Biomedical Journal of Indonesia
Journal Homepage: https://bji-fk.ejournal.unsri.ac.id

Physical Activity and Body Composition Profiles in Elderly Individuals: Insights from a Community-Based Study

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ARTICLE INFO

Keywords:
Elderly
Body composition
Fat mass
Muscle mass
Physical activity

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All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.32539/BJI.v12i1.251

Received 14 May 2025;
Accepted 17 June 2025

ABSTRACT

Introduction. Obesity and sarcopenia are two metabolic disorders that can result from an increase in body fat and a reduction in muscle mass that are not balanced by enough physical exercise. The goal of this study was to examine whether there is a link between physical activity and body composition in the elderly. **Methods.** This cross-sectional study was carried out in the elderly community of RSUP Dr. Mohammad Hoesin Palembang from October to November 2019. The study's sample consisted of older persons over the age of 60 who were able to speak clearly and carry out daily tasks independently. Respondents who agreed to participate signed informed consent. Physical activity data were collected by PASE questionnaire interviews, and body composition was measured using the BIA Tanita. **Results.** The Chi-Square test was used in all analyses. In this study, there were 94 old people: 12 men and 82 women. Physical activity was found to have a significant link with muscle mass (p=0,001) as well as fat mass (p=0,001). **Conclusion.** There is a strong link between physical activity and body composition in the elderly. Physical activity data were obtained through interviews based on the PASE questionnaire and body composition measurements using the BIA Tanita.

1. Introduction

The elderly population is rapidly increasing in both developed and developing nations. The decline in birth rates and mortality, alongside rising life expectancy, has contributed to a higher national dependency ratio. In South Sumatra, data suggests that for every 100 working-age individuals, 48 non-working-age individuals are supported, a dependency ratio exceeding the national average.[1] The aging process is shaped by various factors, including physical activity, enhanced nutrition, sanitation, healthcare services, and advancements in education and socioeconomic status. As individuals age, their health often declines, which can impact their quality of life. A significant factor influencing quality of life is the reduction in their capacity to perform daily activities.[2]

A significant change observed in the elderly is the alteration in body composition. An increase in fat mass and a decrease in muscle mass and bone density are common indicators of aging. Research by Şenoymak et al. identified a 15.4% decrease in muscle strength among individuals aged over 40 years.[3] These changes are associated with an increased susceptibility to degenerative conditions such as heart disease, type 2 diabetes, sarcopenia, and osteoporosis, which can lead to disability in the elderly, even impacting their ability to perform daily activities. Body composition can be assessed through various methods, including anthropometry, bioelectrical impedance, ultrasound, dual-energy X-ray absorptiometry, computed tomography, and magnetic resonance imaging. Anthropometric assessments, such as body mass index (BMI) and body circumference, as well as bioelectrical impedance analysis (BIA), are methods that can be

readily applied by physicians or other healthcare professionals in routine practice.[4]

In addition to nutritional factors, a lack of physical activity can also contribute to a decrease in muscle mass and an increase in fat mass. Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. The level of physical activity in an individual can be characterized by work, exercise, and daily living activities.[5]

Health care institutions use exercise for the elderly in their chronic illness management programs. It has been demonstrated that this exercise provides advantages, such as lowering blood pressure.[6] Elderly individuals often form their own communities that remain active in various activities. A preliminary survey indicates that the senior citizens at Dr. Mohammad Hoesin Hospital Palembang are actively involved and regularly work out in the mornings. In light of these results, the researchers want to evaluate the physical activity levels and body composition of this senior population and examine how these variables relate to one another.

2. Methods

In order to ascertain the association between physical activity and body composition among the senior population at Dr. Mohammad Hoesin Hospital Palembang, this study uses a cross-sectional analytical observational methodology. The study sample consisted of community members who met the research criteria. Sampling was carried out using consecutive techniques. Older adults who were able to carry out daily tasks, willing to participate as respondents, gave informed consent, and attended morning exercise sessions met the inclusion requirements for participation. The study did not include older people with mobility problems.

Age, gender, dietary condition, and body composition (fat and muscle mass) were among the primary variables gathered. Based on the cut-off values determined from the data, muscle mass was classified as either normal or low, and fat mass as either normal or high. The cutoff point for fat mass and muscle mass was determined using the ROC curve. A GEA brand stature meter was used to measure height, and the Tanita BC 545N BIA device was used to test weight and body composition. Measurements were taken in the morning, when the elderly came to take part in community activities. An identity form was used for interviews, and the Physical Activity Scale for Elderly (PASE) questionnaire was used to gauge participants' levels of physical activity. Levels of physical activity that met or surpassed the sex-specific mean score were classified as sufficient.

Version 24 of the Statistical Package for Social Science (SPSS) software was used to process the data after it had been converted into narrative and tabular formats. The frequency distribution of age, gender, body composition, nutritional status, and physical activity among the elderly was determined using a univariate approach. Using the Chi-Square test, a bivariate analysis was conducted to investigate the association between physical activity and body composition in the elderly.

3. Results

Data analysis was conducted on 94 elderly individuals obtained during two data collection periodsThe respondents' average age was 66.4 ± 4.4 years, with a minimum age of 60 and a maximum age of 78 years, according to the distribution of respondent characteristics. The proportion of old women was much higher than that of men (Table 1).

Based on the data distribution of the respondents' nutritional status, the majority of the elderly were categorized as having normal nutritional status. However, the number of elderly individuals who were overweight and obese was found to be equally high (Table 2).

Table 1. Characteristic distribution of respondents

Variable	n	%
Age		
60–69	76	80.8
70–78	18	19.2
Gender		
Male	12	12.8
Female	82	87.2

Table 2. Distribution of respondents' nutritional status

Variable	n	%
Severely underweight	1	1.1
Underweight	2	2.1
Normoweight	46	48.9
Overweight	17	18.1
Obesity	28	29.8

Table 3. Muscle mass percentage distribution among respondents by gender

Gender	Normal muscle mass		Low muscle mass	
	n	%	n	%
Male	6	50	6	50
Female	43	52.4	39	47.6

Table 4. Distribution of fat mass percentage among respondents by gender

Gender	Normal Fat Mass		High Fat Mass	
	n	%	n	%
Male	6	50	6	50
Female	43	52.4	39	47.6

The average muscle mass percentage for males was 72.1% ± 9.2, while for females it was 60.4% ± 7.3. The cutoff point for muscle mass percentage was 71.3% for males and 59.2% for females. In this study, muscle mass was categorized as normal if it was equal to or greater than 71.3% for males and 59.2% for females. The number of males in the normal and low muscle mass categories was the same, whereas more females were categorized as having normal muscle mass (Table 3).

Males had an average fat mass percentage of 23.8% ± 9.7, while females had an average of 36.1% ± 7.4. For males, the cutoff criterion for fat mass percentage was 24.7%, while for females, it was 37.2%. Less than or equal to 24.7% for males and 37.2% for females was considered normal fat mass in this study. The number of males in the normal and high fat mass categories was equal, while a greater number of females were categorized as having normal fat mass (see Table 4).

Males scored 150.5 ± 43.4 on the physical activity scale, while females scored 121.2 ± 45.2. If the score was more than or equal to 150.5 for males and 121.2 for females, the physical activity was considered appropriate. While more females were categorized as having appropriate physical activity, there were comparable numbers of males in the adequate and insufficient physical activity groups (Table 5).

Table 6 shows the link between physical activity and muscle mass in the elderly. The Chi-square test found a significant correlation ($p<0.05$) between physical activity and muscle mass in the elderly, with an odds ratio (OR) of 12.2 (95% CI: 4.6-32.5). Elderly people with insufficient physical activity are 12.2 times more likely to lose muscle mass than those with enough physical activity.

Table 5. Physical activity percentage distribution among respondents by gender

Gender	Adequate Physical Activity		Inadequate Physical Activity	
	n	%	n	%
Male	6	50	6	50
Female	46	56.1	36	43.9

Table 6. The association between elderly people's level of physical activity and muscle mass

Physical Activity	Muscle Mass				Total		P value	OR	CI 95%
	Low		Normal						
	n	%	n	%	n	%			
Inadequate	33	35.1	9	9.6	42	44.7			
Adequate	12	12.8	40	42.6	52	55.3	0.001	12.2	4.6-32.5
Total	45	47.9	49	52.1	94	100			

Table 7. The relationship between physical activity level and fat mass in the elderly

Physical Activity	Fat Mass				Total		P value	OR	CI 95%
	High		Normal						
	n	%	n	%	n	%			
Inadequate	32	34	10	10.6	42	44.7			
Adequate	13	13.8	39	41.5	52	55.3	0.001	9.6	3.7-24.8
Total	45	47.9	49	52.1	94	100			

Table 7 shows the relationship between physical activity and fat mass in the elderly. The results of the Chi-square test yielded a p-value of 0.001 for fat mass, with an odds ratio (OR) of 9.6 (95% CI: 3.7–24.8), indicating a significant relationship ($p<0.05$) between physical activity and fat mass in the elderly. Elderly individuals with insufficient physical activity have a 9.6 times higher likelihood of increased fat mass compared to those with adequate physical activity.

4. Discussion

According to this study, 87.2% of the respondents were female, and their average age was 66.4 years. Similar studies by Morisawa et al. found average ages of 69.3 and 71.9 years, respectively, in elderly communities.[7] This study found a higher number of elderly women than men, consistent with previous research.[8,9] This could be attributed to the fact that many women in the population are housewives, thus having more time to engage in community activities.

In terms of nutritional status, most respondents were categorized as having normal nutritional status, though the number of respondents categorized as overweight was not significantly different. Studies by Chen et al. also found that most elderly individuals had a normal nutritional status.[10] On the other hand, most senior people were categorized as overweight, according to Monteiro et al. and Laddu et al. [11,12] One possible explanation for this disparity is that the older participants in those studies were residing in nursing homes, where their physical activity levels were lower, leading to lower PASE scores.

Regarding muscle mass, the average muscle mass for males was higher than for females. Research by Falsarella et al. and Schorr et al. also found higher muscle mass in men compared to women.[13,14] Along with low muscle mass and excessive fat content, frailty in the elderly is characterized by low muscular mass.[15] Anabolic hormone deficiencies are strong predictors of frailty status. A number of anabolic hormones, including growth hormone and estrogen, which are crucial for preserving muscle mass and strength, are produced less frequently as people age.[16] When aging-related muscle loss is combined with an increase in fat mass, the result is sarcopenic obesity (SO), which is strongly linked to decreased activity, mobility problems, and self-care challenges in the elderly.[17] After the ages of 50 and 70, muscle mass declines by 1% to 2% and 3%, respectively. Because males tend to do more physically demanding activities than women, and because testosterone helps maintain muscle mass, men biologically have more bone density, more muscle mass, and less body fat than women. Preventing SO can begin with increasing physical activity.[18] Therefore, it is necessary to carry out screening by routinely measuring the muscle mass of the elderly.

According to the respondents' fat mass distribution, women generally possessed more fat mass than men. This result is in line with research showing that women typically have more fat mass than men, as reported by Loginov et al. and Falsarella et al. Weight and fat accumulation result from a 5–25% drop in basal metabolic rate, which raises fat mass.[9,13]

The synthesis of interleukin-6 and other adipokines is increased by increased fat mass, and this can directly catabolize muscles and increase insulin resistance.[19] Muscle mass decreases and fat increases as a result of this cycle. 19. A 3,000-subjects study found that the amount of body fat increased gradually from age 20 to age 70, with a 10% difference between men and women.[20] Between the ages of 46 and 52, women experience menopause, and the elderly enter a postmenopausal condition. A steady decrease in estrogen levels is a hallmark of menopause. Women's fat mass is bigger than men's because estrogen can alter the distribution and quantity of body fat, increasing both central and total body fat.[21]

In Sri Lankan senior communities, physical activity has been demonstrated to enhance strength, balance, and functional ability.[22] Promoting physical activity among the elderly is a challenge, especially for those with comorbidities.[23] Elderly physical activity levels decrease with age, and this decline is more prominent among elderly women. Men generally engage in more outdoor activities than women, likely because women, particularly housewives, spend more time at home.[24] However, elderly men who frequently experience falls show reduced recreational or house-related activities compared to those who fall less often.[25]

The results of Oh et al. and Verlaan et al., who found a correlation between physical activity and muscle mass, are supported by this study. Older adults with low muscle mass had lower physical activity scores than those with normal muscle mass ($p=0.001$ for both investigations).[26,27] Nevertheless, Theodorakopoulos et al. found no significant correlation between muscle mass and physical activity ($p=0.42$), which might be because research participants received an extra 15 grams of protein daily.[28]

For older populations, adequate physical exercise is essential because it increases muscle mass and strength, preventing frailty.[12] Reduced physical activity, poor diet, a drop in type II muscle fibers, and a decrease in growth hormone release are the main factors contributing to the loss of muscle mass in the elderly.[29] By directly targeting the mechanisms causing muscle mass reduction, such as decreasing fat infiltration, boosting satellite cells, and reducing inflammation, physical activity improves muscle mass and function in the aged.[30] Regular physical activity improves muscle mass and basal metabolic rate.[31] However, the elderly should not only rely on their physical activities during community event meetings, which may only take place once a week. Health education needs to be provided regarding physical activities that the elderly can do at home

routinely.

This study also supports the findings of Nangoy & Kumala, indicating that physical activity can lead to changes in body composition by slowing the increase in fat mass.[12,32] Research on pre-elderly and elderly populations shows that physical activity is inversely related to body mass index and fat mass. In two individuals with the same body mass index, the more physically active individual may have a lower percentage of body fat.[33]

Higher levels of physical activity lead to greater energy expenditure. The primary energy source during physical activity is derived from food, but once food-derived energy is depleted, the body compensates by metabolizing stored fat. This process, if sustained, will result in a gradual reduction in fat mass.[34] In contrast, Morisawa et al. did not find significant changes in body composition but did observe beneficial effects on physical, vascular, and quality of life functions after a six-month follow-up.[7]

This study has several limitations. This research design cannot explain the cause and effect between variables. Body composition measurement using a simple method with a portable BIA device. There are other more accurate ways to measure body composition, but measurement using a portable BIA is the most feasible for research with elderly subjects. The research was conducted in an elderly community where the majority of members are naturally female, so the gender proportion is unbalanced. This study did not identify other variables that might have an influence, such as the presence of disease, especially degenerative disease. Future studies could explore other factors affecting body composition, such as nutrition and comorbidities, to complement the findings of this research.

5. Conclusion

Elderly people's levels of physical activity and their muscle as well as fat mass are significantly correlated. Frequent exercise is essential for maintaining muscle mass and assisting in the reduction of fat mass, which is especially critical for older persons to preserve their general health and mobility. Muscle strength is better maintained and the risk of obesity and other age-related disorders declines with increased physical exercise. Therefore, encouraging physical exercise in older adults is crucial for maintaining muscle mass, reducing body fat, and improving general health. It is essential to implement customized exercise programs for senior citizens in order to improve their physical and mental health and, consequently, their quality of life.

6. Acknowledgement

Our sincere appreciation goes out to the coordinator and the senior residents of Palembang for their invaluable involvement in this research. Additionally, we would like to sincerely thank Dr. Muhammad Hoesin Palembang and the RSUP management for their unflinching assistance in making this research a success. Furthermore, we are profoundly grateful to Dr. Nur Riviati, Sp.PD-KGer, FINASIM for her expert guidance and constructive feedback in refining and enhancing the quality of this study.

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