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The Multicomponent Exercises for the Management of Sarcopenia: A Systematic Review Study

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ABSTRACT

Purpose: This systematic review investigates the components of exercise programs designed to manage sarcopenia in older adults. The study aims to identify the types of exercises, duration, frequency, intensity, and delivery modes that contribute to improvements in muscle strength, muscle mass and physical performance. Method: A systematic review was conducted in five databases which include PUBMED, SCOPUS, WOS, CINAHL and Google Scholar using relevant keywords. Studies published in English within the last ten years involving participants aged 60 and above diagnosed with sarcopenia or pre-sarcopenia were included. Data extraction focused on exercise prescription parameters and outcomes. Methodological quality was assessed using the Joanna Briggs Institute Critical Appraisal Checklist. Results: Twenty-five studies met the inclusion criteria. Eleven implemented multicomponent interventions, while fourteen used resistance training alone. The most common exercise frequency was three sessions per week, with 60-minute sessions over 12 weeks being the most frequently reported. Intensity was commonly measured using maximum repetition (RM) or perceived exertion scales. Multicomponent programs combining resistance, aerobics, and balance training demonstrated superior outcomes in physical performance compared to single-component approaches. Conclusion: Multicomponent exercise programs are effective non-pharmacological strategies for managing sarcopenia in older adults. Tailored interventions that integrate multiple exercise modalities and apply progressive overload principles show promise in improving muscle health and functional capacity. Future research should focus on standardizing exercise prescriptions and evaluating long-term adherence and outcomes

KEYWORDS: Multicomponent, Exercises, Sarcopenia, Systematic Review

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INTRODUCTION

Sarcopenia is one of the common conditions related to the aging process in elderly people. In the 10th edition of the International Classification of Diseases (ICD), sarcopenia is listed as a disease and prevalent disorders associated with aging manifestation with muscular waste in older people (Aldeljan & Hurezeanu., 2023). Multicomponent exercise is defined as the combination of three types or more of exercise components such as strengthening exercise, aerobic exercise, stretching, balance exercise, resistance training, coordination and proprioception exercise. The aims of the multicomponent exercise include improving physical function and preventing disability in elderly people. The prescriptions of multicomponent exercise programs showed the best strategy for improving gait, balance and strength as well as reducing the falls in older adults (Labata-Lezaun et al., 2022). However, there is lack of study conducted on sarcopenia preventions and management strategy focus on the prescriptions of regular exercise programs which consist of single-component approaches such as strengthening exercise for the muscles, resistance training or balance exercises alone. Recent studies indicate that single component exercise programs result in limited improvements in overall physical function and do not engage participants fully (Nascimento et al., 2022). Hence, this literature review aims to identify the components of exercises program for sarcopenia which include the types of exercises, duration, frequency, mode of exercise prescribed for the improvement of muscle mass, muscle strength and physical performance among sarcopenic older adults.

METHOD

Eligibility Criteria

The studies were included if the article meets the criteria: (a) article written in English, (b) the year of publish should be led than 10 years, (c) study design such as experimental study, quasi experimental and randomised controlled trials, (d) participants aged more than 60 years old, and (e) participants diagnosed with pre-sarcopenia or sarcopenia. The exclusion criteria in this study includes: (a) duplicated publications, (b) outcome measure cannot be extracted and (c) patients with sarcopenia with other comorbidities such as diabetes, osteoporosis, cancer and so on.

Data sources and search strategy

The systematic electronic search was conducted in the following database PubMed, SCOPUS, Web of Science, CINAHL and manual search using all identified keywords such as"sarcopenia" OR "reduced skeletal muscle mass"OR "muscle mass loss" OR "muscle atrophy" AND "aged" OR "elderly" OR "older adults" OR "older people" AND"physical therapy" OR "rehabilitation programme" OR"therapeutic exercise" AND "residential care facilities"OR "long-term care facilities" OR "old age homes" without time restrictions and no filters were applied. The search of the article undertaken in February 2025 and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)

Data extraction

Two reviewers systematically screened the studies individually based on titles and abstracts in all databases mentioned. Eligibility was assessed independently by reviewers for all studies identified that met the inclusion and exclusion criteria. If the screening study was suitable, it progressed to the retrieval of the full text. After a review of the full text, the article was still considered suitable for the analysis, then it progressed to data extraction. Any conflict regarding the article selection, it was resolved by discussion with the third reviewer. The data was extracted using a data sheet to identify the details of exercise like component, mode, frequency, intensity, duration and outcomes of the exercises.

RESULTS

Search results

The Preferred Reporting Items for Systematic Review and Meta-analysis 2020 (PRISMA 2020) in figure 1 were followed as a guidance conducting a systematic review study. Based on the title and abstract, a total of 4729 articles were identified through database searches. After that, 4478 of the studies were removed and remaining 251 studies were screened. A review of the titles and abstracts yielded 134 relevant studies for full-text screening. Finally, the 25 studies met all inclusion criteria and included in this review.

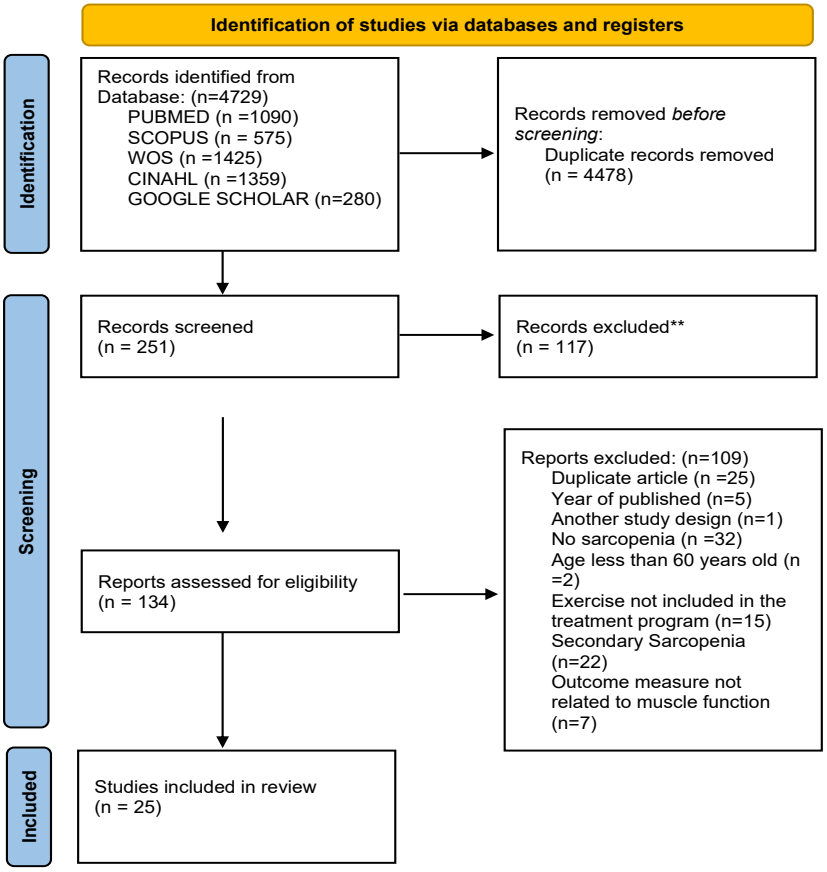

Figure 1: Preferred Reporting Items for Systematic Review and Meta Analysis 2020 (PRISMA 2020) flow diagram.

Risk of Bias Assessment

Two reviewers independently assessed the methodological quality of the studies included in the Joanna Briggs Institute Critical (JBI) Appraisal Checklist for Randomized Controlled Trials containing 13 items. These items were graded as Yes (Y) = 1, No

(N) = 0, Unclear (UC) = 0, Not available (NA) = 0, and comprises criteria such as a clear Reported described in Table 1. The findings from risk of bias assessment and quality of the studies, the reviewer found that all three studies scored between 6 to 7, twelve studies scored between 8 to 9 and remaining ten studies scored 10 to 11 out of a total score of 13.

S. No	Authors	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Overall Quality
1	Sun et al. (2025)	Y	Y	UC	NO	NO	Y	Y	Y	Y	Y	UC	Y	Y	9
2	Liu et al. (2024)	Y	Y	Y	UC	Y	NO	Y	Y	Y	Y	Y	Y	Y	11
3	Wei et al. (2022)	NO	NO	Y	NO	UC	NO	UC	Y	Y	Y	NO	Y	Y	6
4	Tsekoura et al. (2018)	Y	Y	Y	UC	UC	Y	UC	Y	Y	UC	NO	Y	Y	8
5	Makizako et al. (2020)	UC	NO	Y	UC	UC	Y	UC	Y	Y	Y	Y	Y	Y	8
6	Polo-Ferrero et al. (2025)	UC	UC	UC	Y	Y	Y	Y	Y	UC	Y	Y	Y	Y	9
7	Chen et al. (2023)	Y	Y	Y	UC	NO	Y	UC	Y	Y	Y	Y	Y	Y	10
8	Ji et al. (2024)	Y	UC	UC	NO	UC	Y	Y	Y	Y	UC	Y	Y	Y	8
9	Liang et al. (2020)	Y	UC	Y	UC	Y	Y	Y	Y	Y	Y	Y	Y	Y	11
10	Wang et al. (2020)	UC	UC	Y	UC	Y	Y	Y	Y	Y	Y	UC	Y	Y	9
11	Guo et al. (2024)	UC	UC	Y	UC	UC	Y	UC	Y	Y	UC	UC	Y	Y	6
12	Seo et al. (2021)	Y	UC	Y	UC	UC	UC	UC	Y	Y	Y	UC	Y	Y	7
13	Zhang et al. (2025)	Y	Y	Y	NO	Y	Y	Y	Y	Y	Y	UC	Y	Y	11
14	Da Cruz Alves et al. (2022)	Y	UC	UC	Y	Y	Y	Y	Y	Y	Y	UC	Y	Y	10
15	Vikberg et al. (2018)	Y	Y	Y	UC	Y	NO	Y	Y	Y	Y	UC	Y	Y	10
16	Osuka et al. (2021)	Y	UC	Y	NO	NO	Y	UC	Y	Y	Y	Y	Y	Y	9
17	Mori and Tokuda (2022)	Y	Y	Y	UC	UC	Y	Y	Y	Y	Y	UC	Y	Y	10
18	Dedeyne et al. (2020)	Y	Y	Y	UC	Y	Y	UC	Y	Y	Y	Y	Y	Y	11
19	Yue et al. (2022)	Y	Y	NO	NO	NO	Y	Y	Y	Y	NO	Y	Y	Y	9
20	M. Zhang et al. (2024)	Y	UC	Y	UC	Y	Y	Y	Y	Y	UC	Y	Y	Y	10
21	Zhuang et al. (2025)	Y	Y	Y	UC	UC	Y	UC	Y	Y	UC	UC	Y	Y	8
22	Valdés-Badilla et al. (2023)	Y	UC	Y	UC	UC	Y	UC	Y	Y	Y	UC	Y	Y	8
23	N. Chen et al. (2021)	Y	Y	UC	Y	NO	Y	Y	Y	Y	Y	Y	Y	Y	11
24	Chang et al. (2020)	Y	Y	Y	UC	UC	Y	UC	Y	Y	Y	UC	Y	Y	9
25	Flor-Rufino et al. (2022)	Y	UC	Y	UC	UC	Y	UC	Y	Y	Y	UC	Y	Y	8

Table 1: Joanna Briggs Institute Critical Appraisal checklist for randomized controlled trial

After reviewing 25 eligible studies, it was found that 11 studies specifically study no [1, 2,4, 5, 6, 7,8,9,10,18,24] implemented

multicomponent exercise interventions for the management of sarcopenia. In contrast, the remaining 14 studies, study no [3,11,12,13,14,15,16,17,19,20,21,22,23,25] utilized resistance training as a standalone intervention. Among the multicomponent interventions, several studies, including study [2,8,24] combined resistance training with aerobic exercise. Additionally, studies [4,7,9,18] incorporated resistance and balance training. Notably, three studies [5,6,10] included a comprehensive approach involving resistance, balance, and aerobic exercises. Only one study emphasized a combination of flexibility, aerobic, and resistance exercises in its intervention strategy. Moreover, this review found that the most reported exercise frequency was three sessions per week, as implemented in studies [1, 2, 4, 7,11, 12, 13,14, 18, 20,21]. Other studies reported exercise frequencies of twice per week studies [9,16,17,25] or five times per week, as seen in studies [8,10,24]. A total of seven studies did not report the frequency of exercises intervention [3,5,6,15,22,23,24]. The duration of the exercise interventions ranged from 20 to 90 minutes per session. However, a 60-minute session was the most reported duration across the studies. The total length of the exercise interventions varied considerably, ranging from a minimum of 2 weeks to a maximum of 32 weeks. Notably, a 12-week intervention period was the most frequently implemented, as reported in studies [2, 4, 5, 8, 9, 16,18, 20, 21, 22, 23,24]. But, five studies [2,14,15,20,23,] did not report clear information on the total length of the exercise interventions. Among the total of 25 studies on resistance exercise, 13 studies used repetition maximum (RM) criteria [3,9,10,11,14,17,18,19,20,21,23,24,25], whereas 8 studies used the Borg rate of perceived exertion scale (Borg RPE) [2,4,5,7,8,13,15,16], 2 studies [12,22] used OMNI-Rating of perceived Exertion scale (OMNI-RES) and one study [1] used heart rate reserve (HRR) to quantify the intensity of resistance training. Meanwhile, a study [6] did not report the method used for intensity measurement. The percentage of 1RM, which ranged from 30 to 80% of 1RM, was used by all the 13 studies that used RM criteria, and of the 8 studies that used Borg RPE, it ranged from 10 to 14 points. In the study [1] that used heart rate reserve (HRR) mentioned that the intensity of exercise intervention varies depend on the weekly basis such as 40–50% of heart rate reserve (HRR) for 1–4 weeks, 50–60% of HRR for 5–8 weeks, 60–65% of HRR for 9–12 weeks and 65–70% of HRR for 13–16 weeks. The details of the exercise program are summarized in Table 2.

Authors	Components of exercise	Mode of exercise	Frequency/week	Intensity	Time/session	Total Duration (week)
[1] Sun et al. (2025)	Flexibility exercise	The active and passive motion of shoulder, hip, knee and ankle in all directions.	Three times/week	40–50% of heart rate reserve (HRR) for 1–4 weeks, 50–60% of HRR for 5–8 weeks, 60–65% of HRR for 9–12 weeks and 65–70% of HRR for 13–16 weeks.	60 minutes	16 weeks
	Aerobic exercise	Jogging, jumping jack, tai chi.				
	Resistance exercise	Shoulder and elbow, knee flexor/extensor, hip flexor/extensor pectoral/back biceps/triceps.				
[2] Liu et al. (2024)	Progressive resistance training	Standing hip flexion, straight arm lift, sit-to stand, chest expansion, knee extension, side leg raises, and calf raise	Three times/week	RPE scores and heart rate (HR).	Unclear	12 weeks
	Aerobic exercise	Walking steps.				
[3] Wei et al. (2022)	Resistance training	Supine elastic band resistance leg lifts, standing elastic band resistance leg raises, bicep curls, reverse grip curl, and seated pull down.	Not mentioned	Low loads (40.0–60.0% of 1 RM) and high repetitions (12–20) for 2–4 training sets. medium load of (60.0–80.0% of 1 RM), 5–12 repetitions, for 2–4 sets. higher load (70.0–85.0% of 1 RM) and reduced the number of repetitions (5–8 repetitions) for 2–4 sets.	60 minutes	24 weeks
[4] Tsekoura et al. (2018)	Resistance exercise	Knee extensor-flexor, hip abductor-extension, ankle plantar flexors- dorsi flexors, wall push up, seated bicep curl, seated triceps extension, seated lateral shoulder raises, seated abdominal crunches.	Three times/week	Easy (10–11 points in the Borg RPE), Medium to hard (12points in the Borg RPE).	30–35 minutes	12 weeks
	Balance exercise	Walking and turning around, walking-backward tandem-heel-toe- heel to toe-sideways, one leg stand, tandem stance.				
[5] Makizako et al. (2020)	Resistance training	Knee extension (quadriceps), hip flexion (knee raises) (psoas major and iliacus), hip internal rotation (gluteus medius and minimus), elbow flexion and shoulder abduction (trapezius and rhomboid), elbow flexion and trunk rotation (pectoralis major and oblique abdominis), hip extension (gluteus maximus), knee flexion (hamstrings), hip abduction (gluteus medius), and squat (quadriceps, gluteus maximus,and hamstrings).	Not mentioned	12 to 14 on the Borg rate of perceived exertion scale.	60 minutes	12 weeks
	Balance training	Tandem stand, heel-up stand, one-leg stand, weight shifts,and stepping (anterior-posterior and lateral).				
	Aerobics exercise	Anterior-posterior or lateral stepping repetitions for six minutes.				

[6] Polo-Ferrero et al. (2025)	Aerobics exercise	Walking and running.	Not mentioned	Not mentioned	50 minutes	32 weeks
	Resistance exercise	Upper and lower limb isotonic exercises.				
	Coordination and balance	Balance exercises, dual tasks and coordination of upper and lower limb.				
[7] Chen et al. (2023)	Progressive resistance exercise	Not mentioned.	Three times/week	moderate intensity roughly 12–14 on the Borg rate of perceived exertion scale (Borg RPE).	60 minutes	8 weeks
	Balance exercise	Tai chi.				
[8] Ji et al. (2024)	Resistance exercise.	Four upper-body exercises (biceps curls, dips, front raises, and chest presses) and five lower-body exercises (leg lateral rotations, leg extensions, hip abductions, squats, and heel raises.	Five times/week	Rating of Perceived Exertion.	More 30 minutes	12 weeks
	Aerobic exercise.	Walking and stationary bicycles.				
[9] Liang et al. (2020)	Balance exercise	Heel and toe raise and static balance in weeks 1–3, varied directional quick stepping in weeks 4–6, reaching and single leg standing in weeks 7–9, heel to toe walking and complex cross-over stepping activities in weeks 10–12.	Two times/week	70–80% of one-repetition maximum, 3 sets of 8–12 repetitions each (with a 2-min rest between sets).	More 20 minutes	12 weeks
	Resistance exercise	Leg press, leg extension and flexion, leg abduction and adduction, chest press, and seated row.				
[10] Wang et al. (2020)	Balance exercise	Heel and toe raise and static balance in week 1, varied directional quick stepping in week 1, reaching and single-leg standing in week 2, heel toe walking and complex cross-over stepping activities.	Five times/week	Unclear	60 minutes	2 weeks
	Resistance exercise	Leg press, leg extension and flexion, leg abduction and adduction, chest press, and seated row.		70%–80% of one-repetition maximum, 3 sets of 8–12 repetitions		
	Aerobic exercise	Walking.		4–6 of rating of perceived		
[11] Guo et al. (2024)	Strength training	Grip curls, seated pull-downs, and bicep curls. Standing leg raises with an elastic band and supine leg lifts with an elastic band.	Three times/week	light load but many repetitions (from 40% to 60% of 1 repetition maximum [RM] and 12-20 repetitions). A moderate-intensity load with a medium number of repetitions (60%-80% of 1 RM and 5-12 repetitions) greater training load and fewer repetitions (70%-85% of 1 RM and 5-8 repetitions).	90 minutes	24 weeks
[12] Seo et al. (2021)	Resistance training	Upper body (shoulder press, front raise, lateral raise, biceps curl, triceps extension, kick back, Crunch, Bent over row, Seated row, Back extension (prone), Push up (beginner) Lower body (Squat, Lunge, Lying leg abduction, Leg kick back, Pelvic lift, Leg raise, Toe & Heel raise).	Three times/week	progressive overload and the OMNI resistance for active muscle scale (OMNI-RES AM, 0-extremely easy to 10-extremely hard)	More 50 minutes	16 weeks
[13] Zhang et al. (2025)	Resistance training	Back extensors, biceps brachii, gluteus maximus, gluteus medius, deltoid, quadriceps femoris, glute bridges, resisted elbow flexion, hip extension, hip abduction, shoulder abduction, and knee extension.	Three times/week	Borg rating of perceived exertion (RPE), with a target RPE of 12-14.	40 minutes	4 weeks
[14] Da Cruz Alves et al. (2022)	Resistance exercise	Leg extension, 45 leg press, horizontal leg press, bilateral knee flexion with a shin weight, hip abduction and hip adduction.	Three times/week	One-repetition maximum test (1RM)	Not mentioned	14 weeks
[15] Vikberg et al. (2018)	Resistance exercise	Squad, calf raise, chair stand, half lunges, biceps rowing, push ups, bridges.	Not mentioned	Moderate to high intensity using the Borg CR-10 scale.	Not mentioned	10 weeks

[16] Osuka et al. (2021)	Resistance training	The chair-based RT included knee extension, toe raise, heel raise, knee lift, squats, lateral leg raise, and hip adduction exercises, using a rubber ball. Knee lift and heel raise. Elastic band RT consisted of arm rowing, knee lift, and hip adduction exercises. Knee extension, heel raise, knee lift, and lateral leg exercises were provided using ankle weights of 0.5,0.75, 1.0, or 1.5 kg. machine-based RT, including arm rowing, leg extension, hip adduction, knee extension, and trunk flexion.	Two times/week	12–14 points on the Borg Rate of Perceived Exertion Scale.	60 minutes	12 weeks
[17] Mori and Tokuda (2022)	Resistance exercise	Abdominal crunches, rising and sitting from a chair; leg extensions; standing heel kicks, and calf raises. Five exercises were also performed with elastic bands): arm curls, pull-ups, leg extensions, squats, and sit-ups.	Two times/week	50%-70% of 1 maximum repetition (1RM)	30–40 minutes	24 weeks
[18] Dedeyne et al. (2020)	Strengthening exercise	Marching warming exercises and an abdominal strength exercise.	Three times/week	30% of 1-RM, 60% of 1-RM and 90% of 1-RM	More 30 minutes	12 weeks
	balance retraining exercises	Modified Otago exercise program		Participant's progression.		
[19] Yue et al. (2022)	Resistance training	30-sencond still wall squats, 15 repetitions of wall push-ups, 10 repetitions of lunge squats, 30-second backhand plank, and 15 repetitions of wall calf raises	Once a week	Moderate to above average 60 to 80% of maximum HR.	60 minutes	24 weeks
[20] M. Zhang et al. (2024)	Resistance training	Shoulder external rotation, elbow extension, elbow flexion, leg squat abduction, lunge and bend, shoulder abduction and half-squat stand-up.	Three times/week	15 repetitions with 60% 1RM, 12 repetitions with 65% 1RM, 10 repetitions with 70% 1RM	Not mentioned	12 weeks
[21] Zhuang et al. (2025)	Resistance training	Shoulder external rotation, elbow extension, elbow flexion, leg squat abduction, lunge and bend, shoulder abduction, half-squat stand-up.	Three times/week	60% 1RM for weeks 1–4, 65% 1RM for weeks 5–8, and 70% 1RM for weeks 9–12	30 minutes	12 weeks
[22] Valdés-Badilla et al. (2023)	Resistance exercise	Pull down, pull back, shoulder abduction, biceps curl, triceps, and upright row using elastic band.	Not mentioned	5 to 8 OMNI-RES	60 minutes	12 weeks
(23)N. Chen et al. (2021)	Resistance exercise	Upper limb exercises (elbow extension and elbow flexion) followed by lower limb exercises (leg press and knee extension).	Not mentioned	3 sets of 15 repetitions at 60% 1RM in the first 4 weeks, 3 sets of 12 repetitions at 65% 1RM in the second 4 weeks, and 3 sets of 10 repetitions at 70% 1RM in the third 4 weeks.	Not mentioned	12 weeks
(24)Chang et al. (2020)	Resistance exercise	Leg press, leg extension, and leg curl	Not mentioned	3 sets of 10 repetitions each starting from 40% of the 1 RM,	30 minutes	12 weeks
	Aerobic exercise	Walking	Five times/week	Not mentioned		
(25)Flor-Rufino et al. (2022)	*High-intensity resistance training (HIRT)*	Leg press and knee extension	Two times/week	70 % of 1RM	65 minutes	24 weeks

DISCUSSION

This review aimed to synthesize the multicomponent exercise programs prescribed to improve muscle mass, muscle strength, or physical performance among individuals with sarcopenia. A total of 25 studies that met the inclusion criteria were included, and the details of the exercise interventions specifically the type of exercise, exercise mode, frequency per week, intensity, duration, and session time were summarized in Table 2. In addition, the methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist. Many studies demonstrated good methodological quality, with three studies scoring between 6 and 7, twelve studies scoring between 8 and 9, and the remaining ten studies achieving scores between 10 and 11 out of a possible 13 points. Across the 25 included studies our findings provide a granular, evidence-based consolidation of effective exercise prescriptions. Crucially, the studies exhibited a high standard of methodological rigor with most scoring between 8 and 11 out of 13 points on the JBI Critical Appraisal Checklist, thereby lending strong support to the reliability of the synthesized intervention parameters. The findings reveal that multicomponent exercise programs particularly those combining resistance, aerobic, and balance training are more effective in improving physical performance outcomes compared to single-component interventions. This aligns with previous literature suggesting by Chen et al., 2023 which found that moderate intensity comprehensive exercise combining aerobic, balance, resistance and flexibility exercise in one exercise program is more effective, safe and convenient exercise program. Similarly, in studies [1,5,6,10] implemented three components of exercises in their treatment program for older adults with sarcopenia. Other studies [2, 4, 7,8, 9,18, 24] used two components of exercises in their intervention. This showed that multicomponent exercises more preferred by the researcher to improve muscle

strength, muscle mass and physical function.

In addition, among the reviewed studies, resistance training was the most implemented component, either alone or in combination. Resistance training plays an essential role in the potential treatment and prevention strategies of sarcopenia in healthy or sarcopenic older individuals. This can show the trend that resistance training known to predominantly increase muscle strength initially by neuromuscular adaptation in older individuals Vikberg et al. (2018). The studies [3, 11,12,13,14,15,16,17,19,20,21,22,23] implemented resistance training exercise alone in their study. Study by Seo et al., 2021 found that 16 weeks of resistance training improved functional fitness and muscle quality in sarcopenic older adults. Previous studies by Zhang et al., 2024 have reported 4-week remote resistance training program is effective in improving strength, balance and activity daily livings in older adults with sarcopenia. They concluded that the increase in muscle mass in older adults following resistance training may be attributed to enhanced muscle protein synthesis, increased satellite cell activity and quantity, elevated secretion of anabolic hormone, improved mitochondrial quality and function and decreased activity of catabolic cytokines. Therefore, they recommended resistance training alone as an exercise program for sarcopenia. However, studies that incorporated aerobic and balance exercises alongside resistance training demonstrated greater improvements in gait speed, chair stand performance, and overall physical function. Recent studies have consistently demonstrated the benefits of balance exercises in improving outcomes for older adults. A randomized controlled trial by Zouita et al. (2020) involving Twenty-seven older women compared the effects of combined balance and strength training on measures of balance and muscle strength in older women with a history of falls. The results showed a combined balance and strength training program for women with a history of falls improved transfers and control of COG and reduced postural sway and improved weight-shifting ability and balance when standing. Similarly, a meta-analysis by Zhao et al. (2022), which included 13 trials involving over 900 participants, found that multicomponent exercise interventions that included balance training were superior to resistance training alone in improving physical function and reducing falls among older adults with sarcopenia. The authors emphasized the synergistic effects of combining strength and balance components to enhance neuromuscular control and functional performance. In addition, aerobic exercise has well-documented benefits and gives a positive result in improve muscle endurance and strength which are important for maintaining physical function in older adults with sarcopenia. In this systematic review, we found studies [1,2,5,6,8,10,24] implemented aerobic exercise in their program. This finding in line with a study by Liu et al. (2024) demonstrated that a 12-week program combining graded progressive home-based resistance and aerobic exercise significantly improved knee extensor muscle strength and the six-minute walk distance in community-dwelling older adults with sarcopenia. These improvements are indicative of enhanced muscle endurance and functional capacity. Besides that, a systematic review and meta-analysis by Liu et al. (2023) demonstrated that combined aerobic and resistance training significantly enhanced muscle strength and physical performance among sarcopenic individuals. These combined interventions were shown to be more effective than single-mode exercise programs. Similarly, an eight-week moderate-intensity comprehensive exercise program studied by Chen et al., (2023) in elderly women with sarcopenia resulted in notable improvements in body composition, muscle strength, and functional capacity, particularly in gait speed and chair stand performance. Moreover, a meta-analysis by Yoshimura et. Besides that, exercise frequency, intensity, and session also played a critical role for the improvement of the outcomes in sarcopenia. In this review, we found that exercise programs with three sessions per week were most prevalent and appeared to offer a balance between effectiveness and feasibility. Notably, studies with higher frequency (five sessions/week) showed promising results but may pose adherence challenges in real-world settings. Intensity was measured using various methods, with RM and RPE being the most common. Programs using progressive overload principles (e.g., increasing RM percentages or RPE scores over time) were associated with better outcomes in muscle strength and endurance. However, inconsistencies in reporting intensity and progression highlight the need for standardized guidelines. Session duration and total intervention length varied widely, but 60-minute sessions over a 12-week period were most frequently reported and appeared sufficient to elicit meaningful improvements. Longer interventions (e.g., 24–32 weeks) may offer sustained benefits but require further investigation into long-term adherence and outcomes. Overall, the review supports the implementation of tailored multicomponent exercise programs for sarcopenic older adults. These should consider individual capabilities, targeted outcomes, and practical constraints to optimize effectiveness and adherence. Future research should aim to standardize exercise prescription parameters and explore the long-term effects of multicomponent interventions, particularly in diverse elderly populations and across different care settings

CONCLUSION

This review aims to assist practitioners and researchers in selecting appropriate frequency, intensity, duration, type, mode, and progression parameters when prescribing exercise interventions for sarcopenic older adults. Additionally, it may facilitate the identification of variations in exercise prescription components according to specific targeted outcomes in this population.

REFERENCES

1. Ardeljan, A.D, & Hurezeanu, R. (2023). Sarcopenia. StatPearls Publishing.
2. 2.Chang, K., Wu, W., Huang, K., & Han, D. (2020). Effectiveness of early versus delayed exercise and nutritional intervention on segmental body composition of sarcopenic elders - A randomized controlled trial. *Clinical Nutrition*, *40*(3), 1052–1059. https://doi.org/10.1016/j.clnu.2020.06.037.
3. 3.Chen, B., Chen, Y., Shin, S., Jie, C., Chang, Z., Ding, H., & Yang, H. (2023). Effect of a moderate-intensity comprehensive exercise program on body composition, muscle strength, and physical performance in elderly females with sarcopenia. *Heliyon*, *9*(8), e18951. https://doi.org/10.1016/j.heliyon.2023.e18951.
4. 4.Chen, N., He, X., Zhao, G., Lu, L., Ainsworth, B. E., Liu, Y., & Wu, X. (2021). Efficacy of low-load resistance training combined with blood flow restriction vs. high-load resistance training on sarcopenia among community-dwelling older Chinese people: study protocol for a 3-arm randomized controlled trial. *Trials*, *22*(1). https://doi.org/10.1186/s13063-021-05495-z.

5. 5.Da Cruz Alves, N. M., Pfrimer, K., Santos, P. C., De Freitas, E. C., Neves, T., Pessini, R. A., Junqueira-Franco, M. V. M., Nogueira-Barbosa, M. H., Greig, C. A., & Ferriolli, E. (2022). Randomised controlled trial of fish oil supplementation on responsiveness to resistance exercise training in sarcopenic older women. *Nutrients*, *14*(14), 2844. https://doi.org/10.3390/nu14142844.
6. 6.Dedeyne, L., Dupont, J., Koppo, K., Verschueren, S., Tournoy, J., & Gielen, E. (2020). Exercise and Nutrition for Healthy AgeiNg (ENHANce) project – effects and mechanisms of action of combined anabolic interventions to improve physical functioning in sarcopenic older adults: study protocol of a triple blinded, randomized controlled trial. *BMC Geriatrics*, *20*(1). https://doi.org/10.1186/s12877-020-01900-5.
7. 7.Guo, H., Cao, J., He, S., Wei, M., Meng, D., Yu, I., Wang, Z., Chang, X., Yang, G., & Wang, Z. (2024). Quantifying the enhancement of sarcopenic skeletal muscle preservation through a hybrid exercise program: randomized controlled trial. *JMIR Aging*, *7*, e58175. https://doi.org/10.2196/58175.
8. 8.Ji, W., Lee, D., Kim, M., Lim, N., Lim, J., Baek, J. U., Kim, S., Lee, C. H., Kim, M., & Won, C. W. (2024). Efficacy of a combined exercise and nutrition intervention study for outpatients with possible sarcopenia in community-based primary care clinics (ENdSarC): study protocol for a multicenter single-blinded randomized controlled trial. *BMC Geriatrics*, *24*(1). https://doi.org/10.1186/s12877-024-05434-y.
9. 9.Labata-Lezaun, N., González-Rueda, V., Llurda-Almuzara, L., López-De-Celis, C., Rodríguez-Sanz, J., Bosch, J., Vicente-Rodríguez, G., Gorczakowska, D., Araluze-Arizti, P., & Pérez-Bellmunt, A. (2022). Effectiveness of multicomponent training on physical performance in older adults: A systematic review and meta-analysis. *Archives of Gerontology and Geriatrics*, *104*, 104838. https://doi.org/10.1016/j.archger.2022.104838
10. 10.Liang, Y., Wang, R., Jiang, J., Tan, L., & Yang, M. (2020). A randomized controlled trial of resistance and balance exercise for sarcopenic patients aged 80–99 years. *Scientific Reports*, *10*(1). https://doi.org/10.1038/s41598-020-75872-2.
11. 11.Liu, J., Kowal, I., Yang, Y., Zhu, Y., Chen, S., Perez, A., Rao, H., & Group, C. O. a. Q. E. (2023). Culturally tailored group Qigong exercise in older Chinese immigrants: A feasibility study. *Geriatric Nursing*, *51*, 245–252. https://doi.org/10.1016/j.gerinurse.2023.03.021
12. 12.Liu, M., Li, J., Xu, J., Chen, Y., Chien, C., Zhang, H., Zhang, Q., & Wang, L. (2024). Graded Progressive Home-Based Resistance Combined with Aerobic Exercise in Community-Dwelling Older Adults with Sarcopenia: A Randomized Controlled Trial. *Clinical Interventions in Aging*, *Volume 19*, 1581–1595. https://doi.org/10.2147/cia.s473081.
13. 13.Makizako, H., Nakai, Y., Tomioka, K., Taniguchi, Y., Sato, N., Wada, A., Kiyama, R., Tsutsumimoto, K., Ohishi, M., Kiuchi, Y., Kubozono, T., & Takenaka, T. (2020). Effects of a multicomponent exercise program in physical function and muscle mass in Sarcopenic/Pre-Sarcopenic adults. *Journal of Clinical Medicine*, *9*(5), 1386. https://doi.org/10.3390/jcm9051386.
14. 14.Monti, E., Tagliaferri, S., Zampieri, S., Sarto, F., Sirago, G., Franchi, M. V., Ticinesi, A., Longobucco, Y., Adorni, E., Lauretani, F., Von Haehling, S., Marzetti, E., Calvani, R., Bernabei, R., Cesari, M., Maggio, M., & Narici, M. V. (2023). Effects of a 2-year exercise training on neuromuscular system health in older individuals with low muscle function. *Journal of Cachexia Sarcopenia and Muscle*, *14*(2), 794–804. https://doi.org/10.1002/jcsm.13173.
15. 15.Mori, H., & Tokuda, Y. (2022). De-Training Effects Following Leucine-Enriched Whey Protein Supplementation and Resistance Training in Older Adults with Sarcopenia: A Randomized Controlled Trial with 24 Weeks of Follow-Up. *The Journal of Nutrition Health & Aging*, *26*(11), 994–1002. https://doi.org/10.1007/s12603-022-1853-1.
16. 16.Nascimento, C. M., et al. (2022). *Effects of resistance training on physical function in older adults: A systematic review*. *Journal of Sports Sciences*, 40(12), 1423-1431. doi:10.1080/02640414.2022.2058986.
17. 17.Osuka, Y., Kojima, N., Sasai, H., Wakaba, K., Miyauchi, D., Tanaka, K., & Kim, H. (2021). Effects of exercise and/or β-hydroxy-β-methylbutyrate supplementation on muscle mass, muscle strength, and physical performance in older women with low muscle mass: a randomized, double-blind, placebo-controlled trial. *American Journal of Clinical Nutrition*, *114*(4), 1371–1385. https://doi.org/10.1093/ajcn/nqab176.
18. 18.Polo-Ferrero, L., Sáez-Gutiérrez, S., Dávila-Marcos, A., Barbero-Iglesias, F. J., Sánchez-Sánchez, M. C., Puente-González, A. S., & Méndez-Sánchez, R. (2025). Effect of power training on function and body composition in older women with probable sarcopenia. A study protocol for a randomized controlled trial. *PLoS ONE*, *20*(1), e0313072. https://doi.org/10.1371/journal.pone.0313072.
19. 19.Seo, M., Jung, S., Kim, S., Lee, J., Jung, H. C., & Song, J. (2021). Effects of 16 Weeks of Resistance Training on Muscle Quality and Muscle Growth Factors in Older Adult Women with Sarcopenia: A Randomized Controlled Trial. *International Journal of Environmental Research and Public Health*, *18*(13), 6762. https://doi.org/10.3390/ijerph18136762.
20. 20.Sun, P., Yang, J., Li, N., Yang, W., Yang, J., Ran, J., Cheng, F., & Liao, Y. (2025). Effects of aquatic exercise compared with land-based exercise on the body composition and function of older adults with sarcopenia: protocol for a randomised controlled trial. *BMJ Open*, *15*(1), e085474. https://doi.org/10.1136/bmjopen-2024-085474.
21. 21.Tsekoura, M., Billis, E., Tsepis, E., Dimitriadis, Z., Matzaroglou, C., Tyllianakis, M., Panagiotopoulos, E., & Gliatis, J. (2018). The Effects of Group and Home-Based Exercise Programs in Elderly with Sarcopenia: A Randomized Controlled Trial. *Journal of Clinical Medicine*, *7*(12), 480. https://doi.org/10.3390/jcm7120480
22. 22.Vikberg, S., Sörlén, N., Brandén, L., Johansson, J., Nordström, A., Hult, A., & Nordström, P. (2018). Effects of resistance training on functional strength and muscle mass in 70-Year-Old individuals with Pre-sarcopenia: a randomized controlled trial. *Journal of the American Medical Directors Association*, *20*(1), 28–34. https://doi.org/10.1016/j.jamda.2018.09.011.
23. 23.Wang, R., Liang, Y., Jiang, J., Chen, M., Li, L., Yang, H., Tan, L., & Yang, M. (2020). Effectiveness of a Short-Term Mixed Exercise Program for treating sarcopenia in hospitalized patients aged 80 years and older: a prospective

clinical trial. *The Journal of Nutrition Health & Aging*, *24*(10), 1087–1093. https://doi.org/10.1007/s12603-020-1429-x.

24. 24.Wei, M., Meng, D., Guo, H., He, S., Tian, Z., Wang, Z., Yang, G., & Wang, Z. (2022). Hybrid Exercise Program for Sarcopenia in Older Adults: The effectiveness of Explainable Artificial Intelligence-Based Clinical Assistance in assessing skeletal muscle area. *International Journal of Environmental Research and Public Health*, *19*(16), 9952. https://doi.org/10.3390/ijerph19169952.
25. 24.Zhang, L., Ge, Y., Zhao, W., Shu, X., Kang, L., Wang, Q., & Liu, Y. (2025). A Four-Week Mobile App–Based Tele-Rehabilitation Program Versus Conventional In-Person Rehabilitation in Elderly Patients with Sarcopenia: A Randomized Controlled Trial (Preprint). *Journal of Medical Internet Research*, *27*, e67846. https://doi.org/10.2196/67846.
26. 25.Zhang, M., Song, Y., Zhu, J., Ding, P., & Chen, N. (2024). Effectiveness of low-load resistance training with blood flow restriction vs. conventional high-intensity resistance training in older people diagnosed with sarcopenia: a randomized controlled trial. *Scientific Reports*, *14*(1). https://doi.org/10.1038/s41598-024-79506-9.
27. 26.Zhao, H., Cheng, R., Song, G., Teng, J., Shen, S., Fu, X., Yan, Y., & Liu, C. (2022). The Effect of Resistance Training on the Rehabilitation of Elderly Patients with Sarcopenia: A Meta-Analysis. *International Journal of Environmental Research and Public Health*, *19*(23), 15491. https://doi.org/10.3390/ijerph192315491.
28. 27.Zouita, S., Zouhal, H., Ferchichi, H., Paillard, T., Dziri, C., Hackney, A. C., Laher, I., Granacher, U., & Zouita, A. B. M. (2020). Effects of combined balance and strength training on measures of balance and muscle strength in older women with a history of falls. *Frontiers in Physiology*, *11*. https://doi.org/10.3389/fphys.2020.619016.