ORIGINAL ARTICLE

Prevalence and Factors Related to Sarcopenia in Older Adults in a Tertiary Care Hospital: A Cross-Sectional Study

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Background: Sarcopenia frequently manifests in an aging population. Its prevalence is notable among adults aged 60 to 70 years, affecting 5% to 13% of this age group. The prevalence increases over the age of 80, encompassing a range of 11% to 50%. This significantly heightens the risk of various health conditions, including falls and infections. To alleviate the challenges posed by sarcopenia, it is imperative that factors associated with the condition are thoroughly investigated and well-established.

Objective: To examine the prevalence of sarcopenia among older adults and explore the factors associated with this condition in depth.

Materials and Methods: The present study was a retrospective cross-section study. The data were obtained through a meticulous review of medical records and diet diaries of elderly patients in the Geriatric Clinic of Rajavithi Hospital between November 2022 and May 2023. Three hundred forty-one adults aged 60 years and above were included as participants in the study. To analyze the data comprehensively, both univariate and multivariate logistic regression analyses were employed as the primary statistical methods.

Results: The prevalence of sarcopenia was 36.66%. Several factors exhibited a significant association with sarcopenia, including age over 74 years (adjusted odds ratio [OR] 4.89, 95% CI 2.51 to 9.50, p<0.001), absence of obesity (adjusted OR 0.16, 95% CI 0.06 to 0.40, p<0.001), daily protein intake of 60 grams or less (adjusted OR 6.50, 95% CI 2.80 to 15.09, p<0.001) and daily energy intake 1,410 kilocalories or less (adjusted OR 2.49, 95% CI 1.06 to 5.82, p=0.036).

Conclusion: The prevalence of sarcopenia among the elderly patients in the geriatric clinic was significantly elevated. Sarcopenia exhibited statistically significant association with age, obesity, protein intake, and energy intake per day. Therefore, ensuring sufficient daily protein intake should be a priority in preventing sarcopenia among older adults.

Keywords: Sarcopenia; Obesity; Macronutrient; Protein; Older adult

Received 19 January 2024 | Revised 27 March 2024 | Accepted 2 April 2024

J Med Assoc Thai 2024;107(5):349-55

Website: http://www.jmatonline.com

Malnutrition emerges as a pivotal concern within the demographic of aging population, constituting a notable percentage ranging from 18% to 54% of the Thai community[1,2]. This phenomenon is accompanied by a confluence of physiological transformations in older individuals, encompassing delayed gastric emptying time, alterations of hormones and neurotransmitters, and the manifestation of silent inflammation[3].

Malnutrition gives rise to a spectrum of health-related issues, including compromised immunity, diminished cognitive function, heightened susceptibility to cardiovascular diseases, and an elevated risk of falls and fractures[4,5]. These repercussions, in turn, contributed to increased disability, diminished quality of life, and heightened mortality rates among aging individuals.

The elderlies experience a reduction in muscle mass, amounting to approximately 8% between the ages of 40 and 70. Furthermore, with each successive decade, there is an additional decline of 15% in muscle mass among them. Between the age of 60 and 70 years, the prevalence of sarcopenia is documented to range from 5% to 13%. This prevalence exhibits a notable escalation in individuals surpassing 80 years, reaching proportions between 11% and 50%[3].

Furthermore, sarcopenic obesity exacerbates deleterious outcomes among aging individuals, surpassing the impact observed with either sarcopenia or obesity in isolation[6-9]. This condition is associated with an elevated rate of morbidity and

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How to cite this article:

Ruangkiatkul N, Boonyapisomparn R. Prevalence and Factors Related to Sarcopenia in Older Adults in a Tertiary Care Hospital: A Cross-Sectional Study. J Med Assoc Thai 2024;107:349-55.

DOI: 10.35755/jmedassocthai.2024.5.13989

mortality. Additionally, individuals afflicted with sarcopenic obesity face an augmented risk of type II diabetes mellitus, compromised cognitive function, osteoporosis, and a diminished quality of life[6].

As previously discussed, sarcopenia constitutes a multifaceted subject with deleterious implications for the health of aging individuals. It is imperative to systematically address the factors correlated with this condition to devise effective solutions for ameliorating its impact. Furthermore, research on sarcopenia in Thailand has been limited, particularly in the context of tertiary hospitals. The present study aimed to evaluate the prevalence and factors associated with sarcopenia among aging individuals.

Materials and Methods

The present study constituted a retrospective cross-sectional study wherein data were acquired through the examination of medical records pertaining to aging individuals at the Geriatric Clinic of Rajavithi Hospital during the period spanning November 2022 to May 2023. The study encompassed 341 elderly patients, aged 60 years and above, all of whom had undergone a comprehensive body composition assessment through bioelectrical impedance analysis (BIA) utilizing the InBody 570 device and their diet diaries available. The sample size was calculated based on Nguyen et al.'s (2020)[10], using Wayne's single proportion formula from 1995[11].

$$n = \frac{Z^2_{\alpha/2}\, p(1-p)}{d^2}$$

According to Wayne's single proportion formula, α was set at 0.05, p was set at 0.547, and d was set at 0.06. After incorporating into the formula, n was calculated to be 265.

$$n = \frac{1.96^2 \times 0.547 \times (1-0.547)}{0.06^2}$$

$$n = 265$$

However, there were 341 older adults who attended the geriatric clinic and underwent body composition assessments, therefore, all of them would be considered participants.

To maximize external validity, it was noteworthy that individuals afflicted with severe medical conditions such as end-stage renal disease, severe major neurocognitive disorder, and those under palliative care were deliberately excluded from the study. As well, individuals unable to undergo BIA evaluation were excluded from the study, including those with pacemaker.

Sarcopenia in the present study was operationalized according to the Asian Working Group for Sarcopenia (AWGS) 2019 criteria, defining it as an appendicular skeleton muscle (ASM) less than seven kilograms per meter squared (kg/m²) in males and 5.7 kg/m² in females, as determined by BIA. This definition encompassed criteria for poor grip strength denoted as less than 28 kg in males and 18 kg in females[12,13]. Additionally, obesity was delineated by a body mass index (BMI) exceeding 25 kg/m².

Furthermore, the term sarcopenic obesity was employed to identify individuals meeting the concurrent criteria for both sarcopenia and obesity within the confines of the present study[14].

The macronutrient and caloric intake of participants were assessed through the compilation of diet diaries covering two weekdays and one weekend day. Subsequently, the data extracted from these diet diaries underwent analysis to determine the respective averages.

Univariate and multivariate logistic regression analyses were conducted to examine the association between various factors and sarcopenia, employing IBM SPSS Statistics, version 28.0 (IBM Corp., Armonk, NY, USA) for statistical computations. The predetermined level of significance for the present study was set at p-value less than 0.05. From univariate logistic regression results, factors significantly related with sarcopenia were applied to multivariate logistic regression analysis.

The determination of cut-off levels for the identified factors was accomplished through the examination of receiver operating characteristic (ROC) curves using the maximum of Youden's index. Notably, fat intake and exercise were excluded from the subsequent multivariate logistic regression analysis due to observed collinearity with energy intake. Exercise was excluded from the multivariate logistic regression because only one participant reported no exercise. Additionally, daily fat consumption was omitted from the multivariate logistic regression due to collinearity with energy intake.

Ethical approval

The present study was approved by the Ethic Committee of the Rajavithi Hospital in 2022 (approval number 159/2566), which adhered to the SIDCER-FERCAP standard. Thus, the confidentiality and privacy of the participants' medical records and data were managed properly.

Results

Three hundred forty-one individuals were

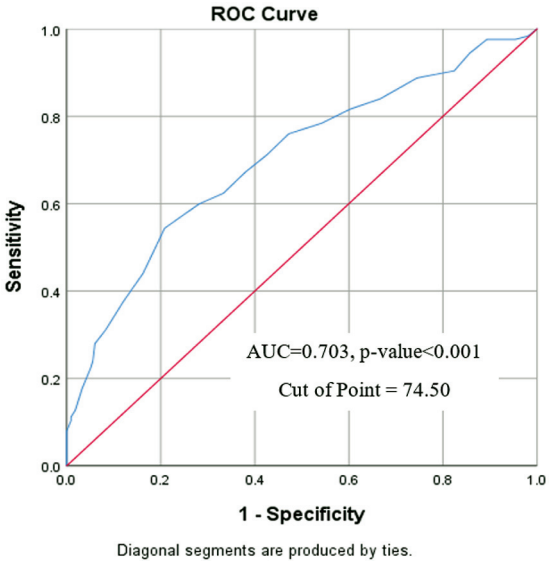

Figure 1. The ROC curve of participants' age.

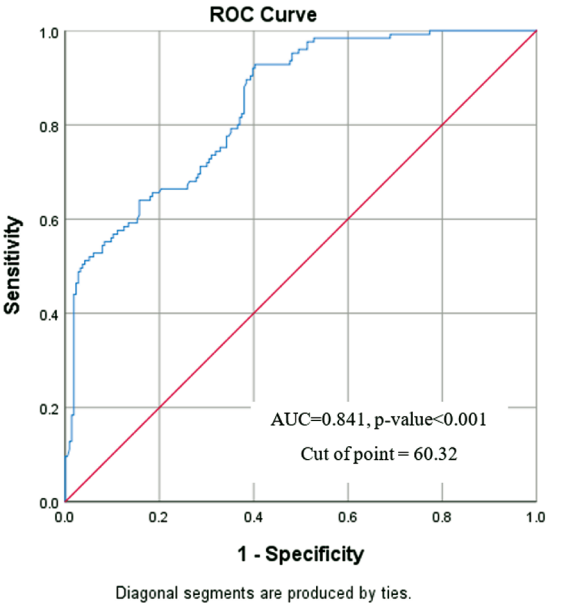

Figure 2. The ROC curve for participants' daily protein intake.

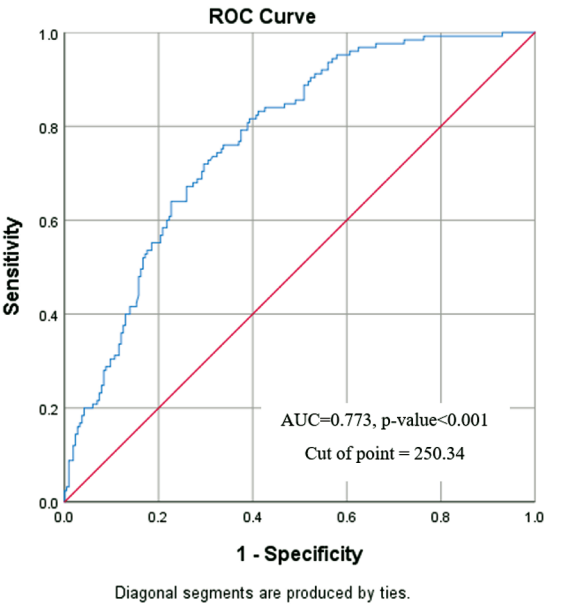

Figure 3. The ROC curve of participants' daily carbohydrate.

included and 138 participants (40.47%) were identified as having obesity. Sarcopenia was observed in 125 participants (36.66%), while a smaller subset of nine participants (2.64%) presented sarcopenic obesity.

The predominant demographic among the participants was female, constituting 238 individuals (69.79%). The mean age of the participants was 71.63±0.37 years. Two hundred thirty-three respondents (68.33%) were unemployed, with 26 individuals (7.67%) being employed, 33 individuals (9.67%) were business owners, and 49 individuals (14.37%) were retired government officials. The average income of the participants was recorded at 6,000 (min-max 600 to 60,000) or (IQR 3,000 to 10,000) Baht.

Two participants did not report any chronic health conditions, whereas 114 participants (33.53%), reported having two chronic health conditions.

The nutritional profile of the participants revealed an average protein intake of 58.95±1.36 grams per day (g/day), carbohydrate intake amounting to 258±5.22 g/day, fat intake averaging 38.99±1.07 g/day, and a daily caloric intake of 1,626.05±28.91 kilocalories (kcal).

Two hundred twelve individuals (62.17%) did not engage in regular exercise. Aerobic exercise was reported by 121 participants (35.48%), while five participants (1.47%) engaged in balance training, and three participants (0.88%) adhered to strengthening exercises on a regular basis. The average duration of exercise across the participants was 182.95±10.99 minutes per week.

The cut-off levels for differentiating participants into groups were calculated using ROC curve, as illustrated in Figure 1-5.

The investigation revealed notable distinctions in age, obesity, occupation, exercise habits, as well as protein, carbohydrate, fat, and calorie intake between individuals identified as sarcopenic and those categorized as non-sarcopenic. A detailed

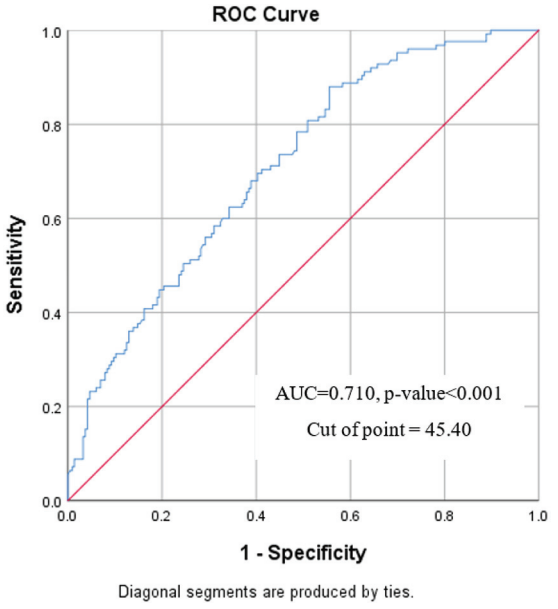

Figure 4. The ROC curve of participants' daily fat intake.

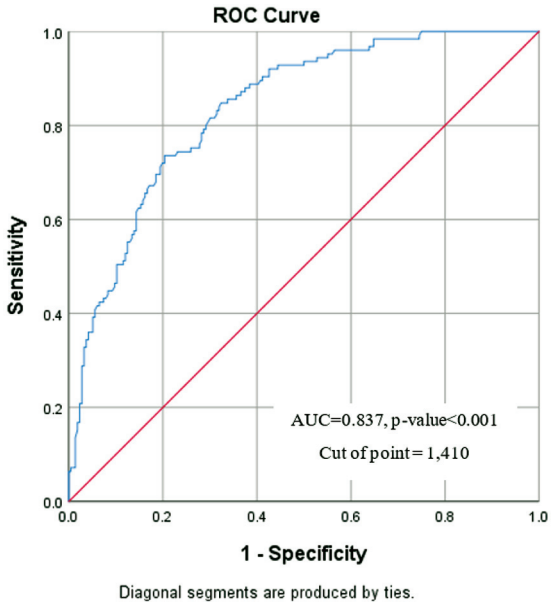

Figure 5. The ROC curve of participants' daily energy intake.

comparative analysis is provided in Table 1.

Factors were identified as being solely associated with sarcopenia. These factors include age (crude odds ratio [OR] 4.53, 95% confidence interval [CI] 2.80 to 7.34, p<0.001), protein intake (OR 17.05, 95% CI 8.46 to 34.37, p<0.001), carbohydrate intake (OR 6.29, 95% CI 3.75 to 10.54, p<0.001), calorie intake (OR 10.90, 95% CI 6.50 to 18.29, p<0.001), and obesity (OR 0.05, 95% CI 0.03 to 0.11), as illustrated in Table 2. These factors were incorporated into multivariate logistic regression.

Table 1. Characteristics of the participants (n=341)

Factors	Sarcopenia; n (%)		p-value
	Yes	No	
Sex			0.199
Female	82 (34.5)	156 (65.5)	
Male	43 (41.7)	60 (58.3)	
Age (years)			<0.001*
≤74	57 (25.0)	171 (75.0)	
>74	68 (60.2)	45 (39.8)	
Obesity			<0.001*
No	116 (57.1)	87 (42.9)	
Yes	9 (6.5)	129 (93.5)	
Occupation			0.030*
Un-employed	97 (41.6)	136 (58.4)	
Retired	11 (22.4)	38 (77.6)	
Self-employed	11 (33.3)	22 (66.7)	
Employee	6 (23.1)	20 (76.9)	
Smoke			1.000
No	123 (36.8)	211 (63.2)	
Yes	2 (28.6)	5 (71.4)	
Alcohol Drinking			0.715
No	123 (36.9)	210 (63.1)	
Yes	2 (25.0)	6 (75.0)	
Number of Chronic health conditions			0.938
0	0 (0.0)	2 (100)	
1	28 (44.4)	35 (55.6)	
2	39 (34.2)	75 (65.8)	
3	36 (34.3)	69 (65.7)	
4	14 (35.0)	26 (65.0)	
5	7 (50.0)	7 (50.0)	
6	1 (50.0)	1 (50.0)	
Exercise			0.016*
Did not engage in regular exercise	1 (100)	0 (0.0)	
Balancing	2 (40.0)	3 (60.0)	
Aerobics	32 (26.4)	89 (73.6)	
Strengthening	0 (0.0)	3 (100)	
Protein (g/day)			<0.001*
≤60	115 (56.9)	87 (43.1)	
>60	10 (7.2)	129 (92.8)	
Carbohydrate (g/day)			<0.001*
≤250	100 (54.3)	84 (45.7)	
>250	25 (15.9)	132 (84.1)	
Fat (g/day)			<0.001*
≤45	107 (47.1)	120 (52.9)	
>45	18 (15.8)	96 (84.2)	
Energy (calories/day)			<0.001*
≤1,410	92 (67.6)	44 (32.4)	
>1,410	33 (16.1)	172 (83.9)	

Table 2. Univariate and multivariate logistic regression between factors and sarcopenia

Factors	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
Age (years)				
≤74	Ref.		Ref.	
>74	4.533 (2.80 to 7.34)	<0.001*	4.89 (2.51 to 9.50)	<0.001*
Obesity				
No	Ref.		Ref.	
Yes	0.05 (0.03 to 0.11)	<0.001*	0.16 (0.06 to 0.40)	<0.001*
Occupational				
Employee	Ref.		Ref.	
Unemployed	2.38 (0.92 to 6.14)	0.074	2.06 (0.55 to 7.77)	0.287
Retired	0.97 (0.31 to 3.00)	0.951	1.43 (0.30 to 6.86)	0.657
Self-employed	1.67 (0.52 to 5.34)	0.390	2.81 (0.57 to 13.85)	0.205
Protein (grams per day)				
>60	Ref.		Ref.	
≤60	17.05 (8.46 to 34.37)	<0.001*	6.50 (2.80 to 15.09)	<0.001*
Carbohydrate (grams per day)				
>250	Ref.		Ref.	
≤250	6.29 (3.75 to 10.54)	<0.001*	1.20 (0.51 to 2.86)	0.676
Energy (Calories per day)				
>1,410	Ref.		Ref.	
≤1,410	10.90 (6.50 to 18.29)	<0.001*	2.49 (1.06 to 5.82)	0.036*

OR=odds ratio; CI=confidence interval

Following a comprehensive analysis employing multivariate logistic regression, several variables exhibited significant associations with sarcopenia. Specifically, age (adjusted OR 4.89, 95% CI 2.51 to 9.50, p<0.001), obesity (adjusted OR 0.16, 95% CI 0.06 to 0.40, p<0.001), protein (adjusted OR 6.50,95% CI 2.80 to 15.09, p<0.001), and energy intake (adjusted OR 2.49, 95% CI 1.06 to 5.82, p<0.036) demonstrated statistically significant correlations with sarcopenia. The detailed statistical results are presented in Table 2.

Discussion

The prevalence of sarcopenia among elderly patients attending the geriatric clinic in the present study was determined to be 36.66%, a rate notably lower than that reported in a study conducted in Vietnam, where the prevalence was documented at 54.7%[10]. Conversely, this figure exceeded the prevalence observed in aging population within the community, ranging between 10% and 16%[15,16]. This disparity in prevalence rates may be attributed to the specific setting of the present study, conducted within a geriatric clinic.

Age has been established as a significant factor associated with sarcopenia, indicating a positive correlation wherein higher age is associated with an increased prevalence of sarcopenia. This observation aligns with studies in Vietnam and Thailand[10,17]. Furthermore, this relationship can be elucidated through an understanding of the pathophysiology of sarcopenia[18].

Obesity has been identified as having a negative correlation with sarcopenia, a conclusion that aligns with the outcomes of previous studies[10,17]. Additionally, research[2,7,10,15,19-21] has consistently reported a positive association between malnutrition and sarcopenia. This is underscored by the observation that an energy consumption level of 1,410 kcal or lower is associated with an increased prevalence of sarcopenia.

Protein consumption 60 g/day and lower positively associated with sarcopenia. This finding is similar to the previous studies[16,22-26]. However, studies[15,19] found that lipid consumption is also associated with sarcopenia, but not in the present study as it has collinearity with other factors.

Daily protein consumption of 60 g or lower has been identified as being positively associated with sarcopenia, a discovery consistent with the study conducted by Buaudart et al. in 2019[15]. However, it is noteworthy to mention that certain studies have indicated an association between lipid consumption and sarcopenia. In the present study, it is important

to note that lipid consumption exhibited collinearity with other factors, potentially complicating the interpretation of its specific association with sarcopenia.

However, as the present study was conducted within a geriatric clinic, it is plausible that the observed prevalence of sarcopenia might be higher compared to community-based studies. Additionally, the data on macronutrient consumption were obtained through recall, introducing the possibility of recall bias. To enhance the generalizability of findings, it is recommended that further research be undertaken in diverse geographic locations, including older adults with severe health conditions. Utilizing dual X-ray absorptiometry to evaluate body composition and setting determination of significance at $p<0.01$ would strengthen the study's validity.

Conclusion

The prevalence of sarcopenia was notably high among elderly patients attending the geriatric clinic. Age exhibited a positive correlation with sarcopenia, indicating an increased likelihood of sarcopenia with advancing age. Conversely, obesity, protein intake, and daily energy consumption demonstrated negative correlations with sarcopenia, suggesting a potential protective effect against the development of sarcopenia with higher levels of these factors. Therefore, proper nutrition should be a focal point in health promotion and prevention among older adults.

What is already known on this topic?

Sarcopenia constitutes a significant concern among the aging population, contributing to heightened mortality and morbidity rates. Moreover, the prevalence of sarcopenia escalates with advancing age. Addressing sarcopenia necessitates a comprehensive approach that includes ensuring adequate protein intake and incorporating resistance exercises into the regimen.

What does this study add?

With respect to the prevention of sarcopenia, it is imperative to underscore the significance of maintaining an adequate daily intake of both protein and calories. Furthermore, this study elucidates the specific thresholds of protein and calorie consumption that exhibit a statistically significant association with the occurrence of sarcopenia.

Conflicts of interest

The authors declare no conflict of interest.

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