

Predictive Value of Gluteal Muscle Index for Diagnosing Sarcopenia in Community-Dwelling Adults

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Background: Sarcopenia research has primarily focused on the diagnostic value of the psoas and paraspinal muscles due to their accessibility and reflection of the total skeletal muscle mass. This focus has overlooked the gluteal muscles, which are essential for mobility, balance, and prevention of falls, especially in elderly individuals. This prospective observational cohort study aimed to investigate the predictive value of the gluteal muscle index (GMI) for diagnosing sarcopenia in community-dwelling healthy adults.

Methods: The analysis included 290 community-dwelling healthy adults using health examination data. Sarcopenia was diagnosed using bioimpedance analysis. The psoas muscle index (PMI), paraspinal muscle index (PaMI), and GMI were measured via abdominal-pelvic computed tomography and adjusted for height. Additionally, body mass index, bone mineral density, and visceral and subcutaneous fat indices were analyzed.

Results: Among the 290 patients, 26 (9.0%) were diagnosed with sarcopenia. GMI ($48.6 \pm 8.4 \text{ cm}^2/\text{m}^2$ vs. $41.0 \pm 7.9 \text{ cm}^2/\text{m}^2$, $p < 0.001$), PaMI ($14.5 \pm 3.2 \text{ cm}^2/\text{m}^2$ vs. $12.2 \pm 3.3 \text{ cm}^2/\text{m}^2$, $p < 0.001$), and PMI (5.7 ± 1.7 vs. 4.9 ± 1.6 , $p = 0.033$) were significantly lower in the sarcopenia group. The receiver operating characteristic curves for GMI indicated an area under the curve of 0.872 for men and 0.811 for women, with cutoff values of $50.6 \text{ cm}^2/\text{m}^2$ and $34.5 \text{ cm}^2/\text{m}^2$, respectively.

Conclusions: The present study highlights the potential of GMI as a clinically meaningful predictor of sarcopenia, outperforming the psoas muscle in diagnostic accuracy. Furthermore, the sex-specific cutoff values identified from the study could aid in early detection and risk stratification, offering a novel approach for sarcopenia assessment in community-dwelling adults.

Keywords: Sarcopenia, Gluteal muscle index, Diagnostic imaging, Computed tomography

Sarcopenia, characterized by the progressive and generalized loss of skeletal muscle mass and strength, is a growing concern for the aging population.¹⁾ This condition not

only diminishes physical capabilities but also contributes to adverse clinical outcomes such as increased risks of falls, frailty, and reduced quality of life.²⁻⁴⁾ Therefore, early recognition and accurate diagnosis of sarcopenia are crucial for preventing these complications and enhancing overall well-being.⁵⁾

While the diagnosis of sarcopenia requires an assessment of muscle mass, strength, and physical performance, numerous studies have explored the validity of predicting sarcopenia by measuring the cross-sectional area (CSA) of specific muscle groups.⁶⁾ Despite ongoing debate over the use of a single muscle's volume or CSA as

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a sentinel marker for sarcopenia, research has shown that muscles such as the psoas, paraspinal, and thigh muscles hold potential as diagnostic indicators.⁷⁻¹⁰⁾ Traditionally, the diagnostic value and clinical outcome predictions associated with sarcopenia are predominantly focused on these muscle groups since they can be easily assessed.¹¹⁾

However, this emphasis on the psoas and paraspinal muscles inadvertently overlooks the critical importance of the gluteal muscles. The primary goal of diagnosing sarcopenia is to assess and mitigate the risk of falls, which is crucial for preserving independence and quality of life in older adults.^{4,12,13)} Physical balance and stability are essential for preventing falls and are closely linked to the posterior chain muscles, particularly the gluteal muscles.¹⁴⁻¹⁶⁾ Despite their pivotal role in maintaining lateral balance and stability, the gluteal muscles have not been extensively studied in sarcopenia. This oversight has limited our understanding of the best assessment methods and management of sarcopenia, particularly in the aging population.

Given the critical role of the gluteal muscles in balance and fall prevention, we hypothesized that the gluteal muscle could serve as a key indicator in the diagnosis of sarcopenia, with a diagnostic value comparable to that of the psoas muscle. In this context, the present study aimed to evaluate the validity of the gluteal muscle index (GMI), measured via computed tomography (CT) imaging using health screening data, as a predictor for diagnosing sarcopenia among community-dwelling adults.

METHODS

The Institutional Review Board of Chung-Ang University Hospital where the research was conducted approved this study (IRB No. 2023-0208). The need for informed con-

sent was waived on the condition that no personally identifiable information would be collected from the subjects.

Study Design and Participants

The present study is a retrospective, cross-sectional study conducted using health examination data from a community-dwelling adult population. Data were collected from 1,125 adults aged ≥ 30 years who underwent abdominal CT, dual-energy x-ray absorptiometry (DEXA) scans, and bioimpedance analysis (BIA) examinations for health screening purposes between January 2019 and October 2020 at Chung-Ang University Hospital. From the collected health examination data, subjects with medical conditions that could potentially influence sarcopenia, specifically those with chronic diseases that could impact bone metabolism and body composition, were excluded. These chronic diseases included thyroid and parathyroid diseases, rheumatoid arthritis, chronic renal failure, malignancy, lung disease, and cerebrovascular disease. Additionally, subjects taking medications that could influence hormone balance, such as glucocorticoids, warfarin, thyroxine, and sex hormones, were excluded. Furthermore, non-Asian subjects were also excluded from the analysis to eliminate the effects of racial differences.

We excluded 626 subjects with chronic diseases listed in the exclusion criteria, 23 subjects receiving hormone-related medications, and 62 non-Asian subjects. Afterward, 414 subjects were screened. Subjects were randomly selected across age groups to match the age distribution based on the 2019 Population and Housing Census statistics: 52 subjects in their 30s (18%), 68 in their 40s (23%), 72 in their 50s (25%), 52 in their 60s (18%), and 46 aged 70 years and above (16%). Thus, a total of 290 subjects were included in the analysis (Fig. 1).

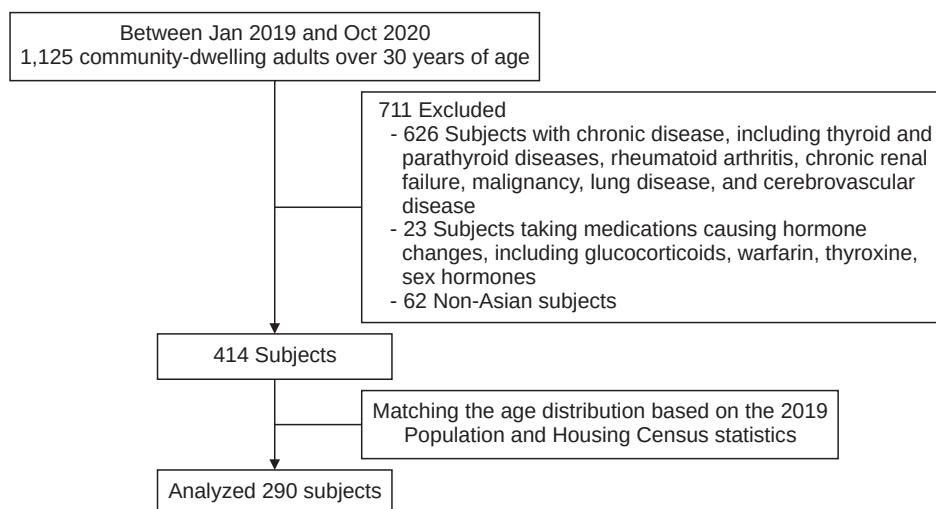


Fig. 1. Patient flow diagram.

Anthropometric Data Collection and Sarcopenia Diagnosis

We collected data on the subjects' age, sex, height, weight, and medical history. Bone mineral density (BMD) of the lumbar spine (L1–L4), femoral neck, and total hip was measured using DEXA with the Lunar Prodigy Advance system (GE Healthcare). Sarcopenia was defined using the appendicular skeletal muscle mass (ASM) index measured by BIA. This measurement was performed using tetrapolar 8-point tactile electrodes (InBody 120, Biospace), with ASM values normalized for height and expressed as kg/m^2 . The cutoff values for diagnosing sarcopenia were set at $< 7 \text{ kg}/\text{m}^2$ for men and $< 5.7 \text{ kg}/\text{m}^2$ for women based on previously established criteria for low muscle mass in the Asian population. Subjects who met these cutoff criteria were classified into the sarcopenia group, while the others were placed in the control group.

Body Composition Data Collection

The CSA of the psoas, paraspinal, and gluteal muscles was measured using abdominal pelvic CT (AP-CT) scans with the Philips Brilliance 64 CT scanner to assess the relationship between each muscle index and the diagnosis of sarcopenia. The CSA of each muscle was determined using image-processing software (Aquarius Workstation, TeraRecon), with density limited to 0 and 120 Hounsfield units (HU) to exclude fat components from the region of interest (Fig. 2).^{17,18} The psoas and paraspinal muscles were measured at the lower endplate level of the L3 vertebral body on axial cuts (Fig. 2A and B). The gluteal muscles, including the gluteus maximus, medius, and minimus, were measured at the most caudal level of the sacroiliac joint on axial cuts (Fig. 2C and D).¹⁹ The measured CSA values were adjusted for height and referred to as the psoas muscle index (PMI), paraspinal muscle index (PaMI), and GMI, expressed in cm^2/m^2 .

Additionally, body composition data obtainable from AP-CT, such as subcutaneous and visceral fat areas,

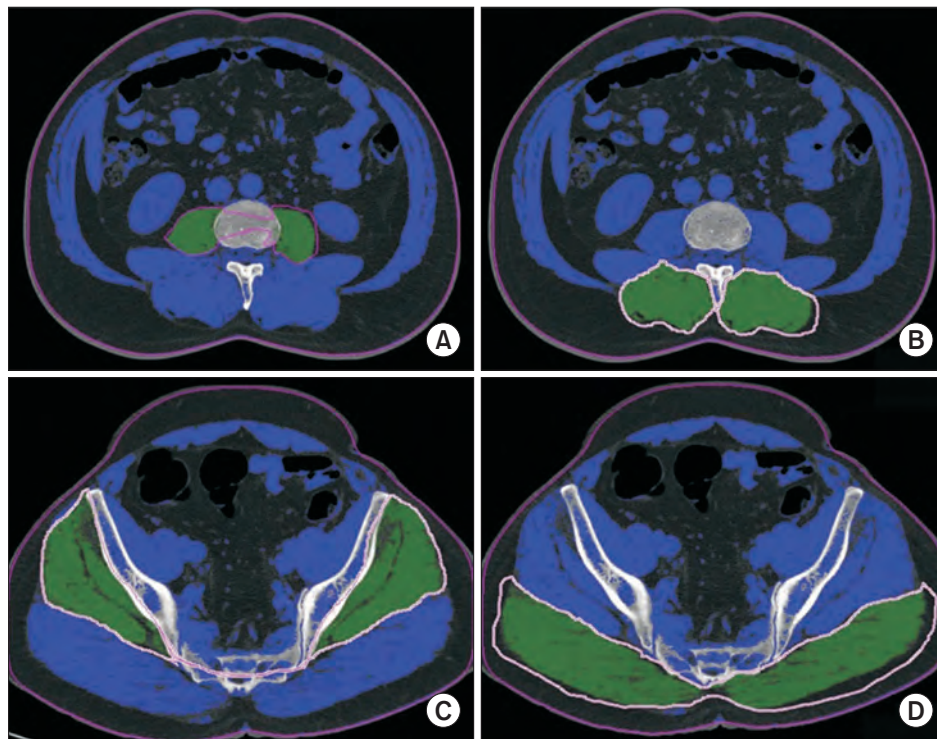


Fig. 2. The cross-sectional areas (CSAs) of the psoas, paraspinal, and gluteal muscles were measured using multiaxial computed tomography scans and a PACS system (ZeTTA PACS, TaeYoung Soft). A predefined Hounsfield unit range from 0 to +120 was utilized to accurately measure the CSA of muscular structures for quantifying the skeletal muscle area within the region of interest. Then, the CSAs were normalized based on the patient's height to calculate the psoas muscle index, paraspinal muscle index, and gluteal muscle index, adjusting these values for the patient's height to cm^2/m^2 for comparative analysis. (A, B) A single axial image at the lower endplate of the L3 vertebral body was selected to delineate the region of interest along the margins of both the psoas and paraspinal muscles to measure their CSAs. (C, D) An axial cut corresponding to the most caudal cut of the sacroiliac joint was chosen to measure the CSAs of the gluteus maximus, medius, and minimus.

were included in the sarcopenia prediction model. The CSA of visceral and subcutaneous fat was measured at the umbilicus level on axial cuts to standardize the measurement method, with the density of adipose tissue limited to -150 to -50 HU (Fig. 3).

Statistical Analysis

Data are presented as mean $\pm$ standard deviation for continuous variables and absolute or relative frequencies for categorical variables. An independent *t*-test was used to compare anthropometric, body composition, and demographic data between the 2 groups. Both univariate and multivariate logistic regression analyses were conducted to identify variables significantly associated with sarcopenia diagnosis within the study cohort. The univariate logistic regression analysis included variables such as age, sex, BMD, body mass index (BMI), PMI, PaMI, GMI, and visceral and subcutaneous fat indices. Variables with a *p*-value < 0.1 from the univariate analysis were included in the multivariate logistic regression analysis to identify significant predictors of sarcopenia diagnosis.

A receiver operating characteristic (ROC) curve was created, and the area under the curve (AUC) was measured to assess the predictive power of the regression model for sarcopenia. Youden's index was also calculated to evaluate the diagnostic effectiveness of the model. The predictive power was classified as follows: non-informative (AUC = 0.5), less accurate ($0.5 < \text{AUC} < 0.7$), moderately accurate ($0.7 < \text{AUC} < 0.9$), highly accurate ($\text{AUC} > 0.9$), and perfect (AUC = 1). A Youden's index value > 0.5 indi-

cates a good diagnostic test, reflecting a balance between sensitivity and specificity. Values approaching 1 demonstrate excellent diagnostic ability, whereas values < 0.3 suggest that the test is less effective at distinguishing between conditions. Additionally, the predictive power and cutoff values for individual variables, including PMI, PaMI, and GMI, were evaluated separately for each sex using ROC curves. Statistical analysis was performed using R software version 4.4.1 (R Foundation for Statistical Computing).

RESULTS

Descriptive Analysis

Table 1 presents the participants' demographic and body composition data. Sarcopenia was present in 9% (26 / 290) of participants. There were no significant differences in sex distribution between the groups ($p = 0.924$). The sarcopenia group had older individuals (58.5 ± 14.3 years vs. 52.7 ± 12.4 years, $p = 0.027$) and lower ASM (5.9 ± 0.9 kg/m² vs. 7.1 ± 1.1 kg/m², $p < 0.001$), BMI (20.6 ± 3.2 kg/m² vs. 23.9 ± 3.2 kg/m², $p < 0.001$), and BMD (0.786 ± 0.130 g/cm² vs. 0.877 ± 0.170 g/cm², $p = 0.008$) compared to the control group.

All 3 muscle indices measured by CT were lower in the sarcopenia group compared to the normal group, with PMI of 4.9 ± 1.6 cm²/m² vs. 5.7 ± 1.7 cm²/m² ($p = 0.033$), PaMI of 12.2 ± 3.3 cm²/m² vs. 14.5 ± 3.2 cm²/m² ($p < 0.001$), and GMI of 41.0 ± 7.9 cm²/m² vs. 48.6 ± 8.4 cm²/m² ($p < 0.001$). Additionally, the subcutaneous fat index was lower in the sarcopenia group (47.6 ± 24.6 cm²/m² vs. 59.4 ± 24.0 cm²/m², $p = 0.018$), whereas the visceral fat index did not show a significant difference between the groups ($p = 0.084$).

Predictive Model for Sarcopenia Diagnosis

Table 2 demonstrates the results of the univariate and multivariate logistic regression analyses. Eight variables with $p < 0.10$ in the univariate regression analysis—age, BMI, BMD, PMI, PaMI, GMI, subcutaneous fat index, and visceral fat index—were included in the multivariate regression analysis. The ROC curve for the regression model had an AUC of 0.831, indicating moderately accurate predictive power, with a Youden's index of 0.566 (Fig. 4). The multivariate logistic regression analysis showed that lower BMI and GMI were significantly correlated with an increased risk of diagnosing sarcopenia ($\beta = -0.427$, $p = 0.019$ and $\beta = -0.101$, $p = 0.037$, respectively).

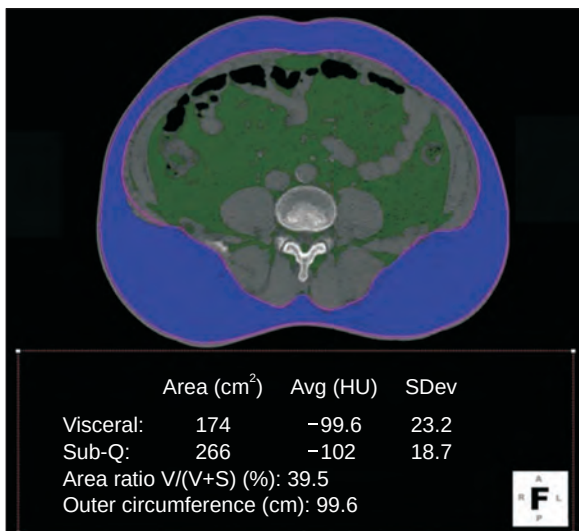


Fig. 3. Cross-sectional computed tomography images reconstructed via Aquarius station. Blue indicates the subcutaneous fat area, while green indicates the visceral fat area at the level of the umbilicus.

Table 1. Demographic Characteristics

Variable	Normal	Sarcopenia	Total	p-value
Number	264 (91.0)	26 (9.0)	290 (100)	-
Sex				0.924
Female	134 (50.8)	14 (53.9)	148 (51.0)	
Male	130 (49.2)	12 (46.2)	142 (49.0)	
Age (yr)	52.7 ± 12.4	58.5 ± 14.3	53.3 ± 12.7	0.027*
ASM index (kg/m ²)	7.1 ± 1.1	5.9 ± 0.9	7.0 ± 1.2	< 0.001*
BMI (kg/m ²)	23.9 ± 3.2	20.6 ± 3.2	23.6 ± 3.4	< 0.001*
BMD (g/cm ²)	0.877 ± 0.170	0.786 ± 0.130	0.869 ± 0.168	0.008*
PMI (cm ² /m ²)	5.7 ± 1.7	4.9 ± 1.6	5.6 ± 1.7	0.033*
PaMI (cm ² /m ²)	14.5 ± 3.2	12.2 ± 3.3	14.3 ± 3.3	< 0.001*
GMI (cm ² /m ²)	48.6 ± 8.4	41.0 ± 7.9	47.9 ± 8.6	< 0.001*
Subcutaneous fat index (cm ² /m ²)	59.4 ± 24.0	47.6 ± 24.6	58.3 ± 24.2	0.018*
Visceral fat index (cm ² /m ²)	38.8 ± 18.1	32.4 ± 16.6	38.3 ± 18.2	0.084

Values are presented as number (%) or mean ± standard deviation.

ASM: appendicular skeletal muscle mass, BMI: body mass index, BMD: bone mineral density, PMI: psoas muscle index, PaMI: paraspinal muscle index, GMI: gluteal muscle index.

* $p < 0.05$.

Table 2. Univariate and Multivariate Logistic Regression Analysis for Diagnosing Sarcopenia in the Present Cohort

Variable	Univariate analysis			Multivariate analysis		
	Std β	Odds ratio (95% CI)	p-value	Std β	Odds ratio (95% CI)	p-value
Age	0.036	1.037 (1.004–1.071)	0.029*	0.052	1.054 (1.005–1.105)	0.025*
Sex, male	–0.124	0.884 (0.394–1.982)	0.764	-	-	-
BMI	–0.398	0.672 (0.565–0.800)	< 0.001*	–0.427	0.653 (0.457–0.932)	0.019*
BMD	–2.240	0.106 (0.013–0.896)	0.039*	0.324	1.383 (0.032–60.168)	0.866
PMI	–0.283	0.753 (0.579–0.981)	0.035*	0.335	1.398 (0.925–2.114)	0.112
PaMI	–0.297	0.743 (0.628–0.880)	< 0.001*	0.010	1.010 (0.758–1.345)	0.947
GMI	–0.116	0.890 (0.842–0.941)	< 0.001*	–0.101	0.904 (0.823–0.994)	0.037*
Subcutaneous fat index	–0.024	0.977 (0.958–0.996)	0.019*	–0.010	0.990 (0.959–1.022)	0.537
Visceral fat index	–0.023	0.977 (0.952–1.003)	0.076	0.023	1.024 (0.981–1.068)	0.283

Std: standardized, BMI: body mass index, BMD: bone mineral density, PMI: psoas muscle index, PaMI: paraspinal muscle index, GMI: gluteal muscle index.

* $p < 0.05$.

Predictive Power and Cutoff Values of Muscle Indices

Fig. 5 illustrates the ROC curves for the 3 muscle indices. The GMI demonstrated moderately accurate predictive power for both sexes, with an AUC (95% CI) of 0.872

(0.785–0.959) for men and 0.811 (0.682–0.940) for women. The PaMI showed moderately accurate power for women with an AUC of 0.855 (0.778–0.932) and moderately accurate power for men, with an AUC of 0.720 (0.537–0.903).

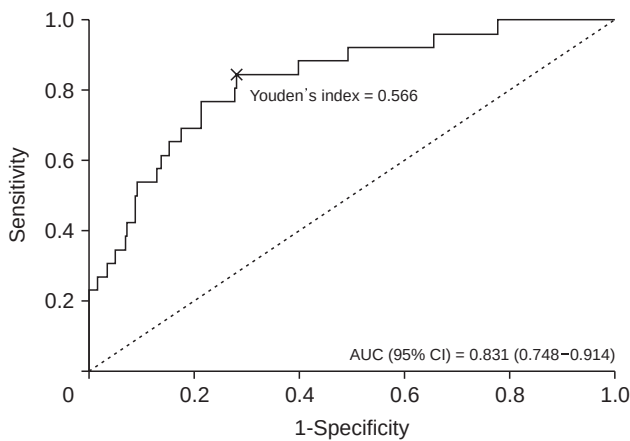


Fig. 4. The receiver operating characteristic curve for the predictive model of sarcopenia diagnosis illustrates the predictive accuracy of the multivariate logistic regression model for diagnosing sarcopenia. The model, incorporating variables such as age, body mass index, bone mineral density, psoas muscle index, paraspinal muscle index, gluteal muscle index, subcutaneous fat index, and visceral fat index, achieved an area under the curve (AUC) of 0.831, indicating moderately accurate predictive power. The Youden's index was 0.566.

In contrast, the PMI exhibited less accurate predictive power for both sexes, with an AUC of 0.638 (0.499–0.782) for men and 0.645 (0.494–0.770) for women. The cutoff values identified for sarcopenia prediction were 50.6 cm^2/m^2 for the GMI in men and 34.5 cm^2/m^2 in women, while the cutoff values for the PaMI were 13.9 cm^2/m^2 for men and 11.8 cm^2/m^2 for women.

DISCUSSION

This study explored the diagnostic value of CT-measured CSA of the gluteal muscles for identifying sarcopenia in community-dwelling adults. The height-adjusted CSA of the gluteal muscle showed robust diagnostic performance for sarcopenia. Specifically, age, BMI, and GMI were identified as independent risk factors for sarcopenia in the present cohort. These results underscore the clinical importance of the gluteal muscles for the early detection and management of sarcopenia in the general population.

Studies addressing sarcopenia traditionally focused on the psoas muscle due to its ease of measurement and

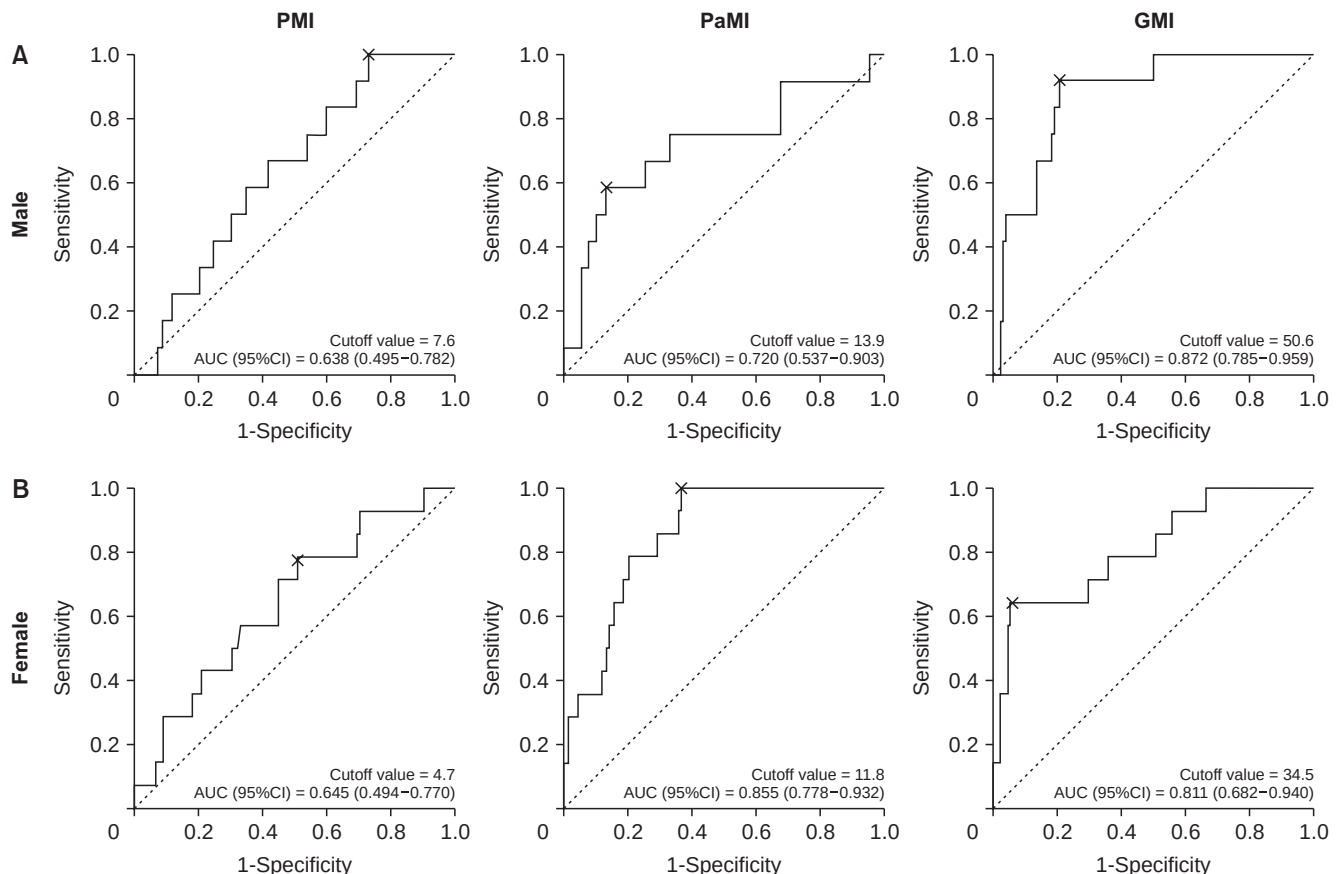


Fig. 5. The receiver operating characteristic (ROC) curves showing the predictive power of psoas (PMI), paraspinal (PaMI), and gluteal (GMI) muscle indices in diagnosing sarcopenia in both sexes. (A) Male, (B) female. AUC: area under the curve.

critical role in locomotion as a hip flexor, exploring its relationship with sarcopenia prevalence and impact on clinical outcomes.⁷⁻¹⁰⁾ However, our study highlights that the gluteal muscles, particularly the hip muscles responsible for maintaining posture, may play a more decisive role in diagnosing sarcopenia. Furthermore, the gluteal muscles play a crucial role in maintaining lateral balance, stability, and pelvic version, which are essential for compensating for age-related changes in sagittal balance, being crucial for preventing falls.^{14,16,20,21)} In this context, focusing on the gluteal muscles in sarcopenia assessments can better reflect fall risk and enhance the mobility and independence of the elderly compared to traditional measures focusing solely on the psoas muscle.

Recent studies have supported the pivotal role of the gluteal muscles in sarcopenia assessment. For instance, Ham et al.²²⁾ demonstrated that a reduced GMI is significantly associated with increased sarcopenia risk in patients with degenerative lumbar disease, underscoring the importance of gluteal muscle preservation for functional independence. Similarly, Suto et al.²³⁾ found that preoperative gluteal muscle CSA correlates with postoperative mobility in hip fracture patients, further highlighting its clinical significance in predicting outcomes. Our current findings in community-dwelling adults corroborate these observations, indicating that GMI may be a robust marker for identifying individuals at risk for sarcopenia regardless of underlying comorbidities. Moreover, this consistency suggests that GMI could be generalizable across different patient populations, lending further support to its use as a practical, imaging-based marker of sarcopenic risk. Lastly, our emphasis on community-dwelling individuals complements the hospital-based settings of previous studies, indicating that gluteal muscle assessment may benefit both surgical patients and the broader older population at risk of mobility decline.

Our multivariate regression analysis identified GMI as a significant independent predictor of sarcopenia, with lower GMI values significantly associated with an increased risk. In contrast, the PMI demonstrated weaker predictive power. The ROC curve analysis further supported the robustness of GMI, showing higher AUC values (0.872 in men and 0.811 in women) compared to those of the PMI. Despite extensive research on the psoas muscle in sarcopenia, our results suggest that gluteal muscles, critical for maintaining posture and balance, may offer a more comprehensive assessment of sarcopenia risk than the traditionally studied psoas muscle. This insight underscores the potential need to shift clinical focus toward the gluteal muscles for a more accurate diagnosis of sarcopenia, par-

ticularly in community-dwelling adults.

In addition to the GMI, our findings revealed that the PaMI demonstrated a higher predictive value for sarcopenia compared to the PMI, particularly among female participants. Several factors may contribute to this observation. First, the paraspinal muscles play a critical role in postural stability and spinal extension, implying that age-related atrophy in these muscles might more directly mirror overall declines in core muscle function.^{24,25)} Second, recent studies suggest that the CSA of the paraspinal muscles may correlate more closely with global muscle mass and functional capacity than the psoas muscles, potentially enhancing PaMI's sensitivity in detecting sarcopenic changes.^{10,11,26)} In this context, in settings where a dedicated pelvic CT slice for measuring the gluteal muscles is unavailable, PaMI could serve as a complementary diagnostic tool for evaluating trunk musculature—especially in older female populations who are more prone to posture-related issues and vertebral fractures. Future longitudinal research could further elucidate whether incorporating PaMI alongside GMI offers incremental benefit in predicting functional outcomes or guiding targeted muscle-preserving interventions.

The present study proposed sex-specific cutoff values for GMI and PaMI, providing practical thresholds for diagnosing sarcopenia. The identified cutoff values were 50.6 cm²/m² for GMI in men and 34.5 cm²/m² in women (corresponding AUC values = 0.872 and 0.811, respectively), indicating moderately accurate predictive power. For the PaMI, the cutoff values were 13.9 cm²/m² for men and 11.8 cm²/m² for women, with AUC values of 0.720 and 0.855, respectively, again reflecting moderately accurate predictive power, particularly in women. These thresholds are especially relevant for the early identification of sarcopenia, allowing for timely intervention. However, these cutoff values were derived from a healthy, community-dwelling population and may not be directly applicable to populations with specific pathological conditions. The criteria for sarcopenia diagnosis should be tailored to the patient population being assessed.²⁷⁻²⁹⁾ Given the lower AUC values for PMI in both sexes, we did not establish specific cutoff values for this index, as it demonstrated less accurate predictive power and might be less useful as a diagnostic tool for sarcopenia in the present cohort.

Our multivariate regression analysis identified BMI as a significant independent predictor of sarcopenia (odds ratio = 0.653, $p = 0.019$). In contrast, the subcutaneous fat index did not retain significance after adjustment despite being significantly lower in the sarcopenia group ($p = 0.018$). The relationship between BMI and sarcopenia is

complex, as BMI can sometimes mask sarcopenia in individuals with higher fat mass.^{30,31)} These findings emphasize the importance of considering BMI alongside muscle indices when assessing sarcopenia risk because this approach provides a more nuanced understanding of the interplay between body composition and muscle status. Additionally, the reduced subcutaneous fat in the sarcopenia group suggests that lower fat reserves may be linked to higher sarcopenia risk. This further complicates the interpretation of BMI alone, as a lower BMI with reduced subcutaneous fat could indicate sarcopenia rather than a simple lean body composition.^{32,33)} Therefore, integrating both BMI and subcutaneous fat index into sarcopenia assessments could offer a more comprehensive evaluation of an individual's risk, helping distinguish between healthy lean individuals and those at risk for sarcopenia.

Despite the strengths of our study, including the use of precise CT imaging for muscle assessment and a well-characterized cohort, it still has several limitations. We excluded individuals with active cancer, cirrhosis, and other severe conditions that could confound the results, but not all comorbidities could be accounted for. Additionally, the study's cross-sectional design limits our ability to establish causality. Thus, the findings need to be validated in independent cohorts. The majority of our participants were of Asian descent, limiting the generalizability of the results to other ethnic groups. Furthermore, muscle strength and performance were not assessed, while these are critical components of sarcopenia diagnosis according to the European Working Group on Sarcopenia in Older People and Asian Working Group for Sarcopenia.

Moving forward, longitudinal studies are warranted to determine whether targeted interventions, such as rehabilitation programs focusing on gluteal muscle strengthening, can improve both short- and long-term outcomes in older adults. For instance, Byun et al.³⁴⁾ demonstrated how psoas muscle CSA influences prognosis, including survival time, in hip fracture patients. Building on that approach, applying time-series analyses to investigate the impact of

gluteal muscle mass on clinical outcomes across various comorbidities could be highly valuable. Additionally, integrating GMI measurements with functional parameters, such as gait speed, grip strength, and balance tests, may help clarify how gluteal muscle integrity directly influences mobility, fall risk, and overall quality of life. Such investigations would not only delineate the underlying mechanisms but also optimize intervention strategies, ultimately reducing the burden of sarcopenia in at-risk populations.

The present study demonstrates the validity of GMI as a reliable predictor of sarcopenia, offering better predictive capability than the psoas muscle, with specific cutoff values proposed for sex-based diagnosis. Thus, incorporating GMI alongside BMI and subcutaneous fat index could significantly enhance the early detection and management of sarcopenia, particularly in community-dwelling adults.

CONFLICT OF INTEREST

Kwang-Sup Song is an editorial board member of the journal but was not involved in the peer reviewer selection, evaluation, or decision process of this article. No other potential conflicts of interest relevant to this article were reported.

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