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Exercise and Sarcopenia: An Umbrella Review of Evidence Synthesis

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I. INTRODUCTION

Badminton is a high-intensity sport requiring explosive movements, rapid directional changes, and strong psychological composure. Among the physical attributes essential to performance, agility, defined as the capacity to change direction rapidly without loss of balance, is considered a critical determinant of competitive success [1]. Speed, agility, and quickness (SAQ) training, including plyometric exercises, has gained prominence in badminton conditioning because it directly replicates match-specific movement demands [2]. Beyond physical performance, psychological factors such as confidence play a significant role in athletic outcomes, particularly under competitive pressure. Despite this, most research has examined physical and psychological outcomes separately. This study addressed that gap by investigating the dual effects of a structured three-week plyometric training programme on both agility and sport-confidence among amateur badminton players.

II. METHODS

This umbrella review included systematic reviews and meta-analyses of structured exercise in adults ≥ 60 years diagnosed with sarcopenia (EWGSOP/AWGS). Six databases (2000–June 2025) and grey literature were searched without language limits. Dual screening, extraction, and AMSTAR-2 appraisal were conducted. Outcomes were harmonized and re-pooled using random-effects meta-analysis and meta-regression; heterogeneity, publication bias, and certainty (GRADE) were assessed. This umbrella review included systematic reviews and meta-analyses of structured exercise in adults aged 60 years and above diagnosed with sarcopenia using EWGSOP or AWGS criteria. Six databases from 2000 to June 2025 and grey literature were searched without language limits. Dual screening, extraction, and AMSTAR-2 appraisal were conducted. Outcomes were harmonised and re-pooled using random-effects meta-analysis and meta-regression. Heterogeneity, publication bias, and certainty of evidence using GRADE were also assessed.

III. RESULTS AND DISCUSSION

Support systems and facilitating conditions are central to effective sarcopenia management because many interventions are built on standard care and health education, which often serve as the control condition in trials and as the practical foundation in real-world care. Their impact matters at a population level because sarcopenia is increasingly treated as a public health issue that requires clear activity targets, including moderate-to-vigorous physical activity, to support healthy ageing [2]. Outcomes also depend strongly on environmental setting, with higher sarcopenia prevalence in nursing homes and hospitals than in community-dwelling older adults. Frailty and nutritional status within each setting therefore shape how well support systems work, even though most research still focuses on community populations [4]. At the system level, government programmes and professional societies provide infrastructure and evidence-based guidelines, and major organisations emphasise regular physical activity and muscle strengthening as essential components of healthy ageing [4].

The Critical Role of Support Systems and Facilitating Conditions

Support systems and facilitating conditions largely determine whether combined nutrition and exercise strategies translate into meaningful improvements in sarcopenia outcomes. Because nutrition and resistance training work through separate physiological mechanisms, combining protein or targeted amino acids, such as leucine, with resistance training has a clear rationale for producing additive gains in muscle mass and strength. Exercise may also re-sensitise older muscle to protein intake, allowing a larger share of ingested protein to be used for de novo muscle protein synthesis. However, results are not uniform across studies because benefits often depend on who is being treated. Effects are more evident in clearly diagnosed sarcopenic individuals and in people with low habitual protein intake, while many studies fail to separate these groups clearly from healthier participants.

Duration is another key facilitator. Evidence suggests that increases in muscle mass are more consistently observed when combined programmes extend beyond 24 weeks, whereas shorter

interventions of 8 to 12 weeks show mixed and sometimes insufficient evidence for sustained changes in muscle mass, strength, or physical performance. Nutritional support also involves how protein is delivered, rather than total quantity alone. An even distribution across meals, approximately 25 to 30 g per meal, appears important for optimising muscle protein synthesis. Protein consumed close to resistance training, ideally within 24 hours, can also enhance the anabolic response. Finally, the setting and quality of professional support influence adherence, which is often the limiting factor in older adults. Practical, sustainable training prescriptions, such as moderate-intensity resistance training twice per week, can improve strength and physical performance without the added burden of higher weekly frequencies that do not consistently provide extra benefit.

Older adults often struggle to sustain high-frequency resistance training over time, so understanding barriers to participation and factors that support long-term adherence is central to using exercise as a practical strategy to prevent or slow sarcopenia. At present, programmes designed specifically for sarcopenic individuals are not standardised. As sarcopenia becomes more recognised in clinical practice, practical guidelines are needed to prevent or slow its progression. Exercise professionals and clinicians play a central role by prescribing training frequencies and intensities that match an older person's functional capacity, and many studies reinforce behaviour change through structured education and health sessions. However, targeted support remains difficult because there is still no universally accepted diagnostic criterion for sarcopenia, and clearer thresholds would strengthen both clinical decision-making and research on how physical activity protects muscle.

Nutrition should also be optimised beyond total daily protein because timing and distribution influence muscle protein synthesis. Evidence supports spreading intake evenly across meals, aiming for about 25 to 30 g of protein per meal, and consuming protein close to training, with approximately 60 minutes post-exercise often linked to a strong anabolic response. Support plans should also adapt to limitations and comorbidities by using options such as seated or standing whole-body vibration for people with disabilities, longer combined protein and resistance programmes for obesity, and safer modes such as elastic bands when machines are not suitable.

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