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EFFECT OF RESISTANCE EXERCISE TO PREVENT AND MANAGE SARCOPENIA

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ABSTRACT

Demographic shift worldwide impacts skeletal muscle strength, with 80% of older people in low- and middle-income countries by 2050. Senotherapeutic interventions can counteract age-related changes. Sarcopenia is a loss of muscle mass and function because of the aging process. The goal of this literature review was to evaluate an resistance training efficacy on pre-sarcopenic body composition and strength in elderly. This literature review will investigate the effect of resistance training determined by body mass analysis in the sarcopenia patient. Google Scholar, ResearchGate, and Mendeley were used as the search engine. The keywords were strength training, resistance exercise & sarcopenia. The effect of resistance exercise on sarcopenia prevention were analyzed from 28.300 articles. Significant effect on sarcopenia proofed by body composition improvement. The depletion of lean body and total fat mass was analyzed by a mean of gram unit. An easy-to-use functional resistance exercise was effective to maintain functional strength and to gain muscle mass in pre-sarcopenia elderly patients.

Keywords : resistance exercise; weight training; sarcopenia

INTRODUCTION

The world's population is experiencing a demographic shift, with 80% of older people living in low- and middle-income countries by 2050. The proportion of the world's population over 60 years is nearly doubled between 2015 and 2050, from 12% to 22%. This growth in older population is expected to impact social systems and health systems worldwide. By 2030, 1 in 6 people worldwide will be aged 60 years or over, and by 2050, the world's population of people aged 60 and older will double, included the disease problem like sarcopenia.[1] Senescence is a cell fate that contributes to aging-related pathologies in skeletal muscle (SkM). Studies on old mice reveal that a subpopulation expresses p16Ink4a and senescence-related genes, causing DNA damage and chromatin reorganization. A senotherapeutic intervention countered age-related changes and improved SkM strength. The senescence phenotype is conserved in older humans, providing evidence for cellular senescence as a potential mediator of SkM aging.[2] The definition of sarcopenia is about muscle atrophy. This disease happens on a half of adult aged more than 80 years. Sarcopenia staging was explained by The European Working Group on Sarcopenia in Older People (EWGSOP). Pre-sarcopenia was low muscle mass condition. The low muscle mass and strength can be followed by poor physical performance.[3] Falls will happen followed by fractures, overall poor health, or mortality. These changes could worsen the quality of life in elderly.[4] Sarcopenia affects elderly patients with chronic heart failure, affecting muscle mass, strength, and physical performance. Techniques like resistance exercise and nutritional supplementation are commonly used to combat wasting disorders, but no universal gold standard exists.[5] Sarcopenia prevention is important. Inactive body in elderly can make muscle wasting and malfunction.[6] To prevent sarcopenia, physical activity should be increased.[7] Sarcopenia and dynapenia, caused by muscle wasting, are significant concerns in old age. Resistance exercise training is suggested as a treatment, improving muscle strength and functional capacity in older adults. However, many prescribed programs are not best practices.[8] This paper will investigate the effect of resistance exercise on sarcopenia.

METHODS

Google Scholar, ResearchGate, PubMed and Mendeley were used as search engines for this literature review. The literature review method uses journals and preliminary research publications.

Resistance exercise or weight training efficacy on sarcopenia are explored. The keywords were resistance exercise or weight training and sarcopenia. The literature search yielded 28.300 articles. There were 20 trusted articles with inclusion criteria of literature publication years 2012-2022. Indonesian or English was used. Non-full-text literature is excluded.

RESULTS

Eleven articles told the effect of resistance exercise on sarcopenia. Resistance exercise was programmed for 8 to 24 weeks. The number of participants varied between 36 and 235 subjects and the age group was approximately 65 years.

Table 1. The Analysis of Resistance Training Effect to Change Muscle and Body Mass in Sarcopenic Elderly

No	Article	Goal	Age	Population	Study Length	Intervention	Results
1	Drug treatment-induced muscle hypertrophy for functional improvement.[9]	To review the benefits	70 years old	70 patients	12 weeks	high intensity resistance training	muscle mass, strength, and function improvement
2	fall prevention.[10]	To identify the efficacy of preventive measures	64-94 years old	63 elderlies (17 males and 56 females)	10-weeks	before and after exercise program	increase in grip strength, functional activities, LDH and CKM with decrease in TnT
3	Comparison with blood flow restriction (BFR) training.[11]	to study the BFR training efficacy	14 studies met the inclusion criteria for this review	People >50 years old	2014-2020	Low & high-load blood flow restriction (LL & HL-BFR)	different effect on muscle mass & strength
4	Fat infiltration and muscle hydration improve after high-intensity resistance training (HIRT).[12]	To assess the effects on clinical and magnetic resonance imaging (MRI) parameters	Mean: 79.8 years old	38 women	six months of	two weekly 65 min sessions for six months, with a minimum recovery time of 72 h.	Good effect for muscle mass, muscle mass index, fat mass and all strength variables
5	Effect of Resistance Exercise on Depression in Mild Alzheimer Disease.[13]	To evaluate the effects on depression, muscle mass, and muscle function	79.3±5.1 years; 66−85years	40 women	2 months	3 training sessions in non-consecutive days every week for 12 weeks.	effectively control depressive symptoms, increased isometric muscle strength

6	Resistance training of peripheral muscles benefits respiratory parameters.[14]	to assess the efficacy on clinical parameters of respiratory function and health-related quality of life (QoL)	aged 70 years and older	Fifty-one women	six months	high-intensity resistance (HIRT)	increased muscle strength, halted age-related respiratory function decline, benefit for health-related QoL and physical well-being.
7	Effects of exercise on muscle mass, strength, and physical performance according to the EWGSOP criteria.[15]	to summarize and synthesize the evidence on muscle mass, strength and physical performance	adults older than 60 years	235 patients	4-12 weeks	Exercise programmes with isokinetic, isometric, plyometric components require additional equipment for optimal results.	Physical performance and muscle strength improvement, but inconsistent effect on muscle mass.
8	adults comorbid with congenital heart disease: nutritional status, dietary intake.[16]	to assess the nutritional status and dietary intake,	172 adults with CHD	60 men (34.5±13.7 (18–68) years) and 112 women (36.0±12.0 (19–70) years)	2 months	an amino acid jelly every day for 2 months. & resistance training, patients	higher calorie, protein, and fat intake
9	Regulation of mitochondrial dynamic equilibrium.[17]	to delineate the effects of physical exercise on mitochondria in order	16 pre-clinical studies	902 papers in English with full text and without duplication	163 were pre-clinical papers.	physical exercise could affect mitochondrial quality control to attenuate sarcopenia	improved muscle performance via regulating mitochondrial dynamic equilibrium,
10	Progressive machine-based resistance training for prevention and treatment.[18]	to analyze the effects that long-term progression	779 articles were scanned (PubMed, Web of Science, CINAHL)	14 randomized controlled trials were included within the review.	2000 and 2020	the Timed-Up-and-Go-test, gait speed test, Short Physical Performance Battery and 6 min-walk-test	enhanced muscle strength and physical performance
11	Effects of Resistance Training on Functional Strength and Muscle Mass[19]	to examine the effects on functional strength and body composition	optional nutritional supplementation (n = 36) or to a control	in men and women aged 70 years with pre-sarcopenia.	a 10-week	instructor-led program	maintaining functional strength and increasing muscle mass

group (n = 34)

DISCUSSION

Drug treatment-induced muscle hypertrophy improved the functional elderly people musculoskeletal organ system. In their 70s elderly adult with sarcopenia used 12 weeks of high-intensity resistance training. Resistance training and physical activity can make muscle mass, strength, and function improvement.[9]

Sarcopenia, exercise and fall in the elderly were identified from the efficacy of preventive measures. Patient with ages between 64 and 94 were recruited. Totally sixty-three elderly individuals (17 males and 56 females) joined a 10-week program designed to improve balance, strength/resistance, flexibility and endurance. Grip strength improvement showed at right hand, from 21.4 to 22.3 kg. Overall functional performance were improved and followed by LDH and CKM increment (from 77.1 to 83.1 mU/mL, and from 106.9 to 114.0 μg/mL). TnT decreased from 16,2 pg/mL. The LDH and CKM slight increases as two key muscle enzymes indicate higher skeletal muscle utilization. The TnT serum levels decrement suggests a skeletal muscle strengthening.[10]

Blood flow restriction training was compared with conventional resistance training for the sarcopenia improvement in older adults using a systematic review and meta-analysis. A total of 14 studies included from PubMed, Web of Science, Embase, and Science Direct. Low-load blood flow restriction (LL-BFR) efficacy wasn't significant on muscle mass compared with high-load resistance training (HL-RT). LL-BFR had a significant effect on muscle strength compared with HL-RT.[11]

Fat infiltration and muscle hydration in women with sarcopenia improved after high-intensity resistance training. A randomized clinical trial assessed the effects of high-intensity resistance training (HIRT) on clinical and magnetic resonance imaging (MRI) parameters from thirty-eight women. They were 20 women in the HIRT group. Their mean age was 79.8 years old. They joined the program for six months. Two weekly 65 min session resistance training for six months was combined with a minimum recovery time of 72 h. Regarding MRI parameters, infiltrated microscopic fat and hydration (T2) decreased significantly after six months resistance exercise program. [12]

Resistance exercise efficacy on depression, muscle mass, and function in sarcopenia patient with mild Alzheimer Disease (AD). The study in 40 women with mild AD and sarcopenia consisted of 79.3±5.1 years (66−85 years). They joined 2 months of 3 training sessions in non-consecutive days every week. The participant will do 10-minute general warm-up, a 40-minute elastic resistance exercise using Theraband, and a cool down routine. Resistance exercise increased isometric muscle strength and can relieve depressive symptoms in elderly patients with sarcopenia.[13]

The efficacy of high-intensity resistance training (HIRT) on clinical parameters of respiratory function and health-related quality of life (QoL) were assessed by a six months study. The research was targeted fifty-one sarcopenic community-dwelling women aged 70 years and older. Muscle strength incline and halted age-related respiratory function decline could benefit health-related QoL and physical well-being.[14]

Muscle mass, strength and physical performance in older adults with sarcopenia according to the EWGSOP criteria were evaluated by four RCTs and three non-randomized interventional studies. A total of 235 patients with sarcopenia adults older than 60 years with sarcopenia were recruited from 2018 until September 2020. Randomized controlled trials (RCTs) and non-randomized interventional studies examined and showed an effect of exercise on physical performance and muscle strength. However, an inconsistent effect showed on muscle mass parameter.[15]

The nutritional status and dietary intake were compared and evaluated after the sarcopenic patient joined resistance training and amino acid intake on 172 adults with CHD. They were 60 men (34.5±13.7 (18–68) years) and 112 women (36.0+12.0 (19–70) years) who intervened by the 2 months program. An amino acid jelly every day for 2 months and resistance training were given to the patients. A home exercise was programmed every other day for 2 months. Patients exercised with elastic bands for arm and leg exercises. Adults with CHD have more calorie, protein, and fat intake. Their skeletal muscle mass was less than the normal one. So, amino acid intake followed by resistance training could improve body fat percentage, skeletal muscle mass, and edema in adults with CHD.[16]

Physical exercise could affect mitochondrial quality control in sarcopenia cases. Muscle performance improvement was regulated by mitochondrial dynamic equilibrium. Exercise can be an alternative intervention for sarcopenia.[17] For analyzing the Timed-Up-and-Go-test, gait speed test, Short Physical Performance Battery and 6 min-walk-test improvement after the machine-based progressive resistance training showed the potential to reverse sarcopenia in the oldest old. Enhancemnt on muscle strength and physical performance was the evidence.[18] A 10-week instructor-led resistance training program on functional strength and body composition was effective in maintaining functional strength and increasing muscle mass in older adults with pre-sarcopenia.[19] Future perspective or direction for resistance training efficacy on sarcopenia is the molecular to bedside investigation, especially for the periodization and regional body target for the patient.

CONCLUSION

The eccentric training has the biggest benefit to increase skeletal muscle mass. It is hoped that future anti-aging resistance training research will be conducted with a larger sample size, gender balance, and specific age-restriction criteria.

CONFLICT OF INTEREST

Nothing is considered as the conflict of interest.

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