Sport and Fitness Journal
E-ISSN: 2654-9182 Volume 10, No.2, May 2022: 104-110

# RESISTANCE TRAINING EFFECT ON IGF1 LEVEL OF SARCOPENIA

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## ABSTRACT

Aging is a natural physiological process that everyone goes through as they get older. The quality and quantity of muscle mass decrease with age. Sarcopenia is a loss of muscular mass that is followed by a loss of muscle strength. Many factors and signaling pathways regulate muscle metabolism. The amount of IGF-1 in the blood has a significant impact in skeletal muscle quality. Resistance training has been demonstrated to be necessary for muscular development and boosting the efficiency of agonist and antagonist muscle groups in recent studies. The study was conducted using the literature method. We reviewed and compared the most recent journals discussing the relationship between sarcopenia and regular long-term physical exercise. Resistance training showed significant results for muscle strength and muscle mass in the elderly. High-resistance training has a major effect on increasing GH and cortisol. In conclusion, resistance training have a positive effect on muscle health that can be withdrawn by IGF1.

***Keywords: Sarcopenia; IGF-1; Resistance training***

## INTRODUCTION

Aging is something that definitely and we can't avoid it but we can prevent it. There are so many signs of aging that occur in our bodies, including decreased body functions, and physical performance abilities, which will cause a risk condition for health problems that interfere with the quality of life[1,2,3]. Sarcopenia comes from the Greek, namely “sarx” and “penia” which means "muscle" and lost" which when put together means reduce of muscle mass. Sarcopenia is a condition that occurs as a result of multifactorial[2,3,4]. Of all the forms of aging that occur, sarcopenia which is a condition of decreased muscle strength accompanied by a decrease in muscle mass is often considered normal or physiological, even though it is something that can be prevented[1,5,6].

Sarcopenia is often associated with aging and usually occurs at the age of 60 years and over when the body's condition has decreased in function and strength. Progressive loss of muscle mass occurs in the early 40s and increases to an 8% decline in function every 10 years[3,5,7]. Judging from the epidemiology, sarcopenia is more at risk, especially in Asian people. It is associated with a lack of physical activity and exercise. In addition, nutrition also plays a role in risk factors for sarcopenia[3,4,8].

Sarcopenia can be identified by looking at the limit values the measurement of muscle mass (5.4 kg/m2 for women and 7.0 kg/m2 for men) they using dual X-ray absorptiometry to measure the values, and 5.7 kg/m2 for women and 7.0 kg/m2 for men that can be analyzed by bioimpedance analysis, grip strength (<18 kg for women and <26 kg for men), and walking speed (<0.8 m/s)[3,9,10]. Many studies have discussed the relationship between sarcopenia and the role of growth hormone and as a growth factor. The pathophysiology of sarcopenia is still uncertain, but the link between the decline in hormones associated with aging is said to be the main cause of sarcopenia[9,10,11]. The decrease in the level of the anabolic hormone IGF-1 in old age greatly influences Growth Hormone (GH), which plays a role in increasing the number of myocytes[3,12,13].

The diagnosis of sarcopenia can be made with a diagnostic criteria and the "stages of sarcopenia" that have been determined based on the European Working Group on Sarcopenia in Older People (EWGSOP)[13,4,15]. The criteria for the diagnosis of sarcopenia are certainly based on 3 things, namely muscle strength, muscle mass, and decreased physical performance. In addition, the degree of sarcopenia can also be determined based on these 3 things[4,16,17,18].

One of the modalities of therapy or prevention that we can do is to do regular physical exercise. However, the type of exercise must be adapted to age, ability and gender.[10] Physical exercise with resistance exercise showed significant results for muscle strength and muscle mass in the elderly[18,19,20]. High resistance training has a major effect on increasing GH also cortisol[11,21]. The main effects obtained are grip strength, balance, walking speed, and other physical abilities[12,22,23]. This literature review aims to analyze the relationship between resistance training effect on IGF1 level of sarcopenia.

## METHODS

This literature review was conducted utilizing secondary data gathered from the internet, various journal searches, journal reviews, and articles. The article databases bases examined were Google Scholar, Pubmed, Science Direct, Mendeley and Scopus, with the keywords "Resistance Training, IGF-1, and Sarcopenia" and a range of years used from 2012 to 2022. The articles which been chosen were those that investigated the association between resistance training and IGF-1 in sarcopenia. Articles are screened using Scimago Journal and Country Rank. We included some research article related to this study, as show in table 1.

## RESULTS

Table 1. Studies examining the effects of resistance training on IGF1 level on sarcopenia

| Author and year of publication | Sample | Intervention | Result | Conclusion |
|---|---|---|---|---|
| Chen et al, 2017[24]. | 60 total participants were women and men, aged from 65 to 75 years with sarcopenia comorbid with obesity | Participants were randomly divided into 4 groups : 15 allocated to AT (2x/weeks for 8 weeks), 15 for RT (2x/weeks for 8 weeks), 15 for CT (1x/ with the AT 48 hours after the RT) and 15 for CON | Baseline :<br>AT : 4.07 ± 1.43<br>RT : 4.07 ± 1.97<br>CT : 4.49 ± 1.47<br>CON : 4.39 ± 1.27<br>After 8 weeks :<br>AT : 3.43 ± 1.44<br>RT : 4.23 ± 2.06[a]<br>CT : 4.55 ± 1.35[bc]<br>CON : 3.42 ± 1.30 | IGF-1 levels were higher in the elderly with sarcopenic obesity who had CT and RT than in the control group. |
| Negaresh, et al. 2019[25]. | 31 elderly men, age from 55 to 70 years | Participant were divived into 2 groups: 16 in SE, 15 in the HE. 8-week RT program, 3 days per week (24 sessions). For a total of 8 weeks, the RT protocol consisted of four sets of ten repetitions. | Baseline HE : 130.15±22.23 after 8 weeks of RT : 138.11±16.41<br>Baseline SE : 115.56±16.86[d] after 8 weeks of RT 113.67±17.06<br>(p = 0.026) | The HE group had a significantly higher mean level of serum IGF 1 than the SE group. |

| | | | | |
|---|---|---|---|---|
| Singh, et al. 2022[26]. | 100 participants, 63 females and 37 males range 72-98 years | Participants were randomized into 4 groups: lower extremity RT, Nutritional Supplementation, Placebo-Control, both Active Interventions and. Resistance training every 3 days/weeks for 10 weeks composed of 3 sets of 8 RM (1-RM) for the hip and knee extensor muscles. | IGF-1 staining % Baseline Exercise group: 6 ±2 after 10 weeks 22 ± 4 Baseline No Exercise Group: 8±2 after 10 weeks 7±3 (p= 0.007) | The presence of IGF-I in skeletal muscle tissue increased considerably after progressive resistance exercise. Which accompanied the damage and repair. |
| Ghayomzadeh, et al. 2022[27]. | 40 HIV-infected patients relate sarcopenia (20 women and omen) between the ages of 23 and 45 | Participants randomized into 2 groups. CT group (10 men, 10 women), CON group (10 men, 10 women). Training protocol 3 sets of 8 resistance exercises (press, bench shoulder press, leg extension, squat, lat pull down, triceps extension, plank, and back extension) for 6 months on 3 days (non-consecutive) per week | CT : 74.36 ± 56,64 pg/mm3, Women vs men (56.62 ± 36.75 pg/mm3 and 83.22 ± 64.25 (p <0.001) | Combined training can be considered to improve muscle function in PLWH |

*Statistically Significant (p<0,05). [ab,c,]:The mean for the RT, AT, CT, and CON groups were substantially higher than the result for the RT, AT, CT, and CON groups (P < .05). [d]: At the baseline, there was a significant difference in SE and HE values (P<0.05). AT: Aerobic Training, RT: Resistance Training, CT: Combination Training, CON: Control, SE: Sarcopenic Elderly, HE: Healthy elderly, PLWH: People living with HIV, RM: Repetition Maximum.

## DISCUSSION

a. The role of exercise on sarcopenia

Exercise is important for health because it reduces body fat and can increase muscle mass, increase muscle strength, endurance, the function of the immune, and cardiovascular system[18,19,28]. Lack of physical activity is closely related to decreased muscle mass (sarcopenia), physical fitness, the performance of physical, which can cause chronic disease and disability, exercise can be an important therapy for sarcopenia. Physical activity can become into aerobics, which can low intense exercise for long periods of time and resistance training, which can become exercising vigorous movement for short periods of time[1,13,29].

Resistance exercise with low/moderate and high intensity performed regularly effective treat and preventive sarcopenia, can regulate muscle protein synthesis, increase skeletal of muscle mass, the mass of muscle index, strength of leg, and strength of grip thereby increasing strength of muscle, mass of muscle boosted IGF-1, testosterone, and insulin responses. Resistance exercise can also play an important role, regulate metabolism in individuals[29,30,32,34]. Suggest that resistance of regular training increases the size and cross-sectional area of fast responding (type IIa and IIx) fibers of

muscle than slow responding (type I) fibers. muscle protein synthesis and increased muscle mass can improve yielding capacity, muscle quality, and physical performance[28,29,32,33]. Recived a report that 10 weeks of resistance training on participants older than 60 years, both male and female, resulted in significantly elevated IGF-1 levels, besides that, Peter Putra et al showed resistance training for 3 months can increase the maximal strength of knee extension[28,31]. Because of it, we must promote resistance training to anyone over the age of 60 in order to avoid muscle damage from not exercising regularly[38].

Table 3. Table of Resistance Exercise[29]

| Subjects | Types | Duration | Significance |
|---|---|---|---|
| Older adults | Leg extension (70% of 1RM) | Acute bout of RE | No significant mTOR, S6K1, 4E-BP1, ERK1/2 |
| Old women | Knee extension (70% of 1RM) | Acute bout of RE | ↑ MuRF-1, FOXO3A, atrogin-1 |
| Older adults | Combined RE (80% of 1RM) | Chronic exercise (6 months) | ↑ Skeletal muscle strength, mitochondrial function<br>↓ Senescence-related transcriptional genes |
| Aged rats | Ladder climbing (10 repetitions) | Chronic exercise (9 months) | ↑ Skeletal muscle strength and mass, IGF-1<br>↓ LC3-II/LC3-I ratio, p62 |

Most study on effects of exercise have focused on aerobic or resistance training. a combined exercise program consisting of aerobic and resistance training is recommended. As noted above. Gudlaugsson et al showed the results of research from 117 elderly subjects for 6 months doing combined exercise to get the results of increasing muscle mass. This report shows that regular combination exercise can treat sarcopenia[28,29].

b. Effects of resistance training on IGF1 of sarcopenia

Anabolic hormone levels decline with age, particularly IGF-1, which is a key mediator for GH-related signaling pathways. The IGF-1 signaling cascade has emerged as a crucial mechanism and regulator of the aging process[9]. Sarcopenia is the elderly is caused by a variety of factors, including age, gender, lifestyle, nutrition, and exercise. The levels of GH/IGF-1 are critical for sustaining skeletal muscle quality[35].

IGF-1 is generated in tissues and cells on a local level (through autocrine and paracrine processes). IGF-I is involved in the commencement of the cell cycle and the production of developmental factors. Proliferation, activation, differentiation, and survival of satellite cells, as well as increasing myotube size, stimulating amino acid and protein synthesis and muscle hypertrophy, neuronal myelinization and damage repair, reducing chronic inflammatory reactions, increasing free fatty acid utilization, and improving insulin sensitivity to receptor binding and intracellular signaling and glucose metabolism, are just a few of the many advantages of IGF[36].

An increase in the number of myocytes and the expression of IGF-1 muscles are two of the effects of GH on muscles. Resistance training is important for muscular growth because it improves the efficiency of both agonist and antagonistic muscle groups[11]. High resistance training resulted in a much larger rise in GH and cortisol concentrations when compared to high-intensity exercises. Exercise boosted IGF-1, testosterone, and insulin responses in a prominent example[37]. Resistance exercise on participants older than 60 years, both male and female, resulted in significantly elevated IGF-1 levels. Because of it, we must promote resistance training to anyone over the age of 60 in order to avoid muscle damage from not exercising regularly[38].

The best way to improve muscular function in people with GH insufficiency is to substitute GH with workouts that stimulate nerve activation and muscle IGF-1 stimulation[11]. Resistance training has been demonstrated to result in a large increase in lean body mass and metabolic rate, as well as a considerable decrease in fat mass. Resistance exercises can help with lower back pain, rheumatic discomfort, functional independence, movement control, and walking speed, among other things. To combat type 2 diabetes, resistance exercise is also suggested[39].

After a relatively short duration of resistance exercise, local IGF-1 muscle synthesis increases dramatically[11]. Resistance training for ten weeks can raise resting metabolic rate by 7%, and improve muscle mass by 1.4 kg[39]. Resistance training appears to affect IGF-1. This reaction is supported by research, which shows that it improves musculoskeletal health. Increased hormones linked to anabolic signals contribute to promoting homeostatic systems for metabolism and skeletal muscle improvement[40].

## CONCLUSION

This literature review shows evidence from several studies that high resistance training has a favorable impact on musculoskeletal health that can be evaluated by IGF1. IGF1 has an important role in maintaining the quality of skeletal muscle mass. IGF1 stimulates myogenin expression by satellite myoblasts. The decrease in the level of anabolic hormone IGF-1 in old age greatly influences Growth Hormone (GH), which plays a role in increasing the number of myocytes. Resistance training improves the effectiveness of both agonist and antagonistic muscle units, which is necessary for muscular growth. As compared to high intensity activities, high resistance training resulted in a substantially higher increase in GH and cortisol concentrations. IGF-1, testosterone, and insulin were all increased by exercise. The increase in hormones associated with anabolic signals supports homeostatic mechanisms for target metabolism and repair involving skeletal muscle. Further studies still need to be carried out in various populations to investigate the effect of resistance training on increasing IGF1 hormone for the prevention and treatment of sarcopenia.

## CONFLICT OF INTEREST

The authors declare no conflict of interest

## ACKNOWLEDGEMENT

The authors are grateful for the cooperation of the Head and all staff of the Physiology Department Medical Faculty Universitas Udayana, Denpasar, Indonesia.

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