Research article

DOI: 10.59715/pntjmp.4.3.22

The relationship between sarcopenia and knee osteoarthritis in elderly patients

Han Duc Dat[1,3], Trinh Thi Bich Ha[2], Huynh Trung Quoc Hieu[2], Hoang Quoc Nam[3], Le Thi Hue[3], Ho Si Dung[1,3], Nguyen Duy Cuong[3], Le Phuong Ngan[1], Bui Thi Cam Hien[1], Cao Thanh Ngoc[2], Nguyen Duc Cong[1,3]

[1]Pham Ngoc Thach University of Medicine
[2]University of Medicine and Pharmacy at Ho Chi Minh City
[3]Thong Nhat Hospital

Abstract

Introduction: The coexistence of sarcopenia and knee osteoarthritis (KOA) in the elderly increases the severity of knee degeneration, heightens knee pain levels, raises the risk of falls, reduces activity capacity, and decreases quality of life, thereby leading to higher rates of disability and dependency.

Methods: A cross-sectional study was conducted on 252 patients aged ≥60 (with and without KOA at the Department of Rheumatology of Thong Nhat Hospital in Ho Chi Minh City, from November 2023 to May 2024. KOA was diagnosed according to the American College of Rheumatology (ACR) criteria established in 1991. Appendicular Skeletal Muscle was assessed using the InBody 270 bioelectrical impedance analysis device, and sarcopenia was diagnosed based on the 2019 consensus of the Asian Working Group for Sarcopenia (AWGS).

Results: The mean age was 72.95 ± 8.29 years, with females accounting for the majority (72.2%). The prevalence of sarcopenia in elderly patients with KOA was 54.0%, compared to 36.5% in those without KOA. Multivariate logistic regression analysis showed an association between sarcopenia and KOA, with an odds ratio (OR) of 3.38 (95% CI: 1.74 – 6.57, p<0.001).

Conclusions: Sarcopenia is highly prevalent among elderly patients with KOA. There are several factors associated with KOA, including sarcopenia, with OR = 3.38 (95% CI: 1.74 – 6.57, p <0.001).

Keywords: sarcopenia, knee osteoarthritis, the elderly.

Received: 20/5/2025
Revised: 20/6/2025
Accepted: 20/7/2025
Author contact:
Nguyen Duc Cong
Email: cong1608@gmail.com
Phone: 0982160860

1. INTRODUCTION

Sarcopenia is a common aging-related syndrome in the elderly. The 2019 Asian Working Group for Sarcopenia (AWGS) defines sarcopenia as a syndrome characterized by age-related loss of skeletal muscle mass, accompanied by reduced muscle strength and/or physical performance [1]. Sarcopenia in the elderly can result in adverse outcomes such as increased cognitive decline, functional impairment, higher risk of osteoporosis, falls, fractures, increased hospitalization, higher risk of metabolic syndrome (hypertension, diabetes), and increased rates of depression. Additionally, it raises mortality, the risk of serious complications, postoperative infections, hospital stay duration, and reduces survival in hospitalized elderly individuals [2].

The association between sarcopenia and knee osteoarthritis (KOA) is described as a pathological loop in older adults. In elderly patients, a high body mass index (BMI) increases the number of adipose cells, which stimulates the production of adipokines like leptin – a factor that promotes inflammation. This chronic inflammatory environment reduces muscle synthesis and accelerates cartilage destruction. The combination of muscle mass loss and cartilage damage impairs physical function. As mobility decreases, physical activity declines, which increases BMI and perpetuates the disease cycle. This vicious circle can begin at any point — increased BMI, reduced muscle mass, or cartilage damage [3].

As defined above, sarcopenia is a progressive loss of skeletal muscle mass and function with age, beginning after age 30 and accelerating after age 60 due to hormonal changes, reduced anabolic signaling, and mitochondrial dysfunction [4]. Low physical activity is associated with higher probable sarcopenia and sarcopenia risk; sedentary behavior is linked to increased muscle wasting and reduced neuromuscular efficiency [5]. Furthermore, malnutrition—or even the risk of it—plays a pivotal role in accelerating sarcopenia. Inadequate intake of protein, vitamin D, and other micronutrients compromises muscle protein synthesis, impairs recovery after muscle injury, and increases systemic inflammation [6].

The coexistence of sarcopenia and KOA in the elderly worsens KOA severity, increases knee pain, raises fall risk, reduces mobility and quality of life, thereby elevating disability and dependency [7]. The link between sarcopenia and KOA in elderly Vietnamese patients has not received sufficient attention, even though international studies have shown its adverse impact. Therefore, this study aims to investigate the relationship between sarcopenia and KOA in elderly patients.

2. METHODS:

2.1. Study subjects: Elderly patients (≥60 years old) visiting the Department of Rheumatology, Thong Nhat Hospital (Ho Chi Minh City) from November 2023 to May 2024.

Inclusion criteria:

- Patients aged ≥60 years.
- Ability to communicate.
- Ability to walk independently.
- Voluntarily agreed to participate in the study.
- No use of any analgesic medications within the past two weeks.

Exclusion criteria:

- Patients with acute inflammatory arthritis (such as gout, pseudogout, septic arthritis…).
- Diagnosed with other rheumatic diseases (such as rheumatoid arthritis, ankylosing spondylitis, systemic lupus erythematosus…).
- Having joint deformities affecting gait.
- Patients with edema, fluid retention, or terminal-stage cancer.

Diagnosis of KOA was based on the 1991 clinical diagnostic criteria of the American College of Rheumatology (ACR) (dignostic criteria was showed in key study variables below) [8]. Participants were divided into two groups: KOA group and non-KOA group.

2.2. Research method:

Research design: Cross-sectional study.

Sample size: Survey of the relationship between sarcopenia and KOA:

$$p_2 = \frac{p_1 OR}{1 + p_1(OR - 1)}$$

$$n_{Disease} = n_{Reference} \geq \frac{\left[Z_{1-\frac{\alpha}{2}}\sqrt{2p(1-p)} + Z_{1-\beta}\sqrt{p_1(1-p_1) + p_2(1-p_2)}\right]^2}{(p_2 - p_1)^2}$$

In which: α: type 1 error probability is 0.05, resulting in Z_(α/2)=1.96;
β: type 2 error probability is 0.2;
p_1=0.312: TC rate in elderly patients without KOA (reference group) according to the study of Francesco et al. (2023) [8];
OR=2.07: odds ratio of the association between sarcopenia and KOA in the elderly, according to the study of Francesco et al (2023) [9];

Therefore, the minimum sample size of the elderly patient group without KOA (reference group) is 126 and the minimum sample size of the elderly patient group with KOA is 126.

The study recruited 252 elderly patients. Of these, 126 patients had KOA and 126 patients did not have KOA. Sampling technique: continuous sampling, all elderly patients who came to the Department of Rheumatology, Thong Nhat Hospital during the study period would be interviewed if the patient agreed to participate in the study and met the sampling criteria as well as did not have any exclusion criteria would be included in the study. This process took about 15 - 20 minutes for each patient. Patients were informed and voluntarily commit to participate in the study.

Key study variables:

- KOA: Diagnosed based on the clinical, laboratory, and radiographic criteria of the American College of Rheumatology (ACR) 1991, including the following elements: (1) Knee joint pain on most days of the previous month; (2) Osteophytes at the joint margins on radiographs; (3) Degenerative synovial fluid (must have at least 2 of the following: clear, viscous, white blood cell count < 2,000 cells/mL); (4) Age ≥ 40 years; (5) Morning stiffness lasting ≤ 30 minutes; (6) Crepitus during movement. A diagnosis of KOA is confirmed if one of the following criteria is met: (1) and (2); or (1), (3), (5), (6); or (1), (4), (5), (6) [8].

- Sarcopenia: Diagnosed according to the 2019 consensus of the Asian Working Group for Sarcopenia (AWGS) when meeting either (1) + (2); or (1) + (3); or all three of the following criteria [1]: (1) Low skeletal muscle mass: Skeletal Muscle Index (SMI) < 7.0 kg/m² in men and < 5.7 kg/m² in women, measured by Bioelectrical Impedance Analysis (BIA). SMI = Appendicular Skeletal Muscle (ASM)/Height². ASM is assessed using the InBody 270 bioelectrical impedance analyzer; (2) Low handgrip strength: < 28 kg for men and < 18 kg for women; (3) Low gait speed over 6 meters: < 1 meter/second.

- Body Mass Index (BMI) (kg/m²): Calculated using the formula: BMI = Weight (kg) / Height² (m²). BMI classification according to WHO standards for Asian populations: Underweight: BMI < 18.5; Normal: BMI 18.5 – 22.9; Overweight: BMI 23 – 24.9; Obese: BMI ≥ 25 [10].

- Nutritional status assessment: Evaluated using the Mini Nutritional Assessment – Short Form (MNA-SF) for the elderly. The MNA-SF consists of six questions focusing on food intake, weight loss, mobility, psychological stress or acute illness, neuropsychological problems, and BMI. The total score ranges from 0 to 14 and is categorized as follows: 12–14 points: Normal nutrition; 8–11 points: At risk of malnutrition; ≤7 points: Malnourished [11].

- Physical activity level: defined as "moderate-high" when the patient engages in moderate-to-vigorous physical activity for at least 150 minutes per week of moderate-intensity activity or 75 minutes per week of vigorous-intensity activity, or a combination of both, spread throughout the week; "low" when the patient does not meet the above criteria [12].

2.3. Data analysis

Data were entered using Excel and analyzed with SPSS version 25. Qualitative variables were presented as frequencies (n) and percentages (%), while quantitative variables were described as mean ± standard deviation (Mean ± SD) if normally distributed, or as median and interquartile range (IQR) if not normally distributed. Differences between two qualitative variables were assessed using the Chi-square test or Fisher's exact test. For quantitative variables, the t-test was used when the data followed a normal distribution, and the Mann–Whitney U test was applied when the data did not follow a normal distribution. A p-value < 0.05 was considered statistically significant at a 95% confidence level.

2.4. Research Ethics

The study was approved by the Biomedical Research Ethics Council of Thong Nhat Hospital, Ho Chi Minh City (No. 87/2023/BVTN-HĐYĐ dated September 5, 2023).

3. RESULTS

Table 1. General characteristics of the study participants

	Total (n=252)	KOA group (n=126)	Non-KOA group (n=126)	p-value
Sex, n (%)				
Female	182 (72.2)	96 (76.2)	86 (68.3)	0.160*
Male	70 (27.8)	30 (23.8)	40 (31.7)	
Age (years), Mean ± SD	72.95±8.29	73.7±8.11	72.21±8.45	0.154#
Age groups, n (%)				
60 – 69	100 (39.7)	46 (36.5)	54 (42.9)	
70 – 79	94 (37.3)	49 (38.9)	45 (35.7)	0.581*
≥80	58 (23.0)	31 (24.6)	27 (21.4)	
BMI (kg/m^2), Mean ± SD	23.89±3.03	24.16±2.94	23.62±3.09	0.152#
BMI groups, n (%)				
<18.50	7 (2.8)	3 (2.4)	4 (3.2)	
18.50 – 22.99	93 (36.9)	39 (31)	54 (42.9)	0.115+
≥23.00	152 (60.3)	84 (66.7)	68 (54.0)	
Physical activity, n (%)				
Low	83 (32.9)	46 (36.5)	37 (29.4)	0.228*
High	169 (67.1)	80 (63.5)	89 (70.6)	
Comorbidities, n (%)				
Hypertension	196 (77.8)	108 (85.7)	88 (69.8)	**0.002***
Diabetes mellitus	75 (29.8)	39 (31.0)	36 (28.6)	0.679*
Nutritional status, n (%)				
Normal	142 (56.3)	68 (54.0)	74 (58.7)	
At risk of malnutrition / Malnourished	110 (43.7)	58 (46.0)	52 (41.3)	0.446*
Sarcopenia, n (%)				
Present	114 (45.2)	68 (54)	46 (36.5)	**0.005***
Absent	138 (54.8)	58 (46)	80 (63.5)	

[#]Independent samples t-test, [*]Chi-square test, [+]Fisher's exact test

Comments: The mean age was 72.95 ± 8.29 and the 60-69 age group had the highest proportion (39.7%). Women accounted for a higher proportion than men. The BMI was 23.89 ± 3.03 and the group with BMI ≥ 23.00 had the highest proportion (60.3%). The most common comorbidities were hypertension (77.8%) and diabetes (29.8%), in which there was a difference in the rate of hypertension between the group with and without KOA. The sarcopenia rate also recorded a statistically significant difference between the 2 groups with and without KOA.

Table 2. Univariate logistic regression analysis of factors associated with KOA in elderly patients (KOA group and reference group)

Factors	Group	p-value	OR	95% CI
Sarcopenia	Present	0.006	2.04	1.23 - 3.38
Age subgroup	60–69		1	
	70–79	0.394	1.28	0.73 – 2.25
	≥80	0.367	1.35	0.71 - 2.58
Sex	Female	0.161	1.45	0.85 - 2.59
Physical activity	Low	0.228	1.38	0.82 – 2.35
BMI subgroup	<18.50		1	
	18.50 – 22.99	0.962	0.96	0.20 – 4.55
	≥23.00	0.523	1.65	0.36 – 7.61
Nutritional status	Normal		1	
	At risk of malnutrition / Malnourished	0.446	1.21	0.74 - 1.99
Hypertension	Present	0.003	2.59	1.38 – 4.85
Diabetes mellitus	Present	0.679	1.21	0.65 - 1.92

Comments: Univariate logistic regression analysis showed that factors related to KOA in both groups (KOA group and reference group) included: sarcopenia and hypertension.

Table 3. Multivariate logistic regression analysis of factors associated with KOA in elderly patients (KOA group and reference group)

Factors	Group	p-value	OR	95% CI
Sarcopenia	Present	<0.001	3.38	1.74 – 6.57
Age subgroup	60–69		1	
	70–79	0.661	1.15	0.62 – 2.13
	≥80	0.627	0.83	0.40 – 1.74
Sex	Female	0.029	1.98	1.07 – 3.64
Physical activity	Low	0.935	1.03	0.57 – 1.85
BMI subgroup	<18.50		1	
	18.50 – 22.99	0.976	0.97	0.17 – 5.45
	≥23.00	0.341	2.34	0.0.41 – 13.42
Nutritional status	Normal		1	
	At risk of malnutrition / Malnourished	0.892	1.04	0.57 - 1.93
Hypertension	Present	0.003	3.03	1.48 – 6.22
Diabetes mellitus	Present	0.964	1.01	0.57 - 1.81

Comments: Multivariate logistic regression analysis showed that factors related to KOA in both groups (KOA group and reference group) included: sarcopenia, female and hypertension.

4. DISCUSSION

The results of this study recorded a prevalence of sarcopenia in the KOA group of 54.0%, which was statistically significantly different from the non-KOA group (36.5%) with p = 0.005. This study used a convenience sampling method, therefore, its strength lies in identifying whether there is a difference in the prevalence of sarcopenia between individuals with and without knee osteoarthritis; however, the study is not strong in determining the true prevalence of sarcopenia within each group. Compared with other studies, the prevalence of sarcopenia in elderly patients with KOA in this study was quite similar to that in the study by Vu Thi Huyen [13] (51.8%), but higher than in the study by Dharmakulsakti [7] conducted in Thailand (41.7%). This difference may be due to the use of the SARC-F tool in the Thai study to diagnose sarcopenia, which has lower sensitivity and specificity compared to the BIA method measured by the InBody device used to assess reduced skeletal muscle index, as applied in this study and that of Vu Thi Huyen. Moreover, when included in the multivariate regression model, this study also recorded a relationship between sarcopenia and KOA with OR = 3.38 (95% CI: 1.74 – 6.57, p <0.001). A systematic review and meta-analysis by Francesco et al. published in 2023 based on four studies in Asia also showed a relationship between sarcopenia and KOA in the elderly, with the prevalence of sarcopenia in the KOA group being 45.2% and in the non-KOA group being 31.2%, with OR = 2.07 (95% CI: 1.43–3.00) [9]. Additionally, due to potential sampling bias, the sarcopenia prevalence (45.2%) reported in the meta-analysis may differ from that found in this study (54.0%).

The explanation for the relationship between sarcopenia and KOA in the elderly lies in both physiological and pathological mechanisms. Age is a non-modifiable physiological risk factor that plays an important role in promoting the progression of both conditions. The older the individual, the higher the risk of KOA, and the inflammatory responses associated with aging affect muscle mass and muscle endurance, thereby accelerating sarcopenia [14]. The limitation of movement in the elderly also leads to decreased muscle elasticity and reduced stimulation for muscle fiber generation, resulting in sarcopenia. Particularly, sarcopenia in muscles around the knee increases the risk of KOA, as these muscles and the knee joint support each other in bearing body weight. Pain symptoms in KOA patients are pathological factors that lead to reduced mobility; this is the main symptom of KOA according to many reports [15]. Furthermore, the inflammatory response in KOA leads to circulating cytokines in the blood, which significantly contribute to the degeneration of skeletal muscle cells. Thus, a vicious pathological cycle is formed between KOA and sarcopenia.

Recommendation

The study duration of only six months is insufficient to represent the entire population of elderly patients, and sampling from a single healthcare facility may introduce selection bias. Therefore, we will strive to address these limitations in future studies.

5. CONCLUSION

Sarcopenia is highly prevalent among elderly patients with KOA. There are several factors associated with KOA, including sarcopenia, with OR = 3.38 (95% CI: 1.74 – 6.57, p <0.001).

REFERENCES

1. Chen LK, Woo J, Assantachai P, et al. Asian Working Group for Sarcopenia: 2019 Consensus Update on Sarcopenia Diagnosis and Treatment. *J Am Med Dir Assoc*. 2020;21(3):300-307.e2.doi:10.1016/j.jamda.2019.12.012.
2. Shuai Yuan, Susanna C. Larsson. Epidemiology of Sarcopenia: Prevalence, Risk Factors, and Consequences. *Metabolism*. 2023;144155533.doi:10.1016/j.metabol.2023.155533.
3. Pickering ME, Chapurlat R. Where Two Common Conditions of Aging Meet: Osteoarthritis and Sarcopenia. *Calcif Tissue Int*. 2020;107(3):203-211.doi:10.1007/s00223-020-00703-5.
4. Alfonso J. Cruz-Jentoft, Gülistan Bahat, Jürgen Bauer et al. Sarcopenia: Revised European Consensus on Definition and Diagnosis. *Age Ageing*. 2019;48(4):601.doi:10.1093/ageing/afz046.
5. Onni Hämäläinen, Anna Tirkkonen, Tiina Savikangas et al. Low Physical Activity Is a Risk Factor for Sarcopenia: A Cross-Sectional Analysis of Two Exercise Trials on Community-Dwelling Older Adults. *BMC Geriatrics*. 2024;24(1):212.doi:10.1186/s12877-024-04764-1.
6. Nifon K. Gkekas, Panagiotis Anagnostis, Vasileios Paraschou et al. The Effect of Vitamin D plus Protein Supplementation on Sarcopenia: A Systematic Review and Meta-Analysis of Randomized Controlled Trials. *Maturitas*. 2021;14556-63.doi:10.1016/j.maturitas.2021.01.002.
7. Dharmakulsakti P, Roopsawang I, Aree Ue S. Sarcopenia among Older Adults with Knee Osteoarthritis: A Cross-Sectional Study of Prevalence and Its Associated Factors. *Pacific Rim International Journal of Nursing Research*. 2022;26(1):121-134.
8. R.D. Altman. Classification of Disease: Osteoarthritis. *Semin Arthritis Rheum*. 1991;20(6 Suppl 2):40-47.doi:10.1016/0049-0172(91)90026-v.
9. Francesco Pegreffi, Alice Balestra, Orazio De Lucia et al. Prevalence of Sarcopenia in Knee Osteoarthritis: A Systematic Review and Meta-Analysis. *Journal of Clinical Medicine*. 2023;12(4):1532.doi:10.3390/jcm12041532.
10. Wen Harn Pan, Wen Ting Yeh. How to Define Obesity? Evidence-Based Multiple Action Points for Public Awareness, Screening, and Treatment: An Extension of Asian-Pacific Recommendations. *Asia Pac J Clin Nutr*. 2008;17(3):370-374.
11. M.J. Kaiser, J.M. Bauer, C. Ramsch et al. Validation of the Mini Nutritional Assessment Short-Form (MNA-SF): A Practical Tool for Identification of Nutritional Status. *J Nutr Health Aging*. 2009;13(9):782-788.doi:10.1007/s12603-009-0214-7.
12. Last Reviewed: Jan 19, 2024. American Heart Association Recommendations for Physical Activity in Adults and Kids. Accessed June 6, 2025. https://www.heart.org/en/healthy-living/fitness/fitness-basics/aha-recs-for-physical-activity-in-adults
13. Vũ Thị Huyền, Trần Viết Lực, Nguyễn Ngọc Tâm et al. Thiểu cơ ở người bệnh cao tuổi thoái hóa khớp gối nguyên phát. *VMJ*. 2023;522(2):284-289.doi:10.51298/vmj.v522i2.4370.
14. Alfonso J. Cruz-Jentoft, Avan A. Sayer. Sarcopenia. *The Lancet*. 2019;393(10191):2636-2646.doi:10.1016/S0140-6736(19)31138-9.
15. T. Neogi. The Epidemiology and Impact of Pain in Osteoarthritis. *Osteoarthritis Cartilage*. 2013;21(9):1145-1153.doi:10.1016/j.joca.2013.03.018.