Evaluating the Effects of Balance Training in Older Adults with Aspire Motion

Introduction

This retrospective analysis evaluates the outcome of a four-week balance training program aimed at improving functional abilities in community-dwelling older adults. Older adults are at an increased risk for falls due to factors such as reduced strength, balance deficits, and gait instability. Enhancing these functional abilities is critical for fall prevention.

For the balance training program, participants were equipped with Aspire Motion Connect, a sensor and app designed to objectively measure body movements and provide immediate performance feedback. Participants reported the feedback increased their motivation and adherence to the program. Participants were assessed before and after the training program using Aspire Motion Fall Risk Management, a comprehensive tool that evaluates body movement and fall risk through a set of basic, functional tasks. The results and impact of the training program can provide valuable insights into effective strategies for fall prevention and the promotion of health in older adults.

Method

Twelve healthy older adults participated in the training program. Each participant was equipped with an Aspire Motion Connect (AMC) unit, a sensor worn around the waist that captures and objectively measures body movements during balance training exercises. The exercises included standing on one leg, single-leg side raises, side bends, tandem stance, forward reach, wall planks, and glute bridges. At the end of each exercise, the AMC app provided participants with a score and insights into their directional movement.

Participants were assessed using the Aspire Motion Fall Risk Management (AM) both before and after the four-week balance training program. The AM Assessment included two dynamic functional tests - a 6m walk and 5 sit-to-stands (STS), and two postural stability tests - Feet Together eyes open (EO) balance and Feet Together eyes closed (EC) balance. Five parameters were evaluated: gait cadence, gait body lift, time to complete five sit-to-stands, EO sway length, and EC sway length.

Results

Improvements were observed across all four AM assessments at the end of the four-week balance training program; the mean values for the five parameters evaluated showed positive changes. Table 1 presents the pre and post-assessment findings.

AM Parameters	Pre-Assessment	Post-Assessment
Gait Cadence (spm)	110.24±12.24	120.46±12.01
Gait Body Lift (%)	0.95±0.64	1.51±0.92
5x STS Time (seconds)	11.08±1.50	9.62±1.78
Sway Len EO (cm)	12.13±4.32	11.26±4.01
Sway Len EC (cm)	18.63±8.22	17.93±7.50

Table 1. The mean values of the five parameters pre and post-assessment.

The majority of the participants demonstrated significant improvement in both gait and STS assessments with an overall 21% increase in cadence, 16% increase in body lift, and a 20% reduction in time to complete 5 STS. Postural stability also showed modest improvement with a 5% decrease in EO sway length and a 2% decrease in EC sway length. Figure 1 illustrates the pre vs. post-assessment changes in the assessment values.

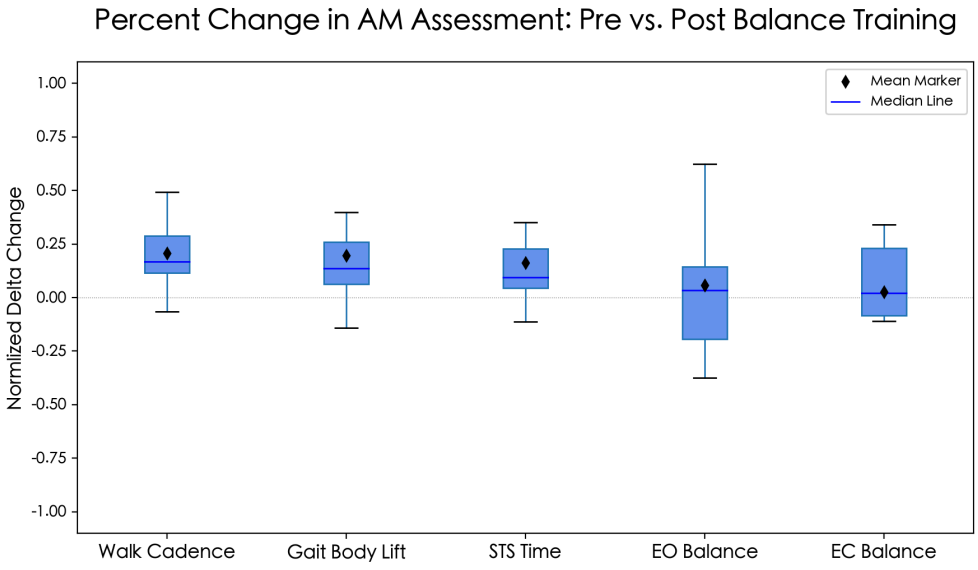


Figure 1. Normalized changes of AM parameters after four week balance training program. The black diamond represents the mean of each parameter while the blue horizontal line represents the median.

A closer examination of individual performance revealed that every participant improved in at least one area of the gait and STS assessments. 10 out of 12 participants showed improvement in both gait and STS performance. Two participants regressed slightly in the time to complete 5 STS. Figure 2 illustrates the changes in STS time of the pre and post assessment of each participant.

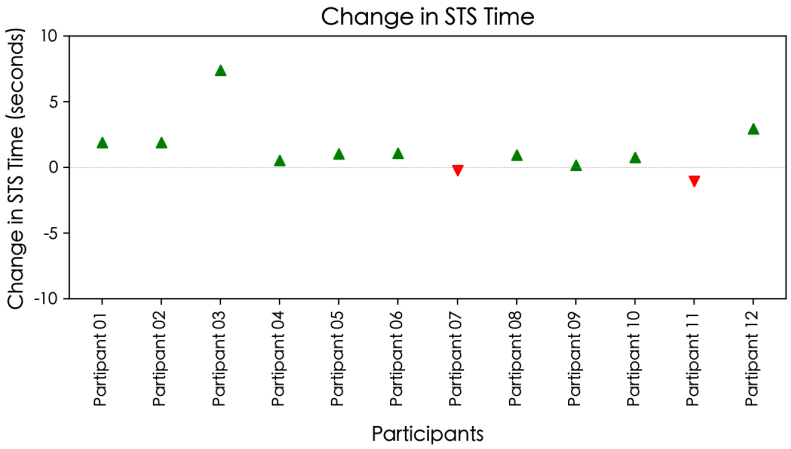
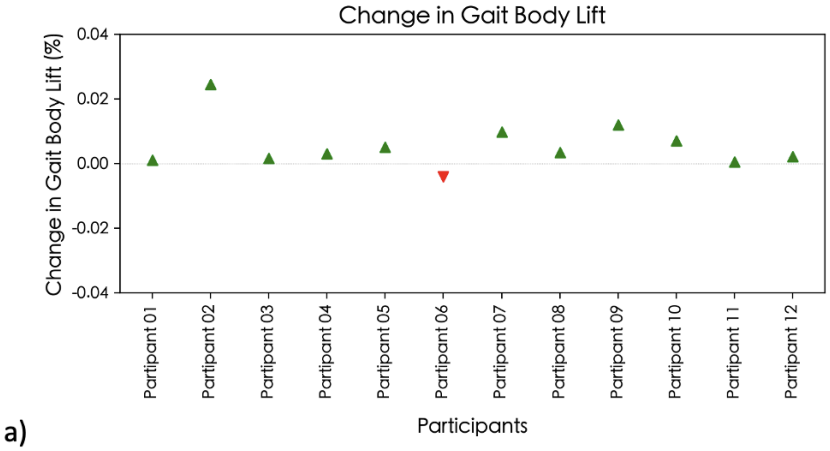
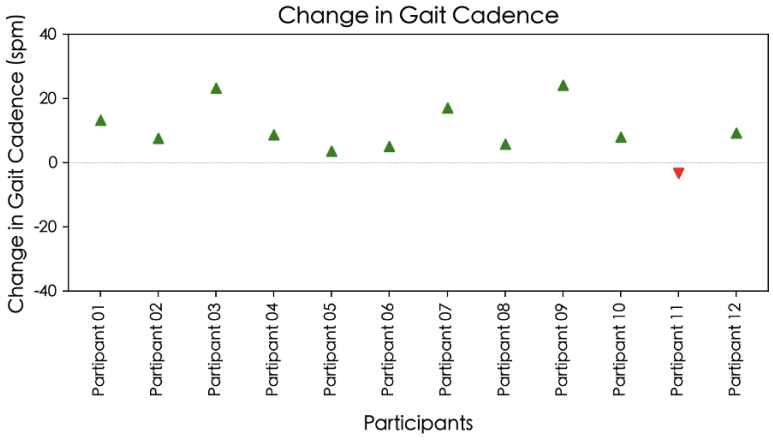


Figure 2. Difference in time to complete 5 sit-to-stands after 4 week balance training program.

Additionally, 11 out of the 12 participants showed improvements in gait. Figure 3 presents the changes in gait parameters of each participant.



a)



b)

Figure 3a) Percentage change in vertical body lift of each participant after completing the 4 week balance training program. **3b)** Change in walking cadence of each participant after completing the 4 week balance training program.

As a group, overall EO sway length improved by 5%. However, when examining individual performance levels, the results were mixed. Figure 4 illustrates the changes in EO sway length and shows that 5 out of 12 participants exhibited greater sway in the post-assessment.

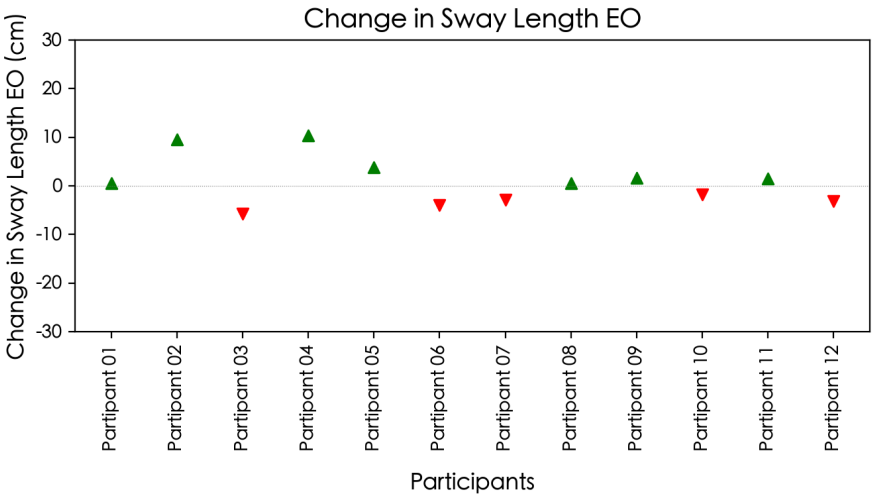


Figure 4. Change in sway length of each participant after completing the 4 week balance training program.

Discussion

This retrospective analysis highlights the positive impact of a four-week balance training program on the functional abilities of community-dwelling older adults. The findings demonstrate significant improvements in gait and STS performance and modest improvements in postural stability.

Particularly noteworthy is the significant decrease in the time taken to complete five STS, suggesting increased lower limb strength and mobility. Lower extremity strength is associated with fall risk[1]. The decrease in STS time supports the observed enhancements in gait performance. The significant increase in gait body lift also functions as an indicator of lower limb strength, which can improve stability and further reduce the likelihood of falls.

The observed improvements in walking cadence are also significant. Walking cadence is closely correlated with gait velocity, a well-established predictor of fall risk[2]. It is well documented that decreased gait speeds correlate with increased fall risk[3,4]. The combined increase in lower limb strength, decreased STS time, and improved gait cadence indicates that participants enhanced their overall gait performance, potentially lowering their risk of falls.

While overall postural balance showed a modest improvement (2-5%), the results were mixed at the individual level. It is noteworthy that individuals who exhibited greater sway in the post-assessment showed only minimal regression. One possible explanation for the limited improvement in postural stability is the ceiling effect[5]. The Feet Together stance is relatively easy for healthy adults. If the postural stability had included more challenging positions such as Tandem Stance or Single Leg Stance, more substantial improvements may have been observed. Having more demanding assessments could better capture the nuances of balance training effects and provide a clearer understanding of individual progress.

Eleven out of the twelve participants reported that feedback from the AMC app increased their motivation to do the exercises each day. The engagement likely played a crucial role in the adherence to the program and functional improvements. Other studies have concluded that both subjective and objective feedback can enhance patient adherence[6]. The one participant who did not report increased motivation encountered difficulties using the app.

Overall, this study underscores the importance of a comprehensive approach to balance training that incorporates strength, stability, and dynamic movement. Future research should aim to explore the long-term effects of such interventions and consider more challenging assessments to minimize potential ceiling effects.

Conclusion

In conclusion, this retrospective analysis demonstrates that a four-week balance training program significantly improves gait performance and lower limb strength among community-dwelling older adults. These improvements can lead to enhanced mobility and reduced fall risk.

While most participants benefited from the program, the mixed results in postural stability tests indicate that static balance components require further investigation. One potential reason for the limited improvement may be the ceiling effect associated with the simple Feet Together stance. However, it remains unclear if this is the sole factor influencing the results. This underscores the importance of incorporating a variety of assessments in future interventions to better capture changes in static balance.

The reported increase in motivation and adherence to the program attributed to AMC, along with the positive outcomes, highlights the important role of providing an engaging experience and having objective feedback. Additionally, ensuring that technology is user-friendly can further enhance participant engagement and results.

Ongoing research to explore the long-term effects and optimize training strategies for older adults is essential for preserving functional independence and enhancing the quality of life.

References

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