Effects of Eight-Week Backward Walking Exercise on the Lower Extremity Performance during Sit-to-Stand Task in Older Adults with Sarcopenia

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Summary

This study examined the effects of an eight-week backward walking program on older adults with sarcopenia. Participants completed 30-minute treadmill sessions thrice-weekly for eight weeks. Ground reaction force (GRF) metrics during the sit-to-stand (STS) task were assessed. Sarcopenia participants showed significant improvements approaching control levels following the intervention. Backward walking effectively addresses sarcopenia-related deficits and enhances functional performance.

Introduction

Sarcopenia, an age-related loss of skeletal muscle, significantly affects the health and functional abilities of older adults. Ground reaction force during STS movement reflects lower limb strength and is often diminished in individuals with sarcopenia [1]. Backward walking which requires increased activations of the rectus femoris and vastus lateralis, particularly during the mid-stance phase of gait, may enhance the stability and efficiency of quadriceps engagement during STS transitions [2]. This study aimed to investigate the impacts of backward walking training on the functional performance of sarcopenia individuals.

Methods

This study recruited 10 older females with sarcopenia and 10 healthy controls. Sarcopenia was defined by the following criteria: age >65 years, skeletal muscle index <5.7 kg/m², grip strength <18 kg, or walking speed <1.0 m/s. Exclusion criteria included cognitive or vestibular impairments, recent musculoskeletal injuries, neuromuscular diseases, BMI >30, and joint replacements. Participants completed 8 weeks of backward walking training on a treadmill with a 10% downhill incline, 30 minutes per session thrice weekly. Pre- and post-intervention assessments were based on the vertical GRF measures during the STS task which included the peak ground reaction force (PeakF) and rate of force development (RFD), defined as the speed of force generation during muscle contraction. T1 (time to reach PeakF) and T2 (time to cessation of GRF fluctuations) were also recorded [1]. Nonparametric Wilcoxon signed-rank and Mann-Whitney U tests were conducted to compare pre- and post-intervention outcomes and group differences.

Results and Discussion

At the pre-training, participants with sarcopenia exhibited significantly lower PeakF and RFD but higher T1 and T2 compared to the healthy control group (PeakF of 276.8 N and 377.1N, RFD of 68.1 N/s and 118.2 N/s, T1 of 0.48 s and 0.34 s, and T2 of 1.62 s and 1.19 s, respectively). Following the eight-week training program, they showed improvements approaching those of the healthy group (281.9 N, 75.9 N/s, 0.41 s, and 1.45 s) (Table 1).

The results indicated that pre-training sarcopenia participants revealed insufficient lower limb strength. However, the intervention enhanced quadriceps strength, enabling faster movements and improved overall mobility. These findings highlight the challenges faced by individuals with sarcopenia in maintaining muscle strength and movement efficiency but also demonstrate the effectiveness of quadriceps-focused training in narrowing the performance gap with healthy individuals.

Table 1: Results of vertical ground reaction force analysis.

	Healthy group	Sarcopenia (Pre-training)	Sarcopenia (Post-training)
PeakF (N)	377.1±73.8	276.8±34.9*	281.9±32.1#
RFD (N/s)	118.2±36.8	68.1±26.9*	75.9±21.4#
T1 (s)	0.34±0.06	0.48±0.23*	0.41±0.15
T2 (s)	1.19±0.29	1.62±0.59*	1.45±0.46

*: indicates a significant difference (p<0.05) between the healthy group and sarcopenia before training.

#: indicates a significant difference (p<0.05) between the healthy group and sarcopenia after training.

Conclusions

An eight-week backward walking regimen significantly enhanced lower extremity strength and mechanical efficiency in older adults with sarcopenia, addressing key functional deficits in mobility. Notably, substantial improvements in the STS task underscore the practical benefits of backward walking for daily activities and transitions. Future research could explore whether incorporating backward walking into regular exercise routines further enhances the quality of life, reduces fall risk, and optimizes overall functional performance in older adults with sarcopenia.

References

[1] Kera et al. (2022). *Gait Posture*, **93**: 177-82.
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