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The Impact of Resistance Training on Body Composition and Muscle Strength in Elderly Patients With Sarcopenia

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ABSTRACT. Introduction: Sarcopenia is a progressive and widespread condition characterized by the loss of muscle mass and function, commonly seen among older adults. This condition leads to decreased functional capacity, a higher risk of falls, impaired independence in daily activities, and, implicitly, a significant decline in quality of life. **Objective**: This paper aims to show the effects of a resistance training program on body composition and muscle strength in elderly patients with sarcopenia. **Material and Methods**: This study involved 15 patients aged between 60 and 80, who were evaluated initially and after 3 months of training. We used body composition analysis by bioelectrical impedance (BIA), measured grip strength with manual dynamometry, and assessed patients' functional independence using the "Time Up and Go" (TUG) test. The intervention consisted of a resistance exercise program conducted over 12 weeks, with two weekly sessions, tailored to each patient's physical condition and specific needs. **Results**: After the training program, patients showed a significant increase in muscle mass measured by BIA, improved hand grip strength, and a notable decrease in execution time on the TUG test, demonstrating the intervention's effectiveness. **Conclusions**: Resistance training significantly boosts muscle mass and strength in elderly sarcopenic patients. It also improves balance and mobility, which are vital for maintaining independence. Therefore, resistance training should be a core part of prevention and treatment plans for sarcopenic patients.

Keywords: *sarcopenia; resistance training; elderly; body composition; muscle strength; bioimpedance; functional rehabilitation*

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INTRODUCTION

Sarcopenia is a progressive and widespread condition of the muscular system characterized by loss of muscle mass and strength. It is mainly associated with natural aging and has notable functional effects. It impacts the mobility, independence, and quality of life of older adults and increases the risk of falls, fractures, and disabilities (Cruz-Jentoft et al., 2019).

Definitions of sarcopenia have changed over time. The European Working Group on Sarcopenia in Older People (EWGSOP) first defined sarcopenia in 2010 as the gradual and widespread loss of muscle mass and strength. In the 2019 EWGSOP2 update, greater emphasis was placed on the decline in muscle strength as a key diagnostic criterion, since strength is a more reliable indicator of functional impact than merely muscle mass (Cruz-Jentoft et al., 2019; Chen et al, 2020).

The prevalence of sarcopenia varies greatly depending on the population studied and the diagnostic methods used. A 2021 meta-analysis found that among older adults, the prevalence ranged from 10% to 27%, depending on the assessment criteria (Petermann-Rocha et al., 2022). When the assessment used the BIA (Bioelectrical Impedance Analysis) method instead of the DXA (Dual-energy X-ray Absorptiometry) for measuring muscle mass, the estimated prevalence was 10%, according to a 2017 systematic review and meta-analyses (Shafiee et al., 2017).

Other studies in the literature estimate the prevalence of sarcopenia to range from 5% (according to EWGSOP2) to 17% (according to IWGS – International Working Group on Sarcopenia) in the elderly population (Yuan & Larsson, 2023).

Physical inactivity is the main cause of sarcopenia development and progression, with about 3 - 5% being lost every decade after age 30 (Moga et al, 2022).

Additionally, sarcopenia impacts muscle mass and strength, and it complexly influences the overall body. It is often linked with other geriatric syndromes, such as frailty and osteoporosis, and raises the risk of chronic diseases like type 2 diabetes and cardiovascular disease (Beaudart et al., 2017; Tanimura et al., 2023; Chen et al., 2024).

Recent studies indicate that moderate- to high-intensity resistance training programs can greatly improve muscle strength and body composition in older adults diagnosed with sarcopenia (Lopez et al., 2018; Sayer et al, 2024).

Among all the methods tested, resistance training remains the intervention with the strongest evidence of long-term benefits on muscle function and body composition (Beaudart et al., 2017; Chen, 2024).

Purpose

This paper, based on recent scientific evidence, aims to analyze the impact of resistance training on body composition, specifically muscle mass and strength, in patients with sarcopenia.

MATERIAL AND METHODS

For this study, we recruited 15 patients aged between 60 and 80, with a mean age of 70.06 ± 7.42. years. These patients included 7 women aged between 60 and 80 (average age 69 ± 7.65 years) and 8 men aged between 60 and 80 (average age 71 ± 7.59 years).

The study lasted three months at the "Association of Rheumatism Patients in Banat," Timișoara, from October 2024 to January 2025.

The inclusion criteria for the study were: (1) patients over 60 years old; (2) a confirmed diagnosis of primary osteoporosis (T-score ≤ -2.5, assessed by DXA) and reduced handgrip strength according to EWGSOP2 criteria; (3) written consent to participate in the study.

The exclusion criteria were: (1) severe mobility disorders; (2) neurological disorders affecting balance and gait; (2) severe heart disease; (3) hip or knee arthroplasty; (4) inflammatory musculoskeletal disorders; (5) malignant tumors; (6) diabetic neuropathy; (7) cognitive disorders; (8) inability to perform physical exercises.

The assessment methods employed included:

Bioelectrical impedance analysis (BIA) is a non-invasive and accessible method for assessing body composition that measures the human body's resistance to a weak electrical current. This technique depends on the differences in electrical conductivity among biological tissues: muscle tissue, which contains high water and electrolyte levels, conducts electricity more effectively than adipose tissue, which has higher resistance. By using impedance measurements and anthropometric data such as weight, height, gender, and age, it is possible to accurately estimate muscle mass, fat percentage, total hydration, bone mass, and body mass index (BMI) (Toomey et al, 2015).

In the context of sarcopenia diagnosis, BIA is considered a valid method for estimating muscle mass and monitoring responses to treatment, as endorsed by the EWGSOP2 consensus (Cruz-Jentoft et al., 2019). For our study, we utilized a BFC-150 BW device from Star Light.

Hand dynamometry was used to measure handgrip strength. The test was performed on the dominant hand, seated, with the elbow flexed at 90 degrees.

The *Timed Up and Go* (TUG) test is a validated clinical tool used to assess functional mobility and fall risk in older adults. It offers valuable insights into postural balance, reaction time, and movement safety, making it an essential measure for evaluating the physical performance of geriatric patients (Centers for Disease Control and Prevention, www.cdc.gov).

The exercise plan for patients was organized as follows:

In the first four weeks—an accommodation and stabilization phase aimed at activating the core muscles, learning proper technique, boosting confidence in movement, and enhancing balance—followed by a five- to ten-minute warm-up, strength exercises (two sets of 10-12 repetitions), balance exercises, and stretching exercises.

In weeks 5–8, a strength progression phase was implemented to build muscle mass, enhance exercise capacity, and improve stability exercises. This phase included a warm-up, strength training (2-3 sets of 10-12 reps), balance drills, and stretching routines.

Weeks 9-12: A phase dedicated to functional strengthening, aimed at increasing strength, enhancing stability, and practicing dynamic postural control. This phase included warm-ups, strength exercises (3 sets of 10-15 repetitions), balance activities, and stretching.

RESULTS

After finishing the 12-week resistance training program, elderly patients with sarcopenia showed significant improvements in body composition, muscle strength, and functional mobility.

Body composition

Bioimpedance analysis of body composition showed a general increase in muscle mass and decreased body fat percentage. As a result, muscle mass (MM) increased from an initial average of 32.16 ± 5.52% to a final average of 32.94 ± 5.62%, a 0.78% rise from baseline. Body fat decreased from an initial average of 35.26% ± 8.91% to 34.46% ± 8.68% after 12 weeks of training, showing a 0.8% reduction. These changes demonstrate an improvement in body composition, highlighting the effectiveness of resistance training in fighting sarcopenia.

Muscle strength

Measurements with a hand dynamometer showed a significant increase in handgrip strength. As a result, the average muscle strength rose from 18.47 ± 1.7 kgf initially to 22.0 ± 2.21 kgf after the program, a gain of approximately 3.53%.

The "Up and Go" test

Performance on the "Up and Go" test (TUG) demonstrated improved functional mobility. As a result, the average time decreased from 14.19 ± 1.19 seconds to 11.63 ± 0.59 seconds after the intervention, a reduction of 2.56 seconds.

This decrease in the time needed to complete the test shows improved stability, coordination, and functional balance.

The results support the hypothesis that resistance exercises are an effective intervention for improving sarcopenia symptoms. The increase in muscle mass and grip strength, the reduction in body fat, and the improved time on the TUG test show clear and measurable progress in function. These findings align with data reported in the literature (Lopez et al., 2018; Cho et al., 2022; Cruz-Jentoft et al., 2019), confirming the benefits of resistance training for this group of patients.

Additionally, the average values observed indicate not only quantitative progress but also a qualitative improvement in the participants' overall functional condition, further supporting the value of the proposed intervention.

Table 1. Initial and final parameter values studied

Indicator	Initial values (mean)	Final values (mean)	t-test (p)
Muscle mass (%)	32.16	32.94	p =1.19238E-08 p < 0.001
Body fat (%)	35.26	34.46	p = 5.95348E-08 p < 0.001
Grip strength (kgf)	18.47	22	p = 2.35927E-08 p < 0.001
"Up and Go" test	14.19	11.63	p = 2.53589E-08 p < 0.001

After applying the t-test for paired samples, we observed that the training program resulted in highly significant results for the parameters studied. Thus, we found a significant increase in muscle mass and final handgrip strength compared to the initial assessment ($p < 0.001$). After the program's implementation,

the calculated p-value confirmed a statistically significant reduction in body fat percentage. Regarding the TUG test, the p-value was also statistically significant ($p < 0.001$), suggesting a clinically and statistically relevant improvement.

DISCUSSION

The results from this study align with existing data, supporting the idea that resistance training should be a key part of prevention and treatment programs for sarcopenia (Cho et al., 2022; Shen et al., 2023; Kim et al., 2025). Lopez et al. (2018) highlighted in a systematic review that moderate- to high-intensity resistance training is associated with significant gains in muscle mass and strength in older adults. Beaudart et al. (2017) also demonstrated that strength training lowers fall risk and improves mobility, which our study further supports through better TUG test results. The research by Lopez et al. (2018), Cruz-Jentoft et al. (2019), and Beaudart et al. (2017) reinforce these findings, providing additional validation for the intervention used in this study.

The EWGSOP2 consensus (Cruz-Jentoft et al., 2019) clearly emphasizes that physical activity-based interventions, particularly resistance exercises, are essential for preventing and treating sarcopenia, and our data support this recommendation.

The data from our study support existing trends in the literature and emphasize the need to develop standardized intervention protocols that can be broadly used in various clinical and community settings. They highlight the importance of maintaining regular physical activity for healthy aging.

Incorporating resistance training into standard rehabilitation protocols can enhance therapeutic outcomes and lower the costs linked to long-term care. Additionally, promoting these interventions via health education campaigns can increase awareness among the general population and healthcare professionals, thereby fostering a culture of active and independent aging (Chaves et al. 2021).

Our study had several strengths, such as the consistent application of a standardized resistance training protocol to all participants, which enabled comparable and reproducible results; the use of validated methods for assessing sarcopenia (bioimpedance, dynamometry, TUG test); and careful participant selection based on specific inclusion and exclusion criteria. However, the study also has limitations: the small sample size of only 15 participants, which restricts the ability to generalize the findings to the broader elderly population; the lack of a control group, which prevents fully ruling out other factors influencing the results; and the relatively short intervention duration of 12 weeks, which limits the evaluation of long-term effects and the sustainability of the improvements.

From a practical standpoint, the data show that resistance training programs can be successfully carried out in different settings (rehabilitation centers, patient groups, senior communities) without the need for advanced equipment or large financial investment. Additionally, the flexibility of resistance exercises allows programs to be tailored to patients' fitness levels, existing health conditions, and personal preferences, thereby enhancing adherence and the overall effectiveness of the intervention.

Future research should also examine how different types of exercises—such as isometric exercises, functional exercises, and circuit training—individually affect outcomes to find the most effective methods for each patient's profile. Customizing interventions should become standard practice, replacing the uniform "one-size-fits-all" approach used for all patients.

CONCLUSIONS

The results achieved after applying the resistance training program to elderly patients diagnosed with sarcopenia confirm the initial hypothesis of the study. The increase in muscle mass, decrease in body fat percentage, improvement in handgrip strength, and shorter time to complete the "Stand Up and Walk" test demonstrate the intervention's effectiveness.

After the study, we discovered that resistance training significantly boosts muscle mass and strength in elderly patients. The gains in muscle mass and handgrip strength show that strength exercises tailored to patients' functional levels can effectively reverse muscle loss related to sarcopenia.

Secondly, the study showed a significant decrease in body fat percentage at the end of the intervention, indicating a positive effect on overall body composition. This finding is important because a balanced body composition directly affects the risk of chronic diseases and functional decline in older adults.

Another key finding is the improvement in functional mobility, measured by the "Up and Go" (TUG) test, where the completion time was reduced by 2.56 seconds. This development emphasizes the positive impact of strength training on balance, coordination, and mobility, which are crucial for maintaining independence and quality of life in the elderly population.

We believe resistance training is an effective, safe, and accessible way to prevent and manage sarcopenia in older adults. Implementing structured strength training programs can significantly improve overall health, increase functional independence, and enhance quality of life in this population.

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