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APPLICATION OF DIFFERENT EXERCISE PROGRAMS IN THE PREVENTION OF FALLS IN PEOPLE OF THE THIRD AGE

Systematic review

ABSTRACT

Introduction: Various exercise programs have a positive effect on reducing the risk of falls in elderly people. Consequences of falls include fractures and injuries, reduced quality of life, fear of falling, loss of self-confidence, and self-limited activity leading to reduced physical function and social interactions. Activity limitation impairs physical capacity and increases the risk of further falls. Falls are the primary cause of injury of the elderly, which can result in serious consequences such as fractures, head injuries, and even death, placing a significant burden on the public health system. Annually, between 28 and 35% of individuals aged 65 and over experience a fall worldwide, with rates reaching 32% - 42% among those aged 70 and over. Therefore, preventing falls has become a key global goal for the older adult population.

Objective: To determine the effectiveness of different exercise programs in preventing falls in people of the third age.

Methods: The search included an overview of the relevant databases: Medline, PubMed, Google Scholar, Research Gate. The systematic literature review included 12 different types of research.

Results: Through a scientific review of the literature, the results of the significance and effectiveness of various programs of Otago exercises, Tai Chi, and Frenkle exercises in the prevention of falls in people of the third age are presented. The greatest effect is realized in the improvement of static and dynamic balance and the fear of falling.

Conclusion: These studies show that different exercise programs have a huge and significant impact on reducing the risk of falls in older people. It is a long-term and continuous method of reducing the risk of falls in the elderly through exercise. Physical exercise is effective in improving components of balance, lower extremity strength, mobility, and reducing falls and fall-related injuries

Keywords: Various exercise programs, fall prevention, Otago exercise program, Tai chi, Frenkle exercises, elderly people

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INTRODUCTION

Although falls can occur at any age, older adults are predisposed to injury due to physiological changes and delayed functional recovery caused by aging. Currently, falls are the leading cause of injury and death in people over the age of 65. It has been shown that among seniors aged 65-74, 25% experience a fall each year, increasing to 29% among those aged 75-84 and up to 39% in seniors over 85 (Sun et. al., 2021). Falls in the elderly can cause irreversible physical injuries, which can even lead to disability or death (Lin et. al., 2015).

In addition, older people who experience a fall also develop a significant fear of falling. Their social isolation and depression can increase the risk of falling, thus creating a vicious circle (Zijlstra et. al., 2007). The World Health Organization recommends that elderly people over the age of 65 adopt an active lifestyle that ensures the physical activity of moderate intensity for a minimum of 150 minutes per week, as well as engage in fall-prevention exercises (Sadaqa et. al., 2023). Exercise interventions are effective when delivered

in a group setting or on an individual basis. Multicomponent programs that target both strength and balance and programs that include balance training appear to be particularly effective (Sherrington et al., 2020). Exercise should be maintained for a continuous effect on muscle strength and fitness. Both in highly trained athletes and in older adults who have been discharged from the hospital, deconditioning occurs when training stops (Dyer et al., 2023). The Otago Exercise Program (OEP) is an effective fall prevention program that contributes to balance function and fear of falling. It was developed for older adults over 65 living in the community. The OEP consists of a set of leg muscle strengthening exercises and balance retraining exercises and is designed to prevent falls, especially for individuals over 80 years of age who have fallen in the previous year. OEP is an effective fall prevention strategy that benefits balance function and reduces fear of falling (Chiu et al., 2021). Tai Chi is a distinctive form of exercise that involves movements primarily performed in a semi-squatting position. These movements require continuous movement of the body's center of gravity, including postural control, trunk rotation, weight transfer, and strength training. All these characteristics are useful for improving balance and strength, reducing the risk of falling and fear of falling (Chen et al., 2023). Frenkel's exercises consist of a series of slow, repetitive movements performed in The aim of this systematic review was to present the importance of the effectiveness of different exercise programs in the prevention of falls in elderly people.

Research by Dyer et al shows that exercise interventions can effectively prevent falls in older people living in residential aged care facilities based on moderate safety evidence. However, this effect is not maintained after cessation of the exercise program (high-certainty evidence), which is not surprising for this frail population who are unlikely to resume exercise when a particular intervention program is withdrawn (Dyer et al., 2023).

Chiu et al. found in subgroup analysis that >30-minute OEP training sessions were most effective for improving balance, but the effects of OEP on balance were not found to be related to training period (total week of training or total number of minutes of training) or frequency (session per week). In fact, the American College of Sports Medicine (ACSM) guidelines for older adults recommend that all healthy older adults exercise regularly for at least 30 minutes five days per week (Chiu et al., 2021).

In their study, Beato et al reached the results of 68 elderly people, it was observed that after 12 weeks of OEP intervention, the ability to score on the Berg Balance Scale (BBS) was significantly improved, and the score on the balance scale increased from 15.32

± 2.18 to 16.78 ± 2.20 , and the ability of static balance in an elderly person was significantly improved ($p < 0.001$). The risk of falling was reduced from two times before the intervention to 0 times. In addition, the level of physical fitness of an elderly person in a nursing home is also significantly improved (Beato et al., 2019). Van Ravenstein and Davis reported that an online OEP intervention in sedentary elderly people can effectively improve their static balance ability, and its economic cost is not high. The most important equipment cost is wearable monitoring equipment, which is used to measure basic information, and the OEP content is presented in the form of a video conference. Following balance training and a walking exercise program based on a family-based basic OEP, the number of falls and the risk of disability of elderly people in assisted living facilities are reduced (Van Ravenstein and Davis., 2018).

2018, through a comparative study of two methods of family OEP and community OEP, Shubert et al found that both methods improve the ability to balance in the elderly and have positive benefits for the elderly, but there are differences in the economic level and the way of development. Group mode OEP can participate more elderly people, and economic costs are more affordable than private treatment, but the positive effect of traditional mode of operation on special elderly people is necessary. Therefore, OEP can be used as a long-term treatment for the elderly to prevent falls, meet the various needs of the elderly, and improve their actual balance ability (Shubert et al., 2018).

Tai Chi and OEP are both effective means of preventing falls in the elderly. Some scientists compared the two methods and found that after participating in Tai Chi and the OEP intervention, both interventions improved the balance ability of the elderly, but the balance ability of the OEP intervention group was better. The sitting and standing test indices for 30 si step frequencies were significantly higher than those of the Tai Chi group, but the one-leg standing test index of the Tai Chi group was better than that of the OEP group, due to different exercise modes and muscle use. In OEP, there is more balance training content, especially dynamic training, while single-leg Tai Chi moves more slowly, but both improve dynamic balance ability in the elderly as a whole (Son et al., 2016). Muñoz Cobos et al. conclude in their study that Tai Chi intervention reduced the number of falls, anxiety, use of psychotropic drugs, depression and use of walking aids, with different Tai Chi programs (Muñoz Cobos et al., 2016).

2018, in a randomized study, Mortazavi et al conducted a Tai Chi program in two groups that were matched in terms of age, gender, education and body mass index. Baseline values of risk of falling and fear of falling did not differ significantly between the two

groups ($P > 0.05$). The fear of falling score at the end of weeks 4 and 8 and at the end of the exercise period was significantly different between the two groups ($P < 0.05$) and decreased in the intervention group, but the risk of falling decreased after weeks 8 and 10 in the intervention group ($P < 0.001$). Performing Tai Chi exercises for at least four weeks could reduce the fear of falling and reduce the risk of falls in the elderly after 8 weeks (Mortazavi et al., 2018).

Jagtap et al., in a study conducted over 3 months of rehabilitation treatment, concluded statistically significant differences. Both groups showed improvement, but the control group showed a much greater and statistically significant improvement. Chair aerobics and Frenkel exercises are effective in balance and coordination in the geriatric population (Jagtap et al., 2023). Tabatabai et al. in their study came to the results of the paired t-test showed that the balance ($P = 0.007$) and the risk of falling ($P = 0.001$) in the exercise group improved significantly after the intervention, while these results did not significantly improve in the control group. The results of the analysis showed that the two groups differed significantly in balance and fall risk after the combined exercise. A combination of Cawthorne-Cooksey and Frenkle exercises can have a positive effect on functional balance and fall risk in the elderly. These exercises can be used to improve balance and reduce the decline of the vestibular and visual systems (Tabatabai et al., 2022). Various lying, sitting and standing positions. Here, the goal is to compensate for disturbed balance by using sensory mechanisms such as visual, auditory and tactile to control voluntary movement (Mańko et al., 2019). Balance is a key component of many activities of daily life in older adults, ranging from simple activities such as standing quietly to more complex activities such as walking while talking (Karimi et al., 2011).

METHODS

Participants and procedure

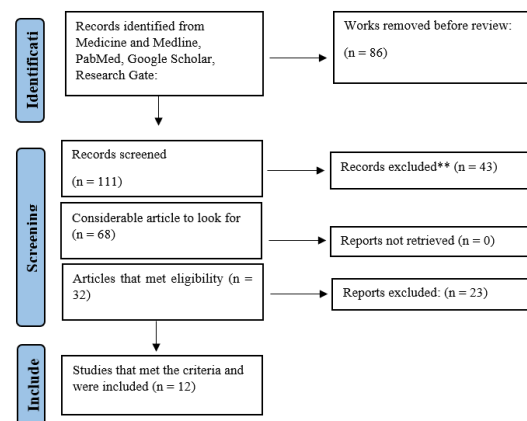
Systematic literature search of relevant databases, Medline, PabMed, Google Scholar, Research Gate was carried out in accordance with the guidelines of PRISMA (Moher D., 2009) by keeping the main search keywords: different exercise programs, fall prevention, Otago exercise program, Tai chi, Frenkle exercises, people of the third age from 2012 to 2024. Articles were also selected from references of relevant articles, by searching on different websites of magazines. Without any restrictions in terms of time period, vocabulary, religiosity, all those studies that will cover certain criteria will be included: (1) static balance; (2) dynamic balance; (3) fear of falling; (4) consequences

of the fall; (5) persons of the third age. Animal studies, records and case series, conference abstracts, or undated letters were excluded.

RESULTS

Through a scientific review of the literature, the results of the importance of risk factors and the significance of abuse of persons of the third age. A total of 197

Figure 1. PRISM diagram of research included in the review



papers, published in the period from 2012 to 2024, extracted from 4 databases, were taken into account. After finishing the copies of studies and publications that are irrelevant, 86 papers were further processed, while only 17 papers were read in full, only 12 papers satisfied the 5 criteria for implementation in the scientific literature review. The studies were of different characteristics: randomized controlled trial, quasi-experimental study, systematic review and meta-analysis, experimental study, and comparative study. In the total number of 12 studies, different exercise programs were aimed at preventing falls in elderly people. The review of these 12 studies proved that there is a great importance of various exercise programs that are applied to people of the third age of life. Picture number 1.

DISCUSSION

The aim of this systematic review was to present the importance of the effectiveness of different exercise programs in the prevention of falls in elderly people. Research by Dyer et al shows that exercise interventions can effectively prevent falls in older people living in residential aged care facilities based on moderate safety evidence. However, this effect is not maintained after cessation of the exercise program (high-certainty evidence), which is not surprising for this frail population who are unlikely to resume exercise when a particular intervention program is withdrawn (Dyer et al., 2023).

Table 1. Summary of study characteristics

ID	Study	Research objective/s	Research method/s	The results	Conclusion
Daqari A, et al., 2016	Otago exercise program for elderly people living in Iran randomized trial.	To analyze the productivity (OEP) on reducing falls of people of the third age.	Elderly people identified in health centers participated in the research. The experimental group conducted (OEP) for 6 months, while the control group had established daily health training.	The study argued for the improvement of static and dynamic balance and functional capacity of people of the third age. A noticeable improvement in the reduction of falls of the experimental group of people of the third age was recorded.	The home exercise program (OEP) greatly reduces the number of falls in elderly people.
Kiik SM, et al., 2020	Effectiveness of the Otago Program for Seniors with Chronic Diseases on Health Status and Fall Risk.	To look at the effectiveness (OEP) on people of the third age with chronic diseases in social institutions in improving the health condition and reducing the risk of falling.	Experimental group (21) control group (21) research participants. Random selection method. The assessment was performed using the Mann–Whitney test, the independent t-test and the Chi-square test. They researched old people who lived in social institutions.	The key benefits in reducing the risk of falling ($p = 0.041$) and health status ($p = 0.011$) were constant.	OEP improves health to a great extent and significantly reduces the risk of falls in old people with chronic diseases. OEP suggestion to various institutions and communities for elderly people.
Yi M, et al., 2023	Productivity of the Otago exercise program on frail or frail elderly people.	To specify the performance (OEP) on physical balance, grip strength, weakness, mobility and quality of life of old people who are weak or faltering.	By editing seven electronic databases involved in the research. Execution (OEP) on old people who are sensitive or physically infirm. Universal method of use (SMD) and 95% precision interval.	They found that (OEP) reduced the level of frailty in the elderly, and improved mobility, readiness for physical balance, and increased postural strength. No improvement in quality of life after exercise (OEP) was identified.	Effectiveness (OEP) is manifested in the physical balance, grip strength, weakness and mobility of old people who are weak or frail.
Jahanpeyma P, et al., 2021	Aspects of the Otago nursing home exercise program in high-risk older people from falls on the domains of falls, balance and physical components.	To assess the impact of (OEP) on physical components, balance and falls in high-risk elderly people who lived in nursing homes.	elderly people who lived in a nursing home in Turkey participated in the research. The experimental group performed (OEP) and walking exercises, while the control group only performed walking exercises. Testing was done before and after the implementation of the Otago exercise program.	People who conducted the funeral (OEP) recorded a noticeable decrease in the number of falls at the end of the study ($p < 0.05$). Medial increases in BBS scores were noted in the (OEP) program group ($p < 0.05$) and 30 s-CST outcomes ($p < 0.05$) after the procedure compared to the group that only performed walking exercises.	OEP reduces the number of falls, improves balance and physical components, and may be effective in nursing homes for fall prevention.
Chen W, et al., 2023	Tai Chi program for the elderly to prevent falls and improve balance.	Significant benefits of Tai Chi in the elderly in preventing falls and improving balance.	A randomized controlled trial of Tai Chi characteristics, falls and balance propensity, browsing various databases.	They found that the Tai Chi program reduces the risk of falls in the elderly as well as the number of falls. The effectiveness is reflected in the improvement of balance as well as the shortening of time and functional reach of the elderly after the Tai Chi program.	Tai Chi is a productive program in preventing falls and improving balance in the elderly, considering people with or without a high risk of falling.
Penn W, et al., 2019	The effects of an individualized Tai Chi program on the balance and strength of the lower limbs of people of the third age	To investigate the effect of the Tai Chi program on elderly people.	Elderly people living in the community, aged 65 and over, without a debilitating disease ($N = 50$) were included in the research. Those willing to participate in the exercise program were assigned to an individualized Tai Chi (ITC) group ($n = 20$), which received ITC training for 8 weeks, and a traditional Tai Chi (ITC) group ($n = 15$), who received ITC training for 8 weeks. The control group ($n = 15$) included those who were unwilling to participate in exercise.	Significant improvements were demonstrated in all tests of functional balance and strength assessment of 16 major muscle groups of the lower extremities in participants in the ITC group compared to the control group, while only BBS and hip and ankle muscle strength improved in the ITC group.	The individual Tai Chi program designed on the basis of objective measurement and implemented in accordance with the degree of intensity and complexity was useful in the prevention of falls in people of the third age.
Lin J, et al., 2024	The effects of different types of Tai Chi exercise programs on the prevention of falls in elderly people	Several studies have compared the effects of different types of Tai Chi exercise programs on fall prevention in elderly people.	Randomized controlled trials involving different types of Tai Chi exercise programs in the prevention of falls in elderly people were included. Outcome measures were the frequency of falls and the Berg Balance Scale (BBS).	Seventeen trials were eligible, including 3470 participants and four types of Tai Chi. They were simplified Tai Chi (24-form), Yang style Tai Chi (Yang style), Sun style Tai Chi (Sun style) and Tai Chi exercise program (TCEP). In a paired meta-analysis, for frequency of falls, the 24-form (relative risk (RR) = 0.59, 95% confidence interval (CI) [0.40, 0.86]) was more effective than the control group. For the BBS outcome, the 24-form (MD (mean difference) = 2.32, 95% CI [1.42, 3.22]) was better than the control group.	Of the four analyzed types of Tai Chi, simplified Tai Chi with 24 forms showed better efficiency than other types.
Taylor D, et al., 2012	The effectiveness of the Tai Chi exercise program as an intervention for the prevention of falls in the elderly community.	To compare the effectiveness of the Tai Chi exercise program and low-level exercise in reducing falls in elderly people.	Tai chi once a week (TC1) ($n = 233$); tai chi twice a week (TC2) ($n = 220$), or a control group of a low-level exercise program (LLE) ($n = 231$) for 20 weeks.	The adjusted incident rate ratio (IRR) for falls was not significantly different between the TC1 and LLE groups or between the TC2 and LLE groups. An adjusted multilevel mixed-effects Poisson regression showed a significant decrease in the log-mean fall rate of -0.050, monthly for all groups. A multilevel fixed effects analysis showed an improvement in balance.	There was no difference in fall rates between groups, with falls decreasing similarly over the 17-month follow-up period. Strength and balance improved similarly in all groups over time.
Maňko G, et al., 2019	The effectiveness of Frankel's stabilization exercises and the stabilometric platform on the balance of people of the third age.	Analysis of the effectiveness of Frankel exercises and training in the use of a stabilometric platform in rehabilitation in reducing the risk of falling in people of the third age.	40 elderly people to the rehabilitation center. Divided into two groups of 20 people each. In experimental group 1 (C), Frankel's stabilization exercises were used; in experimental group 2 (E) a stabilometric platform was used. The correlation between the risk of falling and age, as well as the risk of falling and gender of the examined persons, was taken into account.	The study did not show a correlation between the degree of fall risk and age, as well as between the risk of falling in the elderly and gender. There were also changes in the results that the patients obtained after using the training, both with the application of Frankel's stabilization exercises and with the use of the stabilometric platform. Patients who used the dynamometric platform obtained better results in the Tinetti test after treatment.	In the studied sample, no correlation was found between the risk of falls and age, as well as the risk of falls and gender. Both Frankel exercises and training with the use of a stabilometric platform were effective in a rehabilitation program aimed at reducing the risk of falls in seniors.
Rathi M, et al., 2021	The effectiveness of Frenkel exercises on the balance of people of the third age.	To determine the effectiveness of Frenkel exercises using the Timed up and go test and the Limits of stability component of Balance Master and to compare the effects of conventional exercises with Frenkel exercises.	They were randomly assigned to two groups, a control and an experimental group. Both groups were pre-assessed and home exercises were explained to the control group and Frenkel exercises were given to the experimental group for four weeks and four days a week and were assessed after four weeks of TUG and LOS intervention.	It was determined that the experimental group showed a statistically significant improvement in balance by applying TUG where $p < 0.05$, but no significant difference was found between the control and experimental groups in LOS.	Frenkel exercises were effective in improving balance using the Timed Up and Go test. It helped increase reaction time and improve gait speed in the elderly population, thereby preventing falls, while Frenkel exercises may be clinically useful in improving stability limits, but no significant difference was observed.
Priyabratia D, et al., 2024	Frenkel's stabilization exercises in improving the balance of elderly people with neurological problems.	To evaluate the effectiveness of Frenkel's exercises in relation to general exercises in people of the third age.	The respondents were divided into two groups of 15 respondents each. GROUP A are subjects with general exercises (strengthening and balance exercises), and GROUP B Frenkel exercises (lying, sitting).	It was proven that all interventions gave significant results in all groups, namely Group A (general exercise) and Group B (Frenkel exercise). Subjects of both groups were evaluated using the TUG test to assess balance and the FES to assess fear of falling.	The fall efficiency scale is more effective in home exercises than the Frenkel exercise in reducing subjects' FES. The home exercise program and the Frenkel exercise were equally effective in improving the subjects' balance. However, compared to risk and fear of falling, home exercises were more effective than Frenkel exercises.
Mohammad RV, et al., 2018	Frenkel's balance exercises and aerobic walking exercises in improving the balance of elderly people.	To determine the effectiveness of Frenkel's exercises and aerobic exercises on the balance of people of the third age.	They used a randomized block design, with 4 participants in each block; 48 elderly men and women living in nursing homes in Kerman province were randomly assigned to two groups, balance exercise (Frenkel) and aerobic exercise (walking). The two groups performed Frenkel exercises and aerobic exercise (walking) three sessions of 10 to 15 minutes per week for five weeks.	The mean static balance (RT) increased from 3.16 s to 6.01 s in the Frenkel exercise and from 3.33 s to 4.95 s in the aerobic training group, which indicates an improvement in static balance after the intervention. The mean time of dynamic balance (TUG) during the Frenkel exercise decreased from 17.07s to 12.03s, and during aerobic training from 17.08s to 10.9 seconds, which indicates an improvement in dynamic balance ($p < 0.01$).	Frenkel exercises and walking both improve static and dynamic balance in the elderly in different environments.

Chiu et al. found in subgroup analysis that >30-minute OEP training sessions were most effective for improving balance, but the effects of OEP on balance were not found to be related to training period (total week of training or total number of minutes of training) or frequency (session per week). In fact, the American College of Sports Medicine (ACSM) guidelines for older adults recommend that all healthy older adults exercise regularly for at least 30 minutes five days per week (Chiu et al., 2021).

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CONCLUSION

These studies show that different exercise programs have a huge and significant impact on reducing the risk of falls in older people. It is a long-term and continuous method of reducing the risk of falls in the elderly through exercise. Physical exercise is effective in improving components of balance, lower extremity strength, mobility, and reducing falls and fall-related injuries.

REFERENCES

- Sun M, Min L, Xu N, Huang L, Li X. The Effect of Exercise Intervention on Reducing the Fall Risk in Older Adults: A Meta-Analysis of Randomized Controlled Trials. *Int J Environ Res Public Health*. 2021 Nov 29;18(23):12562.
- Lin Y.-Y., Huang C.-S. Aging in Taiwan: Building a Society for Active Aging and Aging in Place. *Gerontologist*. 2015;56:176–183.
- Zijlstra G.A.R, Haastregt J.C.M.V, Eijk J.T.M.V, Rossum E.V, Stalenhoef P.A, Kempen G.I.J.M. Prevalence and correlates of fear of falling, and associated avoidance of activity in the general population of community-living older people. *Age Ageing*. 2007;36:304–309.
- Sadaqa M, Németh Z, Makai A, Prémusz V, Hock M. Effectiveness of exercise interventions on fall prevention in ambulatory community-dwelling older adults: a systematic review with narrative synthesis. *Front Public Health*. 2023 Aug 3;11:1209319.
- Sherrington C, Fairhall N, Kwok W, Wallbank G, Tiedemann A, Michaleff ZA, Christopher ACM, Bauman A. Evidence on physical activity and falls prevention for people aged 65+ years: systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. *Int J Behav Nutr Phys Act* 17, 144 (2020).
- Dyer S, Suen J, Kwok WS, Dawson R, McLennan C, Cameron ID, Hill KD, Sherrington C. Exercise for falls prevention in aged care: systematic review and trial endpoint meta-analyses. *Age and Ageing*, Volume 52, Issue 12, December 2023, afad217.
- Chiu HL, Yeh TT, Lo YT, Liang PJ, Lee SC. The effects of the Otago Exercise Programme on actual and perceived balance in older adults: A meta-analysis. *PLoS One*. 2021 Aug 6;16(8):e0255780.
- Chen W, Li M, Li H, Lin Y, Feng Z. Tai Chi for fall prevention and balance improvement in older adults: a systematic review and meta-analysis of randomized controlled trials. *Front Public Health*. 2023 Sep 1;11:1236050.
- Mańko G, Pieniążek M, Tim S, Jekielek M. The Effect of Frankel's Stabilization Exercises and Stabilometric Platform in the Balance in Elderly Patients: A Randomized Clinical Trial. *Medicina (Kaunas)*. 2019 Sep 11;55(9):583.
- Karimi MT, Solomonidis S. The relationship between parameters of static and dynamic stability tests. *J Res Med Sci Off J Isfahan Univ Med Sci*. 2011. Apr;16(4):530–5.
- Moher D, Liberati A, Tetzlaff J. PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: 206 the PRISMA statement. *Ann Intern Med*. 151:264–269, W64, 2009.
- Dadgari A, Aizan Hamid T, Hakim MN, Chaman R, Mousavi SA, Poh Hin L, Dadvar L. Randomized Control Trials on Otago Exercise Program (OEP) to Reduce Falls Among Elderly Community Dwellers in Shahrud, Iran. *Iran Red Crescent Med J*. 2016 Feb 14;18(5):e26340.
- Kiik SM, Vanchapo AR, Elfrida MF, Nuwa MS, Sakinah S. Effectiveness of Otago Exercise on Health Status and Risk of Fall Among Elderly with Chronic Illness. *Jurnal Keperawatan Indonesia* 2020 Mar. 30. 2024 Sep. 12;23(1):15-22.
- Yi M, Zhang W, Zhang X, Zhou J, Wang Z. The effectiveness of Otago exercise program in older adults with frailty or pre-frailty: A systematic review and meta-analysis. *Arch Gerontol Geriatr*. 2023 Nov;114:105083.
- Jahanpeyma P, Kayhan Koçak FÖ, Yıldırım Y, Şahin S, Şenuzun Aykar F. Effects of the Otago exercise program on falls, balance, and physical performance in older nursing home residents with high fall risk: a randomized controlled trial. *Eur Geriatr Med*. 2021 Feb;12(1):107–115.
- Penn IW, Sung WH, Lin CH, Chuang E, Chuang TY, Lin PH. Effects of individualized Tai-Chi on balance and lower-limb strength in older adults. *BMC Geriatr*. 2019 Aug 27;19(1):235.
- Lin J, Ning S, Lyu S, Gao H, Shao X, Tan Z, Zhu X, Chen Y. The effects of different types of Tai Chi exercises on preventing falls in older adults: a systematic review and network meta-analysis. *Aging Clin Exp Res*. 2024 Mar 13;36(1):65.
- Taylor D, Hale L, Schluter P, Waters DL, Binns EE, McCracken H, McPherson K, Wolf SL. Effectiveness of tai chi as a community-based falls prevention intervention: a randomized controlled trial. *J Am Geriatr Soc*. 2012 May;60(5):841–8.
- Rathi M, Hamdulay N, Palekar TJ, Joshi R, Patel R, Shah R, Kulkarni M. Efikasnost Frenkelovih vežbi ravnoteže kod starijih osoba. *Indian Journal of Gerontology*. 2021. 35 (4), 483–494.
- Priyabrata D, Dwarikanath R, Alipta Swain, Amitav N, Swami PR, Smrutiranjana S, Nihar RM. Frenkel's stabilization exercises in improving the Balance in elderly patients with neurological Conditions- a comparative study. *International Journal of Research Publication and Reviews*, Vol (5), Issue (7), July (2024), Page – 3429-3435
- Mohammad RV, Athareh A, Mohammad AM, Seyede MN, Hossein AT. Comparative Study of Balance Exercises (Frenkel) and Aerobic Exercises (Walking) on Improving Balance in the Elderly. *Elderly Health Journal*. December 2018.
- Beato M, Dawson N, Svien L, Wharton T. Examining the effects of an Otago-Based Home Exercise Program on falls and fall risks in an assisted living facility. *J Geriatr Phys Ther*. (2019) 42:224–9.
- Van Ravenstein K, Davis BH. When more than exercise is needed to increase chances of aging in place: qualitative analysis of a telehealth physical activity program to improve mobility in low-income older adults. *JMIR aging*. (2018) 1:e11955. 10.2196/11955.
- Shubert TE, Smith ML, Jiang L, Ory MG. Disseminating the Otago Exercise Program in the United States: perceived and actual physical performance improvements from participants. *J Appl Gerontol*. (2018) 37:79–98.
- Son NK, Ryu YU, Jeong HW, Jang YH, Kim HD. Comparison of 2 different exercise approaches: Tai Chi Versus Otago, in community-dwelling older women. *J Geriatr Phys Ther*. (2016) 39:51–7.
- Muñoz Cobos F, Alarcón Pariente E, Gaspar Solanas A, Méndez Ramos M, Canalejo Echeverría A, Burgos Varo ML. The effect of a falls prevention program in elderly people in primary health care. What does Tai Chi practice provide. *Revista Espanola de Salud Publica*. 2019 Jun;93:e201906032.
- Mortazavi H, Tabatabaeichehr M, Golestani A, Armat MR, Yousefi MR. The Effect of Tai Chi Exercise on the Risk and Fear of Falling in Older Adults: a Randomized Clinical Trial. *Mater Sociomed*. 2018 Mar;30(1):38–42.
- Jagtap V, Rayjade A, Warude T, Prasad AS. Effectiveness of Chair Aerobics and Frenkel's Exercise in Geriatric Population on Balance and Coordination—Randomized Control Trial. *Research Article*: 03–Jul–2023.
- Tabatabai Asl SM, Sedaghati P. Effect of Combining Cawthorne-Cooksey and Frenkel Exercises on Functional Balance and

Fall Risk in the Elderly With a History of Falling. *The Scientific Journal of Rehabilitation Medicine*, 2022; 11(1): 114-125.

Conflict of Interest

The authors do not have any conflicts of interest to disclose. All co-authors have reviewed and concurred with the manuscript's content, and no financial interests need to be reported.