

Correlation between sarcopenia and its clinical criteria with the quality of life of older adults with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Introduction: Chronic obstructive pulmonary disease (COPD) is one of the leading causes of disability and mortality worldwide. The presence of sarcopenia in this population has an impact on physical function and quality of life. Identifying sarcopenia in people with COPD allows for the development of personalized rehabilitation strategies.

Objective: To analyze the correlation between the clinical criteria for sarcopenia (muscle mass, muscle strength, and physical performance) and quality of life in older adults with COPD.

Methods: This is an analytical cross-sectional study with a convenience sample consisting of thirty-seven adults aged 60 years or older with COPD diagnosed according to Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria. Muscle mass was assessed using bioelectrical impedance analysis; handgrip strength was measured with a digital dynamometer; and physical performance was evaluated using 4-meter gait speed. Quality of life was assessed with the COPD Assessment Test (CAT). Pearson or Spearman correlation coefficients were calculated according to data distribution, with significance set at $p < 0.05$. Multivariable linear regression models adjusted for

age, comorbidity burden, and GOLD stage were used to identify independent associations with CAT scores.

Results: The study included 37 people with COPD. The total CAT score demonstrated significant negative correlations with handgrip strength ($r = -0,591$; CI 95%: $[-0,8244 \text{ to } -0,1883]$; $p = 0,007$), skeletal muscle mass index ($r = -0,515$; CI 95%: $[-0,7695 \text{ to } -0,1193]$; $p = 0,014$), free-fat mass ($r = -0,514$; CI 95%: $[-0,7691 \text{ to } -0,1183]$; $p = 0,014$), and fat-free mass index ($r = -0,430$; CI 95%: $[-0,7213 \text{ to } -0,01109]$; $p = 0,045$) ($n = 37$ for all the analysis). Among individual CAT components, "chest tightness," "activities," "confidence," and "energy" showed the strongest associations with sarcopenia-related clinical criteria, with correlation coefficients ranging from -0.437 to -0.731 . In the adjusted analyses, handgrip strength was the only variable independently associated with quality of life ($\beta = -0.359$; 95% CI: $-0.678 \text{ to } -0.039$; $p = 0.030$).

Conclusion: Lower muscle mass and reduced muscle strength were correlated with greater symptom burden and poorer quality of life in older adults with COPD. The CAT items related to daily activities, confidence, and energy showed the strongest associations with sarcopenia criteria, underscoring the relevance of evaluating muscle health in this population. After adjusted analysis, handgrip strength emerged as the only independent predictor of quality of life.

KEYWORDS

Bioelectrical impedance analysis; Handgrip strength; Gait speed; Functional assessment; Aging; Pulmonary Function.

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INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a preventable and treatable condition characterized by persistent and typically irreversible airflow limitation resulting from chronic inflammation and alveolar destruction due to the inhalation of harmful gases¹. COPD is one of the leading causes of disability and mortality in older adults and is identified by the World Health Organization (WHO) as the fourth leading cause of death worldwide². It is estimated that by 2060, annual mortality from COPD will be 5.4 million people³. COPD has negative effects on the lungs and other parts of the body, including decreased muscle mass, muscle strength, and balance⁴. These extrapulmonary effects are directly related to the presence of sarcopenia, which negatively impacts the quality of life and prognosis of older adults with COPD⁵.

Sarcopenia is a geriatric syndrome defined as the simultaneous presence of low muscle mass, strength, and physical performance in older adults⁶. The prevalence of sarcopenia in COPD ranges from 15% to 35%, depending on the diagnostic criteria⁷. The presence of sarcopenia in patients with COPD has negative effects mainly associated with reduced functionality, exercise capacity, balance, and quadriceps strength, resulting in impaired physical capacity, increased use of medical care, hospitalization and risk of mortality^{4,8,9}.

Previous studies have shown that patients with COPD who have sarcopenia presented poorer quality of life compared to those without this syndrome⁵. Various instruments to assess the quality of life such as the St. Georges Respiratory Questionnaire (SGRQ) and the COPD Assessment Test (CAT) have been used in individuals with COPD¹⁰. One of the most widely used instruments for assessing the quality of life of COPD patients is the CAT¹¹, which has demonstrated validity, reliability, and sensitivity to change and is recommended by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines in 2025 for quantifying the impact of COPD on patients¹². The CAT questionnaire measures parameters such as cough, sputum production, chest tightness, dyspnea, activity limitation, confidence, sleep, and energy level¹¹.

The quality of life of older people is directly related to their prognosis, so it is important to assess quality of life in patients with COPD, although evidence suggests that sarcopenia has a negative impact on the quality of life in this population⁵. However, to date, the correlation between the clinical criteria for sarcopenia (mass, strength, and physical performance) and each of the CAT quality of life items has not been analyzed. Therefore, the objective of this study was to analyze the correlation between sarcopenia and its clinical criteria (muscle mass, muscle strength, and physical performance) with the quality of life of older adults with COPD.

METHODS

Study Design

This study employs a cross-sectional, observational and analytical design. It follows the guidelines Strengthening the Reporting of Observational Studies in Epidemiology (STROBE)¹³. The research project was approved by the Research Ethics Committee of the State University of Londrina and authorized by the Education Department / Londrina / PR (1.830.048).

Context

This is a secondary analysis of a previous study¹⁴, that included individuals with COPD recruited from 2016 to 2019 at the Outpatient Unit of the University Hospital of the State University of Londrina, Brazil.

Participants

A convenience sample was composed of 37 participants. Inclusion criteria were: 1) diagnosis of COPD according to the criteria of the Global Initiative for Chronic Obstructive Lung Disease (GOLD)¹²; stable disease (no exacerbations in the prior month); over the age of 60 years old; absence of severe comorbidities that could interfere in the assessments; absence of diagnosed balance disorders (e.g. labyrinthitis or benign paroxysmal positional vertigo); absence of severe audiovisual disorders and absence of regular physical exercise practice in the last year.

Variables and measurements

Clinical criteria for sarcopenia were assessed according to the European Working Group on Sarcopenia in Older People (EWGSOP)⁶. Quality of life was also assessed using the COPD Assessment Test (CAT). All assessments were performed at the University Hospital of the State University of Londrina, Brazil. These assessments were performed by the same trained assessors and physical therapists specializing in adult respiratory care.

Sarcopenia Criteria

The clinical criteria of sarcopenia (muscle mass, muscle strength, and physical performance) were assessed according to the European Working Group on Sarcopenia in Older People (EWGSOP)⁶. The measurement of these clinical criteria is described below.

Muscle mass

Muscle mass was quantified using bioelectrical impedance analysis (Biodynamics 310TM; Biodynamics Corp., Seattle, WA, USA). Parameters such as skeletal muscle mass (SMM), skeletal muscle mass index (SMMI-SMM/height²), fat-free mass (FFM), and fat-free mass index (FFMI-FFM/height²) were measured. SMM was estimated using the equation de-

veloped by Janssen et al¹⁵. The measurement was taken after fasting for 10 hours and with an empty bladder⁶.

Handgrip strength

Handgrip strength was assessed using a digital dynamometer (Jamar Plus + Digital 563213; Lafayette Instrument Company, Lafayette, LA, USA). The highest value obtained in three attempts (1 minute rest per attempt) was considered⁶.

Physical Performance

Physical performance was assessed using the 4-meter walk test. Participants were asked to walk at their usual speed on a marked 4-meter track. The time was recorded with a stopwatch, and the average speed to cover the distance in two attempts was used for analysis⁶.

Quality of Life

This was measured using the COPD Assessment Test (CAT). The CAT comprises eight items that evaluate core domains affected by the disease, including cough, sputum production, chest tightness, breathlessness during physical activities, limitations in daily tasks, confidence in leaving home, sleep disturbances, and energy levels. Each item is scored from 0 to 5, and all items are then added together to obtain a total CAT score, which ranges from 0 to 40. Higher scores indicate a greater health burden and poorer quality of life. The CAT has demonstrated strong psychometric properties, including high internal consistency and sensitivity to clinical changes, making it suitable for both clinical assessment and research contexts¹¹.

Comorbidity burden

Comorbidity burden was assessed using the Age-Adjusted Charlson Comorbidity Index (ACCI), a validated tool that quantifies the presence and severity of chronic diseases¹⁶. The index assigns weighted scores to 19 comorbidities and incorporates an age adjustment component, adding one point for each decade above the age of 50. For each participant, the ACCI score was calculated by adding the specific weights for each disease and the age component. Higher scores indicate greater multimorbidity and higher clinical risk.

Lung function

Lung function was assessed according to international standards using spirometry performed with participants in a seated position¹⁷. Forced vital capacity (FVC) and forced expiratory volume in the first second (FEV₁) were obtained from reproducible maneuvers following ATS/ERS guidelines¹⁸. Predicted values were calculated using reference equations appropriate for the study population, and the FEV₁/FVC ratio was used to confirm the diagnosis and severity classification of COPD. The GOLD classification was determined based on the predicted percentage of FEV₁ after bronchodilator administration¹².

Bias control

All assessments were performed by trained evaluators under standardized protocols, using validated instruments, and the baseline condition of the participants was controlled to ensure clinical stability at the time of assessment.

Statistical method

SPSS version 22 (IBM Co., USA) software was used for statistical analysis. These data were presented in frequency, percentage, mean, and standard deviation. Data normality was analyzed using the Shapiro Wilk test. To identify the correlation between the clinical criteria for sarcopenia (muscle mass, strength, and physical performance) and the CAT quality of life questionnaire, Pearson's correlation coefficient was used for normally distributed variables such as MME, IMME, MLG, gait speed, and the total CAT score, while Spearman's correlation coefficient was used for non-parametric variables such as IMLG and FPM. To aid interpretation, the strength of the correlations was classified according 0.20–0.39 = weak, 0.40–0.59 = moderate, 0.60–0.79 = strong, and ≥ 0.80 = very strong correlations¹⁹. Linear regression analyses were performed to examine the association between the total COPD Assessment Test (CAT) score (dependent variable) and each sarcopenia-related clinical criterion, including skeletal muscle mass, skeletal muscle mass index, fat-free mass, fat-free mass index, handgrip strength, and gait speed (independent variables). Two models were constructed: an unadjusted model (Model 1) and an adjusted model (Model 2). The adjusted model included age, ACCI, and GOLD stage as potential confounding variables. Regression coefficients (β), 95% confidence intervals (95% CI), p-values, and coefficients of determination (R^2) were reported. A 95% confidence interval (95% CI) and a significance level with a p-value < 0.05 were adopted. The figures were created using Graphpad Prism version 8.4.2.

RESULTS

The study included 37 people with COPD, mostly men (65%), with mean age of 68.85 ± 6.31 years, and classified mainly in the moderate to severe stages of the GOLD classification. Most participants were classified as GOLD 2 (46%) or GOLD 3 (51%), and only one person (3%) was classified as GOLD 4. The mean CAT score was 14.67 ± 8.15 . The comorbidity burden was moderate, with a mean ACCI score of 4.77 ± 1.22 points. The characteristics of the participants are described in Table 1.

Correlation Between Total CAT Score and clinical criteria of Sarcopenia

Table 2 shows the correlations between the CAT and its subitems and the clinical criteria for sarcopenia. Figure 1 presents the correlations between the total CAT score and the clinical criteria of sarcopenia. Higher CAT scores were consistently associated with lower skeletal muscle mass (graph A;

Table 1. Descriptive characteristics of people with COPD

Variables	Mean $\pm$ SD / n (%)
Male	24 (65%)
GOLD 2	17 (46%)
GOLD 3	19 (51%)
GOLD 4	1 (3%)
CAT score	14,67 $\pm$ 8,15
Age (years)	68,85 $\pm$ 6,31
BMI (kg/m ²)	28 $\pm$ 4,9
FVC (% predicted)	83,79 $\pm$ 18,28
FEV ₁ (% predicted)	48,26 $\pm$ 12,16
Skeletal Muscle Mass (SMM, kg)	23,67 $\pm$ 7,27
Skeletal Muscle Mass Index (SMMI, kg/m ²)	9,22 $\pm$ 2,30
Fat-Free Mass (FFM, kg)	39,15 $\pm$ 15,54
Fat-Free Mass Index (FFMI, kg/m ²)	17,33 $\pm$ 2,51
Handgrip Strength (kg)	32,03 $\pm$ 9,49
Gait Speed (m/s)	1,09 $\pm$ 0,18
Age-Adjusted Charlson Comorbidity Index (ACCI), points	4,77 $\pm$ 1,22

FVC: Forced vital capacity; FEV₁: Forced expiratory volume in 1 second; SMM: Skeletal Muscle Mass; SMI: Skeletal Muscle Mass Index; FFM: Fat-Free Mass; FFMI: Fat-Free Mass Index; ACCI: Age-Adjusted Charlson Comorbidity Index; CAT: COPD Assessment Test.

$r = -0,533$; $n = 37$; CI 95%: [-0,7799 to -0,1449]; $p = 0,010$) and lower skeletal muscle mass index (graph B; $r = -0,515$; $n = 37$; CI 95%: [-0,7695 to -0,1193]; $p = 0,014$). Significant negative correlations were also observed with fat-free mass (graph C; $r = -0,514$; $n = 37$; CI 95%: [-0,7691 to -0,1183]; $p = 0,014$) and fat-free mass index (panel D; $r = -0,430$; $n = 37$; CI 95%: [-0,7213 to -0,01109]; $p = 0,045$). Handgrip strength also showed a moderate negative association with the total CAT score (graph E; $r = -0,591$; $n = 37$; CI 95%: [-0,8244 to -0,1883]; $p = 0,007$). No relationship was identified for gait speed (graph F).

Correlation Between the CAT items and clinical criteria of Sarcopenia

The correlation between the CAT items and the clinical criteria for sarcopenia are presented in Table 2 and Figures 2 to 4, to highlight the relationships that were clinically relevant. The

CAT items "cough," "breathlessness," "phlegm," and "sleep" did not show significant correlations with any of the sarcopenia-related variables. Only the items that showed statistically significant correlations were presented in figure 2 to 4.

Negative correlations were found between the other CAT items and the clinical criteria for sarcopenia. The item "Chest tightness" (Figure 2) correlated with various measures of sarcopenia, such as SMM in graph A, showing a moderate negative correlation ($r = -0,461$; $n = 37$; CI 95%: [-0,7393 to -0,04964]; $p = 0,030$), as well as a negative correlation in SMMI ($r = -0,479$; $n = 37$; CI 95%: [-0,7493 to -0,07191]; $p = 0,024$) in graph B, the FFM ($r = -0,437$; $n = 37$; CI 95%: [-0,7255 to -0,01996]; $p = 0,041$) in graph C, and the FFMI ($r = -0,448$; $n = 37$; CI 95%: [-0,7318 to -0,03335]; $p = 0,036$) in graph D.

In the item "Activities", strong statistically significant negative correlations were identified with the clinical criteria for sarcopenia in various graphs in Figure 3, such as graph A with SMM ($r = -0,684$; $n = 37$; CI 95%: [-0,8585 to -0,3699]; $p = 0,0004$), graph B with SMMI ($r = -0,641$; $n = 37$; CI 95%: [-0,8368 to -0,3013]; $p = 0,001$), graph C with FFM ($r = -0,681$; $n = 37$; CI 95%: [-0,8567 to -0,3641]; $p = 0,0005$), graph D with FFMI ($r = -0,581$; $n = 37$; CI 95%: [-0,8055 to -0,2115]; $p = 0,004$), and E with HGS ($r = -0,731$; $n = 37$; CI 95%: [-0,8900 to -0,4151]; $p = 0,0004$). Meanwhile, in graph F, no correlation was found between limitations in domestic tasks and physical performance.

Figure 4 identified various correlations between the item "Confidence" and the clinical criteria for sarcopenia, mainly SMM ($r = -0,635$; $n = 37$; CI 95%: [-0,8336 to -0,2917]; $p = 0,001$), SMMI ($r = -0,613$; $n = 37$; CI 95%: [-0,8224 to -0,2590]; $p = 0,002$), and FFM ($r = -0,645$; $n = 37$; CI 95%: [-0,8389 to -0,3079]; $p = 0,001$), showed a strong statistically significant correlation, while FFMI ($r = -0,284$; $n = 37$; CI 95%: [-0,8389 to -0,3079]; $p = 0,010$) and HGS ($r = -0,372$; $n = 37$; CI 95%: [-0,8336 to -0,2163]; $p = 0,005$) showed a weak and moderate statistically significant correlation, respectively.

Finally, there is a moderate and statistically significant correlation between the Energy item and HGS in the ($r = -0,497$; $n = 37$; CI 95%: [-0,7761 to -0,05541]; $p = 0,03$), while the other sarcopenia criteria show no correlations.

Association between Clinical Criteria for Sarcopenia and Quality of Life

Table 3 presents the associations between clinical criteria for sarcopenia and quality of life, assessed using the CAT, in individuals with COPD. In the unadjusted analyses (Model 1), significant inverse associations were observed for SMM ($\beta = -0,486$, 95% CI: -0,805 to -0,167; $p = 0,018$), SMMI ($\beta = -1,603$, 95% CI: -2,773 to -0,433; $p = 0,009$), FFM ($\beta = -0,325$, 95% CI: -0,541 to -0,109; $p = 0,005$), FFMI ($\beta = -1,016$, 95% CI: -1,831 to -0,202; $p = 0,016$),

Table 2. Correlations between the CAT and its subitems and the clinical criteria for sarcopenia

Variable		SMM	SMMI	FFM	FFMI	HGS	GS
Total CAT	r	-0,533	-0,515	-0,514	-0,430	-0,591	0,127
	p	0,010	0,014	0,014	0,045	0,007	0,573
Cough	r	0,003	0,035	0,006	0,042	-0,251	-0,126
	p	0,988	0,876	0,976	0,851	0,299	0,576
Phlegm	r	-0,131	-0,106	-0,226	-0,152	-0,331	-0,264
	p	0,558	0,636	0,310	0,497	0,166	0,234
Chest tightness	r	-0,461	-0,479	-0,437	-0,448	-0,416	0,085
	p	0,030	0,024	0,041	0,036	0,076	0,706
Breathlessness	r	-0,413	-0,399	-0,394	-0,321	-0,284	-0,179
	p	0,055	0,065	0,069	0,145	0,237	0,424
Activities	r	-0,684	-0,641	-0,681	-0,581	-0,731	-0,355
	p	0,0004	0,001	0,0005	0,004	0,0004	0,104
Confidence	r	-0,635	-0,613	-0,645	-0,284	-0,372	0,113
	p	0,001	0,002	0,001	0,010	0,005	0,124
Sleep	r	0,074	0,073	0,124	0,107	0,296	0,265
	p	0,741	0,745	0,581	0,634	0,217	0,231
Energy	r	-0,345	-0,3630	-0,263	-0,214	-0,497	0,211
	p	0,115	0,096	0,237	0,337	0,030	0,345

CAT: COPD Assessment Test; SMM: skeletal muscle mass; SMMI: skeletal muscle mass index; FFM: fat-free mass; FFMI: fat-free mass index; HGS: handgrip strength; GS: gait speed.

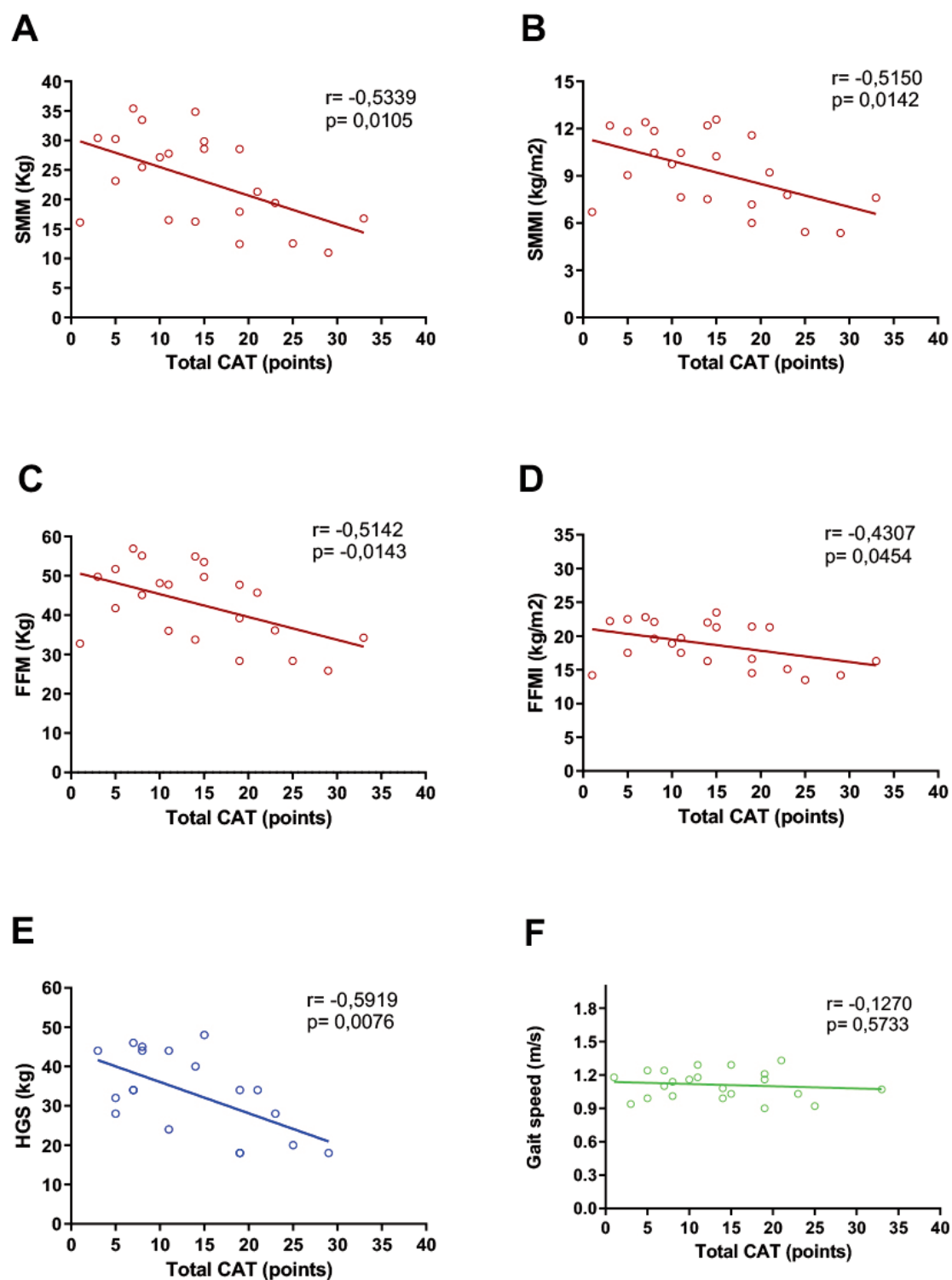
and HGS ($\beta = -0.421$, 95% CI: -0.653 to -0.188; $p = 0.001$), indicating better quality of life. Among these variables, HGS demonstrated the strongest association with CAT scores, explaining 36.7% of the variance ($R^2 = 0.367$). In contrast, gait speed (GS) was not significantly associated with quality of life ($\beta = -6.420$, 95% CI: -28.27 to 15.43; $p = 0.549$).

After adjustment for age, ACCI, and GOLD stage (Model 2), HGS remained independently associated with quality of life ($\beta = -0.359$, 95% CI: -0.678 to -0.039; $p = 0.030$). The adjusted model including HGS explained 56.1% of the variance in CAT scores ($R^2 = 0.561$).

DISCUSSION

This study identified that the quality of life of older adults with COPD is directly correlated with muscle mass and

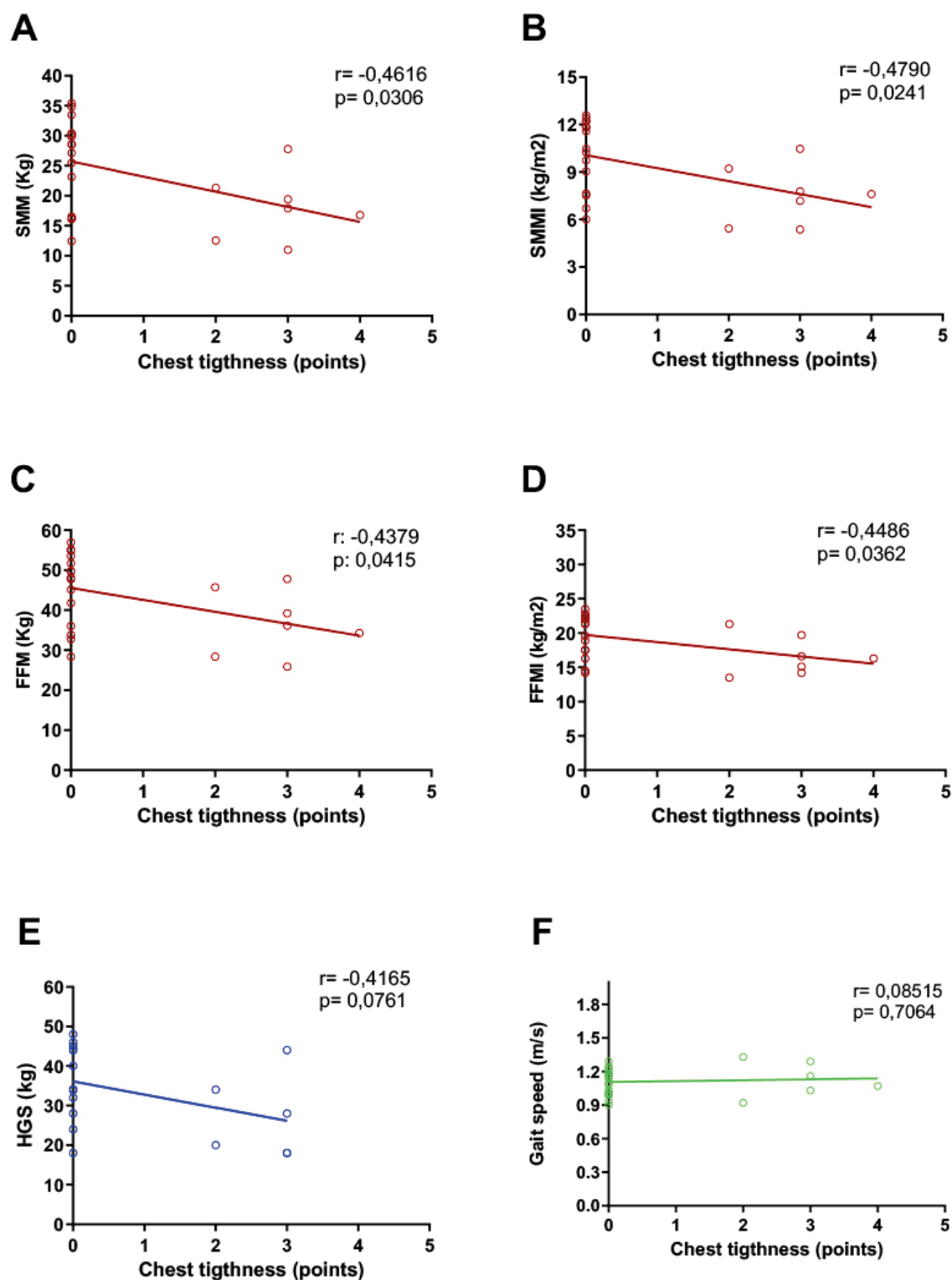
strength. Subjects who had lower skeletal muscle mass and handgrip strength had more respiratory symptoms and a poorer overall quality of life. The CAT questionnaire showed significant correlations between some of the components, such as chest tightness, activity limitation, lack of confidence when leaving home, and energy level, and muscle parameters. The results suggest that lower muscle mass and strength can aggravate respiratory symptoms, dyspnea, fatigue, and functional limitation, directly affecting the quality of life of older adults with COPD. However, although several sarcopenia-related variables were significantly associated with CAT, only handgrip strength remained independently associated with quality of life after adjustment for confounders. This finding suggests that muscle strength may be a more relevant determinant of perceived health status than muscle mass alone in individuals with COPD.



This figure provides an overview of how overall symptom burden, as measured by the CAT, correlates to different components of muscle mass and muscle function in older adults with COPD.

CAT: COPD Assessment Test; SMM: skeletal muscle mass; SMMI: skeletal muscle mass index; FFM: fat-free mass; FFMI: fat-free mass index; HGS: handgrip strength.

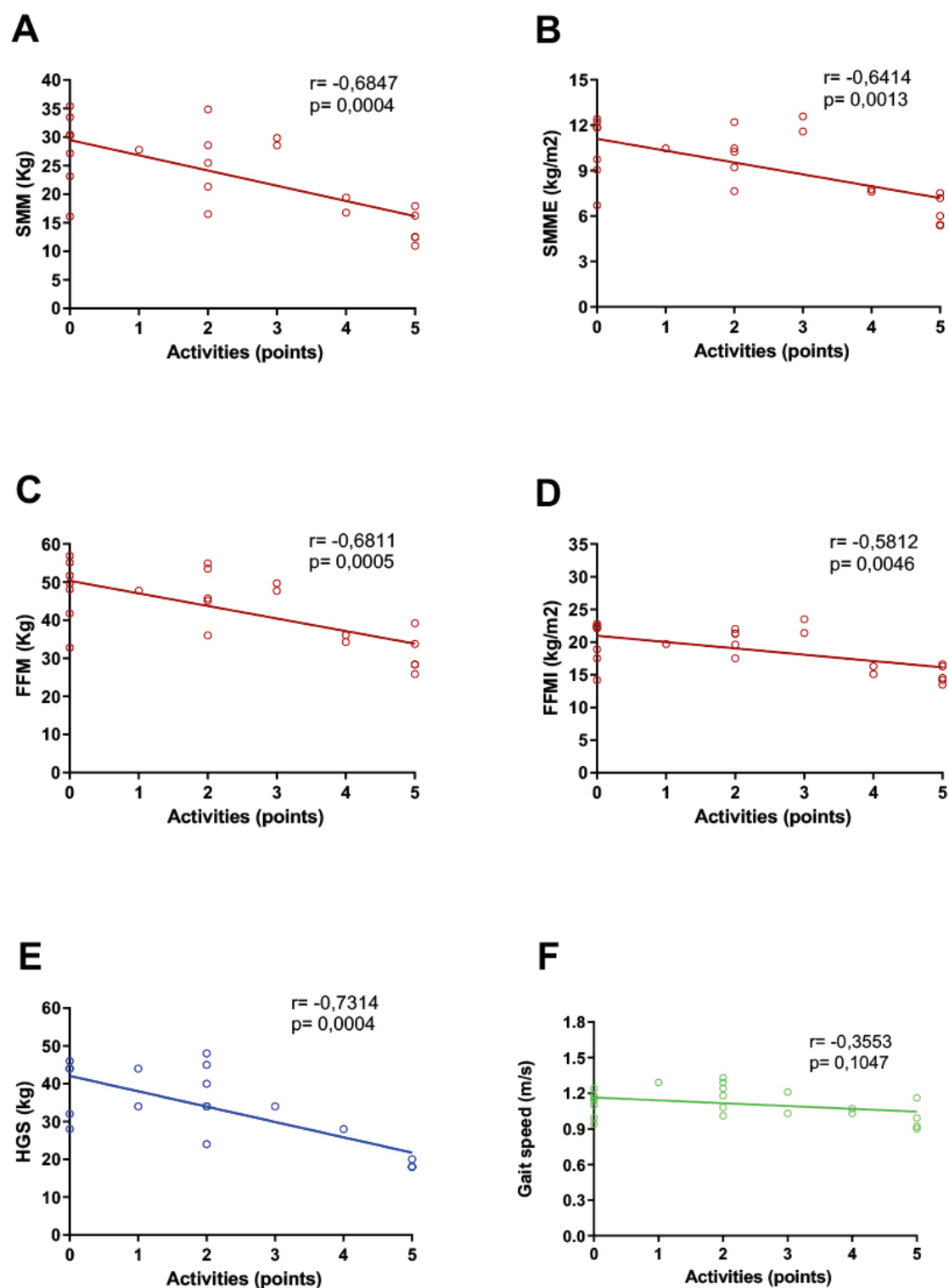
Figure 1. Clinical criteria for sarcopenia and total "CAT score"



This figure summarizes how the symptoms of chest tightness correlates to different components of muscle mass and muscle function in older adults with COPD.

SMM: skeletal muscle mass; SMMI: skeletal muscle mass index; FFM: fat-free mass; FFMI: fat-free mass index; HGS: handgrip strength.

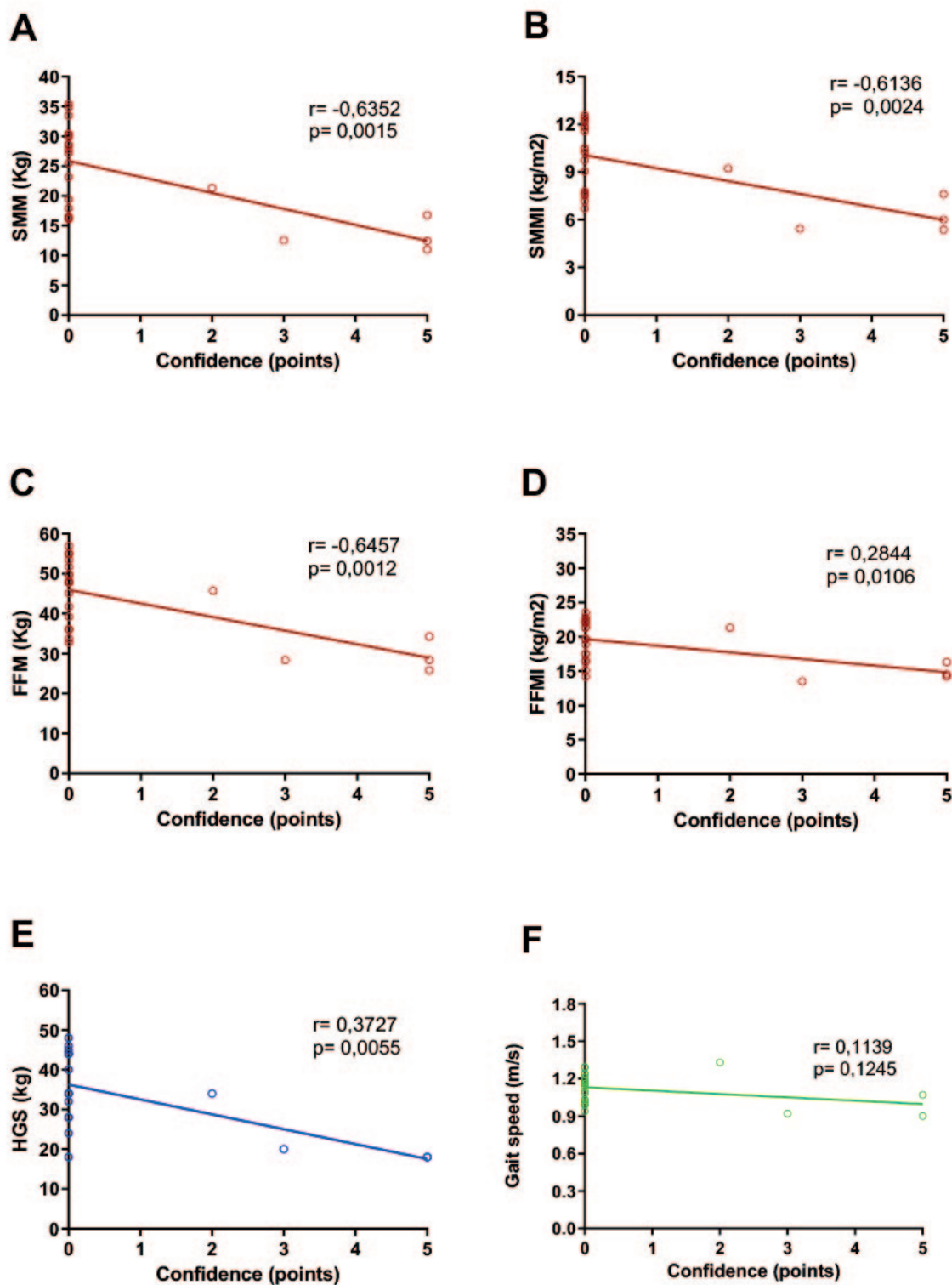
Figure 2. Clinical criteria for sarcopenia and "Chest tightness"



This figure provides an overview of how activity limitations reported in the CAT correlate to different components of muscle mass and muscle function in older adults with COPD.

SMM: skeletal muscle mass; SMME: skeletal muscle mass index; FFM: fat-free mass; FFMI: fat-free mass index; HGS: handgrip strength.

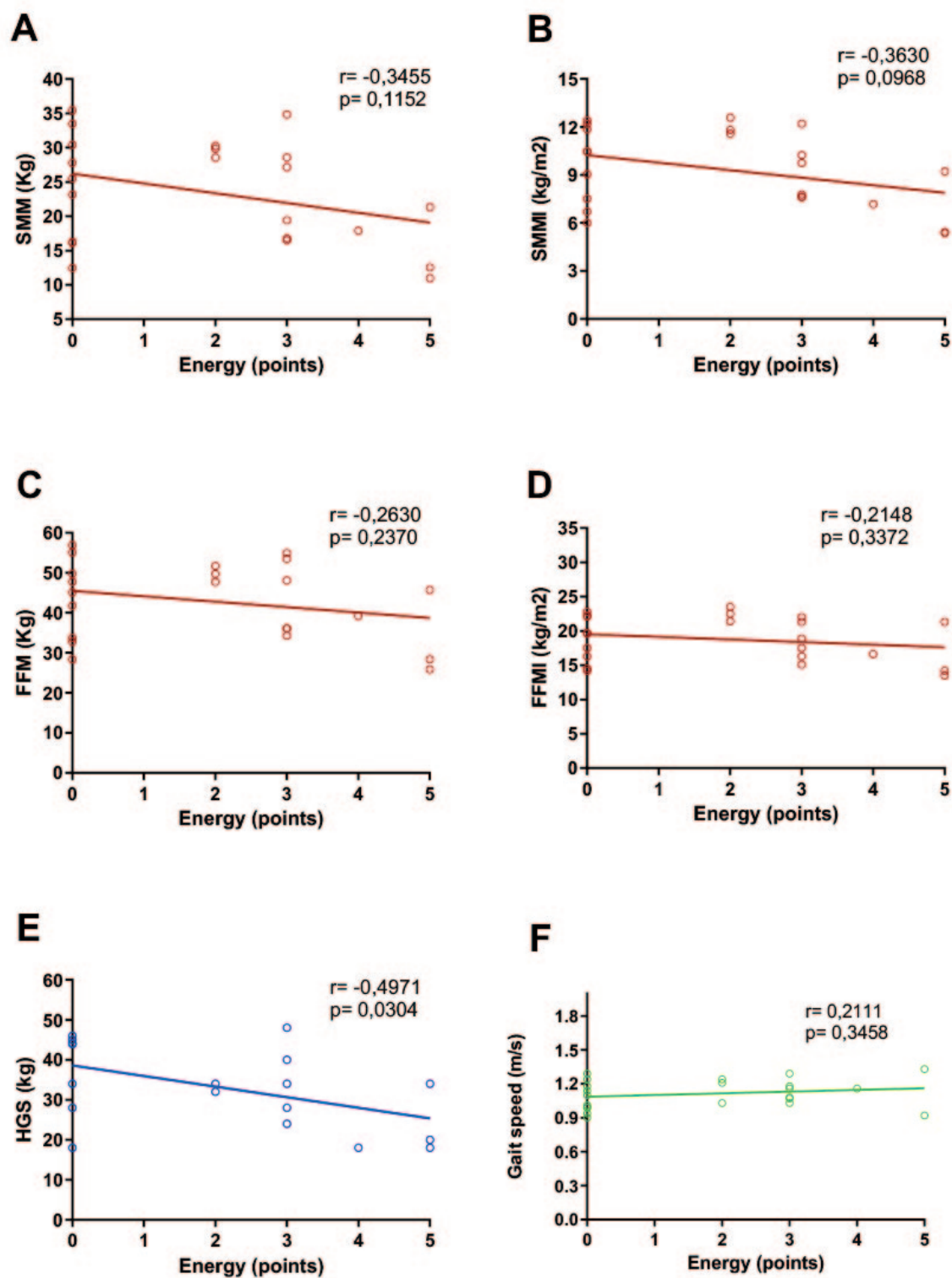
Figure 3. Clinical criteria for sarcopenia and "Activities"



This figure summarizes how reduced confidence reported in the CAT correlates to different components of muscle mass and muscle function in older adults with COPD.

SMM: skeletal muscle mass; SMMI: skeletal muscle mass index; FFM: fat-free mass; FFMI: fat-free mass index; HGS: handgrip strength.

Figure 4. Clinical criteria for sarcopenia and "Confidence"



This figure summarizes how the symptom of energy correlates with different components of muscle mass and muscle function in older adults with COPD.

SMM: skeletal muscle mass; SMMI: skeletal muscle mass index; FFM: fat-free mass; FFMI: fat-free mass index; HGS: handgrip strength.

Figure 5. Clinical criteria for sarcopenia and "Energy"

Table 3. Association between Clinical criteria for sarcopenia and quality of life in individuals with COPD

Variables	Model 1			Model 2		
	β (95%IC)	p value	R ²	β (95%IC)	p value	R ²
SMM	-0,486 (-0,805 to -0,167)	0,018	0,197	-0,613 (-0,910 to 0,104)	0,112	0,457
SMMI	-1,603 (-2,773 to -0,433)	0,009	0,234	-1,506 (-3,155 to 0,143)	0,071	0,479
FFM	-0,325(-0,541 to -0,109)	0,005	0,254	-0,256 (-0,605 to 0,092)	0,141	0,447
FFMI	-1,016 (-1,831 to -0,202)	0,016	0,189	-0,894 (-2,058 to 0,271)	0,125	0,452
HGS	-0,421 (-0,653 to -0,188)	0,001	0,367	-0,359 (-0,678 to -0,039)	0,030	0,561
GS	-6,420 (-28,27 to 15,43)	0,549	0,017	-1,722 (-25,67 to 22,23)	0,881	0,322

CAT: COPD Assessment Test; SMM: skeletal muscle mass; SMMI: skeletal muscle mass index; FFM: fat-free mass; FFMI: fat-free mass index; HGS: handgrip strength; GS: gait speed.

Model 1: Unadjusted model. Model 2: Adjusted model for age, ACCI and GOLD stage.

Our results are consistent with those previously described in the literature, where sarcopenia has been identified as a determining factor in functional decline and perceived well-being in people with COPD²⁰. Variables such as muscle strength and mass, currently used as the main diagnostic criteria for sarcopenia according to the EWGSOP 2 consensus, have been consistently associated with poorer health and greater functional limitation in this population. A recent study¹, demonstrated a close relationship between muscle mass and lung function in older adults with COPD, suggesting that muscle deterioration contributes to lower exercise tolerance and, therefore, poorer quality of life. In the present study, muscle mass-related variables were associated with quality of life in the unadjusted analyses; however, these associations were no longer significant after adjustment for age, comorbidity burden, and COPD severity. In contrast, handgrip strength remained independently associated with CAT scores and explained the highest proportion of variance in quality of life. In contrast, no significant correlation was observed with physical performance measured by gait speed, which could indicate that, in this sample, respiratory and muscular aspects have a greater weight than general mobility in the perception of well-being. This finding is consistent with the recent discussion on the new concept of sarcopenia, which emphasizes that muscle mass and strength are more relevant components than physical performance in characterizing the clinical impact of this condition in COPD^{21,22}.

It is important to note that quality of life is not affected uniformly across all domains. Some CAT items, especially those related to chest tightness, confidence, performing daily activities, and energy, appear to be more closely related to decreased muscle mass and strength. This could be explained by the multifactorial role of sarcopenia, which not only affects physical function but also self-perception of capacity, inde-

pendence, and autonomy, essential components of subjective well-being in older people with COPD^{20,22}. Another study²³ has shown that muscle mass and strength are directly related to better performance in activities of daily living in older adults and people with COPD. Therefore, these results reinforce the need to consider muscle function and mass as key indicators in the comprehensive assessment of quality of life in this population, as well as in the design of pulmonary rehabilitation interventions.

The assessment of sarcopenia should be included due to its association with adverse effects in the elderly population with COPD. According to some studies, sarcopenia is associated with falls, increased hospitalizations, loss of functional independence, and higher mortality^{4,8,22}. In addition, a systematic review reported that sarcopenia increases mortality, the risk of physical disability, and poorer quality of life²⁴. Other studies report that low muscle mass and strength are independent predictors of loss of functionality in activities of daily living and instrumental activities of daily living (ADL and IADL)^{22,23,25}. Our study supports the above findings on loss of functionality in activities of daily living, as we identified a strong correlation between muscle mass and strength and limitations in domestic activities. The presence of sarcopenia in older people with COPD exacerbates existing functional limitations and can accelerate deterioration²⁶. For this reason, it is necessary and important in the clinical setting to include the assessment of sarcopenia in people with COPD.

Recently, the Global Leadership Initiative in Sarcopenia (GLIS)²⁷, published a consensus report in 2025 that seeks to standardize and update the diagnostic criteria for sarcopenia. In their report, they emphasize that the future operational definition should go beyond traditional criteria (mass, strength, and physical performance) and incorporate functional and health

outcome criteria to maximize its clinical utility. In addition, the conceptual consensus derived from the Delphi process proposed three main components for the definition of sarcopenia: muscle mass, muscle strength, and specific muscle strength²⁷. Therefore, physical performance is considered only an outcome, not a central component of the diagnosis, which differs significantly from previous definitions such as the EWGSOP²⁷. The present study found no relationship between physical performance and quality of life components in the CAT. A 2019 study²⁸, compared physical performance in people with COPD with and without sarcopenia using the 6-minute walk test, where no correlation was found between sarcopenia and physical performance. This suggests that perceived functional limitations in CAT are primarily associated with loss of muscle mass and strength, rather than with physical performance alone, supporting the conceptual change proposed by GLIS²⁷. Moreover, the fact that handgrip strength remained independently associated with quality of life after adjustment for age, comorbidity burden, and disease severity provides additional support for the growing recognition of muscle strength as one of the most clinically relevant components of sarcopenia. These findings reinforce the GLIS proposal that muscle strength may have greater clinical utility than physical performance when evaluating patient-centered outcomes in COPD.

This study has some limitations. First, the relatively small sample size and the use of a convenience sampling strategy may limit the generalizability of the findings and reduce the statistical power of the analyses, increasing the possibility of Type II errors. Second, its cross-sectional design prevents the establishment of causal relationships between sarcopenia and quality of life. In addition, muscle mass was estimated using bioimpedance rather than dual-energy X-ray absorptiometry (DEXA), which is considered the gold standard for this measurement²⁹. On the other hand, as strengths of this study, handgrip strength and walking speed were assessed following the international recommendations of the EWGSOP²¹, which lends validity to the results obtained. Future studies should use longitudinal designs with larger sample sizes and consider comparisons between subjects with and without sarcopenia to deepen the understanding of the ways in which muscle function and mass affect quality of life in people with COPD.

CONCLUSION

Clinical criteria for sarcopenia, such as muscle strength and mass, correlate with self-reported respiratory symptoms using the CAT questionnaire. In particular, the items "Activities", "Chest tightness", "Energy" and "Confidence" showed the strongest associations. After adjustment for age, comorbidity burden, and COPD severity, handgrip strength was the only sarcopenia-related variable independently associated with quality of life. These findings highlighting muscle strength and mass as a potentially important clinical marker of health status in this population.

REFERENCES

1. Yang X, Wei Y, Zhao J, Bai Y. Correlation of lung function and sarcopenia in elderly patients with chronic obstructive pulmonary disease and analysis of factors influencing sarcopenia. *Am J Transl Res*. 2025;17(1):358–76. doi:10.62347/OGUT1532
2. The top 10 causes of death [Internet]. [cited 2025 Aug 28]. Available from: <https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death>
3. Wang D, Zhang M, Huang J, Zhang H, Chen S, Wang K. Associations between sedentary behaviour and sarcopenia among patients aged 40 and older with chronic obstructive pulmonary disease: a cross-sectional study. *BMC Public Health*. 2025 Dec 1;25(1):1–10. doi:10.1186/S12889-025-21450-Y/FIGURES/3 PubMed PMID: 39881257.
4. Yu Z, He J, Chen Y, Zhou Z, Wang L. Chronic obstructive pulmonary disease as a risk factor for sarcopenia: A systematic review and meta-analysis. *PLoS One*. 2024 Apr 1;19(4):e0300730. doi:10.1371/JOURNAL.PONE.0300730 PubMed PMID: 38635756.
5. Sepúlveda-Loyola W, Osadnik C, Phu S, Morita AA, Duque G, Probst VS. Diagnosis, prevalence, and clinical impact of sarcopenia in COPD: a systematic review and meta-analysis. *J Cachexia Sarcopenia Muscle*. 2020 Oct 1;11(5):1164–76. doi:10.1002/JCSM.12600 PubMed PMID: 32862514.
6. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, Boirie Y, Cederholm T, Landi F, et al. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. *Age Ageing*. 2010 Jul 1;39(4):412–23. doi:10.1093/AGEING/AFQ034 PubMed PMID: 20392703.
7. Sepúlveda-Loyola W, Álvarez-Bustos A, Valenzuela-Fuenzalida JJ, Ordinola Ramírez CM, Saldías Solís C, Probst VS. Are There Differences in Postural Control and Muscular Activity in Individuals with COPD and with and Without Sarcopenia? *Adv Respir Med*. 2025 Feb 1;93(1):5. doi:10.3390/ARM93010005/S1 PubMed PMID: 39996622.
8. He J, Li H, Yao J, Wang Y. Prevalence of sarcopenia in patients with COPD through different musculature measurements: An updated meta-analysis and meta-regression. *Front Nutr*. 2023 Feb 16;10:1137371. doi:10.3389/FNUT.2023.1137371/BIBTEX
9. Sepúlveda Loyola W, Pereira Junior PS, Valenzuela Fuenzalida JJ, Santillán Zuta M, Suziane Probst V. Impact of pre-sarcopenia and sarcopenia on biological and functional outcomes in individuals with chronic obstructive pulmonary disease: a cross-sectional study. *Nutr Clín Diet Hosp* [Internet]. 2024 Feb 14;44(1). doi:10.12873/441 SEPULVEDA
10. Cherian M, Masoudian P, Thavorn K, Sandoz J, Shorr R, Mulpuru S. The impact of frailty on clinical outcomes among individuals with COPD: a systematic review and meta-analysis. *BMC Pulm Med*. 2025 Dec 1;25(1):1–12. doi:10.1186/S12890-025-03595-Z/FIGURES/3 PubMed PMID: 40165150.
11. Jones PW, Harding G, Berry P, Wiklund I, Chen WH, Kline Leidy N. Development and first validation of the COPD Assessment Test. *European Respiratory Journal*. 2009 Aug 31;34(3):648–54. doi:10.1183/09031936.00102509 PubMed PMID: 19720809.

12. Global Initiative for Chronic Obstructive Lung Disease - Global Initiative for Chronic Obstructive Lung Disease - GOLD [Internet]. [cited 2025 Aug 30]. Available from: <https://goldcopd.org/>
13. Malta M, Cardoso LO, Bastos FI, Magnanini MMF, da Silva CMFP. Iniciativa STROBE: subsídios para a comunicação de estudos observacionais. *Rev Saude Publica*. 2010;44(3):559–65. doi:10.1590/S0034-89102010000300021 PubMed PMID: 20549022.
14. Sepúlveda Loyola WA, Vilaça Cavallari Machado F, Araújo de Castro L, Hissnauer Leal Baltus T, Rampazzo Morelli N, Landucci Bonifácio K, et al. Is oxidative stress associated with disease severity, pulmonary function and metabolic syndrome in chronic obstructive pulmonary disease? *Rev Clin Esp*. 2019 Jun 29. doi:10.1016/j.rce.2019.04.007 PubMed PMID: 31266638.
15. Janssen I, Baumgartner RN, Ross R, Rosenberg IH, Roubenoff R. Skeletal Muscle Cutpoints Associated with Elevated Physical Disability Risk in Older Men and Women. *Am J Epidemiol*. 2004 Feb 15;159(4):413–21. doi:10.1093/AJE/KWH058 PubMed PMID: 14769646.
16. Charlson M, Szatrowski TP, Peterson J, Gold J. Validation of a combined comorbidity index. *J Clin Epidemiol*. 1994 Nov 1; 47(11):1245–51. doi:10.1016/0895-4356(94)90129-5 PubMed PMID: 7722560.
17. Graham BL, Steenbruggen I, Barjaktarevic IZ, Cooper BG, Hall GL, Hallstrand TS, et al. Standardization of Spirometry 2019 Update. An Official American Thoracic Society and European Respiratory Society Technical Statement. <https://doi.org/10.1164/rccm.201908-1590ST>. 2019 Oct 15;200(8):E70–88. doi:10.1164/RCCM.201908-1590ST PubMed PMID: 31613151.
18. Stanojevic S, Kaminsky DA, Miller MR, Thompson B, Aliverti A, Barjaktarevic I, et al. ERS/ATS technical standard on interpretive strategies for routine lung function tests. *European Respiratory Journal*. 2022 Jul 13;60(1). doi:10.1183/13993003.01499-2021 PubMed PMID: 34949706.
19. Schober P, Boer C, Schwarte LA. Correlation Coefficients: Appropriate Use and Interpretation. *Anesth Analg*. 2018 May; 126(5):1763–8. doi:10.1213/ANE.0000000000002864
20. Matera MG, Page C, Cazzola M. Sarcopenia as a Treatable Trait in COPD: From Mechanisms to Management. *Respir Med*. 2025 Nov 1; 248:108401. doi:10.1016/j.rmed.2025.108401
21. Cruz-Jentoft AJ, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, et al. Sarcopenia: revised European consensus on definition and diagnosis. *Age Ageing*. 2019 Jan 1;48(1):16–31. doi:10.1093/AGEING/AFY169 PubMed PMID: 30312372.
22. Beaudart C, Alcazar J, Aprahamian I, Batsis JA, Yamada Y, Prado CM, et al. Health outcomes of sarcopenia: a consensus report by the outcome working group of the Global Leadership Initiative in Sarcopenia (GLIS). *Aging Clin Exp Res*. 2025 Dec 1;37(1):1–13. doi:10.1007/S40520-025-02995-9/FIGURES/1 PubMed PMID: 40120052.
23. Ruas G, Urquiza WEC, Abdalla GK, Abrahão DPS, Cardoso FAG, Pinheiro PS, et al. Relationship of muscle strength with activities of daily living and quality of life in individuals with chronic obstructive pulmonary disease. *Fisioterapia em Movimento*. 2016 Mar;29(1):79–86. doi:10.1590/0103-5150.029.001.AO08
24. Beaudart C, Zaaria M, Pasleau F, Reginster JY, Bruyère O. Health Outcomes of Sarcopenia: A Systematic Review and Meta-Analysis. *PLoS One*. 2017 Jan 1;12(1):e0169548. doi:10.1371/JOURNAL.PONE.0169548 PubMed PMID: 28095426.
25. Voulgaridou G, Tyrovolas S, Detopoulou P, Tsoumana D, Drakaki M, Apostolou T, et al. Diagnostic Criteria and Measurement Techniques of Sarcopenia: A Critical Evaluation of the Up-to-Date Evidence. *Nutrients* 2024, Vol 16, Page 436. 2024 Feb 1;16(3): 436. doi:10.3390/NU16030436 PubMed PMID: 38337720.
26. Van Bakel SIJ, Gosker HR, Langen RC, Schols AMWJ. Towards Personalized Management of Sarcopenia in COPD. *Int J Chron Obstruct Pulmon Dis*. 2021;16:25. doi:10.2147/COPD.S280540 PubMed PMID: 33442246.
27. Kirk B, Cawthon PM, Arai H, Ávila-Funes JA, Barazzoni R, Bhasin S, et al. The Conceptual Definition of Sarcopenia: Delphi Consensus from the Global Leadership Initiative in Sarcopenia (GLIS). *Age Ageing*. 2024 Mar 1;53(3). doi:10.1093/AGEING/AFY169 PubMed PMID: 38520141.
28. Chua JR, Albay AB, Tee ML. Body Composition of Filipino Chronic Obstructive Pulmonary Disease (COPD) Patients in Relation to Their Lung Function, Exercise Capacity and Quality of Life. *Int J Chron Obstruct Pulmon Dis*. 2019;14:2759. doi:10.2147/COPD.S22809 PubMed PMID: 31819408.
29. Lee JH, Kim HJ, Han S, Park SJ, Sim M, Lee KH. Reliability and Agreement Assessment of Sarcopenia Diagnosis through Comparison of Bioelectrical Impedance Analysis and Dual-Energy X-ray Absorptiometry. *Diagnostics (Basel)*. 2024 May 1;14(9). doi:10.3390/DIAGNOSTICS14090899 PubMed PMID: 38732314.