

Age-Related Differences and the Effects of Sensorimotor Training on Postural Control in Older Adults

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INTRODUCTION & AIM

Postural control deteriorates progressively with age as sensory, motor, and cognitive subsystems become less efficient, contributing to instability and increased fall risk^{1,2}. Understanding how balance performance evolves across later adulthood and how targeted interventions may counteract these changes is essential for optimizing preventive strategies³. Sensorimotor training has emerged as a promising approach to enhance stability by stimulating multisensory integration, improving neuromuscular coordination, and promoting adaptive postural responses⁵. This study investigated age-related differences in postural control among adults aged 55–80 years and evaluated the effects of a six-month sensorimotor training program on linear and nonlinear balance parameters. Additionally, the study examined changes in sway variability and complexity as indicators of postural system adaptability.

METHOD

Eighty-six community-dwelling older adults were randomly allocated to a control group (CG, n=43; 73.50±6.08 years) or an exercise group (EG, n=43; 72.40±7.03 years). The EG completed a twice-weekly, six-month sensorimotor training program centered on six circuits of progressively challenging exercises, each comprising eight adaptable tasks targeting sensory reweighting, coordination, and postural responsiveness. Balance assessments were performed with eyes open and eyes closed, using variability measures and linear and nonlinear parameters such as acceleration metrics, entropy indices, and Lyapunov Exponents to analyze postural behavior. Pre- and post-intervention comparisons were conducted to determine training-related changes between groups.

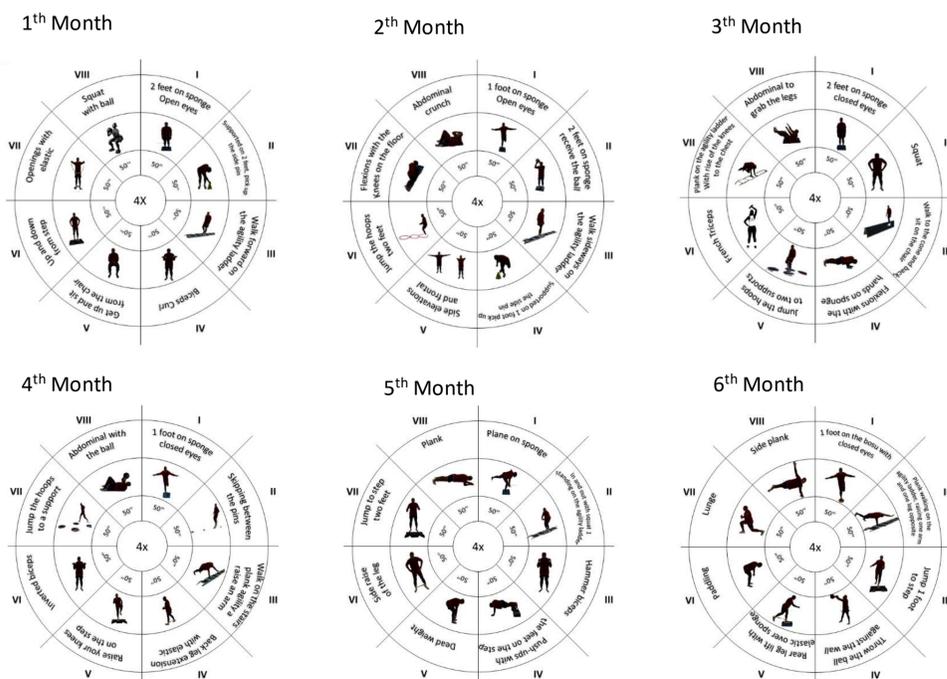


Figure 1. Main sessions organized by study month.

RESULTS & DISCUSSION

Participants in the EG demonstrated significant improvements in postural control across sensory conditions. Decreases in sample entropy and approximate entropy indicated greater regularity and improved organization of sway patterns. Significant reductions in the Lyapunov Exponent suggested enhanced dynamic stability, while lower acceleration values reflected reduced instability. Conversely, the CG exhibited tendencies toward increased sway variability and loss of control over time.

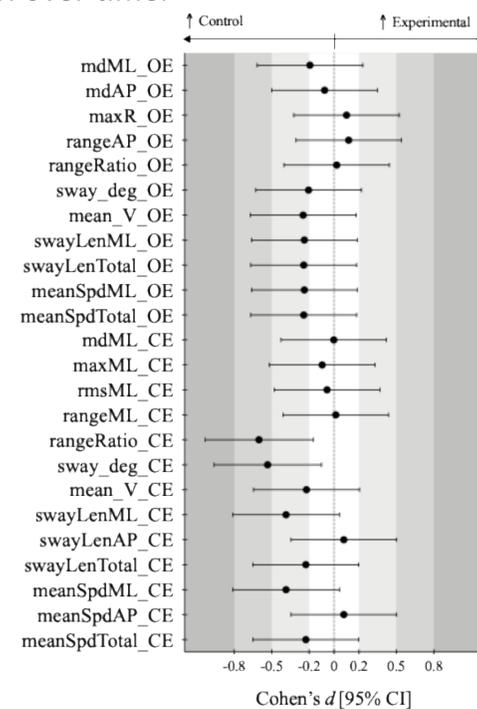


Figure 2. Cohen's d differences between Control and Experimental group for considered variables according. Error bars indicate uncertainty in true mean changes with 95% confidence intervals.

CONCLUSION

The six-month sensorimotor intervention effectively supported balance maintenance by improving sway regularity, stability, and adaptability, mitigating age-related declines observed in non-exercising peers. These findings reinforce the relevance of sensorimotor training as a preventive and clinically meaningful strategy to promote safer, more stable movement in older adults.

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