

Muscle Makers: A 10-Week Strength and Nutrition Program for Sarcopenia

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Abstract

Aim

Sarcopenia, a progressive muscle loss condition in older adults, contributes to disability, frailty, and falls. This study evaluated the efficacy of the Muscle Makers programme, a 10-week physiotherapy-led Progressive Resistance Training (PRT) intervention with clinical nutrition input, in improving mobility, strength, and balance.

Methods

Forty-four community-dwelling older adults with probable sarcopenia (median SARC-F: 4; range: 0–8) completed a 10-week programme of weekly PRT sessions and fortnightly group-based nutrition education. Functional outcomes were assessed pre- and post-intervention using the Timed Up and Go (TUG) and Five Times Sit-to-Stand (5TSTS) tests.

Results

Participants (median age: 80; range: 66–92; 20 males, 24 females) attended a median of 8.1 sessions (81.2% attendance). Significant improvements were seen in Timed Up and Go (TUG), with median times decreasing from 15.96s (range: 7.32–60.95) to 12.09s (5.78–23.6), a reduction of 2.6s (–9.03 to 41.06; $p < 0.01$). Five Times Sit to Stand (5TSTS) times also improved, from a median of 18s (10.18–40) to 12.43s (7.3–23), a reduction of 5.5s (–0.4 to 17; $p < 0.01$).

Discussion

This programme significantly improved strength and mobility. These results support the integration of targeted exercise and nutrition interventions into routine care for sarcopenia-related functional decline and fall prevention.

Introduction

Sarcopenia, characterised by the progressive loss of muscle mass, strength, and function, significantly increases the risk of disability, frailty, reduced quality of life, and mortality common in older adults. With aging populations globally, sarcopenia poses a major public health concern, necessitating early detection and intervention to maintain independence and enhance outcomes.

In 2018, the European Working Group on Sarcopenia in Older People (EWGSOP2) revised its consensus definition and diagnostic criteria. This framework identifies low muscle strength as the primary feature of sarcopenia, reflecting its critical role in functional capacity. Diagnosis also considers low muscle mass and impaired physical performance, including slow gait speed and difficulties with standing, walking, or climbing stairs¹.

The Timed Up and Go (TUG) test has been recommended for assessing gait and balance to prevent falls in older adults. Several lines of evidence have established that the TUG test is reliable for identifying those at risk of falls, frailty, and mortality^{2, 3}. Similarly, the Five Times Sit-to-Stand Test (5TSTS) is a widely validated tool that assesses lower extremity strength, dynamic balance, and fall risk in older adults. Research has demonstrated its utility as a predictor of functional performance, reflecting critical mobility attributes such as endurance and balance control^{4, 5}.

Effective management of sarcopenia requires targeted interventions, combining Progressive Resistance Training (PRT) and appropriate nutritional support, as recommended in current clinical guidelines¹. While strong evidence supports the efficacy of PRT in improving muscle strength and function^{6, 8}, its integration into routine clinical practice in Ireland remains limited. Barriers to implementing resistance training in older adults include limited staffing and resources, lack of staff training, individual factors such as low motivation and fear of injury, inflexible program designs, and poor integration into existing healthcare services, highlighting the need for tailored interventions and multidisciplinary collaboration to enhance adherence and sustainability^{8, 16}.

The Muscle Makers programme, conducted within an ambulatory clinic for older persons, is designed to bridge the gap between research and clinical practice. This 10-week physiotherapy-led PRT initiative, supplemented by fortnightly Clinical Nutrition input, specifically targets the physical and nutritional aspects of sarcopenia. Each class includes a structured warm-up, 4–6 multijoint strength exercises (e.g. sit-to-stand, deadlift with kettle bell), and functional conditioning and balance retraining activities (e.g. farmer's walks, and ball games performed in standing). Exercises are adapted to individual capabilities, with initial resistance determined using perceived exertion and progressed weekly based on tolerance and functional improvements. Sessions focused on improving muscle strength, functional mobility, and balance. Participants are also encouraged to increase general activity in line with WHO guidelines⁷.

As part of the Clinical Nutrition intervention, participants received fortnightly group-based nutrition education delivered by a clinical dietitian or therapy assistant using a standardised script. These brief (10-15 minute) sessions focused on evidence-based dietary strategies to support muscle health in older adults with probable sarcopenia. Topics included eating regular meals and snacks, choosing high-quality foods, and increasing dietary protein. Participants also received supplementary written materials to support implementation at home. While dietary intake, weight, or grip strength were not measured in this evaluation, the nutrition component was integrated to support the resistance training programme in line with expert recommendations for nutrition interventions in sarcopenia in older adults^{11, 12, 13, 14}. Nutritional risk of participants was also screened using a validated nutrition screening tool in line with best practice guidelines for community-dwelling older adults^{14, 15}, and at-risk individuals were then referred for one-to-one dietetic support.

While progressive resistance training (PRT) and nutritional support have been shown in research settings to significantly improve muscle strength, functional capacity, and reduce fall risk in older adults with sarcopenia^{6, 8, 9}, translating these outcomes into routine clinical care remains a challenge. Studies have highlighted the need to evaluate such interventions in real-world ambulatory settings, particularly within the Irish healthcare context, where local implementation data are limited³. This retrospective chart audit examined whether improvements in key sarcopenia markers—previously demonstrated in controlled trials—could be replicated in routine practice through a multidisciplinary PRT and nutrition programme delivered in an ambulatory care clinic.

This study evaluates the programme's effectiveness in improving functional mobility, strength, and balance over a 6-month period following the intervention.

Methods

This study included older adults who attended the Muscle Makers programme, a 10-week intervention consisting of weekly 1-hour sessions of PRT combined with fortnightly Clinical Nutrition input to address dietary factors linked to muscle health.

Participants were recruited from September 2023 to February 2024. Inclusion criteria required participants to have a diagnosis of probable sarcopenia and be assessed by a physiotherapist as likely to benefit from class-based strength training interventions. Participants were community-dwelling adults aged 65 and older, referred to physiotherapy by an ambulatory geriatric medicine clinic for older adults. Only participants with both pre- and post-programme outcome measures (OCMs) were included.

Exclusion criteria included participants without completed pre- and post-programme OCMs and those deemed unsuitable for group-based rehabilitation by a physiotherapist.

Outcome measures were collected at baseline and post-intervention by trained physiotherapy staff or healthcare assistants. The Timed Up and Go (TUG) test and 5-time sit-to-stand (5TSTS) test were used as primary measures of functional performance. The TUG test evaluates the time taken for a participant to rise from a chair, walk 3 meters, turn around, and return to the chair, assessing both balance and mobility². The 5TSTS test measures the time taken to stand from a seated position five times, providing insight into lower body strength and endurance⁴.

Data were collected using standardised protocols. Due to non-normal data distribution and small sample sizes, data are presented as medians and interquartile ranges. However, statistical comparisons were conducted using independent t-tests on log-transformed data to satisfy normality assumptions. All statistical analyses were conducted using Microsoft Excel.

Results

A total of 44 out of 100 participants (20 males, 24 females) completed the Muscle Makers programme with both pre- and post-intervention data available. The median age of participants was 80 years (range: 66-92). At baseline, the median sarcopenia score (SARC-F) was 4 (0 – 8), indicating a high likelihood of sarcopenia among participants. Additionally, participants reported a median of 1 fall (0-8) in the preceding 12 months, underscoring their elevated fall risk. Median number of sessions attended was 8 of the 10 sessions, demonstrating a high level of adherence to the intervention.

Pre-intervention performance on the TUG test showed a median time of 15.96 seconds (range: 7.32 – 60.95), while the median time for the 5TSTS test was 18 seconds (range: 10.18-40). Following the 10-week programme, participants exhibited clinically significant improvements in both outcome measures. The median TUG time decreased to 12.09 seconds, with a median reduction of 2.6 seconds (range: -9.03 – 41.06) ($p < 0.01$). Similarly, the median 5TSTS time improved to 12.43 seconds (range: 7.3 – 23), showing a median reduction of 5.5 seconds (range: -0.4 – 17) ($p < 0.01$). These median changes exceeded established minimal clinically important differences (MCIDs) for older adults—approximately 1.4 to 2.0 seconds for the Timed Up and Go (TUG) test^{2,3} and around 2.3 seconds for the Five Times Sit-to-Stand (5TSTS) test⁴—indicating that improvements were not only statistically significant but also likely meaningful in a clinical context.

Our findings indicate that the Muscle Makers programme is an effective intervention for improving muscle strength and functional performance in community-dwelling older adults with probable sarcopenia. The clinically significant improvements observed in the TUG and 5TSTS tests align with existing evidence supporting the benefits of PRT for this population^{6, 8}.

Numerous studies have demonstrated the efficacy of resistance training in mitigating sarcopenia. For instance, a meta-analysis by Liao et al. found that older adults engaging in resistance training showed significant improvements in muscle strength and functional capacity⁶. Similarly, Liu-Ambrose et al. reported that resistance training not only enhances strength but also reduces fall risk, reflecting the reductions in fall-risk profile as indicated by improvement in TUG observed in our participants⁹.

Our findings reflect improvements in functional markers associated with fall risk, suggesting that programmes like Muscle Makers have the potential to enhance physical capacity and possibly reduce fall risk in older adults. While the majority of participants showed improvements, a minority experienced minimal or negative changes in performance, reflecting individual variability in response to the intervention. This underscores the importance of individualised programme adaptation and monitoring to optimise benefits across diverse participants.

While improvements in TUG and 5TSTS indicate enhanced functional mobility and lower-limb strength, future studies should incorporate direct measures of nutritional status, muscle mass, and fall incidence to comprehensively evaluate the intervention's full impact.

The successful delivery of this programme within a standard ambulatory clinic setting in Ireland, using existing multidisciplinary staff and infrastructure, demonstrates its real-world feasibility and supports the translation of evidence-based sarcopenia care into everyday practice.

However, this evaluation has limitations. The relatively small sample size and retrospective design may limit generalisability. It did not assess feasibility metrics such as reasons for non-attendance, adverse events, or characteristics of individuals who declined or were not offered the programme. These data, while beyond the scope of the current study, would be valuable for future service planning to ensure equitable access and responsiveness to the needs of all individuals with sarcopenia.

Future research should explore the scalability and long-term impact of such interventions on sarcopenia and related outcomes.

Declarations of Conflicts of Interest:

None declared.

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References:

1. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, et al. Sarcopenia: revised European consensus on definition and diagnosis. *Age Ageing*. 2019;48(1):16-31. doi:10.1093/ageing/afy169
2. Bohannon RW. Reference values for the timed up and go test: a descriptive meta-analysis. *J Geriatr Phys Ther*. 2006;29(2):64-8. doi:10.1519/00139143-200607000-00001
3. Savva GM, Donoghue OA, Horgan F, O'Regan C, Cronin H, Kenny RA. Using Timed Up-and-Go to identify frail members of the older population. *J Gerontol A Biol Sci Med Sci*. 2013;68(4):441-6. doi:10.1093/gerona/gls190
4. Dyer CB, Edgerton MR, White JT, Hu J, Sloane R, Hardy SE, et al. Performance on sit-to-stand tests in relation to measures of functional fitness and sarcopenia diagnosis in community-dwelling older adults. *Eur Rev Aging Phys Act*. 2016;13:8. doi:10.1186/s11556-016-0160-8
5. Whitney SL, Wrisley DM, Marchetti GF, Gee MA, Redfern MS, Furman JM. Clinical measurement of sit-to-stand performance in people with balance disorders: validity of data for the Five-Times-Sit-to-Stand Test. *Phys Ther*. 2005;85(10):1034-45
6. Liao CD, Tsao JY, Chen HC, Liou TH, Huang YY, Ku JW, et al. Effects of resistance exercise on muscle function and quality of life in older adults with sarcopenia: a meta-analysis. *Arch Phys Med Rehabil*. 2019;100(2):241-51. doi:10.1016/j.apmr.2018.06.017
7. World Health Organization. Guidelines on physical activity and sedentary behaviour. Geneva: WHO; 2020.
8. Papa EV, Dong X, Hassan M. Resistance training for activity limitations in older adults with skeletal muscle function deficits: a systematic review. *Clin Interv Aging*. 2017;12:955-61. doi:10.2147/CIA.S111289

9. Liu-Ambrose T, Donaldson MG. Exercise and cognition in older adults: is there a role for resistance training programmes? *Br J Sports Med.* 2009;43(1):25-7. doi:10.1136/bjsm.2008.055616
10. Bauer J, Biolo G, Cederholm T, Cesari M, Cruz-Jentoft AJ, Morley JE, et al. Evidence-based recommendations for optimal dietary protein intake in older people: a position paper from the PROT-AGE Study Group. *J Am Med Dir Assoc.* 2013;14(8):542-59. doi:10.1016/j.jamda.2013.05.021
11. Dent E, Morley JE, Cruz-Jentoft AJ, Arai H, Kritchevsky SB, Guralnik J, et al. International Clinical Practice Guidelines for Sarcopenia (ICFSR): screening, diagnosis and management. *J Nutr Health Aging.* 2018;22(10):1148-61. doi:10.1007/s12603-018-1139-7.
12. Chen LK, Arai H, Assantachai P, Akishita M, Chew STH, Dumlao LC, et al. Roles of nutrition in muscle health of community-dwelling older adults: evidence-based expert consensus from Asian Working Group for Sarcopenia. *J Cachexia Sarcopenia Muscle.* 2023;14(4):909-28. doi:10.1002/jcsm.12981
13. Robinson SM, Reginster JY, Rizzoli R, Shaw SC, Kanis JA, Bautmans I, et al. Does nutrition play a role in the prevention and management of sarcopenia? *Clin Nutr.* 2018;37(4):1121-32. doi:10.1016/j.clnu.2017.09.019
14. Bloom I, Shand C, Cooper C, Robinson S, Baird J. Diet quality and sarcopenia in older adults: a systematic review. *Nutrients.* 2018;10(3):308. doi:10.3390/nu10030308
15. Volkert D, Beck AM, Cederholm T, Cruz-Jentoft A, Hooper L, Kiesswetter E, et al. ESPEN practical guideline: clinical nutrition and hydration in geriatrics. *Clin Nutr.* 2022;41(4):958-89. doi:10.1016/j.clnu.2022.01.024
16. Burton E, Farrier K, Lewin G, Watts JJ, Tiedemann A, Downer T, et al. Implementing evidence-based physical activity interventions in aged care: a systematic review. *BMC Geriatr.* 2019;19(1):253. doi:10.1186/s12877-019-1303-4.