ORIGINAL ARTICLE

Association of Physical Activity and Physical Performance with Sarcopenia in Elderly Obese Patient in Community

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ABSTRACT

Introduction: Sarcopenic obesity (SO) is a condition in which sarcopenia and obesity occur simultaneously. This condition will lead to risk of higher morbidity, mortality, and reduced quality of life. This study aimed to examine the proportion of SO patients in community and observation the association of physical activity level and physical performance with sarcopenia in elderly obese patient in community

Methods: An analytic observation cross-sectional study with consecutive sampling was carried out. Inclusion criteria included subjects with age ≥ 60 years old, body mass index (BMI) ≥ 25 Kg / m^2, able to walk at least 10 meters, and has a good cognitive function. Subjects with pacemaker, using metal implants, history of cancer, acute cardiovascular and respiratory disorders, deformities, or pain in extremities and receive regular therapeutic exercise were excluded from this research. Measurement of physical activity level using Physical Activity Scale for Elderly (PASE) questionnaire and physical performance using gait speed and timed up and go test (TUG). Sarcopenia is based on criteria from Asian Working Group of Sarcopenia (AWGS) 2019 with body composition assessment using Bioelectric Impedance Analysis (BIA)

Results: There were 119 subjects in this study. Proportion of sarcopenia obesity in all subjects was 23,5% with 71,4% was female. The results showed that physical activity level and physical performances values in SO patients were lower than in obesity patient. There were no significant association on physical activity level ($p > 0,05$) and significant association on physical performance, both in gait speed and TUG test ($p < 0,05$).

Conclusion: Physical performance is associated with sarcopenia in elderly obese patient in community. Coexistence between sarcopenia and obesity has a synergistic impact on functional limitations.

Keywords: elderly, obesity, physical activity level, physical performance, sarcopenia

ABSTRAK

Pendahuluan: Sarkopenia obesitas (SO) merupakan suatu kondisi dimana sarkopenia dan obesitas terjadi secara bersamaan. Kondisi ini menyebabkan peningkatan risiko morbiditas, mortalitas, dan penurunan kualitas hidup. Penelitian ini bertujuan untuk mengetahui proporsi SO dan hubungan antara tingkat aktivitas fisik dan performa fisik dengan sarkopenia pada pasien obesitas lanjut usia di komunitas.

Metode: Studi menggunakan desain analitik potong-lintang dengan teknik pengambilan secara konsekutif. Kriteria inklusi diantaranya adalah subjek berusia ≥ 60 tahun, indeks massa tubuh (IMT) ≥ 25 Kg / m^2, mampu berjalan minimal 10 meter dan fungsi kognitif baik. Subjek yang menggunakan alat pacu jantung, terdapat implant metal di dalam tubuh, memiliki riwayat penyakit kanker, gangguan kardiovaskular dan respirasi akut, deformitas atau nyeri pada ekstremitas dan mendapatkan latihan terapeutik atau olahraga teratur dieksklusi dari penelitian ini. Pengukuran tingkat aktivitas fisik menggunakan kuesioner *Physical Activity Scale for Elderly* (PASE) dan performa fisik menggunakan uji kecepatan berjalan dan uji *timed up and go test* (TUG). Penegakkan sarkopenia berdasarkan kriteria *Asian Working Group of Sarcopenia* (AWGS) 2019 dengan pengukuran komposisi tubuh menggunakan *Bioelectric Impedance Analysis* (BIA).

Hasil: Terdapat 119 subjek pada penelitian ini. Proporsi sarkopenia pada keseluruhan subjek adalah 23,5% dengan 71,4% berjenis kelamin perempuan. Hasil analisis menunjukkan bahwa tidak ada hubungan yang signifikan pada variabel tingkat aktivitas fisik ($p > 0,05$) dan hubungan yang signifikan pada variabel kecepatan berjalan dan uji TUG ($p < 0,05$).

Kesimpulan: Performa fisik berhubungan signifikan dengan kondisi sarkopenia pada penderita obesitas usia lanjut di komunitas. Koeksistensi antara sarkopenia dan obesitas memiliki dampak sinergis pada keterbatasan fungsional pasien usia lanjut.

Kata Kunci: obesitas performa fisik, sarkopenia, tingkat aktivitas fisik usia lanjut

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INTRODUCTION

Along with the development of health technology, life expectancy is increasing. With the increase in elderly population, there are negative impacts related to the decline in functional capacity and quality of life due to the aging process.[1] Sarcopenic obesity (SO) is a condition in which two conditions occur simultaneously. Sarcopenia is age-related condition characterized by loss of muscle mass accompanied by a decrease in muscle strength and/or physical performance. Meanwhile,

obesity is defined by an abnormal accumulation of fat in the body.[2,3]

The prevalence of sarcopenic obesity (SO) in the various countries were reported with a far range, which is between 5-45%.[2,4,5] In Indonesia, data related to sarcopenia at specific elderly obese patient population has not yet been obtained. SO condition will increasing the risk of falls, fractures, metabolic disease, cardiovascular disease, frailty, dependency, mortality, and ultimately reduced quality of life compared to sarcopenia or obesity alone.[6]

Evidence suggests that SO can be prevented by modifying risk factors. Physical inactivity has gained wide attention as a possible target for intervention to slow down the progression of age-dependent muscle loss.[7] Currently, the association between physical activity with sarcopenia in the elderly obese patient in Indonesia is still unknown.

On the other hand, physical performance can be used as an objective measurement to assess physical function in the elderly. Gait speed and timed up and go (TUG) test are simple assessments of physical performance that can be used both as screening and monitoring.[8] Previous studies related to physical performance and sarcopenia in the elderly obese population were not well established.[6,9,10] Because of data related to SO and association of physical activity and physical performance with SO in Indonesia has not been obtained, this study was aim to examine the proportion of SO patients and observe the association between physical activity level and physical performance with sarcopenia in elderly obese patient in community.

MATERIAL AND METHODS

This study is an analytic observation cross-sectional study with consecutive sampling. Data collection was carried out in Puskesmas Kelurahan Bambu Apus and Kecamatan Cipayung, Jakarta from December 2020 to March 2021. The eligible criteria were subjects with age ≥ 60 years old, body mass index ≥ 25 Kg / m^2, able to walk at least 10 meters, and has a good cognitive function. Subjects with pacemaker, using metal implants, history of cancer, acute cardiovascular and respiratory disorders, deformities, or pain in extremities and receive regular therapeutic exercise were excluded from this research. Participants signed an informed consent form approved by the Faculty of Medicine Universitas Indonesia's ethic committee.

Assessment of Obesity, Sarcopenia, Physical Activity Level and Physical Performance

Anthropometric measurements which include body height weight, and waist circumference were taken by trained examiner. Body mass index (BMI) was based on calculation of body weight divided by squared height values (kg/m^2). BMI ≥ 25 kg/m^2 is classified as obesity based on Asia-Pacific Criteria.

Sarcopenia is diagnosed based on criteria from Asian Working Group of Sarcopenia (AWGS) 2019 which defined by low muscle mass with low muscle strength and/or low physical performance. SO was defined while subjects meet criteria obesity based on BMI Asia-Pacific and Sarcopenia based on AWGS 2019.[11] Body composition assessment using

Bioelectric Impedance Analysis (BIA) Tanita BC-601 (Tokyo, Japan). This BIA model analyzes the bioimpedance obtained at more than two frequencies to measure muscle mass of the trunk and each extremities.[12] Appendicular skeletal muscle index (ASMI) was based on calculation of the total of muscle mass in the each of extremities and divided by squared height (kg/m^2). ASMI below 7.0 kg/m^2 for male and 5.7 kg/m^2 for female indicated low muscle mass based on AWGS 2019.[11]

Muscle strength assessment using handgrip strength measurement with the Jamar dynamometer J00105. The maximum reading of three trials using dominant hand in a maximum effort isometric contraction at 90^o elbow flexion was included in analysis. Cut off values for low muscle strength based on AWGS 2019 is less than 28 kg for male and 18 kg for female.[11]

Physical performance measurement using gait speed and timed up and go (TUG) test. Subjects were asked to walk in 6meter distances at their usual pace and calculate the gait speed. For TUG test, a marker was placed on the floor at 3 m from a chair. Subjects were ask to rise from the chair and walk at a comfortable pace to the marker at 3 m, turn and come back to sit on the chair.[8,11] The mean time from three trials of gait speed and TUG test were included in analysis. Gait speed less than 1.0 m/s is indicated for low physical performance to defined sarcopenia based on AWGS 2019.[11]

Measurement of physical activity level was using Physical Activity Scale for Elderly (PASE) questionnaire. The questionnaire includes assessment of leisure time, household, and work-related activities during the past one week. The intensity and duration of the activities were calculate to produce a global physical activity score.[13]

Statistical Analysis

All analysis were conducted with IBM SPSS version 20.0, using independent t-test and Mann-Whitney to determine the association between physical activity level and physical performance with sarcopenia in elderly obese patient. It is considered significant if $p < 0.05$ with a 95-confidence interval.

RESULTS

The study had recruited 119 subjects, 40 males and 79 females, with average aged 65.59 ± 4.11 years old. Proportion of sarcopenia in elderly obese subjects in the study was 23.5% (28 subjects) with 71.4% were female. Study subject's characteristics in table 1 showed that the average age and BMI was significantly different between group with SO and obesity. Subjects with SO compared with obesity group were older, higher BMI and fat mass percentage.

Table 1. Characteristics of study participants by sarcopenia obesity and obesity

	Sarcopenic Obesity n = 28 (23,5%)		Obesity n = 91 (76,4%)		p
	Mean ± SD	Median (min-max)	Mean ± SD	Median (min-max)	
Age (y.o)	69,75 ± 3,38	69 (65 – 78)	64,31 ± 3,41	64 (60 – 74)	0,000a
BMI (kg/m^2)	29,06 ± 3,24	28,10 (25 – 38,4)	27,32 ± 1,54	27,39 (25,1-30,6)	0,007a
Waist Circumference (cm)	100,10 ± 6,41	100 (87 – 112)	103,12 ± 7,51	103 (85,50 –125)	0,057a
Fat Mass (%)	37,39 ± 6,33	38,80 (16 -53)	36,57 ± 8,50	37,05 (26,4-47,7)	0,723b
ASMI (kg/m^2)	6,00 ± 0,59	5,69 (5,41 – 6,99)	8,48 ± 2,26	8,00(5,95–18,71)	0,000b
Male	6,90 ± 0,14	6,96 (6,57 – 6,99)	9,93 ± 2,53	9,45(5,95–18,71)	0,000 b
Female	5,64 ± 0,11	5,65 (5,41 – 5,99)	7,69 ± 1,66	7,16(6,29–17,49)	0,000b
Muscle Strength (kg)	16,60 ± 6,92	15 (8 – 33)	20,56 ± 6,47	19 (9 – 34)	0,004b
Male	23,75 ± 6,13	22,5 (15-33)	26,12 ± 5,76	26,5 (13-34)	0,310a
Female	13,75 ± 4,91	13,50 (8 – 26)	17,54 ± 4,58	18 (9 – 32)	0,001b

[a] Independent t-test; [b] Mann-Whitney

Physical activity level was assessed using the PASE score. The average and median of PASE scores in the SO group were lower than in the obese group. Table 2 showed that there was no significant association between the variable of physical activity level with sarcopenia in elderly obese patient ($p > 0.05$). Physical performance was assessed by gait speed and TUG test. The average and median values of gait speed in the SO group were lower than in the obese group, while times value of TUG test was higher in SO group than in the obese group. The result in table 2 showed that there were significant association between gait speed and TUG test with sarcopenia in elderly obese patient ($p < 0.05$).

Table 2. Physical Activity Level and Physical Performance related to Sarcopenia in Elderly Obese Patient

	Sarcopenic Obesity n = 28 (23,5%)		Obesity n = 91 (76,4%)		p
	Mean ± SD	Median (min-max)	Mean ± SD	Median (min-max)	
PASE score	67,79 ± 27,90	60,25 (27,2-119,35)	84,13 ± 57,50	75 (22,00 – 346,20)	0,255a
Gait speed (m/s)	0,781 ± 0,13	0,785 (0,53 – 1,04)	0,996 ± 0,28	0,970 (0,60 – 2,39)	0,000 a
TUG (s)	14,01 ± 2,65	13,38 (9,68–19,23)	12,26 ± 2,53	11,67 (7,76–22,15)	0,000 a

[a] Mann-Whitney

DISCUSSION

Proportion of sarcopenia in elderly obese subjects in the study was 23.5% (28 subjects) with 71.4% were female. Data related to sarcopenia at specific elderly obese patient population in Indonesia has not yet been obtained. Study in Bandung found prevalence of sarcopenia in community was 9.1% but not classified based on BMI or obesity status.[14] Another hospital-based study in Jakarta found that prevalence of patient with sarcopenia was 15.83%. Of those with sarcopenia, none were obese. The difference in the results of this study, could be due to differences in inclusion criteria where in this study was community based and also the criteria for establishing sarcopenia diagnosis in the previous study was using AWGS 2014 with gait speed cut off values less than 0.8 m/seconds.[15]

The prevalence of sarcopenia obesity in the various countries were reported with a far range, which is between 5-45%.[2,4,5] This could be due to differences in ethnicity and heterogenicity of determining the diagnosis criteria for sarcopenia and also obesity with the various cut-off points used. In addition, this study data collection was carried out during the global Covid-19 Pandemic which has lasted for eight months starting from March 2020. The World Health Organization (WHO) recommends isolation, quarantine, and restrictions on social activities to suppress the spread of the virus. This led to a decrease in physical activity and an increase in a sedentary lifestyle. Based on the results of surveys in West Asia, America, Africa, and Europe reported that there was a 33.5% decrease in the number of minutes per day and overall physical activity decreased by 48% during the pandemic.[16] Hasegawa et al in Japan conducted a retrospective study of the aged population with type II diabetes mellitus to assess changes in muscle mass during Covid-19 pandemic that showed a significant decrease in appendicular muscle mass index with a measurement distance of 6 months.[17]

In this study, it was shown that the SO group had higher adipose accumulation indicators, BMI values and body fat percentages, than the obese group. Previous studies obtained similar results.[9,10,18] Adipose tissue and skeletal muscle mass are interconnected. Accumulation of adipose tissue will activate macrophages, mast cells, T lymphocytes, which will cause inflammation so that TNF, leptin, and growth factors are secreted. The secretion of these inflammatory factors triggers insulin resistance, thereby increasing the process of muscle catabolism. Obesity conditions will trigger the occurrence of leptin resistance which causes a decrease in fat oxidation in muscles and fat deposition in intramyocellular muscles, thereby reducing the number of mitochondria and oxidative capacity which will disrupt the contractility function of muscle fibers and muscle protein synthesis. This condition will exacerbate the occurrence of sarcopenia. Healthy muscle generally contains 1.5% intramuscular fats and increases to more than 5% in obese people.[19]

This study obtained results showing that the level of physical activity assessed by the PASE score in the SO group was found to be lower compared to the obese groups with no significant difference. Bouchard et al found that the level of physical activity which was also assessed by the PASE questionnaire gave

lower results in the SO group compared to the obese group with significant difference in male population.9 Nascimento et al conducted an assessment of physical activity based on the recall of physical activity in the last 1 week which is then converted based on the compendium. The results obtained lower values in the SO group with no significant difference in the two groups.[10]

It was found that the level of physical activity in the SO group was lower than the obese group in all studies, although statistically showed inconsistent significance. In this study, the activity assessment was measured only once through a questionnaire based on activity in the last seven days where moderate and/or severe activities were not routinely carried out in one week. Factors that data was taken during restrictions on social activities due to the Covid-19 pandemic can cause physical activity in the entire elderly population to decrease.[16]

Increasing physical activity is one strategy to treat sarcopenia obesity. Exercise has a role in regulating energy balance, improving physical function parameters, and together with nutrition regulation can stimulate anabolic metabolism for muscle protein synthesis. Exercise prescription strategies that include type, intensity, volume, frequency, and progression must be appropriate to treat both sarcopenia and obesity. The goals are to improve mobility, physical performance, increase muscle strength and endurance, as well as prevent complications and improve quality of life.[20] Aerobic exercise will improve muscle function by increasing aerobic capacity by improving mitochondrial adaptation, increasing stroke volume capacity, and increasing capillary density of muscle tissue. Muscle strengthening exercises will trigger the proliferation of satellite cells, increase the speed of muscle contractility, increase mitochondrial protein synthesis, improve oxidative capacity, and motor neuron function so that it is expected to contribute to hypertrophy of muscle fibers and increase muscle strength which in turn improves physical performance.[21]

Physical performance in this study was assessed through two variables, gait speed and TUG test. The results showed that there was a significant relationship between the two variables with sarcopenia in elderly obese subjects. Chang et al found a significant difference between the SO and obesity groups in the gait speed test value.[22] The mean value of gait speed in both groups was below 1 m/sec which indicates that both groups are at risk for functional limitations. The difference in the average value in this study was obtained at 0.215 m/second so that it reached the minimum clinically different.[23] It appears that the SO population has more clinically severe functional limitations.

The SO group had a higher TUG value, although the difference in their values did not reach the minimal clinically difference value based on Donoghue's study.[24] Bolinger et al stated that an increase in adipose tissue is associated with a dysfunction of skeletal muscle contractility, including a decrease in muscle strength (strength and power) and the occurrence of premature fatigue as well as changes in the structure of the muscles themselves (fat infiltration in muscles, decreased muscle fibers, and changes in muscle tone and type). This condition can cause an increase in load and decrease in joint stability. In the end, this will disrupt muscle contractility so that the production of the force generated

by the muscle during isometric, concentric, or eccentric contractions can changes the kinematics of walking and ultimately reduce gait speed.[25] Vicious cycle conditions between decreased functional capacity will decrease in energy expenditure and muscle mass leads to increase in fat mass which will further increase the risk of comorbidity and disability. It appears that the coexistence between sarcopenia and obesity has a synergistic negative impact on reducing gait speed and balance in the elderly population.[22]

Limitation of the study are some confounding factors that not evaluated, such as history of nutritional intake and blood test biomarker to detect the comorbid. Measurement of physical activity level with questionnaire can be influenced with seasonal variations of physical activity. The use of objective measurements of physical activity, such as pedometer, and taking objective measurement of confounding factors with longitudinal design may explain more about the association including causal relationship.

CONCLUSION

This study concluded that physical performance, gait speed and TUG test, is associated significantly with sarcopenia in elderly obese patient in community. Coexistence between sarcopenia and obesity has a synergistic impact on functional limitations. The proportion of sarcopenia obesity in the community was 23.5%. It is necessary to educate people in primary health care facilities regarding SO condition. Recommendations for have an active lifestyle with proper body mechanics and exercises, both aerobics and strengthening, at home as a prevention of sarcopenia obesity during the Covid-19 pandemic. Further studies are needed related to diagnosis assessment, prospective longitudinal studies, and interventions to determine changes in muscle mass in elderly obese sarcopenia patients.

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