched between groups. The threat of

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Armat, and Mohammad Reza Yousefi (2018), Iran	were randomly divided into two groups		under the direction of a coach. The control group continued with their normal routines.	falling and fear of falling did not differ substantially between the two groups at baseline (P>0.05). The fear of falling rating varied substantially between the two groups at the end of the fourth, eighth, and final weeks of the workout period (P<0.05), and it dropped in the intervention group, although the risk of falling decreased after eight and ten weeks in the intervention group (P<0.001).

DISCUSSION

Almost all Tai Chi therapies featured an active instructor, according to the five publications reviewed. All training sessions and programs are organized in one book. Furthermore, practising Tai Chi exercises takes between 10 and 12 weeks, with 2 to 3 training sessions every week. Almost all research findings include the same Tai Chi exercise stages, which include warming up, conducting Tai Chi exercises, and cooling down. Warm-up exercises for 5 to 10 minutes, Tai Chi activities for 35 minutes, and cooling down exercises for 5 to 10 minutes, according to Gallant et al. (2017) and Hosseini (2018). Each research averaged 35 to 55 minutes of Tai Chi activities per session (12) (4) (13).

With 131 senior respondents, Gallant et alstudy .'s has the most participants. However, there was only one pretest-posttest group in this study. In this study, the elderly were also advised to practice exercises at home with the help of a DVD. Participants were asked to keep a monthly calendar of the days they fell and identify whether an injury happened, the medical treatment sought, and the causes of the fall while participating in the Tai Chi training program. The results show that Tai Chi successfully reduces the risk of falls in the elderly living in the community after 12 weeks of practice (11). Other studies have found that even a short (8-week) Tai Chi program can have a significant impact on physical functional performance (14) (13). Gallant et al. (2017) found that mobility and functional balance markers, as well as perceived balance, had improved (12). Simultaneously, the number of alterations in functional mobility and balance markers detected was low (12)(4). (13). The size of the changes we saw, on the other hand, is similar with what Li et al. (2008) observed during their community-based TCMBB demonstration (15). Gallant et al. (2017) reported that from baseline to follow-up, participants improved by 0.35 seconds (completers) and 0.30 seconds (all participants) on the TUG test and by 1.05 inches (completers) and 0.83 inches (all participants) on the functional reach test (12). 0.23 seconds and 0.83 inches were reported by Li and

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colleagues (15). Although these improvements are less than those seen in the 24-week TCMBB program (16), participants who continue to practice Tai Chi, either separately or as part of a continuation class, are likely to see even more improvements in fall-related functional performance measures. These data, on the other hand, help define the "minimum intensity" of TCMBB required for effectiveness (12).

According to Hosseini et al. (2018), Tai Chi Chuan enhanced elderly people's balance and fear of falling. In other words, Tai Chi Chuan is a great workout for the elderly, especially those who have poor balance and are at risk of falling. Because falls generate physical, psychological, and financial difficulties for the elderly, simple and cost-effective solutions are required that do not require specialized equipment and can be completed quickly. Tai Chi exercise is a simple and inexpensive intervention that can be given to older individuals at risk of falling in geriatric clinics as a fall prevention tool (13). In the current study, we discovered that Tai Chi Chuan greatly reduces fear of falling, which is in line with earlier studies. Sattin et al. (2005) found that Tai Chi Chuan significantly reduces fear of falling in frail adults aged 70–79 years when compared to wellness education programs focusing on diet and nutrition, pharmacological management, health-related legal issues, changes in body function, and mental health issues such as stress, depression, and life changes (17). Prior studies, however, have been unable to show that Tai Chi Chuan has a sufficient effect on the fear of falling in older people (18). The disparity could be explained by sample heterogeneity; for example, in one study, participants had a low fear of falling at baseline, so there was no significant improvement in fear of falling in the study's population after the intervention period. Fear of falling has an inverse association with physical activity in older people; hence, a drop in physical activity might lead to an increase in the rate of falls, and vice versa (19). During important and stressful times, the slow motions of Tai Chi Chuan can help a person maintain a condition of serenity and relaxation. In other words, a person will experience physical and psychological relaxation and well-being when doing Tai Chi Chuan exercises in a tranquil setting while breathing deeply and slowly. (20)

Similar to Okuyan and Devici's (2020) research, 22 participants practiced Tai Chi for 12 weeks, and posttest scores for cognitive adaptation, protective mobility, observation, and changes in the falls behavioral (FaB) sub-scale were significantly increased in the elderly in the intervention group who performed Tai Chi exercises (p.01). Tai Chi practice affects fall rates, physical activity levels, kinesophobia, and falls or protective behavior associated with safety in older persons. The most common concerns encountered by the elderly are fear of mobility disorders and balance problems associated with falls, all of which impair everyday activities and activities. Their fear of movement is lessened as a result of Tai Chi training. Additionally, the elderly's physical activity measure (PASE). Tai chi is one of the most effective workouts for reducing the risk of falling because it improves musculoskeletal flexibility, particularly in healthy elderly . The study's weakness is the study's modest sample size for a random control experiment (21).

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There is a little difference in the duration of the Tai Chi training undertaken by Sungkarat et al. (2016) for three weeks with an instructor versus twelve weeks of self-study. In contrast to previous studies, these respondents were asked to complete a notebook immediately following their practice session to ensure the information was as accurate as possible. Several additional tactics were utilized to aid in obedience training, including requesting family members to remind participants to exercise and posting the exercise schedule in a prominent position in the home. Additionally, the research staff conducted weekly recorded reminder phone calls and kept track of the frequency, duration, and side effects of Tai Chi practice, as well as any changes in health or lifestyle (e.g., attending recreational clubs, medication and supplement use, illness, and hospital admissions in both cases). The results indicated that Tai Chi increased performance significantly on the Logical Memory, Block Design, and Trail-Making Tests (B–A). Tai Chi can also be used to avoid falls. After Tai Chi training, all components of the Physiological Profile Assessment (PPA) (proprioception, muscle strength, response time, and postural sway) improved. The increases were attributed to the characteristics of Tai Chi that emphasize sequential movements with alternating lower extremity joint flexion and extension, changes in the limb movement direction, dynamic weight shift, and single-leg support. Improvements in knee joint proprioception and knee extension strength and a decrease in GOLD postural desire (22).

Based on Mortazavi et al.'s (2018) research on 60 senior men and women, randomly assigned to one of two groups: Tai Chi exercise or control (daily activities). Tai Chi exercises were performed in the intervention group three times each week for ten weeks. The results of this study indicated a significant difference in the mean score of fear of falling, as measured by the FES-I, between the intervention and control groups in the fourth, eighth, and tenth weeks, indicating that Tai Chi reduced the fear of falling by 33.6 percent in the intervention group compared to the control group. The current study's findings are congruent with those of Kooshiar et al. (23) and Khajavi et al. (24) Both trials lasted eight weeks and included three 20-minute sessions each week, with a focus on the fear of falling among the elderly. Both investigations used the FES-I instrument, which is comparable to the one used in this research. Khajavi's research included exercises concentrating on central function, whereas Kooshiar et al. included amusing physical activity that was distinct from the current study's Tai Chi exercise but was comparable in terms of fear of falling outcomes. It is reasonable to suppose that Tai Chi and physical exercise may assist older people to build confidence and minimize their fear of falling. Fear of falling, on the other hand, was reduced by 33.6 percent in this trial, which was significantly higher than in previous studies (23) and (24) in which exercise significantly affected balance, motor function, and fear of falling, which corroborated previous research. Another study found that increasing the frequency of Tai Chi activities and practicing the Yang style is more helpful in preventing falls in older adults (25).

Tai Chi activities appear to facilitate the integration of nerve, muscle, and

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skeletal function (26). In summary, multiple studies have demonstrated that when taught by competent instructors and implemented in the community, Tai Chi activities appear to reduce the risk of falls, are well accepted by older people, and are practicable (5) (26) These findings contribute to the expanding body of research supporting community-based fall prevention programs and indicate that Tai Chi practice is a feasible, beneficial, and widely accepted technique for including nursing interventions to reduce falls in older individuals. This evidence can also be used to spread Tai Chi practice programs around the community, which will make them more accessible and available.

CONCLUSION

According to the five publications analyzed, Tai Chi exercises dramatically decrease the risk and fear of falling in the elderly. As a non-invasive and complication-free technique, Tai Chi practice appears to have a considerable effect on improving balance and motor function in the old, strengthening their independence, permitting fun, and transforming the aged into active individuals.

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