The BASES Expert Statement on Physical Activity and Limiting Sedentary Behaviour for Effective Management of Sarcopenia in Community-dwelling Older Adults

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr Daniel Low, Dr Daniel Bailey, Dr Gladys Pearson and Prof. Michael Duncan FBASES.

Introduction

Sarcopenia is an ageing-related disease, characterised by muscle mass and strength loss. The global prevalence of sarcopenia in community-dwelling older adults is estimated to be 10-40% and is associated with adverse health outcomes, such as functional impairment, loss of independence, and increased risk and incidence of falls and mortality (Mayhew *et al.*, 2019).

Sarcopenia diagnosis and prognosis can be made through the determination of muscle strength, mass and quality. Severe sarcopenia is considered in the presence of low muscle strength, mass and quality, and reduced functional performance below a threshold unlikely to facilitate independent living; the criteria of each component depend on the diagnostic methodology used.

There are three general approaches to maintaining or increasing muscle mass and function: physical activity (PA) (particularly resistance exercise training, RET), nutrition (particularly the consumption of protein; see Maden-Wilkinson *et al.*, 2022), and hormonal/pharmacological. This Expert Statement provides a review and recommendations for increasing PA and limiting sedentary behaviour as intervention strategies for the prevention and management of sarcopenia in community-dwelling older adults.

Physical activity and sarcopenia

Observational evidence shows that increased daily PA and time spent in moderate-to-vigorous intensity PA (MVPA) are beneficially associated with sarcopenia outcomes (Steffl *et al.*, 2017). Physical activity interventions in the form of supervised or home-based structured resistance exercise tends to be used given its success with slowing and preventing muscle loss, and relatively low number of associated contraindications/adverse events when carried out properly (appropriate training or supervision is, therefore, recommended).

Meta-analytic evidence suggests that RET using resistance bands, ankle weights and free weights leads to gains in muscle strength, mass and physical function in older adults, including those with sarcopenia (Vlietstra *et al.*, 2018); these benefits occur independent of dietary changes. Gait and balance training for 20-30 minutes alongside RET is also effective. Adherence and factors affecting implementation of these interventions (e.g. experiences of group versus home-based exercise) are seldom reported (Vlietstra *et al.*, 2018). Nonetheless, a prescribed RET frequency of between 1-3 sessions per week improves sarcopenia. As substantial benefits are seen with two sessions per week, this may be optimal for promoting adherence more so than higher frequencies. Strength gains can occur at a low intensity (≤ 50% 1 repetition maximum [RM]), yet greater gains are achieved at higher intensities e.g. 80% 1RM (Beckwée *et al.*, 2019). For the majority of individuals with sarcopenia, lower RET intensities may be more feasible and tolerable initially. A progressive training approach should be implemented so individuals can achieve optimal strength gains that result from higher intensities, which, in turn, will improve the ability to undertake activities of daily living (ADL). A single set of 6-12 repetitions for each exercise is generally sufficient to improve muscle function and physical performance initially. For gains in muscle strength over the long-term, 2-3 sets are recommended

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Sedentary behaviour and sarcopenia

Higher amounts of daily sedentary behaviour are associated with reduced muscle mass and physical function, and increased risk of sarcopenia (Gianoudis, 2015). Conversely, regularly interrupting prolonged periods of sedentary behaviour with short bouts of light intensity PA (e.g. standing or slow walking) is associated with improved physical function, ability to carry out ADL and reduced risk of sarcopenia. The benefits of reducing and interrupting sedentary behaviour appear independent from MVPA (Sardinha *et al.*, 2014). Targeting reductions in sedentary behaviour separately from MVPA may thus be needed for optimal sarcopenia management. However, there is limited literature investigating sedentary behaviour interventions on sarcopenia-related outcomes. An intervention comprising functional test feedback, visual and real-time feedback on sedentary time, and motivational interviewing led to improvements in physical function (timed up and go and sit-to-stand tests) and quality of life after 14 weeks in older adults with frailty (Harvey *et al.* 2018). A similar 12-week intervention comprising of real-time self-monitoring of sedentary time, behavioural consultations and goal setting improved older adults' physical function (standing up from a chair) (Barone Gibbs *et al.*, 2017). The potential of sedentary behaviour interventions to improve sarcopenia-related outcomes is thus indicated. That said, the minimum clinically important change (MCIC) in sarcopenia indicators to assess the meaningfulness of individual responses to sedentary behaviour and PA interventions appears seldom used or available.

Mechanisms

Skeletal muscle phenotypes, particularly muscle mass, muscle strength and physical function, are determined by multiple factors. Heritability is proposed to explain 45-82% of the variability in these phenotypes. Nonetheless, studies typically show poor correlations between indices of muscle mass and physical function. This mismatch is considered to reflect changes in muscle quality.

Skeletal muscle-related functional impairment may result from low skeletal muscle mass (Janssen *et al.*, 2002) and a decrease in muscle fibre pennation angle, sarcomere number, myofilament packing density, increased connective tissue accumulation, a change in the ultrastructure of muscle fibres, and/or change in fibre recruitment capacity. Non-muscular factors include altered activation capacity, fewer receptor cells in vestibular organs, alteration in sensory perception, slower reaction times, and increased tendon compliance. A number of these pathways are proposed to be improved by PA and sedentary behaviour interventions (Wullems *et al.*, 2016).

Conclusions and Recommendations

- RET appears an effective management strategy for sarcopenia. There is potential for other modes of exercise to have beneficial effects, although evidence is not yet sufficiently robust to recommend in sarcopenia management.
- Individual exercise prescription is needed. For example, exercise intensity and volume should be prescribed and reviewed based on the person's technical proficiency, functional capacity and exercise tolerance.
- Reducing and interrupting sedentary behaviour with light-intensity activity such as standing and slow walking has potential to positively impact sarcopenia outcomes. Research is in its infancy so definitive recommendations cannot be made.
- PA and sedentary behaviour interventions for sarcopenia management should consider the needs, capabilities, motivation, and enjoyment of participants. Studies examining these aspects are scarce.
- High-quality markers of change are not available to assess the importance of change due to an intervention. Consequently, statistics such as the MCIC are required to understand whether clinical symptoms are sufficiently changed.
- Knowledge gaps prevent effective translation from research to practice in regard to interventions for sarcopenia management in community-dwelling older adults. Researchers need to ensure that factors affecting implementation of the intervention, fidelity measures and process evaluations are included to address this issue.

For success, PA and sedentary behaviour interventions require cross sector collaboration including involvement from sport and exercise scientists, public health, local and national government, and community groups. ■

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