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The relationship sarcopenia, obesity with Lung function in the elderly group in Tabanan City, Bali

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ABSTRACT

Background: The aging process is characterized by a gradual decline in physical aspect. Changes in body composition are an important sign of the aging process. Lung disease and respiratory disorders are one of the main health problems in the elderly. Various studies have examined the relationship between decreased muscle mass, obesity, and lung function. However, the results of these studies are still unclear. Aims of this study to determine the relationship between sarcopenia, obesity, and lung function in the elderly group in Tabanan City, Bali.

Methods: This study is an analytical study with cross-sectional design conducted at Tabanan City, Bali, in February 2017. The data was taken using the consecutive sampling technique method; 187 samples were collected from the primary data according to inclusion and exclusion criteria—the analysis using univariate, bivariate and multivariate analysis.

Results: Prevalence of Sarcopenia and obesity in the elderly in Tabanan Regency, Bali was 18.2% and 46%, respectively. Meanwhile, those who experienced sarcopenic obesity were 3.2%. Peak expiratory rates were significantly lower in the elderly group with sarcopenia than those without sarcopenia (p=0.026). Peak expiratory rate was significantly higher in the obese elderly group than in the non-obese group p=0.001).

Conclusion: Peak expiratory rates were significantly different in the elderly group with Sarcopenia and obese than those without Sarcopenia or obese.

Keywords: Sarcopenia, obesity, ageing, lung function.
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INTRODUCTION

The ageing process is followed by changing decline gradually in physical, cognitive, and body composition as a sign. Increasing body weight, gradual accumulation, and fat redistribution in the central and visceral areas lead to obesity, accompanied by a decrease in muscle mass and strength known as sarcopenia.[1] Sarcopenia is a physical and metabolic concern, such as decreasing basal metabolic rate, muscle strength, and neuromuscular disorders leading to increased mobility, gait, balance, falls, reduced activity, obesity, and death. The prevalence of sarcopenia was 10-20%, and however, sarcopenia is usually undetected until manifested as a gradual decline.[2] Sarcopenia affects and impairs quality of life and contributes to raising the chance of obesity, metabolic disease, and multiple organs.[3] The latest studies stated the relationship between decreased muscle mass and increased fat mass, either separately or together, affects functional and susceptibility to chronic diseases. A more than 40% muscle mass decline is associated with a higher mortality risk and affects several organ systems.[4] Respiratory systems are most affected by aging, known as respiratory sarcopenia.[5] Obesity and sarcopenia can overlap and accompany each other called sarcopenic obesity. The mechanism altering skeletal muscle lipid metabolism, insulin resistance, inflammatory pathways, and association with sarcopenia can negatively affect sarcopenia due to ectopic fat deposition into skeletal muscle.[6]

Recent studies have examined the relationship between decreased muscle mass, obesity, and lung function. An obese person hypothesized that excess fat decreases total respiratory system compliance increases pulmonary resistance and reduces respiratory muscle strength. Low muscle mass is related to decreased physical performance and disability, associated with decreased lung function.[7] Study was conducted by Rubenstein et al. showed significant differences in expiratory flow at 25% of the reduced vital capacity in obese population and tended the possibility of peripheral airway obstruction in obese men.[8] During respiration, the obese population, has more demand to consume oxygen and energy than normal. At the same time, low muscle mass (LMM) was associated with decline lung function due to aging causes decreasing skeletal and respiratory muscle mass. A reduction in diaphragm muscle mass has been demonstrated in

aging mice.[9] However, the results of these studies are still controversial and not fully understood.[9]

This study aims to determine the association between sarcopenia, obesity, and its effect on lung function in the elderly population.

MATERIAL AND METHODS

Study design and population

This study is an analytical study with a cross-sectional observational design. The place and time of this study were held in Tabanan City, Bali, in February 2017. Samples were taken from the primary data. Tabanan has chosen to be a study area because of the greater prevalence of the geriatric population. One hundred eighty-seven samples were collected with a consecutive sampling technique. Sarcopenia is defined as the presence of low skeletal muscle mass and either low muscle strength (e.g., handgrip) or low muscle performance (e.g., walking speed or muscle power. The instruments used in this study were bioelectric impedance to measure muscle mass (BIA) using Omron KaradaScan™ HBF-375, handgrip dynamometer to measure muscle strength, scales to measure body weight, height measuring instrument, and peak flow meter to measure the peak expiratory rate. Inclusion criteria were age (60 years or more), the ability to take a vertical position (necessary for measuring body height and analyzing body composition, while any acute condition altered BIA interpretation as exclusion criteria. Informed consent was obtained from each subject before the study. Two authors assessed the variable interpretation to reduce bias.

Ethical board

This research has been obtained and approved. The letter of ethical negligence of the research ethics commission Udayana University Faculty of Medicine/ Sanglah General Hospital Denpasar (1905/ UN.14.2/KEP/2017) and a formal letter of permission obtained from Tabanan City Licensing and Investment Agency. All the subject information collected from this study will be kept confidential.

Statical Analysis

This study used univariate and bivariate analysis. The number of participants was included to add 20% as estimated missing data. Numeric data such as age were tested using the normality test (Kolmogorov-Smirnov). Numeric data were presented in the median and interquartile range (IQR). Normality and frequency test was used as univariate analysis to describe the characteristic proportion of the sample and determine the type of test used in bivariate analysis. A comparative test was done to explain the association by using Mann-Whitney. The dependent variable in this study was lung function which was measured using the peak expiratory flow parameter. The independent variables were sarcopenia and obesity. Control variables were age, gender, smoking history, and history of lung disease. The variables of age, sex, smoking history, and history of lung disease were controlled by analysis. Variable below p<0.25 was continued to multivariate analysis. Statistical analysis was done by using SPSS 23.

RESULT

The characteristic of this study is described in Table 1; the median age is 70 (60-81) for sarcopenia group and non-sarcopenia 66(51-83) years old. The female gender is nearly one by one between both groups. Out of 17.6% in sarcopenia and half (52.3%) in non-sarcopenia group obese. Prevalence of Sarcopenia and obesity in the elderly population of Tabanan Regency, Bali was 18.2% and 46%, respectively. Meanwhile, the sample that experienced sarcopenic obesity was reported at 3.2%.

Comparison test shown peak expiratory rates significantly were statistically different between elderly group with Sarcopenia than those without; p=0.026).

Peak expiratory rate was statistically different and higher in the obese elderly group than in the non-obese group. Other variable was not associated in multivariate analysis p value >0.05.

Table 1. Participant Characteristics at Enrolment

	Sarcopenia		
	Yes (n=34)	No (n= 153)	p-value
Age (years)	70 (60-81)	66(51-83)	0.11
Male	4 (11.8%)	32 (20.9%)	0.35
BMI (kg/m2)	22.0 (10.30-31.50)	25.3 (14.7-22.5)	0.00
SMI	4.87 (1.52-6.99)	5.77(0.58-74.24)	0.00
Subcutaneous Fat	27.05 (13-230)	28.6 (6.9-261.4)	0.134
Skeletal mass	11.4(3.52-16.1)	14.3 (1.49-207.0)	0.167
History of Lung disease	1 (2.9%)	10(6.5%)	0.69
History of smoking	1 (2.9%)	9(5.9%)	0.69
Obese	6(17.6%)	80 (52.3%)	0.00

BMI: body mass index; SMI: skeletal mass index

Table 2. Mann whiney test Peak expiratory flow rate (PEFR) with Sarcopenia

Sarcopenia	Peak expiratory flow rate (PEFR) liters/ second	P- Value
Yes (n=34)	205 (120-300)	0.026
No (n= 153)	240 (50-324)	

Table 3. Mann whiney test Peak expiratory flow rate (PEFR) with Obesity

Obese	Peak expiratory flow rate (PEFR) liters/second	P- Value
Yes (n=34)	250 (110-324)	0.01
No (n= 153)	200 (50-400)	

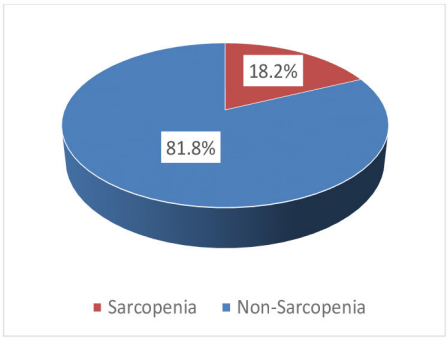

Figure 1. Sarcopenia Prevalence (%) in The Elderly Group

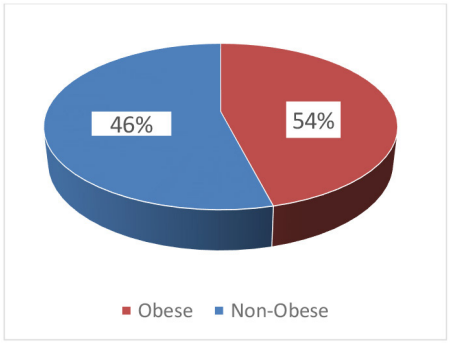

Figure 2. Obesity Prevalence (%) in The Elderly Group

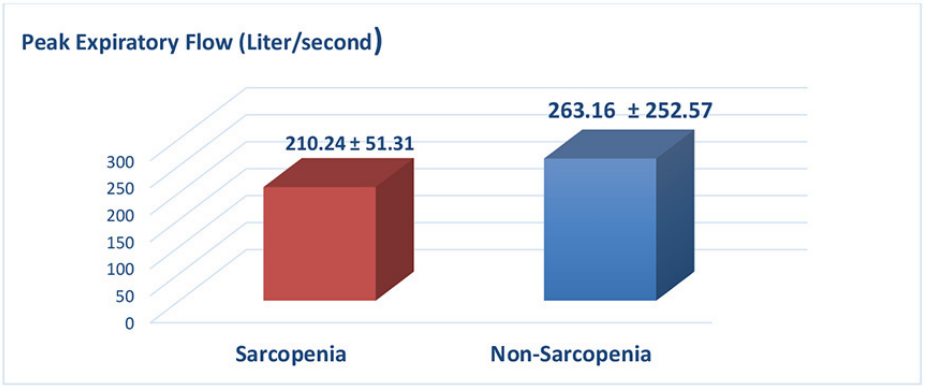

Figure 3. Comparison of Peak Expiratory Rates in Sarcopenia and Non-Sarcopenia (p=0.026)

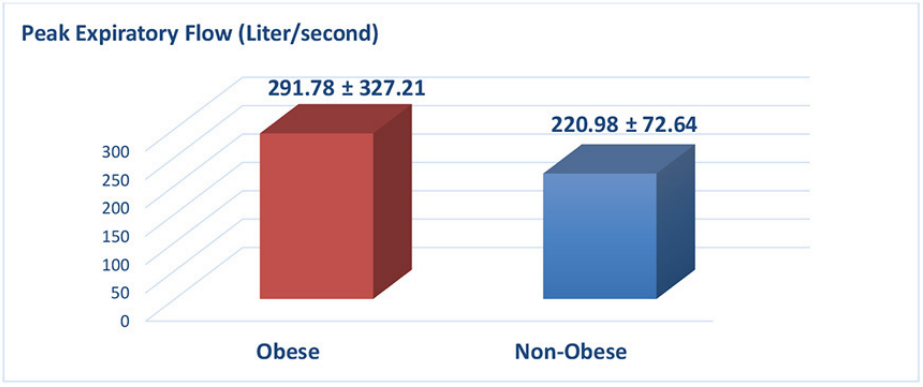

Figure 4. Comparison of Peak Expiratory Rate in Obese and Non-Obesity (p=0.001)

DISCUSSION

Respiratory disorders are one of the leading health problems in the elderly. Recent studies have shown that decreased lung function causes respiratory disease and cardiovascular and cerebrovascular diseases, even in healthy individuals. Multiple factors contribute to a person's lung health condition, including age, gender, smoking status, physical performance, and comorbidities such as lung disease. A study conducted by moon et al. has examined the relationship between decreased muscle mass, obesity, and lung function.[10] However, the results of these studies are still controversial, and how the mechanism of obesity which includes increased fat mass and decreased muscle mass (Sarcopenia), is not fully understood.[9]

Our study found prevalence of Sarcopenia and obesity in the elderly in Tabanan Regency was 18.2%.[10] Another study where most Sarcopenia in Taiwan was 8%-22% in women and 6%-23% in men.[7] Silanpaa et al. stated the prevalence rate of sarcopenia according to Asian Working Group for Sarcopenia (AWGS) criteria was 9.1% (7.4% for men and 1.7% for women), while based on the cut-off value of the Taiwanese population was 40.6% (20.1% for men and 20.5% for women).[11] Study was conducted by Putra et al. in Bali was 40% and dominated below 70 years with ratio gender almost one by one. Gender male was comparable in our study, nearly one by one between both groups in this study. Gallagher et al. stated that almost twice males risk sarcopenia than women and may explain by free testosterone.[12] The Prevalence of obesity in the elderly in Tabanan Regency, Bali, is 46%. Several studies on obesity in Bali, including a survey in Sangsit, Singaraja, in 2004, found abdominal obesity in men of 10.8%; Ubud reported the Prevalence of abdominal obesity was 51. 88%.[9] Study conducted by Utami (2016) showed that most obesity in the elderly in the working area of Puskesmas I North Denpasar was 61.46%.[13] Obese in this study was examined by body mass index and this way as questioned for older adults. Body composition was correlated with aging, BMI was not relevant to capture actual composition. However, CDC many international consensuses still using BMI to define obese. Other disparities and vary instruments are also for sarcopenic obesity The prevalence of sarcopenic obesity in this study was 3.2%. Several studies show that the sarcopenic obesity population in Korea was 7.6% for men and 9.1% for women by weight-adjusted definition but nearly zero for men and women by height-adjusted definition.[9,14] The Prevalence of Sarcopenia increased with age for men, while women applied with weight-adjusted intention.[14,15]

Previous studies have shown decreased lung function causes respiratory disease and cardiovascular and cerebrovascular disease even in healthy older adults. Many factors can affect lung function. Age, gender, smoking status, physical performance, and comorbidities such as lung disease are essential factors that affect lung function. Many studies have reported an association between obesity and lung

function. In this study, that factor was comparable to each other, shown in Table 1.

In this study, the peak expiratory rate was significantly lower in the elderly group with sarcopenia than those without. The reduced pulmonary function could result from low muscle strength or muscle mass and been demonstrated that PEFR significantly correlated to handgrip strength, gait speed, and maximal inspiratory pressure, and some study postulated PEFR to predict sarcopenia.[16] However, the peak expiratory rate was significantly higher in the elderly group with obesity than in the non-obese group. During the aging process, musculoskeletal changes occur along with changes in lung function. Decreased muscle strength begins a series of reduced lung function, decreased physical performance, and inability to mobilize. Decreased chest wall recoil and reduced chest muscle strength are musculoskeletal changes that cause reduced lung function. Reduced muscle strength will also cause a decrease in physical activity and mobility, causing a decline in lung function.[17] Increasing stiffness in the respiration system alters respiratory system compliance and breathing pattern. Air moves into the lungs along the negative pressure gradient within the pleural space. However, in obese conditions intra-abdominal and pleural pressures are increased slightly in obesity because the downward movement of the diaphragm and the outward movement of the chest wall are impaired caused by exceed fat accumulation around the thoracic and abdominal cavities.[18] As right with that hypothesis, this study shows a significant relationship statically in the comparison test of PEFR between both groups ($p<0.05$).

This study has several limitations first, a cross-sectional study performed our study. Consequently, we could not confirm a cause-and-effect relationship between sarcopenia, obesity mass and pulmonary function. Second, although examined using BIA, several factors may affect hydration status, age, and ethnicity.

CONCLUSION

Peak expiratory rates were significantly different in the elderly group with Sarcopenia and obese than those without sarcopenia or obese. Further research is needed on a larger scale, using prospective design and more precision modality to assess muscle and lung function

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AUTHOR CONTRIBUTIONS

All named authors had full access to all the data in this study and took complete responsibility for the integrity of the data and the accuracy of the data analysis.

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POTENTIAL CONFLICTS OF INTEREST

All authors declare there are no conflict of interest

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