Featured Falls Research – March

Effectiveness of the Safe Step Digital Exercise Program to Prevent Falls in Older Community-Dwelling Adults: Randomized Controlled Trial

Pettersson B, Lundin-Olsson L, Skelton DA, Liv P, Zingmark M, Rosendahl E, Sandlund M. J Med Internet Res. 2025 Mar 31;27:e67539.

DOI: 10.2196/67539 **PMID:** 40163860

Abstract

Background: Falls among older adults are a significant public health issue due to their high incidence, severe consequences, and substantial economic impact. Exercise programs incorporating balance and functional exercises have been shown to reduce fall rates, but adherence and scaling up the interventions remain challenges. Digital technology offers a promising avenue to deliver this type of exercise, potentially improving exercise adherence and enabling self-management of exercise in the aging population.

Objective: This study aims to assess the effectiveness of the Safe Step app, a self-managed, unsupervised, home-based digital exercise program, in reducing fall rates or fall risk in community-dwelling older adults. Additional aims were to describe fall-related injuries in both the exercise and control groups, study attrition, and adherence to the Safe Step exercise program.

Methods: Community-dwelling individuals, aged 70 years or older, who had experienced falls or a decline in balance in the past year were randomized to either an exercise group using the Safe Step app combined with educational videos, or a control group receiving educational videos alone. Both interventions lasted for 1 year. Information regarding fall events was self-reported monthly through questionnaires. Exercise adherence was monitored through questionnaires every third month. Negative binomial and logistic regression estimated the incidence rate ratio of fall rate and the risk ratio (RR) of experiencing falls, respectively. Fall-related injuries, study attrition, and exercise adherence were reported descriptively.

Results: In total, 1628 people were enrolled in the study, 79% were women, and the mean age was 75.8 (SD 4.4) years (range 70-94 years). The intention-to-treat analysis showed no significant difference in fall rates between the exercise and control groups after 12 months (2.21 falls per person-year in the exercise group and 2.41 in the control group; incidence rate ratio 0.92, 95% CI 0.76-1.11; P=.37). The risk of experiencing at least 1 fall was significantly lower (11%) in the exercise group compared to the control group (53% vs 59.6%; RR 0.89, 95% CI 0.80-0.99; P=.03). No differences were observed regarding the risk of 2 or more falls (34.1% in the exercise group, 37.1% in the control group; RR 0.92, 95% CI 0.79-1.06; P=.23). Injurious fall rates were similar between the exercise and control group. During the trial, 161 (20%) participants from the exercise group and 63 (8%) from the control group formally withdrew. The proportion of exercise group participants meeting the 90-minute weekly exercise goal was 12.7%, 13.4%, 8.6%, and 9.1% at 3, 6, 9, and 12 months, respectively.

Conclusions: Access to a self-managed unsupervised digital exercise program can be an effective component of a primary fall prevention strategy for community-dwelling older adults. Further research is needed to explore the mediating factors that influence the outcomes and develop strategies that enhance adherence for optimal impact in this population.

Trial registration: ClinicalTrials.gov NCT03963570; https://clinicaltrials.gov/study/NCT03963570.

International registered report identifier (irrid): RR2-10.1136/bmjopen-2019-036194.

Keywords: accidental falls; aging; digital technology; effectiveness; electronic health; exercise therapy; fall prevention; geriatric medicine; independent living; mobile health; older adults; preventive medicine; randomized controlled trial; self-management.

Falls Research – March

Longitudinal Changes in Dynamic Balance in Community-Dwelling Older Adults

Banarjee C, Suarez JRM, Lafontant K, Choi H, Chen C, Xie R, Thiamwong L. Clin Interv Aging. 2025 Mar 20;20:335-348.

DOI: 10.2147/CIA.S495112 **PMID:** 40129901 **PMCID:** PMC11932031

Abstract

Purpose: Dynamic balance, an important contributor to fall risk in older adults, involves maintaining the center of pressure while in locomotive states and is. Fall risk appraisal (FRA) is defined as assessing an older adult's awareness of their physiological and perceived fall risk. This longitudinal study aimed to evaluate how multimodal factors predict fluctuations in dynamic balance in community-dwelling low-income older adults, utilizing fear of falling (FoF), static balance, fall history, and moderate-to-vigorous physical activity (MVPA).

Patients and methods: The longitudinal study included 140 community-dwelling, low-income older adults, with 124 women and 16 men. FoF was assessed using the Short Falls Efficacy Scale International (Short FES-I) and static balance using BTracks Balance Test (BBT). Both were utilized to define FRA Distance, an integrated quantification of physiological and perceived balance deficits. MVPA was assessed using accelerometers, fall history using self-report, and dynamic balance using the Timed Up and Go (TUG) test. The study was conducted at 4 timepoints at T1 (baseline), T2 (2 months), T3 (4 months), and T4 (6 months).

Results: Using mixed effects multilevel models, TUG scores were predicted by time, %MVPA, and FRA distance ratio. The effect of FRA distance ratio was primarily driven by FoF, and the effect of %MVPA varied by age. Additionally, while fall history did not show a predictive relationship with TUG scores, it did predict FRA distance.

Conclusion: Dynamic balance fluctuated over time and was influenced by multimodal factors, namely MVPA and FRA, which captured the interplay between static balance and FoF. Fall history did not directly predict dynamic balance but played a role in FRA, implicating the subjective effects of fall history. These findings demonstrate how physical activity, FRA, and their interactions can predict changes in dynamic balance. Future work can utilize the results to evaluate low-cost interventions for community-dwelling older adults.

Keywords: balance; fear of falling; older adults; physical activity.

The epidemiology of unintentional falls among older people in the Middle East and North Africa: a systematic review and meta-analysis

Chaabna K, Jithesh A, Khawaja S, Aboughanem J, Mamtani R, Cheema S. J Glob Health. 2025 Mar 14;15:04072.

DOI: 10.7189/jogh.15.04072 **PMID:** 40084526 **PMCID:** PMC11907375

Abstract

Background: Falls epidemiology in the Middle East and North Africa (MENA) remains underexplored despite being a major cause of morbidity and mortality. We synthesised the data on unintentional falls among older adults in MENA countries.

Methods: We conducted a systematic review, meta-analysis, and meta-regression, searching MEDLINE/PubMed, Web of Science, and Google Scholar up to 5 May 2024, without language or time restriction. We included records on fall prevalence, frequency, location, self-reported reasons, consequences, and health care utilisation. Two reviewers independently conducted multi-stage screening, data extraction, and quality assessment. We estimated the pooled-average prevalence using random-effect models and calculated MENA population-size weighted-averages.

Results: We identified 7392 records, finding 90 eligible studies covering 99 588 older adults from 14 countries. The MENA population-size weighted-average prevalence of older adults with ≥1 fall was 17.6% (95% confidence interval (CI) = 9.8-36.3), with higher prevalence in older age (P = 0.001). Among fallers, 59.0% (95% CI = 40.0-76.0) reported ≥2 falls. The pooled prevalence of fallers was 60.1% (95% CI = 42.2-75.7) among older trauma unit patients, while 49.3% (95% CI = 33.9-64.8) of older outpatients reported falling in the past year. Falls occurred primarily at home (pooled-average proportion of fallers = 66.1%; 95% CI = 46.6-81.3), with fewer at work (10.1%; 95% CI = 1.6-44.2), and in hospitals (6.0%; 95% CI = 2.5-13.8). On average, post-fall, 45.6% (95% CI = 37.8-53.5) sought medical care, 36.8% (95% CI = 21.9-54.8) had fractures, and 17.3% (95% CI = 8.0-33.2) experienced anxiety or depression. The in-hospital death rate following a fall was 7.5% (95% CI = 1.5-29.8). Self-reported reasons for falls included medical conditions, balance problems, and environmental factors. We observed substantial heterogeneity and some publication bias (LFK index = 7.34).

Conclusions: The prevalence of older adults in MENA reporting ≥1 fall is lower than global estimates. However, substantial fracture proportions, mental health issues, and in-hospital deaths following a fall underscore the need for region-specific fall prevention strategies.

Registration: This review is registered on the Open Science Framework (https://osf.io/3cu4q; https://doi.org/10.17605/OSF.IO/3CU4Q).

Screening of Fall Risk in Older Adults With Hearing Loss Living in the Singapore Community

Charmaine T, Ling ATY, Ling KT. Am J Audiol. 2025 Mar 13:1-13.

DOI: 10.1044/2024_AJA-23-00123 **PMID:** 40080874

Abstract

Purpose: Hearing loss is an independent risk factor for falls. Research has demonstrated the importance of a combination of self-report and performance-based tools in predicting falls. Using this approach, the purpose of this study was to examine the association between the degree of hearing loss and fall risk.

Method: Community-dwelling older adults with hearing loss, aged 60 years and above, completed a history form, the Activities-Specific Balance Confidence Scale and the modified Clinical Test of Sensory Interaction in Balance. Average pure-tone audiometry of the better hearing ear was calculated. Fall risk was determined for each participant. Binomial logistic regression and Cohen's kappa were performed.

Results: Fifty-eight participants, with mild (n = 12), moderate (n = 27), moderately severe (n = 14), and severe (n = 5) hearing losses were included in the analysis. Overall fall risk incidence was 46.6%. No significant association was found between the degree of hearing loss and fall risk, while age, gender, and diabetes were revealed to be significant fall risk factors. A key finding was the tendency to overestimate balance confidence using self-report measures.

Conclusions: To our knowledge, this is the first study in Asia employing self-report and performance-based measures to examine hearing loss and fall risk. Our findings provide insight into region-specific factor(s) affecting fall risk and serves to pave the way for future fall risk research. Future studies should include a combination of self-report and performance-based measures, as well as account for protective fall risk factors.

A smarter approach to fall prevention: insights for action

Delbaere K. Age Ageing. 2025 Mar 3;54(3):afae291.

DOI: 10.1093/ageing/afae291 **PMID:** 40104973

Abstract

Abstract not available

Influence of low bone mineral density on risk of falls and gait in post-menopausal women and elderly: A systematic review

Demeco A, de Sire A, Marotta N, Frizziero A, Salerno A, Filograna G, Cavajon M, Costantino C. J Back Musculoskelet Rehabil. 2025 Mar 25:10538127251316187.

DOI: 10.1177/10538127251316187 **PMID:** 40130480

Abstract

Background Low bone mineral density (LBMD) significantly contributes to loss of independence, gait impairment, and increased fall risk. Instrumental gait analysis provides an accurate evaluation of walking ability, that represent the first step for a personalized rehabilitation.

Objective To collect and describe the available literature on the effect of LBMD on walking characteristics and the use of motion analysis systems in patients with LBMD.

Methods We performed a literature search of the last ten years on PubMed, Web of Science and Scopus of papers on older people and patients with LBMD in terms of gait parameters, balance, and fall risk. The review protocol was registered on PROSPERO (CRD42024590090).

Results The database search identified totally 756 records; after duplicates deletion, 13 were considered eligible. The results reported that subjects with LBMD had kinematic alterations of the walk, alterations of posture, speed of walking and the strength generated in the gait. Patients with osteoporosis show a reduction of gait speed and trunk asymmetry; moreover, there is a a decrease in body rotation and lower hip and ankle moments in post-menopausal women.

Conclusions Patients with LBMD showed gait alterations that can higher the risk of falls. In this context, gait analysis can be useful in detecting variations in pattern, symmetry, gait speed and posture in elderly patients, that can represent an essential step for a personalized rehabilitation program.

Keywords: balance; gait symmetry; osteoporosis; risk of fall.

Effects of Otago Exercise Program and aquatic exercise on fall risk in older adults: A systematic review

Dong M, Liu X, Choi Y, Li N. Arch Gerontol Geriatr. 2025 May;132:105799.

DOI: 10.1016/j.archger.2025.105799 **PMID:** 40037071

Abstract

Background: The aim of this systematic review was to determine the processes and forms of participation in Otago Exercise Program (OEP) and Aquatic exercise(AE) for the prevention of falls in older adults, and to compare the effectiveness of the two exercises as interventions for the prevention of falls in older adults.

Methods: Using electronic databases such as PubMed, Web of Science, Embase, Scopus, and Google Scholar, we searched for relevant domestic and foreign papers in the last 15 years, and evaluated the methodology and quality of the report by both AMSTAR 2 and PRISMA scales to evaluate the methodology and reporting quality.

Results: A total of 33 papers were included by searching various literatures related to the topic of this study and carefully reviewed by the researcher.

Conclusion: This systematic review confirms that OEP and AE effectively prevent falls in older adults by improving cognitive function, lower limb muscle strength, and balance. OEP significantly enhances muscle strength, while AE shows slight superiority in improving balance-related abilities like gait stability. These findings highlight the need for optimized training cycles in OEP and AE to maximize muscle adaptation. Both programs are safe and effective, with potential to reduce falls and enhance physical and cognitive functions. Tailored interventions, aligned with home health care guidelines and specific living environments, can improve quality of life. Future research should explore the optimal exercise modalities and intensities, and conduct longitudinal studies to assess long-term outcomes, particularly for older adults with specific health conditions.

Keywords: Aquatic exercise; Balance improvement; Fall risk; Muscle strength; Older adults; Otago exercise program.

Feasibility of a mat-based Pilates program for community dwelling seniors to improve balance and core strength

Gonzales L, Ngo K, Kraus P, Zander Y, Hatch MN. PM R. 2025 Mar 29.

DOI: 10.1002/pmrj.13358 **PMID:** 40156452

Abstract

Background: Popular programs to combat the increased rates of falls and improve overall balance and strength in the aging population are limited by accessibility or focus on distal movements, thereby limiting gains from the programs. The use of an age-appropriate, community-based Pilates program focusing on core strengthening for improved balance is proposed.

Objective: The primary objective was to test the feasibility, acceptability, and appropriateness of a mat-based, core strengthening Pilates program (aka Pilates Gold). The secondary objective was to investigate changes in balance and core strength for participating seniors.

Design: Prospective pre-post, observational study.

Setting: Classes were on site at two retirement community centers.

Participants: Males and females (65 years old and older) were recruited from two different senior community centers on a first-come first-serve basis. Participants had to be (1) English speaking, (2) an existing resident at one of the retirement communities, and (3) considered healthy by common standards.

Interventions: Mat-based Pilates program for 8 consecutive weeks. Movement difficulty and pace were slowly increased over the 8-week program, with a maximum of 17 different movements.

Main outcome measures: Primary outcomes for feasibility of the Pilates program were the Acceptability of Intervention Measure, Intervention Appropriateness Measure, and Feasibility of Intervention Measure. Secondary outcomes included the Sitting-Rising test, Activities Balance Confidence, and Patient Global Impression of Change.

Results: The Pilates program was deemed appropriate, acceptable, and feasible by >80% of senior participants. Over 80% also reported some level of change in overall health due to the program. No significant differences were observed in balance outcomes, although there were individual improvements.

Conclusions: Community-based Pilates programs are highly desired, feasible, and acceptable. These results justify further studies, of longer training periods and perhaps increasing difficult levels, to determine if core strengthening mat-based Pilates is truly capable of improving balance, strength, and fall risks in seniors.

Cross-sectional assessment of the Tinetti performance-oriented mobility tool for screening physical frailty syndrome in older adults

Hayati M, Furtado GE, Nazarali P, Sardroodian M, Mohammadi H, Hosseinzadeh M. BMC Geriatr. 2025 Mar 29;25(1):214.

DOI: 10.1186/s12877-025-05858-0 **PMID:** 40158095

Abstract

Background: Physical-functional fitness (PFF) assessments have become crucial tools for identifying physical frailty syndrome (PFS) in older adults, helping guide preventive and interventional strategies.

Purpose: This study aimed to evaluate the predictive value of performance-based PFF tests for detecting PFS among community-dwelling older adults in Tehran, Iran. Additionally, it sought to compare PFF variables between PFS groups to assess the applicability of these tests as practical screening tools in clinical and community settings.

Methods: Data were collected from 161 participants (91 males, 56.5%; 70 females, 43.5%), including sociodemographic, anthropometric, medical history, PFF, and PFS assessments.

Results: Frail participants exhibited significantly lower scores in various PFF tests, including the Tinetti balance, walking, and total score components, physical activity levels (PAL), mean hand grip strength (MGS), 30-s arm curl (30 s-AC), 30 s-chair stand (30 s-CS), Standing Stork Balance (SSB), and back stretch (BST) tests ($p < 0.001$). Frail individuals also had lower levels of education, shorter stature, and higher BMI compared to non-frail/pre-frail participants, highlighting broader vulnerabilities. Logistic regression analyses showed that all PFF tests, including Tinetti balance and walking components, MGS, 30 s-AC, 30 s-CS, were significant protective factors against FS. However, ROC curve analysis revealed optimal cutoff points for PFS identification, with PAL and MGS demonstrating the highest sensitivity and specificity for predicting PFS. The all components of Tinetti scale also proved to be strong predictors of FS.

Conclusion: Our findings demonstrate that, regardless of age, sex, education level, stature, and fall incidence, PFF assessments remain critical for identifying older adults at risk for PFS. The study highlights the predictive strength of key variables, such as PAL, MGS, and the Tinetti-POMA components, offering novel insights into the role of these tests in improving PFS screening accuracy. These results underscore the importance of integrating PFF assessments into routine clinical and community-based health evaluations, enabling early detection and timely interventions to promote healthier aging trajectories.

Keywords: Accidental falls; Fatigue; Frailty syndrome; Health risk assessment; Muscle weakness.

Effects of the Chinese traditional fitness practice Wuqinxi on balance improvement in older women with a history of falls: a randomized controlled trial

Jiang Y, Liu H. Front Public Health. 2025 Mar 6;13:1503309.

DOI: 10.3389/fpubh.2025.1503309 **PMID:** 40115332 **PMCID**: PMC11922865

Abstract

Objective: This study evaluated the impact of Wuqinxi Qigong, a traditional Chinese fitness practice, on the balance abilities of older women with a history of falls.

Methods: Participants in the experimental group (n = 35) and the control group (n = 36), matched for age, height, and weight, engaged in a 24-week Wuqinxi exercise program (three times per week, 70 min per session). Dynamic and static balance abilities were assessed at weeks 0, 12, and 24.

Results: Within the experimental group, compared to baseline, the movement distance of the center of pressure with open eyes (left and right) decreased by 17.0 and 22.1% at weeks 12 and 24, respectively ($p < 0.05$). The movement distance with closed eyes, the total length of displacement of the center of pressure, and the speed of center of pressure (left and right) decreased by 17.1, 8.6, and 16.6% at week 24 ($p < 0.05$). The one-leg stand time with eyes open and closed increased by 47.7, 68.0, and 77.1%, 80.6% at weeks 12 and 24, respectively ($p < 0.01$). Compared to week 12, the one-leg stand time with eyes open increased by 19.9% at week 24 ($p < 0.01$).

Conclusion: A 24-week Wuqinxi exercise regimen enhances both static and dynamic balance abilities in older women with a history of falls. A longer regimen further improves static balance with eyes open compared to the 12-week mark.

Keywords: balance training; fall risk reduction; gender-based interventions; older adult health; randomized trial.

The effect of proprioceptive neuromuscular facilitation techniques compared to general aerobic exercise on balance, fear of falling, and quality of life in older adults living in nursing homes: a randomized controlled trial

Kajbafvala M, Eshlaghi MA, ShahAli S, Pourkazem F, Hejazi A. BMC Geriatr. 2025 Mar 27;25(1):200.

DOI: 10.1186/s12877-025-05822-y **PMID:** 40148762 **PMCID:** PMC11948863

Abstract

Background: With aging, changes occur in various body systems, such as cardiovascular, respiratory, neuromusculoskeletal, and vestibular, leading to a decreased quality of life (QOL) and an increased fear of falling (FOF). Exercise and physical activity reduce the progression of aging complications. Therefore, we examined the effect of proprioceptive neuromuscular facilitation techniques compared to aerobic exercise on balance, fear of falling, and quality of life in older adults living in nursing homes.

Methods: Fifty-two older adults aged over 60 (31 males, 21 females) living in nursing homes were included. After initial evaluation, individuals were randomly assigned to two treatment groups (PNF techniques and aerobic exercise). Both treatment groups received 12 treatment sessions over 4 weeks. Balance, fear of falling, and quality of life were assessed at baseline and after a 4-week intervention. Analysis of covariance (ANCOVA) and paired samples t-test were utilized to between and within-group changes of variables.

Results: The results showed no significant differences in balance, fear of falling, and quality of life between groups after the intervention ($P > 0.05$). In the within-group comparison, only the PNF techniques group showed significant improvement in the Berg Balance Scale (BBS) after the intervention ($P < 0.05$).

Conclusion: The findings suggest that PNF techniques compared with aerobic exercise could not contribute to improved balance, fear of falling, and quality of life. Therefore, more clinical trial studies with a control group are needed to determine the exact effects of these techniques.

Trial registration number (trn) and date of registration: The trial was registered at the (https://www.irct.ir), (IRCT20210505051181N4) on 9/2/2023.

Keywords: Aerobic exercise; Aging; Balance; Fear of falling; Proprioceptive neuromuscular facilitation; Quality of life.

Supervised and self-directed technology-based dual-task exercise training programme for older adults at risk of falling - Protocol for a feasibility study

Mathur P, Thomas H, Cooper A, Chechlacz M, Stathi A, Goodyear V, Miller C, Krauss T, Ives N, Magill L, Kinghorn P, Wilson D, Chiou SY. PLoS One. 2025 Mar 24;20(3):e0314829.

DOI: 10.1371/journal.pone.0314829 **PMID:** 39992460 **PMCID:** PMC11932479

Abstract

Falls among older adults pose a significant public health challenge, as they lead to severe outcomes such as fractures and loss of independence. Research has shown that training cognitive function and balance simultaneously, termed Dual-Task (DT) training, improves mobility and reduces fall risks in older adults. This study aims to evaluate the feasibility and acceptability of a blended supervised and self-directed technology-based DT training programme for older adults who have high risk of falling. This is a single-arm, non-randomised feasibility study employing quantitative and qualitative methods. Fifty healthy adults aged 65 years or above will be recruited from the NHS primary and secondary care pathways and from the community. Participants will undergo supervised cognitive and balance DT training for 12 weeks, followed by self-directed DT training for an additional 12 weeks. The cognitive training will be delivered using a commercial mobile application (app) available from the AppStore or Google Play. The balance training will involve static (Marching on the spot, Tandem Stand, Hip Abduction & Extension, Squats, Tiptoe Stand, and Pendulum/Sideways Sway) and dynamic (Figure of Eight Walk, Walking Forwards and Backwards, Lunges, Functional Reach, Toe Tapping, Upper Limb Strength Exercises, and Side-Steps/Simple Grapevine) exercises focused on improving balance, postural stability and strength. Feasibility outcomes will be recruitment, adherence, usage of the app, and attrition. Outcomes measure data, that will be collected at baseline and at 24 weeks, includes the Timed- Up and Go (TUG) test (likely primary outcome in any future trial), along with self-reported questionnaires assessing cognition, fear of falling, quality of life, healthcare service usage, and the self-reported number of falls. Focus group interviews will be conducted with thirty participants and thirty healthcare professionals for in-depth exploration of the feasibility and acceptability of the DT training programme.

Comparison of Balance Confidence in Older Adults With and Without Long-Haul COVID-19

Relyea M, Buddhadev HH, Chalmers GR, Bennett S. J Aging Phys Act. 2025 Mar 6:1-8. doi: 10.1123/japa.2024-0116.

DOI: 10.1123/japa.2024-0116 **PMID:** 40049177

Abstract

Background/objectives: The effects of long COVID-19 on balance and fall risk in older adults are unknown. This study aimed to explore the relationship between balance confidence/fall risk, as assessed by the Activities-Specific Balance Confidence Scale and the Falls Efficacy Scale-International, and long COVID-19 status in older adults.

Methods: This study assessed balance confidence and concern of falling in older adults (≥60 years) with long COVID-19 (long-haulers, n = 30) compared with older adults who experienced COVID-19 but not long COVID-19 (non-long-haulers, n = 60) and older adults (controls) who self-reported never having COVID-19 (n = 52). Participants gave informed consent and completed the Activities-Specific Balance Confidence Scale and the Falls Efficacy Scale-International. Data were analyzed using Kruskal-Wallis tests.

Results: Long-haulers had lower balance confidence and greater concern of falling compared with non-long-haulers ($p < .001$; $p < .001$) and controls ($p = .011$; $p = .027$).

Conclusion: Older adults with long-haul COVID-19 have decreased balance confidence and increased concern of falling compared with non-long-haulers and healthy controls, which may indicate a greater fall risk. Significance/Implications: Older adults with long COVID-19 may have a heightened need for resources and healthcare services related to fall prevention. Consideration of long COVID-19 status may be an important factor in improving older adult's outcomes.

Keywords: fall risk; long COVID-19; postacute COVID-19 syndrome.

Effects of Tactile Sensory Stimulation Training of the Trunk and Sole on Standing Balance Ability in Older Adults: A Randomized Controlled Trial

Tanaka T, Maeda Y, Miura T. J Funct Morphol Kinesiol. 2025 Mar 17;10(1):96.

DOI: 10.3390/jfmk10010096 **PMID:** 40137348 **PMCID:** PMC11943072

Abstract

Background: Aging is associated with a decline in both motor and sensory functions that destabilizes posture, increasing the risk of falls. Dynamic standing balance is strongly linked to fall risk in older adults. Sensory information from the soles and trunk is essential for balance control. Few studies have demonstrated the efficacy of targeted sensory training on balance improvement.

Objectives: To assess vibratory sensation function in the trunk and sole using a vibration device and evaluate the effects of trunk and sole tactile sensation training on dynamic standing balance performance in older adults.

Methods: In this randomized controlled trial, eighteen older adults were randomly assigned to three groups: control (n = 8, mean age 66.6 ± 3.4), trunk training (n = 5, mean age 71.0 ± 1.9), and sole training (n = 5, mean age 66.4 ± 3.6). The training lasted for 10 weeks, utilizing vibratory stimulation at 128 Hz through tuning forks for 15 min during each session, conducted three times a week. The primary outcomes were vibratory sensitivity, assessed with a belt-fitted device on the trunk and a plate equipped with vibrators on the soles, and dynamic balance, evaluated through force plate testing that measured limits of stability (LoS) in multiple directions.

Results: Correct response rates for trunk vibratory stimulation significantly improved in the trunk training group ($p < 0.05$). The rate of two-stimuli discrimination improved in both training groups. Significant advancements in balance metrics were observed in the trunk and sole training groups when compared to the control group, especially regarding anterior-posterior tilts ($p < 0.05$). A positive correlation was identified between two-point vibratory discrimination and LoS test performance.

Conclusions: Sensory training of the trunk and sole enhances balance performance in older adults, suggesting potential benefits for fall prevention. Future studies should assess long-term effects and explore optimal training duration with larger sample sizes.

Keywords: dynamic standing balance; older adults; sensory stimulation training.