Review Article **IJOAR (2022) 5:99**

International Journal of Aging Research (ISSN:2637-3742)

Physical Activity and Sarcopenic Obesity in Older Adults

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ABSTRACT

Background: Sarcopenic obesity causes a decline in the ability to perform activities of daily living and instrumental activities of daily living in older adults. Physical activity is defined as the movement of any body part derived from the work of skeletal muscle, which leads to energy consumption. Physical activity comprises not only exercise but also all activities of daily life and promotes benefits of health outcomes, with the shift from a sedentary lifestyle to that including physical activity of any intensity (including light intensity) even leading to health benefits. **Objective:** The current study aims to review the associations of aerobic exercise, resistance exercise, and physical activity with body composition, physical performance, and activities of daily living in older adults with sarcopenic obesity, including older adults requiring assistance with the performance of activities of daily living. **Results:** Resistance and aerobic exercises could have positive effects on muscle mass, body fat, and physical performance in older adults with sarcopenic obesity. Besides, physical activity may reduce the risk of sarcopenic obesity in older adults. **Conclusion:** There has been a paucity of studies particularly on whether physical activity could still prevent the risk of sarcopenic obesity and improve muscle mass, body fat, physical performance, and the capacity for activities of daily living and instrumental activities of daily living in older adults with sarcopenic obesity, including older adults with sarcopenic obesity requiring care. Future studies need to additionally clarify whether physical activity affects the risk of sarcopenic obesity and promotes benefits in body composition, physical performance, and the capacity for activities of daily living in older adults and older adults with sarcopenic obesity requiring care.

Keywords: Sarcopenic obesity, Physical activity, Activities of daily living, Older adults, Long term care

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How to cite this article:
Daisuke Takagi, Masatoshi Kageyama.Physical Activity and Sarcopenic Obesity in Older Adults International Journal of Aging Research, 2022, 5:99.

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Website: https://escipub.com/

Introduction

Sarcopenic obesity (SO) is the coexistence of decreased skeletal muscle mass and increased body fat [1]. Although sarcopenia is defined as low skeletal muscle mass and muscle strength and/or physical function and obesity as increased body fat using the body mass index (BMI), waist circumference (WC), or body fat percentage, there is still no unified diagnostic consensus on SO [1]. Subjects with SO have been found to be at high risk for death from cardiovascular diseases, with SO leading to the decline in the ability to perform activities of daily living (ADL) and instrumental activities of daily living (IADL) in the elderly [2, 3]. Muscle mass, muscle strength, and body fat have been associated with the ability to perform of ADL and IADL in older adults [4, 5, 6]. Hence, maintaining or improving muscle mass, muscle strength, and body fat in older adults is important for ADL and IADL capacity.

Resistance exercise (RE) and aerobic exercise (AE) have been shown to increase muscle mass and decrease body fat in older adults [7], as well as improve physical performance, which has been associated with ADL and IADL capacity [4, 8, 9, 10]. However, some older adults cannot tolerate formal or prolonged exercise, particularly older adults requiring care (in long-term care) due to conditions such as decreased exercise tolerance or pain. Moreover, SO among older adults requiring care may particularly accelerate the decline in the ability to perform ADL and IADL. Thus, methods that maintain or improve muscle mass, muscle strength, fat mass, and physical performance for ADL and IADL capacity or directly improve ADL and IADL capacity among older adults who cannot tolerate formal or prolonged exercise are urgently needed. Physical activity (PA) is defined as the movement of any body part derived from the work of skeletal muscle, which leads to energy consumption [11]. PA comprises not only exercise but also all activities of daily life. Studies have shown that the shift from a sedentary lifestyle to that including PA of any intensity (including light intensity) can lead to health benefits [12]. Thus, the current study aims to review associations between AE, RE, and PA and body composition, physical performance, and ADL in older adults with SO, including older adults who need assistance with ADL performance.

The recommendation of AE and RE for older adults

Guidelines have recommended the following intensity, frequency, and type of AE and RE in older adults: intensity: moderate (5–6) and vigorous (7–8) intensity using physical exertion (on a scale of 0–10); frequency: at least 30–60 min per day for a total of 150–300 min per week, with bouts of at least 10 min each (moderate intensity), 20–30 min per day for a total of 75–150 min per week (vigorous intensity), or an equivalent combination of the two; and type: any mode without excessive orthopedic stress (e.g., walking) and intensity: from moderate (5–6) to vigorous (7–8) intensity on a scale of 0–10; frequency: at least 2 days per week; type: weight training or weight bearing calisthenics (8–12 repetitions each), respectively [7]. Thus,

moderate and vigorous intensities are recommended for both RE and AE in older adults. AE promotes a decrease in body fat in older adults, whereas RE increases muscle strength and fat-free mass in the same population [7]. Studies have shown that muscle mass, muscle strength, and body fat was associated with the ability to perform ADL and IADL in older adults [4, 5, 6]. Moreover, reports have suggested that AE and RE improve physical performance, which has been associated with the ability to perform of ADL and IADL in older adults [4, 8, 9, 10].

AE and RE for older adults with SO

One study showed that among older women with SO, those who performed RE [approximately 10 different types of exercises (e.g., knee extension), 60%–80% 1 RM (repetition maximum), three sets, three times/week for 24 weeks] showed significant improvements in fat-free mass and peak torque of knee extensor, but not BMI and fat mass, compared to the control group [13]. A study by Liao et al. in 2017 [14] reported that among older women with SO, those who performed RE [elastic RE, 35–40 min, moderate intensity (rated perceived exertion 13-grade), three sets (10 repetitions/set) for 12 weeks] showed a significant change in fat-free mass, leg lean mass, fat mass, and physical capacity compared to those in the control group. Furthermore, another study on elderly with SO showed that the RE group [weight training equipment, 60%–70% 1 RM, three sets (8–12 repetitions/set), two times/week for 8 weeks] exhibited lower body fat and higher muscle strength than did the control group [15]. Moreover, a 2018 study by Chiu et al. [16] revealed that among sarcopenic obese residents in long-term care facilities, those in the RE group [chair muscle strength training, approximately 60 min, 2–5 Ibs, three sets (4–10 repetitions/set) for 12 weeks] exhibited higher handgrip and pinch strength, but not body composition, compared to the control group. However, some reports also showed no change in physical function (e.g., muscle strength and gait speed) in the RE group (knee exercises: 40%–75% 1 RM, hip exercises: 1–3 kg, squat for 10 weeks) in older women with SO. On the other hand, the group who performed AE (moderate road, 60 min session, two times/week for 8 weeks) had lower body fat and higher muscle strength (e.g., back extensor) compared to those in control group after 8 weeks [15].

Regarding concurrent exercises (CE), which combines RE and AE, a 2016 study by Kim et al. [18] reported that among elderly women with SO, the CE group [RE: chair exercise, resistance band exercise, hydraulic exercise machine (three sets, 10 repetitions/set); AE: stationary bicycle, 40 Watts~, 12 min, two times/week for 12 weeks] showed greater muscle strength, body fat, and physical function (e.g., stride and step length) than the control group. Moreover, the CE group [RE: elastic band exercise, 20–30 min, 2–3 sets (8–15 repetitions/set), three times/week; AE: various walking activities, 30–50 min, rating of perceived exertion 13–17, five times/week for 24 weeks] showed better body fat percentage, WC, handgrip strength, 30-s chair-

stand test results, maximum gait speed, sit-and-reach test results, and 2-min step test results, but not appendicular skeletal muscle mass, compared to the control group [19]. Moreover, among in older adults with SO, those in the CE group [RE: weight training equipment, 60%–70% 1 RM, three sets (8–12 repetitions/set); AE: moderate road, 60-min session, two times/week for 8 weeks] had higher muscle strength and lower body fat than those in the control group after 8 weeks [15]. Therefore, performing RE, AE, and CE, particularly at moderate intensity, could have positive effects on muscle mass, body fat, and physical performance in older adults with SO consistent with the recommendation levels. However, some older adults cannot tolerate formal or prolonged exercise, particularly those requiring care due to conditions such as decreased exercise tolerance or pain. As such, we need to consider methods for maintaining or improving muscle mass, muscle strength, fat mass, and physical performance among older adults who cannot tolerate formal or prolonged exercise.

Table 1. Summary of the relationship between physical activity and sarcopenic obesity in older adults SO: Sarcopenic obesity PA: Physical activity

Study (years)	Sample size	Age (years)	PA	Outcomes
Hwang et al (2012) [20]	2221	60 years or older	The PA from database	・The duration of walking → risk of SO (no significant relevant)
Ryu et al (2013) [21]	2264	65 years or older	The questionnaire	・Moderate and high levels of PA in men and high level of PA in women → lower risk of SO
Aggio et al (2016) [22]	1286	70-92 (men)	Accelerometer	・Sedentary time ↑ → higher risk of SO (marginal)
			Self-reported habitual PA	・Light PA ↑ → lower risk of SO (marginal) ・Moderate-to-vigorous PA ↑ → lower risk of SO
Tyrovolas et al (2016) [23]	18363	65 years or older	The questionnaire	・Low levels of PA → higher risk of SO
Ribeiro Santos et al (2020) [24]	211	60 years or older	The questionnaire	・Insufficient active (locomotion domains) → higher risk of SO

PA for older adults with SO

PA is defined the movement of any body part derived from the work of skeletal muscle, which leads to energy consumption [11]. PA comprises not only exercise but also all activities of daily life. Moreover, PA has been shown to improve health outcomes, with the shift from a sedentary lifestyle to that including PA of any intensity (including light intensity) even leading to health benefits [12]. Therefore, maintaining or increasing the amount of PA regardless of intensity is important for preventing adverse health outcomes in older adults.

Regarding PA and SO in older adults, Hwang et al. in 2012 [20] reported that the duration of walking did not significantly reduce the risk of SO

in the elderly. However, higher PA has been associated with reduced the risk of SO, whereas lower PA has been associated with increased risk of SO [21, 22, 23]. Moreover, studies have shown that insufficient activity (locomotion domains) in older adults with the incidence of clinical factors promoted higher risk of SO at the 24-month follow-up [24]. The relationship between PA and SO in older adults is summarized in Table 1. PA measured using a pedometer/accelerometer has been associated with muscle mass in older adults [25]. In addition, standing and walking activities have been associated with balance and physical performance in even older residents of nursing homes [26]. Furthermore, low levels of PA influence metabolic syndrome in the elderly, with PA (low intensity) also having positive effects on blood lipids in older adults [27, 28]. Therefore, it is possible that PA decreases the risk of SO in older adults, although there has been still a paucity of studies on whether PA could prevent the risk of SO and improve muscle mass, body fat, physical performance, the ability to perform ADL and IADL in older adults with SO, particularly older adults requiring care with SO.

Conclusion

Our findings showed that PA may decrease the risk of SO in older adults. Nonetheless, a few studies have still reported association between PA and the risk for SO, as well as benefits in muscle mass, body fat, physical performance, ADL capacity in older adults with SO, particularly older adults requiring care with SO. Further studies are need to clarify whether PA affects the risk of SO and improves body composition, physical performance, and ADL capacity in older adults, including older adults requiring care with SO who may experience an accelerated decline in the ability to perform ADL.

Acknowledgements

This work was supported by JSPS KAKENHI (Grant Number 20K19466).

Abstract

Abbreviations:

ADL, Activities of daily living

AE, Aerobic exercise

BMI, Body mass index

CE, Concurrent exercise

IADL, Instrumental activities of daily living

PA, Physical Activity

RE, Resistance exercise

RM, Repetition maximum

SO, Sarcopenic obesity

WC, Waist circumference

References

[1]. Japanese Association on Sarcopenia and Frailty. Clinical Guidelines for Sarcopenia 2017-Revised Edition. 2019 (in Japanese).

[2]. Baumgartner RN. Body composition in healthy aging. Ann N Y Acad Sci, 2000; 904, 437-448.

[3]. Baumgartner RN, Wayne SJ, Waters DL, Janssen I, Gallagher D et al. Sarcopenic obesity predicts instrumental activities of daily living disability in the elderly. Obes Res, 2004; 12(12): 1995 - 2004.

[4]. Wang DXM, Yao J, Zirek Y, Reijnierse EM, Maier AB. Muscle mass, strength, and physical performance predicting activities of daily living: a meta-analysis. J Cachexia. Sarcopenia Muscle. 2020; 11(1): 3-25.

[5]. Janssen I, Heymsfield SB, Ross R. Low relative skeletal muscle mass (sarcopenia) in older persons is associated with functional impairment and physical disability. J Am Geriatr Soc. 2002; 50(5):889-896.

[6]. Vincent HK, Vincent KR, Lamb KM. Obesity and mobility disability in the older adult. Obes Rev. 2010; 11(8): 568-579.

[7]. American College of Sports Medicine, Chodzko-Zajko WJ, Proctor DN, Fiatarone Singh MA, Minson CT et al. American College of Sports Medicine position stand. Exercise and physical activity for older adults. Med Sci Sports Exerc. 2009; 41(7): 1510-1530

[8]. Wennie Huang WN, Perera S, VanSwearingen J, Studenski S. Performance measures predict onset of activity of daily living difficulty in community-dwelling older adults. J Am Geriatr Soc. 2010; 58(5): 844-852.

[9]. Villareal DT, Aguirre L, Gurney AB, Waters DL, Sinacore DR. Aerobic or Resistance Exercise, or Both, in Dieting Obese Older Adults. N Engl J Med. 2017; 376(20): 1943-1955.

[10]. Bai X, Soh KG, Omar Dev RD, Talib O, Xiao W et al. Aerobic Exercise Combination Intervention to Improve Physical Performance Among the Elderly: A Systematic Review. Front Physiol. 2022;12: 798068.

[11]. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public Health Rep. 1985; 100(2): 126-131.

[12]. WHO guidelines on physical activity and sedentary behaviour https://www.who.int/publications/i/item/9789240015128 (Accessed 9 May 2022).

[13]. Gadelha AB, Paiva FM, Gauche R, de Oliveira RJ, Lima RM. Effects of resistance training on sarcopenic obesity index in older women: A randomized controlled trial. Arch Gerontol Geriatr. 2016; 65: 168-173.

[14]. Liao CD, Tsauo JY, Lin LF, Huang SW, Ku JW et al. Effects of elastic resistance exercise on body composition and physical capacity in older women with sarcopenic obesity: A CONSORT-compliant prospective randomized controlled trial. Medicine（Baltimore）. 2017, 96: e7115.

[15]. Chen HT, Chung YC, Chen YJ, Ho SY, Wu HJ. Effects of different types of exercise on body composition, muscle strength, and IGF-1 in the elderly with sarcopenic obesity. J Am Geriatr Soc. 2017; 65(4): 827-832.

[16]. Chiu SC, Yang RS, Yang RJ, Chang SF. Effects of resistance training on body composition and functional capacity among sarcopenic obese residents in long-term care facilities: a preliminary study. BMC Geriatr. 2018, 18(1): 21.

[17]. Vasconcelos KS, Dias JM, Araújo MC, Pinheiro A. Effects of a progressive resistance exercise program with high-speed component on the physical function of older women with sarcopenic

obesity: a randomized controlled trial. Braz J Phys. Ther. 2016; 20(5): 432-440.

[18]. Kim H, Kim M, Kojima N, Fujino K, Hosoi E et al. Exercise and nutritional supplementation on. community-dwelling elderly japanese women with sarcopenic obesity: a randomized controlled trial. J Am Med Dir Assoc. 2016; 17(11): 1011-1019.

[19]. Park J, Kwon Y, Park H. Effects of 24-week aerobic and resistance training on carotid artery intima-media thickness and flow velocity in elderly women with sarcopenic obesity. J Atheroscler Thromb. 2017; 24(11): 1117-1124.

[20]. Hwang B, Lim JY, Lee J, Choi NK, Ahn YO et al. Prevalence rate and associated factors of sarcopenic obesity in korean elderly population. J Korean Med Sci. 2012; 27(7): 748-755.

[21]. Ryu M, Jo J, Lee Y, Chung YS, Kim KM et al. Association of physical activity with sarcopenia and sarcopenic obesity in community-dwelling older adults: the Fourth Korea National Health and Nutrition Examination Survey. Age Ageing. 2013; 42(6): 734-740.

[22]. Aggio DA, Sartini C, Papacosta O, Lennon LT, Ash S et al. Cross-sectional associations of objectively measured physical activity and sedentary time with sarcopenia and sarcopenic obesity in older men. Prev Med. 2016; 91: 264-272.

[23]. Tyrovolas S, Koyanagi A, Olaya B, Ayuso-Mateos JL, Miret M et al. Factors associated with skeletal muscle mass, sarcopenia, and sarcopenic obesity in older adults: a multi-continent study. J Cachexia Sarcopenia Muscle. 2016; 7(3): 312-321.

[24]. Ribeiro Santos V, Dias Correa B, De Souza Pereira CG, Alberto Gobbo L. Physical Activity Decreases the Risk of Sarcopenia and Sarcopenic Obesity in Older Adults with the Incidence of Clinical Factors: 24-Month Prospective Study. Exp Aging Res. 2020; 46(2): 166-177.

[25]. Park H, Park S, Shephard RJ, Aoyagi Y. Yearlong physical activity and sarcopenia in older adults: the Nakanojo Study. Eur J Appl Physiol. 2010; 109(5): 953-961.

[26]. Ikezoe T, Asakawa Y, Shima H, Kishibuchi K, Ichihashi N. Daytime physical activity patterns and physical fitness in institutionalized elderly women: an exploratory study. Arch Gerontol Geriatr. 2013; 57(2): 221-225.

[27]. Bianchi G, Rossi V, Muscari A, Magalotti D, Zoli M; Pianoro Study Group. Physical activity is negatively associated with the metabolic syndrome in the elderly. QJM. 2008; 101(9):713-721.

[28]. Pescatello LS, Murphy D, Costanzo D. Low-intensity physical activity benefits blood lipids and lipoproteins in older adults living at home. Age Ageing. 2000; 29(5): 433-439.