

Effects of taekwondo on health in older people: a systematic review

Efectos del taekwondo sobre la salud en adultos mayores: una revisión sistemática

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Abstract. Objective: This study aimed to identify the effects of taekwondo on health in elderly individuals. Methods: A systematic literature review was conducted following the PRISMA recommendations and registered on PROSPERO, as number CRD42021279561. The electronic databases MEDLINE (via PubMed), Scopus, SPORTDiscus, and Web of Science were searched, with the Medical Subject Headings (MeSH) terms “martial arts” and “aged” and the alternative terms “taekwondo”, “elderly”, and “older”. We included studies that analysed the effects of taekwondo on health-related variables in older adults of both sexes. The risk of bias of the included experimental and quasi-experimental studies were analysed using the Cochrane Collaboration tool and the Risk Of Bias In Non-randomised Studies – of Interventions (ROBINS-I) tool, respectively. Results: Seven studies met the eligibility criteria. The interventions of the included studies ranged from 6 to 17 weeks, with 45 to 90 minutes per training session, and frequency from 3 to 5 times a week. The total sample number was 160 participants, with a predominance of females in the samples. After the taekwondo intervention, the protocols demonstrated improvement in muscle strength, flexibility, balance, and body composition. Conclusion: The investigated studies showed that taekwondo can effectively maintain health and develop physical qualities in the older population. Nevertheless, these findings should be considered preliminary due to the relatively small sample and heterogeneity of the interventions of the identified studies.

Keywords: Sports, Exercise, Aged, Martial arts, Health.

Resumen. Objetivo: Este estudio tuvo como objetivo identificar los efectos del taekwondo en la salud de adultos mayores. Métodos: Se realizó una revisión sistemática de la literatura siguiendo las recomendaciones PRISMA y registrada en PROSPERO, con el número CRD42021279561. Se realizaron búsquedas en las bases de datos MEDLINE (a través de PubMed), Scopus, SPORTDiscus y Web of Science, con los términos del Medical Subject Headings (MeSH) “martialarts” y “aged” y los términos alternativos “taekwondo”, “elderly”, y “older”. Se incluyeron estudios que analizaron los efectos del taekwondo sobre variables relacionadas con la salud en adultos mayores de ambos sexos. El riesgo de sesgo de los estudios experimentales y cuasiexperimentales incluidos se analizó mediante la herramienta de la Colaboración Cochrane y la herramienta Riesgo de sesgo en estudios no aleatorios de intervenciones (ROBINS-I), respectivamente. Resultados: Siete estudios cumplieron los criterios de elegibilidad. Las intervenciones de los estudios incluidos variaron de seis a 17 semanas, con 45 a 90 minutos por sesión de entrenamiento y una frecuencia de tres a cinco veces por semana. El número total de la muestra fue de 160 participantes, con predominio del sexo femenino. Los protocolos demostraron una mejora en la fuerza muscular, la flexibilidad, el equilibrio y la composición corporal después de la intervención de taekwondo. Conclusión: Los estudios investigados demostraron que el taekwondo puede ser efectivo en el mantenimiento de la salud y el desarrollo de las cualidades físicas en la población de adultos mayores. No obstante, estos hallazgos deben considerarse preliminares debido a la muestra relativamente pequeña y la heterogeneidad de las intervenciones de los estudios identificados.

Palabras clave: Deportes, Ejercicio, Envejecimiento, Artes marciales, Salud.

Introduction

Biological ageing is associated with a reduction in repair capacity and regenerative potential in human tissues and organs. The decrease in physiological reserve in response to stress (homeostenosis) is characterised by immunosenescence, a progressive degenerative process of the immune system (Khan et al., 2017).

Other factors related to ageing are osteopenia (loss of bone mass) and sarcopenia (loss of muscle mass). The search for functional autonomy is crucial and the loss of

bone and muscle mass appears as a negative aspect in obtaining results related to the health of elderly people. Thus, osteoporosis presents itself as a public health problem and is correlated with the risk of fractures due to frailty (Cruz-Jentoft & Sayer, 2019; Curtis et al., 2015).

Likewise, structural and functional brain reductions occur with the ageing process, impairing reaction speed, perception, and memory. This entails difficulty in making decisions and performing daily life activities. Physical exercise plays an essential role in reducing these degenerative processes caused by senescence (Cho & Roh, 2019; Romero Ramos et al., 2021).

The number of deaths in older people is related to physical inactivity and can be caused by cerebrovascular, cardiovascular, metabolic diseases, age, gender, and lifestyle habits

Fecha recepción: 05-02-22. Fecha de aceptación: 16-05-22

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(Kim et al., 2021). According to Ramalho et al. (2021), a sedentary lifestyle is common in older people. This excessive daily sedentary behavior can be reduced to achieve healthy aging. There is a correlation between higher physical activity levels and a decrease in cardiovascular morbidity and mortality in the aging process. Older individuals who practice regular physical exercise show positive physiological responses (Honisett et al., 2016; Jakovljevic, 2018).

The regular practice of physical exercise has a prophylactic and therapeutic effect on older individuals, leading to better functional autonomy, improved quality of life, and performance of activities of daily living (Won et al., 2019; Ramalho et al., 2021). Hence, physical exercise works as a non-pharmacological strategy to maintain health during ageing. Additionally, it prevents diseases, preserves muscle mass and strength, improves body composition, and positively impacts the quality of life of older people (Galloza et al., 2017; Marcos-Pardo et al., 2019).

However, physical exercise, in its different forms such as resistance training, aerobic training, and aquatic exercises, is vital in maintaining and developing health. Martial arts are an option that can bring benefits to older people, such as improvements in motor coordination, static and dynamic balance, muscle strength, and endurance (Csapo & Alegre, 2016; Sungkarat et al., 2017; Silva et al., 2019; Seals et al., 2019). Among the various martial arts, there is taekwondo, which originated in Korea and entered the Olympic context in the Sydney 2000 Olympic Games (Apollaro & Ruscello, 2021).

Taekwondo is a combat sport practised in most countries worldwide with approximately 120 million children and adults around the world. The word taekwondo means “path of the feet and hands”, which characterises this modality as a full-contact free-sparring sport that uses punching and kicking movements (Wazir et al., 2019; Castro-Garrido et al., 2020).

The practice of taekwondo can be an effective strategy for the older population. The diversity of frequency, intensity, duration, and type of application of this modality can optimise the results in the intervening physical qualities of the taekwondo martial art (Lee et al., 2019).

However, it is not clear in the scientific literature the contribution of this type of physical exercise to variables related to health in older people. This increases the need to expand scientific knowledge about the practice of taekwondo in aging. Therefore, the present study aimed to identify the effects of taekwondo on health in older individuals.

Methods

This study is characterised as a systematic literature review. The procedures for conducting this research

followed the criteria of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Page et al., 2021). The protocol of this study was registered in the International Prospective Register of Systematic Reviews (PROSPERO), with registration ID CRD42021279561.

Search strategy

Two experienced and independent researchers conducted an electronic search without language or time filters, in November 2021, in the MEDLINE (via PubMed), Scopus, SPORTDiscus, and Web of Science databases. Any divergences between the two researchers were solved through discussion or arbitration of a third researcher. The terms related to the theme were searched in the Health Sciences Descriptors (DeCS) and the Medical Subject Headings (MeSH) and the descriptors found were “martial arts” and “aged”, and the alternative terms were “taekwondo”, “elderly” and “older”. Then, these terms were grouped in a single Boolean sentence as follows: “taekwondo AND elderly” OR “taekwondo AND older” OR “taekwondo AND aged” OR “martial arts AND elderly” OR “martial arts AND older” OR “martial arts AND aged”.

Inclusion criteria

Experimental and quasi-experimental studies that analysed the effects of taekwondo on health-related variables in older adults of both sexes were included. Studies that did not use taekwondo as the primary intervention and articles published in congresses, systematic review articles, and meta-analyses were excluded.

Risk of bias assessment

Two authors independently assessed the risk of bias for each included study. If the score was inconsistent, a third author was consulted to decide the final score. We used the Risk of Bias In Non-randomized Studies – of Interventions (ROBINS-I) tool to verify the risk of bias in the quasi-experimental studies. This instrument contains seven elements for classification and is carried out in three stages, pre-intervention, intervention, and post-intervention. The risk of bias score is assigned to each domain according to the classification “high risk of bias”, “severe risk of bias”, “moderate risk of bias”, “low risk of bias”, and “no information” (Sterne et al., 2016).

To verify the risk of bias in the experimental studies, we used the Cochrane Collaboration tool, available at <<https://training.cochrane.org/handbook/>>. This instrument has seven domains that analyse the risk of bias from the randomised controlled trials (RCT): 1) generation of the random sequence; 2) allocation concealment; 3) blinding of evaluators and participants; 4) blinding of

outcome evaluators; 5) incomplete outcomes; 6) reports of selective outcomes; 7) report on other sources of bias. Each domain has the risk of bias classified as “high”, “uncertain”, or “low” (Carvalho et al., 2013).

Data extraction

Data from the included publications were extracted independently by two authors, and any discrepancies were settled in a consensus meeting with a third author. The variables extracted were: authors, publication year, country, characteristics of the study population (age, sex, and sample size), and intervention data, including general and specific exercises, duration of the intervention(weeks), training volume (duration of the training session, in minutes, and frequency, in times per week), evaluation, and outcome findings for physical and mental health.

Results

In total, 155 publications were found from the database search following the proposed research methodology (MEDLINE via PubMed = 19; Scopus = 63; SPORTDiscus = 8; Web of Science = 65). After using the selection criteria, a total of 7 studies were included: 4 RCT and 3 non-randomised studies (Figure 1).

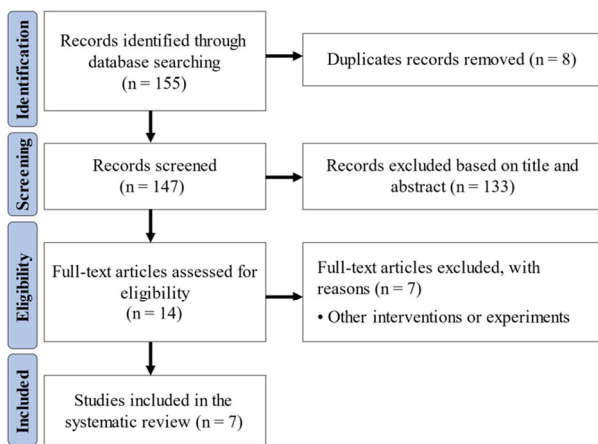


Figure 1. Flow diagram of study selection.

Table 1 shows the mean and standard deviation values of the experimental (EG) and control (CG) groups, sex, and sample size of the studies included in this systematic review. The mean age of the participants in the EG and CG of all included studies was 71.47 and 70.78 years old, respectively, and the average number of participants was 15.1. The sample of the included studies consisted of 160 participants, with 100 individuals from the EG and 60 from the CG. Regarding the origin of the interventions, 5 studies (Baek et al., 2021; Cho & Roh, 2019; Kim et al., 2021; Kim & Park, 2012; Youm et al., 2011) were held in the home country of taekwondo, Korea. The years of publication ranged from 2002 to 2021. Females had greater participation in the number of volunteers in the included studies. Baek et al. (2021), Kim et al. (2021), and Lee et al. (2019) used a specific program for sample calculation.

Table 1
Sample characterisation.

Author, year	Country	Study design	Age: Mean ± SD (years)	Sex	Groups (n)
Baek et al., 2021	Korea	Intervention study	EG: 72.55 ± 5.45 CG: 72.40 ± 3.81	F	EG: 12 CG: 12
Brudnak et al., 2002	USA	Intervention study	EG: 71	F/M	EG: 12
Cho & Roh, 2019	Korea	RCT	EG: 68.89 ± 4.16 CG: 69.00 ± 4.41	F	EG: 19 CG: 18
Kim & Park, 2012	Korea	Intervention study	EG: 75.58 ± 0.58	F/M	EG: 17
Kim et al., 2021	Korea	RCT	EG: 72.90 ± 5.84 CG: 71.90 ± 3.11	F	EG: 10 CG: 10
Lee et al., 2019	Netherlands	RCT	EG: 70 ± 4 CG: 70 ± 4	F	EG: 10 CG: 10
Youm et al., 2011	Korea	RCT	EG1: 69.4 ± 5.8 EG2: 71.4 ± 7.6 CG: 70.6 ± 4.8	F	EG: 20 CG: 10

SD: standard deviation; RCT: randomised controlled trial; EG: experimental group; CG: control group; F: female; M: male; USA: United States of America.

Table 2 presents the risk of bias in the non-randomised included studies by the ROBINS-I tool. Two studies (Baek et al., 2021; Kim & Park, 2012) had a moderate risk of bias, and one study (Brudnak et al., 2002) had a high risk of bias.

Table 2
Risk of bias of the non-randomised studies (ROBINS-I tool).

Studies	Bias due to confounding	Bias in the selection of participants into the study	Bias in the classification of interventions	Bias due to deviations from intended interventions	Bias due to missing data	Bias in measurement of outcomes	Bias in the selection of the reported result	Overall bias
Baek et al., 2021	NI	NI	Moderate	NI	NI	NI	NI	Moderate
Brudnak et al., 2002	High	Moderate	NI	High	High	High	High	High
Kim & Park, 2012	Moderate	Moderate	NI	NI	NI	NI	NI	Moderate

NI: No information.

Table 3 shows the risk of bias of the included RCT assessed through the Cochrane Collaboration tool. The four studies (Cho & Roh, 2019; Kim et al., 2021; Lee et al., 2019; Youm et al., 2011) were classified as having no risk of bias.

Table 3
Risk of bias analysis for randomised studies (Cochrane Collaboration tool).

Studies	1	2	3	4	5	6	7	Total
Cho & Roh, 2019	Low	Low	Low	Low	Low	Low	Low	Low
Kim et al., 2021	Low	Low	Low	Low	Low	Low	Low	Low
Lee et al., 2019	Low	Low	Low	Low	Low	Low	Low	Low
Youm et al., 2011	Low	Low	Low	Low	Low	Low	Low	Low

1: Randomisation; 2: Allocation of randomisation; 3: Blinding of participants; 4: Blinding of the evaluators; 5: Incomplete outcomes; 6: Report on the selective outcome; 7: Other sources of bias.

Table 4 shows the intervention characteristics and training volume of the studies. Most studies (Baek et al., 2021; Brudnak et al., 2002; Cho & Roh, 2019; Kim & Park, 2012; Kim et al., 2021; Lee et al., 2019; Youm et al., 2011) used 2 groups: 1 EG and 1 CG. Of these studies, EG participants performed specific taekwondo exercises and CG participants did not perform exercises. Warm-up, walking, stretching, and cool-down were also part of the intervention in the EG. The training intensity ranged from 40 to 80% using the physiological parameters heart rate and scores of 9 to 13 on the rating of perceived exertion (RPE-Borg). The training volume ranged from 6 to 17 weeks, 45 to 60 minutes per week, and 3 to 5 sessions per week.

Table 4
Study intervention data.

Study	Intervention	Duration (weeks)	VT
Baek et al., 2021	EG: Warm-up, walking, stretching, taekwondo-specific exercises, and cool-down Intensity: 1 to 6 weeks with RPE 10 and 11 7 and 12 weeks with RPE 12 and 13 CG: No exercise	12	60 min 3×/week
Brudnak et al., 2002	EG: Taekwondo training	17	NI
Cho & Roh, 2019	EG: Warm-up, walking, stretching, taekwondo training, and cool-down Intensity: 50–80% HRmax CG: No exercise	16	60 min 5×/week
Kim & Park, 2012	EG: Warm-up, taekwondo training, and cool-down	6	45 min 3×/week
Kim et al., 2021	EG: Warm-up, taekwondo training, and cool-down Intensity: weeks 1 to 4: 40–59% of HRR weeks 5 to 12: 60–75% of HRR CG: No exercise	12	90 min 3×/week
Lee et al., 2019	EG: Warm-up, taekwondo training, and cool-down Intensity: week 1 to 4: 30–40% of HRR last 4 weeks: increased up to 50–60% of HRR CG: No exercise	12	60 min 3×/week
Youm et al., 2011	EG1: Warm-up, taekwondo training, and cool-down EG2: Warm-up, stretching, walking, and cool-down Intensity (EG1 and EG2): weeks 1 to 4: 40–50% HRmax and 9–11 RPE weeks 5 to 12: 50–60% of HRmax and 9–13 RPE CG: No exercise	12	60 min 3×/week

EG: experimental group; CG: control group; VT: volume of training; RPE: rating of perceived exertion; HRmax: maximum heart rate; HRR: heart rate reserve; min: minutes; ×/week: times a week; NI: not informed.

Table 5 presents the extracted data regarding the evaluation and results. According to each study, the evaluation variable was divided between 1 and 4 moments. Functional fitness and balance appeared more frequently in the included studies. Variables such as muscle strength, depression, body composition, and physiological markers were also analysed. Regarding the statistical treatment performed in the studies, all authors, except for Brudnak et al. (2002), used a significance level of $p < 0.05$ in inter and intra-group comparisons.

Discussion

The present study aimed to identify the effects of taekwondo on variables related to physical and mental health in older people. The analysis of the 7 included studies showed that taekwondo practice for at least 6 weeks, 3 sessions with 45 minutes per week, can be effective in the performance of balance and gait of elderly people.

In the study by Baek et al. (2021), functional fitness and depression were evaluated. After the intervention with taekwondo, positive results were observed in increasing functional fitness and reducing levels of depression in the elderly. In a similar study, Lee et al. (2019) found improvement in physical fitness results with the application of taekwondo techniques compared to the CG, which did not perform physical exercises. Those studies used different instruments to assess the same variable, including anthropometry, physical fitness, biochemical factors, and cognitive activity. However, regarding physical fitness, studies by Cho and Roh (2019) and Kim et al. (2021) found similar significant results on increased post-taekwondo intervention physical fitness in older adults.

Studies by Kim and Park (2012) and Brudnak et al. (2002) analysed body positioning during walking and balance and Youm et al. (2011) verified the balance. In the studies conducted by Kim and Park (2012), Brudnak et al. (2002), and Youm et al. (2011), the balance variable showed significant improvement after the intervention. Regarding the body position variable, there was a significant improvement ($p < 0.05$) in the studies presented by Kim and Park (2012) and Brudnak et al. (2002).

Studies involving other martial arts corroborate this systematic review, such as the experimental study by Cojocariu and Cuza (2012). Eight individuals aged between 50 and 60 years practiced martial arts exercises for 6 months, 2 times a week, 1 hour per session. The authors found an increase in cardiorespiratory function (mL/kg·min), a reduction in resting heart rate (bpm), a reduction in systolic blood pressure at rest (mmHg), and an increase in lung elasticity (cm). Likewise, Kim et al. (2021) found significant improvements in the assessment of cardiovascular factors after 12 weeks of taekwondo practice, 3 times a week, 90 minutes per session.

Table 5
Evaluation data and results of the included studies.

Study	Assessment	Results (EG)
Baek et al., 2021	Physical fitness	↑ hand grip strength ($d=1.81$); ↑ gait speed ($d= 2.00$)
	Body composition	↓ BMI ($d=-0.29$); %BF ($d=-0.56$)
	Mental health	↑ GDS-K ($d=1.41$); ↑ K-DSQ ($d=-0.95$)
	Biochemical markers	↓ total cholesterol ($d=-1.25$); ↓ LDL ($d=-1.07$); ↓ adiponectin ($d= 0.98$); ↓ arteriosclerosis index ($d= -1.39$); ↓ β -amyloid ($d=-0.51$); ↔ irisin ($d=-0.50$)
Brudnak et al., 2002	Physical fitness	↑ 3.5-inch flexibility; ↑ one leg balance; ↑ pushups
Cho & Roh, 2019	Physical fitness	↑ 30 s chair stand ($d=0.65$); ↑ chair sit-and-reach ($d=0.21$); ↑ 2 min step ($d=0.36$); ↔ 30 s arm curl ($d=0.03$); ↔ back scratch ($d=-0.07$); ↔ 2.44 m up-and-go ($d=-0.18$)
	Neurotrophic growth	↑ BDNF ($d=0.65$); ↑ VEGF ($d=0.15$); ↑ IGF-1 ($d=0.27$)
	CBF velocity	↔ SFV ($d=0.02$). DFV ($d=0.07$). and MFV ($d=0.05$) of MCAs
	Cognitive function	↑ MMSE-DS ($d= 0.37$); ↑ color-word test ($d=0.47$)
Kim & Park, 2012	Physical fitness	↑ maximum oscillation ($d=-3.56$); ↑ oscillation distance ($d=-2.29$); ↑ oscillation area ($d=-0.87$)
	Gait	↑ BBS ($d=0.08$); ↔ gait time ($d=0.00$); ↑ step length ($d=1.79$); ↓ right base of support ($d=-3.89$); ↓ right limb support time ($d=-3.57$); ↑ left stride length; ↔ right stride length ($d=2.36$)
Kim et al., 2021	Physical fitness	↑ moderate-high intensity physical activity ($d=3.42$); ↑ handgrip strength ($d=0.76$); ↑ step count ($d=4.41$); ↑ trunk flexion in a sitting position ($d=0.76$); ↑ 2 min walk ($d=0.96$)
	Body composition	↓ BMI ($d=-0.16$); ↑ lean body mass($d=0.57$); ↓ %BF ($d=-0.75$); ↓ hip circumference ($d=-0.65$)
	CVD risk factors and EAT	↓ total cholesterol ($d=-0.77$); ↓ triglycerides ($d=-0.77$); ↑ HDL ($d=1.32$); ↓ LDL ($d=-0.77$); ↓ interleukin-1 β ($d=-1.00$); ↓ TNF1 ($d=-0.89$); ↓ MVO ₂ rest ($d=-1.29$); ↓ diastolic blood pressure ($d=-2.58$); ↓ systolic blood pressure ($d=-1.75$); ↓ EAT ($d=-0.11$); ↔ mean blood pressure ($d=-2.32$)
Lee et al., 2019	Physical fitness	↓ HR ($d=-0.77$). ↓ systolic blood pressure ($d=7.00$); ↓ diastolic blood pressure ($d=-5.50$); ↑ hand grip strength ($d=-0.75$); ↑ leg strength ($d= 0.33$)
	Body composition	↓ BMI ($d=-0.63$)
	Biochemical marker	↓ epinephrine
	Pulse wave velocity	↓ brachial-ankle pulse wave velocity
Youm et al., 2011	Physical fitness	↓ COP trajectories ($d=-1.32$)

EG: experimental group; BMI: body mass index; %BF: body fat percentage; GDS-K: Geriatric Depression Scale-Korea; K-DSQ: Korean Dementia Screening Questionnaire; MMSE-DS: Mini-Mental State Examination for dementia screening; LDL: low-density lipoprotein; HDL: high-density lipoprotein; CBF: cerebral blood flow; SFV: systolic flow velocity; DFV: diastolic flow velocity; MFV: mean flow velocity; MCAs: middle cerebral arteries; BDNF: brain-derived neurotrophic factor; VEGF: vascular endothelial growth factor; IGF-1: insulin-like growth factor I; BBS: Berg balance scale; CVD: cardiovascular disease; TNF1: tumor necrosis factor-1; MVO₂: measurement of the oxygen consumed by the myocardium muscle; EAT: epicardial adipose tissue; HR: heart rate; COP: center of pressure; d : Cohen's d effect size. ↑ increase; ↔ maintenance; ↓ reduction.

The study conducted by Mendonça et al. (2017) compared 20 older Kendo fighters in terms of quality of life, strength (kg), balance, and body composition (kg). Participants were divided into 2 groups: the Kendo group (age: 71.8 ± 5.4 years) and the CG (age: 73.1 ± 4.8 years). The results showed gains in strength, balance, quality of life, and better body composition in the EG compared to the CG.

Ma et al. (2019) analysed 33 older people who received an intervention with 1 hour per session, and 2 sessions per week for 3 months. The results revealed that the mean latency of onset of gastrocnemius muscle activation (ms) was significantly higher in the EG after the intervention. The time to peak strength in the knee flexors (kg) was significantly longer in the EG but not in the CG at post-test compared to the pre-test value.

Following the same line of intervention, Kim et al. (2019) analysed a total of 46 older women divided into 2 groups, group 1 (Tai chi) and group 2 (Taekkyon), with a mean age of 71.4 ± 3.3 and 70.9 ± 4.3 years, respectively. Both groups completed 1 hour of Tai chi or Taekkyon exercises twice a week for 12 consecutive weeks (24

sessions in total). The study aimed to compare the effects of Tai chi and Taekkyon exercise programs on lower limb strength, balance, and gait ability in community-dwelling elderly women as a method of preventing falls. Both groups showed improvements ($p < 0.05$) in balance (s), muscle strength (kg), and spatiotemporal gait parameters (cm/s), except for step width.

Additionally, Lip et al. (2015) investigated 12 elderly people divided into 2 groups: EG ($n=12$; age: 69.0 ± 7.3 years) and CG ($n= 27$; age: 74.0 ± 4.7 years). The intervention lasted 3 months in the EG while the CG did not receive any type of training. This study investigated the effects of the Chinese martial art Ving Tsun on radial bone strength, upper and lower limb muscle strength (kg), shoulder joint mobility, and balance performance. The results showed that there was no statistically significant difference in time interaction effect, group effect, and time effect for all outcome variables. However, general maintenance trends or improvement in all outcome parameters were observed to a greater extent in the EG than in the CG.

In evaluating the risk of bias in the studies, according to the ROBINS-I tool, two studies (Baek et al., 2021; Kim & Park, 2012) were classified as “moderate risk of bias”, presenting an intervention activity in disagreement with the study. The study by Brudnak et al. (2002) was classified as “high risk of bias”, as data were omitted, confusing the allocation of participants, reliability of assessments, and lack of statistical data. However, four studies (Kim et al., 2021; Lee et al., 2019; Youm et al., 2011; Cho & Roh, 2019) presented significant sample numbers, statistical data, and results within the evaluation criteria according to the Cochrane Collaboration tool, ranking them at low risk of bias. A strong point in the included studies was the intervention, which was characterised by warm-up, stretching, specific taekwondo techniques involving kicking, punching, forms, fighting techniques, and cool-down, factors that improve physical fitness and development of functional autonomy.

Some variations in the results related to the physical fitness variable in the studies included in the present systematic review can be justified due to the different intervention methods, time, volume, and training intensity. It should be considered that taekwondo has a variety of techniques and movements that can generate different physiological responses after a training period.

The present study has some limitations. The first limitation was the low number of studies that were screened according to the search strategy addressing the effectiveness of taekwondo in older people. The second limitation was the presence of different intervention methods in analysing the effects of taekwondo in older people.

Conclusion

Taekwondo presented itself as an intervention that brings positive responses to health by promoting improvements in physical fitness, physiological, biochemical, and cognitive variables of older individuals. Increases in physical fitness, improvements in physiological components, and cognitive activities were verified in the studies included in this systematic review, confirming that Korean martial art can improve the health of the older population. Thus, the practice of taekwondo regularly can be an efficient intervention strategy to minimize the deleterious effects of aging and provide a better perception of the health state and well-being of older people.

However, further experimental studies are needed to verify the effects of taekwondo in this population, which, due to senescence, present physiological degenerative processes in different body systems. It is suggested that future studies analyse possible changes in aspects of exercise science, such as bone mineral density, cardiac alterations, and muscle markers to elucidate other effects of taekwondo in older individuals.

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