ARTIKEL PENELITIAN

CORRELATION OF SERUM ALBUMIN TO MUSCLE MASS, MUSCLE STRENGTH, AND PHYSICAL PERFORMANCE IN ELDERLY

KORELASI KADAR SERUM ALBUMIN TERHADAP MASSA, KEKUATAN OTOT DAN PERFORMA FISIK PADA USIA LANJUT

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ABSTRAK
Pendahuluan: *Sarkopenia merupakan masalah umum yang ditemukan pada lansia. Hal ini ditandai dengan hilangnya massa otot, kekuatan otot, dan/atau performa fisik yang rendah. Saat ini belum banyak penelitian mengenai hubungan antara albumin serum dengan massa otot, kekuatan otot, dan performa fisik pada lansia, khususnya di Indonesia. Penelitian ini bertujuan untuk mengetahui hubungan antara serum albumin dengan massa otot, kekuatan otot, dan performa fisik pada lansia.*
Metode: *Studi cross sectional dilakukan dari Juli 2022 hingga Desember 2022 terhadap pasien lanjut usia (>60 tahun) dari poliklinik geriatri RSUP Moh. Hoesin Palembang. Kadar albumin diperiksa dan dilakukan analisis korelasi dengan massa otot, kekuatan otot, dan performa fisik menggunakan uji Spearman.*
Hasil: *Sebanyak 41 pasien lanjut usia masuk dalam penelitian ini (usia rata-rata 70,75 ± 7 tahun, 56,1% wanita). Analisis korelasi menunjukkan bahwa terdapat korelasi positif yang signifikan antara serum albumin dengan kekuatan otot (r=0,354, p=0,012) dan korelasi negatif dengan performa fisik (r=-0,5, p <0,001). Sebaliknya, tidak terdapat korelasi yang signifikan antara albumin serum dan massa otot (r=- 0,05, p=0,367).*
Simpulan: *Kekuatan otot dan performa fisik memiliki korelasi yang signifikan dengan serum albumin pada lansia. Oleh karena itu, meski dalam kisaran normal, albumin serum yang lebih rendah terkait erat dengan sarkopenia pada lansia.*
Kata Kunci: *albumin, masa otot, kekuatan otot, performa fisik, sarkopenia.*

ABSTRACT
Introduction: Sarcopenia is a common problem found in the elderly. It is characterized by loss of muscle mass, muscle strength, and/or low physical performance. Currently, there's little research on the association between serum albumin and muscle mass, muscle strength, and physical performance in the elderly, especially in Indonesia. This study aimed to find the correlation between serum albumin and muscle mass, muscle strength, and physical performance in the elderly.
Method: A cross-sectional study was conducted from July 2022 to December 2022 towards elderly patients (>60 years) from the geriatric polyclinic at RSUP Moh. Hoesin Palembang. Serum albumin was examined for its correlation with muscle mass, muscle strength, and physical performance using Spearman's test.
Result: 41 elderly patients were included in this study (mean age 70.75 ± 7 years, 56.1% women). Correlation analysis showed that there's a significant positive correlation between serum albumin with muscle strength (r=0.354, p=0.012) and a negative correlation with physical performance (r=-0.5, p <0.001). In comparison, there was no significant correlation between serum albumin and muscle mass (r=- 0.05, p=0.367).

Conclusion: Muscle strength and physical performance have a significant correlation with serum albumin in the elderly. Therefore, even in the normal range, lower serum albumin is closely related to sarcopenia in the elderly.

Key Words: albumin, muscle mass, muscle strength, physical performance, sarcopenia.

INTRODUCTION

As the elderly population in the world is predicted to increase over the year, including in Indonesia, which in 2022 is estimated to be more than 30 million elderly people in Indonesia. This number will continue to increase to 40 million elderly in 2035. However, this increase is also followed by increasing health problems that arise with aging, such as sarcopenia.[1]

Sarcopenia is a syndrome characterized by loss of muscle mass, plus low muscle strength, and/or low physical performance. Diagnosis sarcopenia is based on AWGS 2019 criteria, i.e. score SARC-F ≥4 or score SARC-CalF ≥11 or calf circumference <34 cm in men, <33 cm in women, plus low muscle strength (handgrip strength <28 kg for men and <18 kg for women); low physical performance (6-m walk <1.0 m/s, Short Physical Performance Battery score ≤9, or 5-time chair stand test ≥12 seconds), low muscle mass (dual-energy X-ray absorptiometry, <7.0 kg/m2 in men and <5.4 kg/m2 in women; and bioimpedance, <7.0 kg/m2 in men and <5.7 kg/m2 in women).[2]

Nowadays, serum albumin is believed to have a strong relationship with the occurrence of sarcopenia in the elderly. A previous study stated that low serum albumin causes catabolic processes in the elderly.[3] Another possible mechanism is serum albumin reflects nutritional status among the elderly, with a lower level of albumin indicating that the body lacks protein to be used for muscle protein synthesis, which in turn causes a decrease in muscle mass, muscle strength, and physical performance.[4] But, until now the exact mechanism albumin can cause sarcopenia in the elderly is still unclear.

In the Indonesian population, there are still few studies related to albumin and sarcopenia parameters in the elderly. Therefore, we aimed to find out the correlation between serum albumin with muscle mass, muscle strength, and physical performance in the elderly.

METHODS

Total 41 elderly patients (older than 60 years) were included in this cross-sectional study. They were outpatient at Geriatric Polyclinic RSUP Moh. Hoesin (RSMH) Palembang between July 2022 and December 2022. Patients who have nephrotic syndrome, chronic liver disease or severe liver disfunction, malignancy, Geriatric Depression Scale >10, Abbreviated Mental Test score <8, and patients who received parenteral or enteral albumin were excluded from this study.

The basic characteristics of participants were obtained directly from patients. Serum albumin was measured with the colorimetric assay in RSMH Laboratory and presented in g/dl units. Sarcopenia was examined as criteria by the AWGS (Asian Working Group for Sarcopenia) 2019, with three components, including SARC-F score, muscle mass,

muscle strength, and physical performance. Muscle mass was examined using Bioimpedance analysis (Omron Karada Scan: Body Composition Monitor HBF-375®). Muscle mass <7 kg/m^2 in men and <5.7 kg/m^2 in women were classified as low muscle mass, result will be shown as Appendicular Skeletal Mass Index (ASMI). Handgrip dynamometer (Lafayette Hand Dynamometer®) was used to assess patient's muscle strength, where patients who have results <28 kg in men or <18 kg in women are classified as having low muscle strength. Physical performance was assessed with a 5-times chair stand test as the result ≥12 seconds was defined as low physical performance.

All data were processed using SPSS 25 software. Continuous variables were present by mean ± standard deviation (SD) and categorical variables were summarized as numbers and percentages. As muscle mass, physical performance, and serum albumin data were nonparametric based on the normality test, correlation analysis was performed by Spearman's rho test to measure the coefficient of correlation. Associations were considered statistically significant if $p < 0.05$.

RESULTS

This study involved 41 elderly who visited Geriatric Polyclinic at RSMH Palembang in the period July 2022 – December 2022. Characteristics of the participant are shown in Table 1. Mean age was 70.75 ± 7 years, with majority of women over men. Overall, men have better muscle status than women. All subjects in this study have low muscle mass based on BIA measurement and all subjects have normal serum albumin, with an average serum albumin 4.3 ± 0.3 g/dl. Table 2 shows a comparison of the serum albumin mean in each group based on sarcopenia parameter. Mean serum albumin from abnormal group based on SARC-F Questionnaire (4.06 g/dl) and handgrip strength (4.21 g/dl) were significantly lower than normal group. While there was no significant difference in mean serum albumin between the abnormal and normal group based on physical performance assessment.

Table 1. Basic Characteristics of Study Subjects

Variables	Values
Age (years), mean (SD)	70.75 (7)
Sex, n (%)	
Women	23 (56.1)
Men	18 (43.9)
ASMI (kg/m^2), mean (SD)	
Women	3.31 (0.59)
Men	4.89 (1.06)
Handgrip strength (kg), mean (SD)	
Women	16.9 (6.1)
Men	27.5 (8.3)
5 times chair stand test (sec), mean (SD)	
Women	24.2 (14.2)
Men	21.8 (11.1)
Serum albumin (g/dl), mean (SD)	4.3 (0.3)

Table 2. Serum Albumin Mean Difference Based on Sarcopenia Parameter

Variables	Abnormal	Normal	p-value[*]
SARC-F score	4.06	4.39	0.005
Handgrip strength	4.21	4.47	0.004
Physical performance	4.32	4.44	0.48
ASMI	4.37	none	-

[*] Mann-Whitney U test

Table 3. Correlation Analysis of Serum Albumin with Sarcopenia Parameter

Variables	r	p-value[*]
Handgrip strength	0.35	0.012
Physical performance	-0.5	<0.001
Muscle mass	0.05	0.367

[*] Spearman's Rho test

The correlation between serum albumin with muscle mass, muscle strength, and physical performance was shown in Table 4. Handgrip strength (r=0.35, *p*=0.012) and physical performance (r=-0.5, *p* <0.001) have a significant correlation with serum albumin.

DISCUSSION

In this study of 41 elderly patients, based on the SARC-F questionnaire, more women were identified as being at risk of sarcopenia, as many as 6 out of a total of 8 (75%). Handgrip test found 22 patients (53.7%) had decreased muscle strength and 12 of them were women. Whereas for the 5-times chair stand test to assess physical performance, 36 patients (87.8%) completed the 5-times chair stand test ≥12 seconds and 22 of them were women. According to a study conducted by Jongseok Hwang, et al. of the elderly popu-lation in Korea, the prevalence of sarcopenia is higher in women, where it was found to be 19.2% in men and 26.4% in women. The high prevalence of sarcopenia in women is thought to be due to hormonal factors, where at the age of 65-74 years, female sex hormones tend to decrease faster than male sex hormones, where this decrease in sex hormones will accelerate the loss of muscle mass, which in turn will affect muscle strength and physical performance in elderly.[5]

Serum albumin is synthesized in the liver, its production will decrease with age and albumin can also be used as a parameter that describes muscle. Albumin is thought to have a role as an antioxidant, so a decrease in albumin levels will increase oxidative damage to the muscles so that the elderly is suscep-tible to sarcopenia.[6] We found that higher serum albumin levels correlate significantly with greater muscle strength and physical performance. A similar study conducted at RSUD Dr. Zainoel Abidin Banda Aceh also found a positive correlation between serum albumin levels and muscle strength.[7] Study conducted by Yamamoto on elderly people in Japan also found a significant relationship between serum albumin and muscle strength.[8] Low serum albumin levels indicate a decrease in body protein and can increase catabolism in a person. This decrease in body protein can cause a decrease in muscle mass as well, which will affect muscle strength and physical activity. Low serum albumin levels also indi-

cate malnutrition. In a state of malnutrition, there is a decrease in amino acids that play a role in protein synthesis, which can cause a decrease in muscle mass and muscle strength, which in turn affects physical performance in the elderly. Therefore, exercise programs and nutritional interventions such as increasing protein intake can be considered to improve serum albumin so that it can slow down the decline in muscle mass in the elderly.[9,15]

All the subjects have low ASMI in this study. Muscle mass is not related to serum albumin in both sexes. This result is in line with a previous study, where it is stated that serum albumin has no significant relationship to muscle mass in the elderly. The same thing was also carried out in Snyder's study, where although serum albumin was statistically significantly related to appendicular muscle mass, there was an overlap of CI 95%, so the statistic became meaningless.[11] A study on elderly patients with DM also found no significant relationship between serum albumin and muscle mass.[12] Serum albumin is a marker of body protein status, where low serum albumin indicates reduced body protein reserves that will stimulate catabolism including muscle breakdown. However, the direct relationship between serum albumin and muscle mass remains unclear. A possible explanation for this result is that decreasing muscle strength occurs more rapidly than that of muscle mass.[12,13] Also, in this study, ASMI was measured using BIA, designed for household use, which AWGS does not recommend because of its poor accuracy.[2]

This study excluded patients who have comorbidities that significantly affect serum albumins, such as chronic liver disease or severe liver function disorder, nephrotic syndrome, and receive parenteral albumin are excluded so that the influence of external factors on serum albumin can be reduced. In addition, this is the first study in Indonesia to simultaneously assess the effect of serum albumin on the parameters used to diagnose sarcopenia based on the AWGS 2019.

LIMITATION

This cross-sectional study cannot determine the causal relationship between serum albumin with muscle mass, muscle strength, and physical performance. As the sample for assessing serum albumin was taken at one time, it cannot describe average serum albumin as its levels fluctuate. Muscle mass was measured with BIA that was designed for home use which AWGS does not recommend because of lack of accuracy. Furthermore, serum albumin is not a specific marker for sarcopenia and inflammation, as its level is also influenced by another biological factor. In the end, pros-pective studies related to serum albumin with muscle mass, muscle strength, and physical performance are needed to determine the causal relationship between serum albumin and sarcopenia in the elderly, especially in Indonesia. Likewise, a subsequent study is also needed to determine the influence of other inflammatory markers on sarcopenia in the elderly. However, from this study, it is clear that there is a significant correlation between serum albumin with

muscle strength and physical performance in the elderly.

CONCLUSION

Albumin has a significant correlation with muscle strength and physical performance in the elderly but does not have a significant correlation with muscle mass. The results indicated that lower serum albumin levels, even in the normal range, were associated with weaker muscle strength and lower physical performance in the elderly. Therefore, protein supplementation, especially essential amino acids, can be considered to prevent sarcopenia or improve muscle health in the elderly.

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