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Sarcopenia: The Prevalence and Associated Factors in Community-Dwelling Elderly

Sumandar Sumandar[1*], Mersi Ekaputri[2], Arya Ramadia[3]
[1]Department of Geriatric Nursing, Health Faculty, Institute of Health and Technology Al Insyirah, Indonesia
[2]Department of Medical Surgical Nursing, Health Faculty, Institute of Health and Technology Al Insyirah, Indonesia
[3]Department Psychiatric Nursing, Health Faculty, Institute of Health and Technology Al Insyirah, Indonesia
[*]Authors Correspondence: sumandar.05mangiri@gmail.com/082112606740

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ABSTRACT
Sarcopenia is a syndrome characterized by a decrease in skeletal muscle mass and function due to aging. This study aims to assess the prevalence and associated factors of sarcopenia among the elderly in the Pekanbaru. 275 samples were selected using cluster sampling technique. The independent variables were socio-demographic characteristics, metabolic syndrome, independence level, physical activity, quality of life, depression, and nutritional status. Meanwhile, the dependent variable was sarcopenia. Data analysis was carried out through SPSS using statistical tests including descriptive statistics, chi-square, and multivariate logistic regression. The results show that 45.5% of the participants experienced sarcopenia. The mean age of participants was 63.3 years old; most were female; 90.2% were married; and 39.3% had moderate quality of life. The education level was mostly high school; 69.1% were not working; 72% did not experience metabolic syndrome; and 78.5% had normal nutritional status. Gender, education, metabolic syndrome, independence level, physical activity, quality of life, nutrition, marital, depression, and occupational status are associated with sarcopenia. The most significant variables for sarcopenia in the elderly were nutritional status (p=0.031) and physical activity (p= 0.016). Nutritional status and physical activity were predictors of sarcopenia. *Posyandu*, or integrated service post, for the elderly in the public health center, needs to be optimized which requires continuous collaboration among the doctors, nurses, nutritionists, social workers, physiotherapists, psychologists, families, religious institutions, and community shops. Furthermore, a treatment program needs to be developed, both in the community and in the health services area.

INTRODUCTION

Sarcopenia can be defined as an universal decreased ability and skeletal muscle mass.[1] It is a recognized geriatric syndrome which is an important threat to the independence of the elderly and it is caused by a decrease in muscle mass.[2,3] Sarcopenia has emerged as a significant aging-related health problem affecting many facets of public health and represents a major cause of falls and functional deterioration in older persons and increase morbidity.[4,5] Sarcopenia had increased risks of all-cause mortality.[6] This problem also needs attention because of the increased prevalence and negative impact.[7] Sarcopenia was estimated to influence 10 %-16 % of the elderly worldwide.[8] Sarcopenia was increased age, Namely was 60-70 years reported 5-13%, >80 years was 11-50%.[9]

Several previous studies about the prevalence of sarcopenia was spread in various cities in Indonesia and it can be seen to experience a fluctuating increase. The studies have been carried out about sarcopenia was 91,3%.[5] Prevalence sarcopenia of elderly in the urban area in the Surabaya was 41.8%.[10] Furthermore, the research results have been carried out in Indonesia with national scale, it was 50.25% .[11] In addition to urban areas, sarcopenia was also found in the elderly in sub-districts in Pangkalan Pinang, such as a decrease in muscle strength with 29.5% and walking speed with 71.2%.[12]

The cause of sarcopenia is generally considered multifactorial, with environmental causes such as declines in physical activity and nutritional intake. It is also an age-related disease.[11] It is strictly related to poor quality of life, and have risk factors including age and gender.[13] Sarcopenia was independently associated with depression.[14] Metabolic syndrome is a component of Sarcopenia which is associated with greater lean mass and forearm muscle size but poorer muscle quality.[15] The other risk factors for sarcopenia including age, gender, lifestyle, nutritional status, physical activity, disability, and decreased independence.[12]

Screening and early identification of sarcopenia is important to prevent adverse outcomes in elderly.[16] The studies of sarcopenia among elderly in the community undertaken in the Indonesia are not only just a few but also narrow. Therefore, investigation of the prevalence of sarcopenia and associated factors is urgently needed. Currently, no prevalence data has been found in Pekanbaru, Indonesia. The aim of this research was to identify the community's older adult population's sarcopenia risk factors.

MATERIAL AND METHOD

A study with cross-sectional design was carried out in Tenayan Raya Sub-district which covers thirteen villages in Pekanbaru, From August to October 2020. According to the Pekanbaru statistics center, the number of elderlies in Tenayan Raya is high.[17] The samples were selected by cluster sampling. The sample's amount has been established using the following formula ($n=N/1+Ne^2$) with an error value of 5%.[18] There are 275 samples obtained from the elderly living in thirteen villages in the Tenayan Raya sub-district. The Eligibility criteria were elderly with age of 60 years old and above who were Tenayan Raya citizens and stay in the selected information collection process. They were invited to participate in the study. Those who have mental health disorders, severe communication problems hearing, vision disorders, and people who had received therapy or drugs which impacted exercise ability and developed a health problem causing muscle mass loss had been eliminated from the study. The Asian Working Group for Sarcopenia (AWGS) has taken the same approach as the European Working Group on Sarcopenia in Older People (EWGSOP) and it also recommend a cut-off value for sarcopenia diagnosis parameters different from that of the Europe.[19] This consisted of muscle mass <7.0 kg for men and <5.7 kg for women, muscle strength <26/28(men) and <18 kg (women), and walking speed <0.8/0.1 m/s.[19]

The Prevalence of metabolic syndrome was assessed by the presence of central obesity, type 2 diabetes mellitus, or hypertension and triglyceride therapies. The assessment is based on triglyceride levels ≥150 mg/dl, HDL <40 mg/dL (men) and 50 mg/dL (women), blood pressure ≥ 130/85 mmHg and glycemia ≥100 mg/dl .[20] Blood pressure (systolic and diastolic) was measured by using a sphygmomanometer and stethoscope.[21] central obesity was defined according to the WHO, WC ≥ 94 cm for men and ≥ 80 cm.[22] The Mini Nutritional Assessment (MNA) has been used to determine nutritional

status. MNA, as defined by Bauer JM, Kaiser MJ, Anthony P et al (2008), is an incredibly reliable measure of sensitivity and specificity. This is an appropriate tool to analyze elderly people with normal nutritional status as well as people at risk of malnutrition.[23] The MNA displays excellent reliability levels for the overall score, the classified score, and the majority of its elements.[24]The nutritional status tool received scores on three categories: mild malnutrition (0-7 points), malnutrition risk (8-11 points), and normal (12-14 points).

According Tas Ü, Verhagen AP, Bierma-Zeinstra SM, Odding E, Koes BW forward that the respondents were also assessed based on ADL which is defined as a person's independence in carrying out activities and daily life functions routinely and universally. This was performed through the modification of the Barthel Index.[25] Thus, according to (Mahoney, Barthel, 1965), functional status was assessed by the Barthel index Activities of Daily Living (ADLs), which measures the ability to perform daily living activities eating, dressing, personal hygiene, bathing, bowel, and urine continence, toileting, walking up stairs and along a plane, and transfer from bed to chair. Evaluation of the results of the questionnaire are interpreted according to points gained, whereby 0–40 points were considered high dependency, 45–60 points are considered a moderate dependency, 65 to 95 points is considered a mild dependency, and 100 points independence.[26] WHO (2001) stated that the formula for assessing physical activity is Physical activity Level (PAL) = Physical Activity Ratio (PAR) X time allocation (W) / 24 hours.[27] Depression level was measured through the Geriatric Depression Scale (GDS). This covers 15 closed- question items with a sensitivity of 92% and specificity of 89% when evaluated against the diagnostic criteria by D'ATH et al. 1994.

The Geriatric Depression Scale (GDS) was developed by Brink et al in the United States, and Sheikh, J.I.; Yesavage, J.A (1986), which is the original questionnaire with internal consistency Cronbach's α coefficient was 0.72. It is widely used for psychological evaluation to screen the depression level of elderly in long-term care institutions, without racial or regional bias, and has high reliability and validity in research around the world. The questionnaire has 15 dichotomous "yes" (1 point) and "no" (0 points) items related to emotional, cognitive, and behavioural symptoms to evaluate life over the past week. The total scores are 0–15, with higher scores indicating a higher depression level. The scores are also categorized into Normal (0-4 points), Mild (5-8 points), Moderate (9-11 points), Severe (12-15 points).[28]

The quality of life was assessed from the World Health Organization Quality of Life (WHOQOL) and a score range of 0–100.[29] To determine quality of life, the WHOQOL-BREF questionnaires (Czech version, Dragomirecká, Prajsová, 2009) had been applied. The WHOQOL-BREF questionnaire includes twenty-six questions, 24 of which have been divided into four main domains: physical health, mental health, social interactions, and environment. The questionnaire has 24 items classified into 6 domains: sensory capacities, autonomy, past, present, and future activities, social engagement, death and dying, and intimacy. After conversion, the standardized ratings in these domains range from 0 to 100 (WHO 2006), where 0 representing the poorest quality of life and 100 indicating the best quality of life.[30]

Muscle mass measurement was used to assess sarcopenia in the participants through Bio-Impedance Analysis (BIA) by asking them to stand barefooted on the analysis board and then hold the detector with both hands. Its data were obtained from the muscle mass index by calculating the appendicular skeletal muscle mass (ASM). This was obtained from the total muscle mass of both lower and upper limbs in kg divided by the square of height in meters (ASM/TB2). Muscle strength was measured in kg using a dynamometer, which was taken 3 times on the dominant hand and then the highest score in a standing position. Physical performance was measured by the walking speed in m/s through the calculation of distance travelled within 6 minutes according to the American Thoracic Society (ATS). All Data were analysed using SPSS. Univariate analysis was used to determine frequency of each variable and bivariate test using chi-square test were used. A regression test was used for multivariate analysis and using multiple logistic regression models. Inferences were drawn at a significant level of <0.05. A multiple regression test was conducted to analyse the associated factors correlated with the sarcopenia, with a *p*-value

less than 0.05 was considered statistically significant. Furthermore, logistic regression analysis consisted of 3 steps. The model consists of bivariate analysis was performed by including all sarcopenia-associated variables (p<0.05) with logistic regression, multivariate analysis was conducted by re-entering the sarcopenia-associated variables (p<0.025) with logistic regression, interaction testing was carried out by re-entering variables that interacted substantially or had a relationship (p<0.05) by the means of logistic regression. All the participants were informed in advance about the study procedure and they also signed the consent form in Indonesian. Data collection was carried out after obtaining approval from the ethics committee of the Medicine Faculty, University of Riau, Indonesia with No.B/13/UN.19.5.1.1.8/UEPKK/2020.

RESULTS

A total of 275 participants were involved in the study. The mean age of the participants was 63.39 (SD±37) years. More than half of the (63.60%) participants were females. More than half (90.20%) were married. The majority, 112 (40.70%) of the participants were graduated from senior high school and 190 (69.10%) were not working (Table 1). Most respondents were not found to have metabolic syndrome at 198 (72%), and the majority of nutritional status is normal. Furthermore, Independence Level and depression status were normal (with 260 independents participants (94.50%). 198 (72%) did not experience metabolic syndrome and 216 (78.50%) had normal nutritional status. Most of the independence level and depression status were normal, the physical activity was mostly mild.

Based on Table 2, elderly male (55%) with sarcopenia are rather common. Compared to old adults with no companion, married elders (48%) had a higher rate of sarcopenia. Sarcopenia was most common in the elderly who had completed elementary school (63.60%). Elderly who does not work experience sarcopenia at 50.50%. Elderly who have metabolic syndrome was at 50%. 69.20% of the elderly at risk of malnutrition developed sarcopenia. Sarcopenia relates to the elderly with moderate independence is at a risk of 66.70%. In 46.90% of the elderly with depression, sarcopenia was displayed. Sarcopenia affected the elderly who involve to physical activity at 54.10% and 59.40% of the elderly having poor quality of life experienced sarcopenia.

Table 3 shows the dominant factors related to the prevalence sarcopenia of the participants. The value used to identify the predictor factors that related to sarcopenia among elderly in the community was the p-value and standardized coefficient beta (β) and odds ratio (95%CI). The result of analysis shows nutrition status with a value of p=0.031; (β)=1.134; CI 95%=1,272-7.588 and physical activity with a value of p=0.016; (β)= 0.681; CI 95% = 0,271-0,944).

Table 1. Characteristics of Respondent

Characteristics	n = 275	%
Age (Mean ± SD) Years	63,39 (± 37)	
Gender		
Male	100	36.40
Female	175	63.60
Marital Status		
Married	248	90.20
Widower/Widow	27	9.80
Education Status		
No Education	1	0.40
Elementary School	44	16
Junior High School	44	16
Senior High School	112	40.70
Diploma/Bachelor/ Master	74	26.90
Occupational Status		
Working	85	30.90
Not Working	190	69.10
Sarcopenia		
Positive	125	45.50
Negative	150	54.50
Metabolic Syndrome		
Positive	77	28
Negative	198	72
Nutritional Status		
Malnutrition	33	12
Risk of Malnutrition	26	9.50
Normal	216	78.50
Independence Level		
Heavy	2	0.70
Moderate	3	1.10
Light	10	3.60
Normal	260	94.50
Depression Status		
Severe	0	0
Moderate	9	3.30
Mild	49	17.80
Normal	217	78.90
Physical Activity		
High	63	22
Moderate	64	23.30
Light	148	53.80
Quality of Life		
Very Bad	3	1.10

Bad	32	11.60
Moderate	108	39.30
Good	46	16.70
Very Good	86	31.30

Source: Primary Data, 2020

Table 2. Socio-Demographic and The Factors Associated with Sarcopenia

Variables	Sarcopenia				*p-value*
	Positive		Negative		
	n	%	n	%	
Gender					
Male	55	55	45	45	0.023
Female	70	40	105	60	
Marital Status					
Married	119	48	129	52	0.019
Widower/Widow	6	22.20	21	77.80	
Education Status					
No Education	1	100	0	0	
Elementary School	28	63.60	16	36.40	0.033
Junior High school	21	47.70	23	52.30	
Senior High School	69	61.61	43	38.39	
Diploma/Bachelor/Master	26	35.10	48	64.90	
Occupational Status					
Working	29	34.10	56	65.90	0.017
Not Working	96	50.50	94	49.50	
Metabolic Syndrome					
Positive	26	33.80	51	66.20	0.022
Negative	99	50	99	50	
Nutritional Status					
Malnutrition	18	54.50	15	45.50	
Risk of Malnutrition	18	69.20	8	30.80	0.014
Normal	89	41.20	127	58.80	
Independence Level					
Heavy Dependence	1	50	1	50	
Moderate Dependence	2	66.70	1	33.30	0.881
Light	5	50	5	50	
Normal	167	64.23	93	35.77	
Depression Status					
Severe	0	0	0	0	
Moderate	0	0	9	100	0.021
Mild	23	46.90	26	53.10	
Normal	102	47	115	53	
Physical Activity					
High	22	34.90	41	65.10	0.008
Moderate	23	35.90	41	64.10	
Light	80	54.10	68	45.90	
Quality of Life					
Very bad	3	100	0	0	
Bad	19	59.40	13	40.60	0.022
Moderate	53	49.10	55	50.90	
Very Good	29	33.70	57	66.30	

Source: Primary Data, 2020

Table 3. Final Model of Analysis Results Multivariate

	Variables	Coefficients Beta (β)	*p-value*	OR (95% CI)
Steps 1	Gender	-0.108	0.666	0.898 (0.551-1.461)
	Marital status	-0.62	0.831	0.939 (0.529-1.668)
	Education	-21.693	0.132	0.65 (0.108-2.341)
	Occupation status	-0.227	0.455	0.797 (0.439-1.446)
	Metabolic Syndrome	-0.179	0.058	0.836 (0.459-1.523)
	Nutritional status	1.166	0.013	3.211 (1.337-7.708)
	Depression Status	-21.083	0.004	5.109 (0.356-5.910)
	Physical Activity	-0.785	0.008	0.456 (0.248-0.840)
	Quality of Life	1.571	0.013	4.812 (1.135-8.650)
Steps II	Nutritional status	0.954	0.049	2.597 (0.945-7.140)
	Depression Status	-20.898	0.999	0.65(0.006-3.235)
	Physical Activity	-0.673	0.046	0.510 (0.264-0,988)
	Quality of Life	20.907	0.999	1.12 (0.17-7.25)
Steps III	Nutritional status	1.134	0.031	5.089 (1.272-7.588)
	Physical Activity	-0.681	0.016	1.591 (0.271-0.944)

Source: Primary Data, 2020

DISCUSSION

According to our analysis, the overall prevalence of sarcopenia was 45.50%. In Indonesia, sarcopenia has been the subject of several research in the past. This is in line with the finding of sarcopenia in the city of Surabaya, as much as 41.8.[10] Furthermore, the data of Indonesia Longitudinal Aging Study (INALAS) from community-dwelling outpatients in eight center found that the prevalence of sarcopenia was 17,6%.[31] The difference in the prevalence of sarcopenia in regions in Indonesia was influenced by sample. It can be seen that there were fewer studies in Bandung, so the findings are different. However, the findings in the city of Surabaya were higher because of there were more samples. In addition, the difference in gender produced a difference in sarcopenia. The results of previous studies have been found that sarcopenia among the elderly in Malaysia was 28.5%.[3] In the Singapore was 16%.[32] In the di Thailand was 10%.[33] It can be seen that there is a significant difference among these countries. The low number of sarcopenia cases in the above countries is due to several factors. Geriatric nursing has received by high attention and high comprehension. In addition, taken care by families can cause low number of sarcopenia percentages.

Moreover, variables related to sarcopenia in the elderly in the community include gender, marital status, level of education, occupation, metabolic syndrome, nutritional status, depression status, physical activity, and quality of life. The findings of this study were similar to those of earlier ones. One of them is European interconnection which the majority of older women are vulnerable to disproportional Sarcopenia.[34] Disadvantaged socioeconomic position was an independent determinant of probable sarcopenia in community-dwelling older adults.[35] Those with social disadvantages are disproportionately more likely to develop sarcopenia.[36]

The major element of insulin-induced glucose metabolism is the muscle. Furthermore, metabolic syndrome and glucose intolerance were intimately related to muscle loss.[37] The results also showed that the elderly with malnutrition tend to get sarcopenia by an OR value of 5.089 compared to their counterpart. It was stated that internal factors cause this condition and sarcopenia has a relationship with physical performance, muscle strength, and mass. Energy is required to fulfill these three conditions, of which strength is obtainable from the daily nutritional intake. This is supported by the previous study that protein supplementation combined with exercise provides additional benefit on lower-extremity strength in healthy older adults with sarcopenia in Asian countries.[38] One important organ for insulin-induced glucose metabolism is the skeletal muscle.

Moreover, Sarcopenia has been associated to a higher probability of a variety of adverse health consequences, namely metabolic disorders.[39] Previous studies have shown that there was a link between sarcopenia and depression in the elderly.[40] Physical activity issues in the elderly have an impact on health concerns, particularly when it comes to muscular illnesses like sarcopenia.[41] The quality of life, rather than the quantity of time left to exist, is what greatly importantwhile people get older. The elderly's ability to establish enjoyable, meaningful life is an indicator of their quality of life. Sarcopenia in the elderly is linked to a variety of negative clinical outcomes, including physical debilitation, mobility restrictions, a decrease in quality of life, a greater chance of falling, hospitalization and mortality.

On the other hand, the study indicated that reduced physical activity causes a higher risk of sarcopenia development.[42] Elderly should be engaged in physical activity to avoid diseases and enhance their quality of life.[41] Previous multivariate studies found that sarcopenia was unrelated to the degree of independence of the elderly in the community.[43] Elderly might prevent muscle tension, weakness, and poor physical performance while being independent in their daily activities.

Based on the results of multivariate analysis, in this study, elderly with nutrition disorders were 5.089 times more likely to develop sarcopenia compared to elderly with normal nutrition status (OR: 5.089, 95% CI: 1.272-7.588).[44] The elderly who had physical activity disorders were 1.591 times more likely to develop sarcopenia compared to those not having problems with physical activity**.** Physical activity was associated with sarcopenia by an OR of 1.591 and a p-value of 0.032, which aligns with the previous studies. It showed that Physical activity was mostly in the light category (53.8%). Furthermore, the study indicated that reduced physical activity causes a higher risk of sarcopenia development.[42]

The findings of the current investigation have implications for health care in the community (*PERKESMAS*) and nursing care for the elderly policies in setting of reducing morbidity, such as muscle disorders in the elderly. In addition, enhancing health services with various disciplines is necessary to comprehend the causes of sarcopenia. There are definitely some limitations in this research, for instance, during data collection on factors related to sarcopenia, it is still reported that some elderly were assisted by researchers and their family to answer questionnaires, which could results in inaccurate and biased data that ultimately affects the research findings.

CONCLUSION AND RECOMMENDATION

According to this study, sarcopenia affects 45.50% of elderly in Pekanbaru City, Indonesia. In addition, the most dominant influencing factors were nutritional status (p=0.031; (β)= 1.134; CI 95%=1,272-7.588) and physical activity (p=0.016; (β)=0.681; CI 95%=0,271-0,944). Furthermore, a program for sarcopenia treatment needs to be developed, both in the community and health services area. Posyandu, or an integrated service unit for elderly people, has to be enhanced at Tenayan Raya Primary Health Centre (PHC). Nurses and doctors need to collaborate together continuously to solve problems, social workers, physiotherapists, psychologists, families, and religious and community shops. Exercise is also an effective strategy to avoid sarcopenia.

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AUTHOR CONTRIBUTIONS

S, ME, and AR, wrote the manuscript. The research article has been thoroughly reviewed and authorised by all contributors. S = Sumandar; ME = Mersi Ekaputri; AR = Arya Ramadia.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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