LUPUS SCIENCE & MEDICINE™

Prevalence of sarcopenia and its association with clinical features and health-related quality of life in Brazilian women with systemic lupus erythematosus

Emerson Pena ,[1,2] Leonardo Peterson dos Santos,[1,2] Rafaela Cavalheiro do Espírito Santo,[1,2,3] Lucas Denardi Dória,[1,2] Stephanie Pilotti,[1,2] André Luiz Silveira Mallmann,[1,2] Daniel Nóbrega de Moraes,[1,2] Clarice Moura Mata Machado,[4,5] Cristina Costa Duarte Lanna,[4,6] Olivio Brito Malheiro,[4] Emanoel Luis da Silveira,[5] Rosa Weiss Telles,[4,7] Fabiana de Miranda Moura,[4,6] Andrese Aline Gasparin,[1,2] Vanessa Hax,[1,2] Poli Mara Spritzer,[1,2] Tayane Muniz Fighera,[1,2] Rafael Mendonça da Silva Chakr,[1,2] Ricardo Machado Xavier,[1,2] Odirlei André Monticielo[1,2]

To cite: Pena E, Peterson dos Santos L, Cavalheiro do Espírito Santo R, *et al*. Prevalence of sarcopenia and its association with clinical features and health-related quality of life in Brazilian women with systemic lupus erythematosus. *Lupus Science & Medicine* 2025;**12**:e001447. doi:10.1136/lupus-2024-001447

Received 12 November 2024
Accepted 5 April 2025

For numbered affiliations see end of article.

Correspondence to
Dr Emerson Pena;
emersonpena1997@rede.ulbra.br

ABSTRACT

Objectives To assess the prevalence of sarcopenia and examine its association with clinical features, health-related quality of life (HRQoL), muscle-specific strength and body composition in patients with systemic lupus erythematosus (SLE).

Methods In this cross-sectional multicentre study, women with SLE (18–50 years old) were included. Data collected included clinical features and HRQoL. Muscle strength was assessed using the handgrip test (kg), appendicular skeletal muscle mass index (ASMI, kg/m²) was measured using dual-energy X-ray absorptiometry. Physical performance was assessed using the timed-up-and-go test (TUG, seconds). Sarcopenia was defined by the European Working Group on Sarcopenia in Older People-2 criteria. The muscle-specific strength was evaluated by dividing their arm strength by their lean arm mass. Pearson's or Spearman's correlation coefficients were performed (accepted at $p<0.05$).

Results Seventy-three SLE women were included, with median (IQR) age and disease duration of 37 (30–44) years old and 10.0 (4.0–16.8) years, respectively. Most of the patients (83.5%) had inactive or low disease activity and 31.0% presented a disease damage index score ≥1. Mean (±SD) handgrip strength, ASMI and muscle-specific strength was 25.58±8.31 kg, 6.62±0.97 kg/m² and 6.6±2.3, respectively. Median TUG was 6.9 (6.1–8.2) s. The prevalence of probable sarcopenia was 11.1%, and sarcopenia was 2.7%. Lower muscle strength, lower muscle-specific strength and lower physical performance, as well as sarcopenia, were correlated with worse HRQoL ($p<0.05$).

Conclusion In Brazilian patients with SLE with inactive or low disease activity, the prevalence of sarcopenia was low. However, low muscle strength, low muscle-specific strength and low physical performance were correlated with worse HRQoL, emphasising the need for muscle strength assessments in SLE management.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Sarcopenia affects physical function and quality of life in many chronic rheumatic diseases, but its prevalence and impact in systemic lupus erythematosus (SLE) are not well established.

WHAT THIS STUDY ADDS

⇒ This study found that reduced muscle strength and physical performance are associated with poorer health-related quality of life in women with SLE.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ These findings suggest that routine assessment of muscle strength and physical performance may support disease management and help improve quality of life in patients with SLE.

INTRODUCTION

Systemic lupus erythematosus (SLE) is a chronic inflammatory autoimmune disease with multisystem involvement.[1 2] SLE may affect various organs and systems, including the musculoskeletal system.[1–3] A meta-analysis demonstrated that patients with SLE often experience decreased muscle strength compared with healthy individuals.[4] On the other hand, studies comparing appendicular skeletal muscle mass in patients with SLE and healthy controls are limited, and the available data present conflicting results.[5] This discrepancy is likely due to variations in the methods used to assess muscle mass.[4–7] Changes in

muscle strength and muscle mass can result in sarcopenia.[8]

Sarcopenia is a generalised disease of skeletal muscle characterised by a reduction of muscle mass and muscle strength, which has a negative impact on physical performance.[8] Sarcopenia can occur as a consequence of the age-related decline, which is referred to as primary sarcopenia or as a consequence of complications of several diseases, called secondary sarcopenia.[8–10]

Only three studies reported the prevalence of sarcopenia in SLE.[11–13] Santos *et al* assessed 92 women with SLE and used the fat-free mass index to diagnose sarcopenia.[11] In this study, the authors found 10.9% of sarcopenia prevalence. Sumatri *et al* investigated 145 Indonesian women with SLE and diagnosed sarcopenia in 17.9% using the Asian Working Group on Sarcopenia (AWGS) 2019 criteria.[13] Finally, a recent study in the Turkish population evaluated 82 women with SLE and 54 age-matched and sex-matched health controls using the European Working Group on Sarcopenia in Older People-2 (EWGSOP2) criteria and specific cut-off points for the Turkish population. Sarcopenia was observed in 12.9% of SLE patients and 5.8% of the control group. However, this difference was not statistically significant.[12]

Adiposity is a well-known confounder that may lead to underestimating the prevalence of sarcopenia,[14] making it an important factor to assess in patients with SLE.[5] Additionally, muscle-specific strength, defined as strength standardised to muscle size,[15] is an emerging concept in the literature. The importance of this measure was highlighted by Delphi consensus from the global leadership initiative in sarcopenia (GLIS).[10]

Recognising that sarcopenia is a public health concern by virtue of numerous consequences (such as the development of physical disability, depression, hospitalisation and mortality) and that there is limited evidence of sarcopenia in SLE, more studies are necessary to expand our understanding of sarcopenia in patients with SLE and associations with clinical features and health-related quality of life (HRQoL).[5 16–18]

Therefore, our objectives were (1) to assess the prevalence of sarcopenia according to the EWGSOP2 diagnostic classification criteria and (2) to examine the correlation of sarcopenia and its components with clinical features, quality of life, muscle-specific strength and body composition in Brazilian patients with SLE.

METHODS

Study design and participants

In a cross-sectional study conducted at a public hospital in Rio Grande do Sul (Hospital de Clínicas de Porto Alegre, HCPA) and a public hospital in Minas Gerais (Hospital das Clínicas da Universidade Federal de Minas Gerais/Ebserh (HC-UFMG), participants diagnosed with SLE were recruited in a convenience sampling. This study was approved by the institutional review boards of HCPA (number: 2020–0576) and HC-UFMG (number: 189–2017). The declaration of Helsinki principles was followed and all subjects gave written informed consent. This study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology checklist for cross-sectional studies.[19]

Inclusion/exclusion criteria

Women diagnosed with SLE according to the Systemic Lupus International Collaborating Clinics (SLICC-2012) and aged between 18 and 50 years old were included in the study. This age range was selected to minimise confounding factors related to the potential presence of primary sarcopenia, which is related to age and the ageing process.

Patients who met at least one of these criteria were excluded: (1) dysphagia; (2) illicit drug use or alcohol abuse (self-reported by the patient, defined as the consumption of three or more drinks per day or seven or more drinks per week, with each serving equivalent to 330 mL of beer or 150 mL of wine or 45 mL of distilled spirits); (3) severe chronic heart failure defined as New York Heart Association class 3 or 4; (4) severe chronic obstructive pulmonary disease (modified Medical Research Council (mMRC) ≥2, according to the modified medical research council scale); (5) chronic kidney disease (with mean CKD-EPI creatinine clearance <30 mL/min/1.7², according to the Chronic Kidney Disease Epidemiology Collaboration); (6) diabetes; uncompensated thyroid disorder; (7) history of cancer within the last 5 years (except non-melanoma skin cancer); (8) other rheumatic diseases; (9) myositis; (10) chronic viral, bacterial and fungal infections; (11) history of locomotor system surgery within the past year; (12) clinical or surgical complications requiring hospitalisation for more than 7 days in the last 6 months; (13) pregnant and lactating women; (14) patients with deformities in the lower and upper limbs (bone erosions that make it impossible to carry out the data collection protocol); (15) osteonecrosis at any site; (16) patients with a history of engaging in resistance exercise, supervised or unsupervised by physicians or physical therapists, for a duration of 12 weeks or more within the last 6 months.

A total of 161 patients were eligible and 89 patients did not consent to participation in this study. Therefore, our sample consisted of 73 patients (figure 1).

Sample size calculation

The sample size calculation for estimating the prevalence of sarcopenia was based on the study by Santos *et al*,[11] who evaluated the prevalence of sarcopenia in patients with SLE compared with patients with rheumatoid arthritis and healthy controls. They found sarcopenia in 10.9% of patients with SLE. A sample size of 68 patients was determined to be sufficient for the present study with a 99% confidence level, considering this prevalence rate, with a margin of error of 5% and a design effect of 1.0. The sample size calculation was performed using OpenEpi software (V.3).

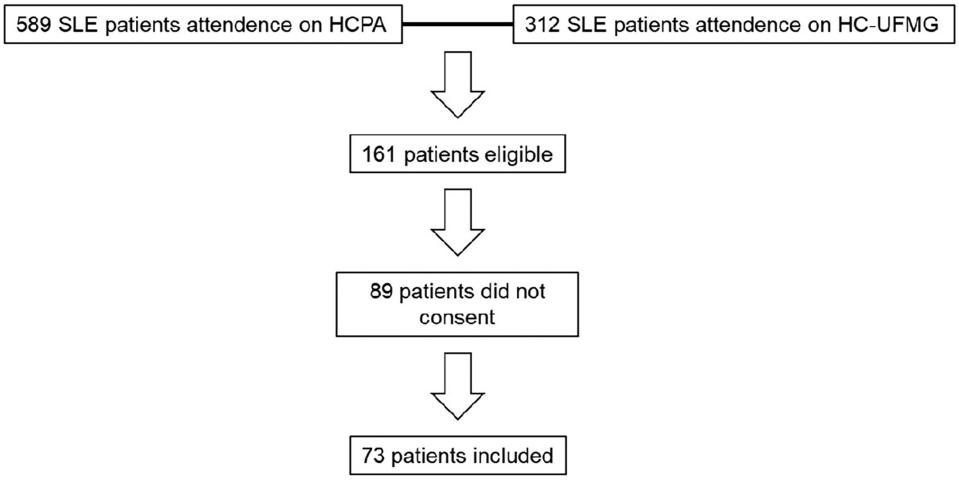

Figure 1 Flow diagram of the study population. HCPA, hospital de Clínicas de Porto Alegre; HC-UFMG, Hospital das Clínicas da Universidade Federal de Minas Gerais.

Measurement procedures

Data collection

Clinical features such as age, disease duration (years), self-reported race/colour (white, brown, black) defined by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística),[20] pharmacological treatments and current smoking status were assessed by a review of medical records. Disease activity and cumulative damage were evaluated by rheumatologists during routine outpatient visits. Physical activity level, HRQoL, muscle strength, muscle mass, muscle-specific strength, physical performance and sarcopenia were collected by the physiotherapists (research team) during the study visit. Prior to data collection, a training session was conducted to standardise the data collection process between teams (HCPA and HC-UFMG).

Muscle strength

Muscle strength was measured by handgrip test using a handheld dynamometer (Jamar Hydraulic Hand Dynamometer, Preston, USA). The patient was instructed to squeeze the handle as hard as possible for 5 s, and the maximal isometric voluntary contraction of the right hand was thus quantified. The highest strength achieved by the subjects during the three attempts of maximum isometric contraction was used.[5 21 22] Muscle strength value below 16 kg for women was considered as low muscle strength.[5 8 23]

Body composition

Body weight was measured on an anthropometric scale with a resolution of 100 g (Filizola S.A. Pesagem e Automação, São Paulo, Brazil). Body mass index (BMI) was calculated as weight divided by height squared, expressed in kilograms per square metre, adjusted for age, and categorised as according to the definition of the WHO: underweight (≤18.5 kg/m^2), normal weight (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2) and obese (≥30 kg/m^2).[5 24]

To assess body composition, whole-body dual-energy X-ray absorptiometry (DXA) using a dual X-ray absorptiometry examination (Lunar Prodigy Primo, GE Medical Systems (HCPA) and Discovery W densitometer, Hologic, Bedford, MA (HC-UFMG)) was performed to estimate appendicular skeletal muscle mass and fat mass.[25 26] Appendicular skeletal muscle mass index (ASMI) was determined by sum of arm muscles and leg muscles and dividing the respective estimate by height squared (kg/m^2). Patients with ASMI below 5.5 kg/m^2 was considered to have low muscle mass. Fat mass index (FMI) was determined by total fat mass and dividing the respective estimate by height squared (kg/m^2). Patients with FMI above >9 kg/m^2 were considered to have increased fat mass.[5 27]

Muscle-specific strength

Muscle-specific strength (or specific force) is defined as strength standardised to muscle size.[15] In the present study, muscle-specific strength was quantified using the handgrip test normalised to the muscle mass of the upper extremities handgrip strength (kg)/arm lean mass by DXA (kg).[26 27]

Physical performance

Physical performance was assessed by the timed-up-and-go (TUG) test (total of 6 metres). Any time >20 s was considered low physical performance.[8]

Definition of sarcopenia

The diagnosis of sarcopenia was based on EWGSOP2 criteria. Probable sarcopenia was considered when patients showed low muscle strength. Sarcopenia was diagnosed when patients had low muscle strength and low muscle mass. Severe sarcopenia was diagnosed when patients exhibited low muscle strength, low muscle mass and low physical performance.[8]

Disease activity and cumulative permanent damage

The Systemic Lupus Erythematosus Disease Activity Index 2000 (SLEDAI-2k) was used to assess disease activity. The SLEDAI-2K score, which ranges from 0 to 105 points, is

classified as follows: The SLEDAI-2K score is classified as follows: SLE inactive (0 points); mild activity (1–5 points); moderate activity (6–10 points); high activity (11–19 points) and very high activity (20 or more points).[28] Cumulative permanent damage was evaluated using the Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index questionnaire.[5 29]

Health-related quality of life

The HRQoL was evaluated using the Systemic Lupus Erythematosus Quality of Life Questionnaire (SLEQoL), a SLE-specific questionnaire translated, adapted and validated for Brazilian patients.[30 31] The questionnaire comprises 40 items, divided into six domains: physical functioning (6 items), activities (9 items), symptoms (8 items), treatment (4 items), mood (4 items) and self-image (9 items), answers are given on a 1 to 7-point Likert scale (including 'not difficult at all' to 'extremely difficult'; 'not at all troubled' to 'extremely troubled'; and 'not at all often' to 'extremely often'). The total score is the sum of all responses across all domains, with higher scores indicating a poorer HRQoL. The total score ranges from 40 to 280.[5 30 31]

Statistical analysis

Descriptive statistics were used to summarise the data. The normality of continuous variables was assessed using the Shapiro–Wilk test. Normally distributed data were expressed as mean±SD, while non-normally distributed data were reported as median and IQR. Categorical variables were presented as absolute frequencies and percentages (%). Pearson's or Spearman's correlation coefficients were explored to assess the correlations between muscle strength, muscle mass, physical performance and muscle-specific strength with clinical features and HRQoL. A significance level of $p<0.05$ was adopted for all correlation analyses. All statistical analyses were conducted using the SPSS V.18. A two-tailed significance level of $p<0.05$ was considered statistically significant.

RESULTS

Sarcopenia status and clinical features

Our study identified eight patients (11.1%) with probable sarcopenia, two patients (2.7%) had sarcopenia confirmed (none presented severity) and sixty-two patients without sarcopenia. Our sample consisted of 73 patients with median age of 37.0 years old (IQR 30.0–44.0), and the median of disease duration was 10.0 (IQR 4.0–16.5) years. 31 (42.5%) participants described themselves as white, 13 (17.8%) as black, and 29 (39.7%) as mixed race. In regarding to disease activity, most patients (83.5%) exhibited inactive or low disease activity, while 31 (42.5%) patients exhibited cumulative disease damage. Thirty-two (43.8%) patients had received glucocorticoid in the last 12 months, and 55 (75.3%) patients had used hydroxychloroquine. Additional demographic and clinical details are shown in table 1.

Table 1 Clinical and epidemiology features of the patients with SLE

Characteristic	n	Results
Age (years), median (IQR)	73	37.0 (30.0–44.0)
Disease duration (years), median (IQR)	73	10.0 (4.0–16.5)
Current smoking status	20	27.4%
Disease activity		
SLEDAI-2k, median (IQR)	73	2 (0.0–4.0)
Inactive, %	32	43.8%
Low disease activity, %	29	39.7%
Moderate disease activity, %	7	9.6%
High disease activity, %	4	5.5%
Very high disease activity, %	1	1.4%
Cumulative disease damage		
SLICC/ACR-DI, median (IQR)	73	0.0 (0.0–1.0)
Treatment regime		
Cumulative dose of corticosteroid 12 months (grams), median (IQR)	32	2.1 (1.1–5.4)
Hydroxychloroquine (mg/day), median (IQR)	55	400.0 (342.8–400.0)
Health-related quality of life		
SLEQoL, total score, mean±SD	73	115.1±47.8

Results are expressed as mean±SD, median (IQR: interquartile 25%–75%); N: number and %: frequency.
SLE, systemic lupus erythematosus; SLEDAI-2k, Systemic Lupus Erythematosus Disease Activity Index 2000; SLEQoL, Systemic Lupus Erythematosus Quality of Life; SLICC/ACR-DI, Systemic Lupus International Collaborating Clinics/American College of Rheumatology Damage Index.

Components of sarcopenia and body composition

The mean handgrip strength was 25.6±8.3 kg. The mean appendicular skeletal muscle index was 6.6±1.0 kg/m². The median of physical performance was 6.9 (6.1–8.2) s. Eight patients (11.1%) exhibited probable sarcopenia, two patients (2.7%) had sarcopenia and no patients showed severe sarcopenia.

Additionally, the median BMI was 25.4 (22.8–30.8) kg/m² and most of the patients were overweight or obese (57.5%). The median FMI was 11.2 (7.7–14.6) kg/m², and most of the patients (60.3%) had increased fat mass. More details are described in table 2.

Correlations between the components of sarcopenia with clinical features and HRQoL

Lower muscle strength, lower muscle-specific strength and lower physical performance were associated with poorer HRQoL (figure 2). In addition, increased appendicular skeletal muscle index was correlated with increased fat mass ($\rho=0.623$, $p<0.001$). None of the correlations was found between sarcopenia components and clinical features ($p>0.05$).

Table 2 Prevalence of sarcopenia, muscle strength and body composition in patients with SLE

Characteristic	n	Results
BMI (kg/m²), median (IQR)	73	25.4 (22.8–30.8)
Underweight	1	1.4%
Normal weight	30	41.1%
Overweight	20	27.4%
Obese	22	30.1%
FMI (kg/m²), median (IQR)	73	11.2 (7.7–14.6)
Muscle mass		
ASMI (kg), mean±SD	73	6.6±1.0
Low muscle mass<5.5, (%)	7	9.6%
Muscle strength		
Handgrip test (kg), mean±SD	72	25.6±8.3
Muscle-specific strength, mean±SD	72	6.6±2.3
Physical performance		
TUG (seconds), median (IQR)	73	6.9 (6.1–8.2)
Sarcopenia status, n (%)		
No sarcopenia	63	87.5%
Probable sarcopenia	8	11.1%
Sarcopenia	2	2.7%

Results are expressed as mean±SD, median (IQR: interquartile 25%–75%) and number (n) with frequency (%).
ASMI, Appendicular Skeletal Muscle Mass Index; BMI, body mass index; FMI, fat mass index; SLE, systemic lupus erythematosus; TUG, timed up and go test.

Sarcopenia status and clinical features

Due to the small number of patients in the probable sarcopenia and sarcopenia group, no statistical analysis was performed. On the other hand, numerically, patients with sarcopenia showed of higher disease activity, cumulative disease damage, poorer quality of life (HRQoL) and lower BMI and FMI. More details are described in table 3.

DISCUSSION

Our study demonstrated 2.7% sarcopenia in women with SLE. Additionally, 11.1% of patients exhibited probable sarcopenia. Low muscle strength, low muscle-specific strength and low physical performance were correlated with a worse HRQoL. In addition, patients with sarcopenia numerically showed a trend of higher disease activity, cumulative disease damage, poorer quality of life (HRQoL), lower BMI and FMI.

The prevalence of sarcopenia in the present study was lower compared with literature. Santos *et al*[11] considered sarcopenia as a low lean mass index divided by height² and found 10.9% of sarcopenia in women with SLE. Sumantri *et al*[13] assessed by the AWGS criteria and reported 17.9% of sarcopenia. Recently, Bilici *et al*[12] evaluated sarcopenia in Turkish patients using the EWGSOP2 criteria and reported a prevalence of 12.9% in patients with SLE. Although sarcopenia can onset across various ages, the cut-off points used to estimate sarcopenia are still based on data from older populations. Therefore, recognising that our population is young, using the EWGSOP2 criteria could have underestimated the frequency of sarcopenia in our population. On the other hand, despite the cut-off points for estimating sarcopenia being based on older populations, we still identified sarcopenia in young adults with SLE. This highlights that alterations in body composition and muscle strength occur earlier in patients with SLE.

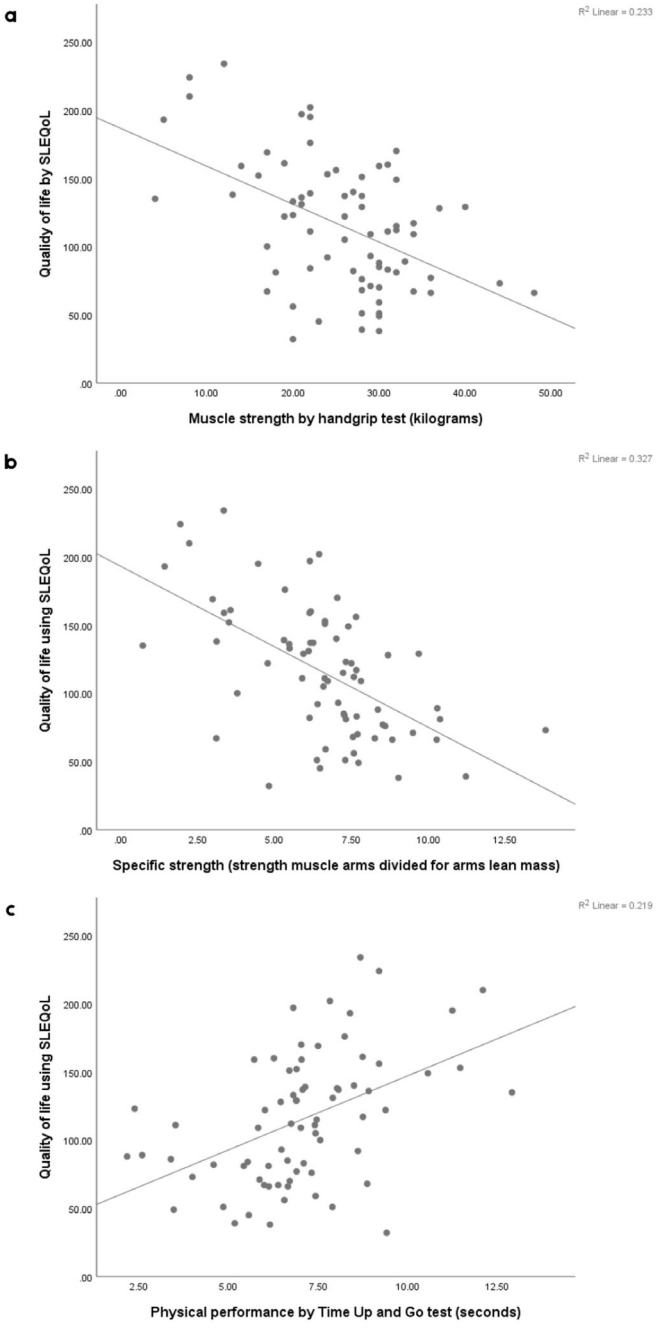

Figure 2 (a) Correlation analysis was significant between lower quality of life and lower muscle strength (r=−0.482; p<0.001), (b) lower specific strength (r=−0.572, p<0.001) and (c) lower physical performance (r=−0.368; p=0.038). SLEQoL, Systemic Lupus Erythematosus Quality of Life Questionnaire.

Table 3 Clinical features according to sarcopenia status

	No sarcopenia (n=64)	Probable sarcopenia (n=6)	Sarcopenia (n=2)
Age (year), median (IQR)	37.0 (29.2–44.0)	33.5 (30.7–44.0)	30.0; 35.5
Disease duration (years), median (IQR)	9.5 (4–16.7)	12.5 (3.2–21.5)	4.0; 7.0
SLEDAI-2k, median (IQR)	2.0 (0.0–4.0)	0.0 (0.0–1.0)	8.0; 10.5
SLICC/ACR-DI, median (IQR)	0.0 (0.0–1.0)	0.0 (0.0–1.0)	0.0; 1.5
Corticosteroid 12 months (grams), median (IQR)	1.9 (0.9–5.56)	2.1 (1.1–2.1)	1.1; 3.0
SLEQoL, mean±SD	109.0 (71.5–137.0)	155.5 (137.2–213.5)	193.0; 213.0
BMI (kg/m²), median (IQR)	25.35 (22.62–30.82)	28.9 (26.59–44.02)	19.0; 23.8
FMI (kg/m²), median (IQR)	10.8 (7.7–14.27)	16.1 (10.8–22.22)	4.0; 8.4

Results are expressed as mean±SD, median (IQR: interquartile 25%–75%) and number (n) with frequency (%). Statistical significance was considered at p<0.05.
BMI, body mass index; FMI, fat mass index; SLEDAI-2k, The Systemic Lupus Erythematosus Disease Activity Index 2000; SLEQoL, Systemic Lupus Erythematosus Quality of Life Questionnaire; SLICC/ACR-DI, Lupus International Collaborating Clinics/American College of Rheumatology Damage Index.

Another point to be considered as a confounding factor in the low prevalence of sarcopenia is related to the body composition of our patients. The majority of our patients had overweight or obese status and a high FMI. It is well-recognised that adiposity is an important confounding factor, potentially resulting in an underestimation of the prevalence of sarcopenia.[14]

Regarding muscle strength, our patients exhibited higher muscle strength when compared with Turkish[12] and Indonesian[13] patients. This difference can be explained by disease activity status. In our study, most patients had low disease activity, whereas in the Turkish study[12] and Indonesian study[13] most patients had moderate to high disease activity. It is known that SLE is a chronic inflammatory autoimmune disease with multisystem involvement, including the musculoskeletal system,[1–3] which may lead to the higher prevalence of sarcopenia. Furthermore, high disease activity is known to be associated with sarcopenia in rheumatic diseases.[9] The chronic inflammation, prolonged glucocorticoid therapy, and hormonal imbalances can induce muscle catabolism and atrophy.[9] In addition, factors such as decreased physical activity due to pain and fatigue further aggravate muscle loss.[9] A deeper understanding of these mechanisms is crucial to improve treatment strategies and preserve muscle function and quality of life in patients with SLE.

Correspondingly, 9.6% of our patients presented low muscle mass. It is important to highlight that our study was the first to use the ASMI by DXA for the assessment of sarcopenia in patients with SLE, in accordance with the EWGSOP2 criteria.[8] Moreover, our sample did not demonstrate low physical performance. Balsamo *et al*[32] evaluated the physical performance of patients with SLE using the TUG test. The authors reported mean times of 5.3±0.4 s for patients with SLE and 5.0±0.6 s for the control group (p=0.049). These values are slightly lower than those found in our patients (6.9 IQR 6.1–8.2 s); however, both values are considered good physical performance (<20 s).

Concerning muscle-specific strength, our study was the first to evaluate specific strength in patients with SLE, where it was correlated with worse HRQoL. Muscle-specific strength is an innovative concept that has been explored in the literature. It was recognised that muscle-specific strength was proposed by the GLIS committee recently.[10] More studies are necessary to explore the associations of muscle-specific strength with health outcomes in patients with SLE.

Our findings indicated that sarcopenia was correlated with worsening quality of life by the SLEQoL. Only one study assessed the association between sarcopenia and quality of life. Sumantri *et al*[13] did not find a difference in quality of life by the SARQoL between patients with sarcopenia and patients without sarcopenia, but there was an association between low muscle strength and SARQoL. On the other hand, our findings demonstrate this correlation between sarcopenia and low quality of life (SLEQoL). Although the quality of life questionnaire and the diagnostic criteria for sarcopenia were not the same in both studies, the importance of addressing muscle strength in the management of SLE is highlighted, particularly to improve the quality of life of patients with SLE. Recognising sarcopenia as a public health problem and its correlation with low HRQoL, longitudinal studies are necessary to assess the risk factors of sarcopenia in patients with SLE.

This study has some limitations. First, a control group of healthy women was not included in the study for comparative analysis. Furthermore, the selection criteria resulted in a sample of young adult patients, with inactive and low disease activity, which may have underestimated the prevalence of sarcopenia. Consequently, it would be important to assess the prevalence of sarcopenia in another clinical context such as older patients with SLE, with higher disease activity and chronicity. Moreover, the nutritional status of the patients was not evaluated, which may have influenced the findings. In addition, although

the assessment of body composition using DXA at both centres, different machines were used, which constitutes a limiting factor in our study. Despite these limitations, we conducted a two-centre study that is the first to evaluate sarcopenia in a Brazilian population with SLE. Additionally, we assessed sarcopenia using the criteria, cut-off points, and robust methods established by the EWGSOP2, measuring muscle strength with the handgrip test and muscle mass with DXA. In addition, our study is the first showing specific strength in patients with SLE.

It is recommended that patients undergo muscle strength testing at their routine outpatient visits. The tests are easy and quick to perform and directly predict the patient's muscle strength. Physical exercise should be suggested to improve HRQoL in patients with SLE. In conclusion, in Brazilian patients with SLE who exhibited low disease activity and low permanent damage under regular outpatient care, the prevalence of sarcopenia was 2.7% and probable sarcopenia was 11.1%, based on the diagnostic criteria outlined in the EWGSOP2 criteria. In addition, low muscle strength, low muscle-specific strength and low physical performance were correlated with a worse HRQoL. Patients with SLE with sarcopenia numerically showed a trends of higher disease activity, cumulative disease damage, poorer quality of life (HRQoL), lower BMI and FMI. Our findings underscore the significant impact of muscle-related factors on the HRQoL in patients with SLE, emphasising the importance of incorporating muscle strength assessments in SLE management.

Author affiliations
[1]Hospital de Clinicas de Porto Alegre, Porto Alegre, Brazil
[2]Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
[3]Klaipeda University, Klaipeda, Lithuania
[4]Hospital das Clinicas da Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
[5]Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
[6]Locomotor System Department, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
[7]Department of Internal Medicine, UFMG, Belo Horizonte, Brazil

Correction notice This article has been corrected since it was published. An author name has been corrected.

Contributors EP: main author, responsible for all stages of the work. Co-authors responsible for all stages of the work: OAM, RMX, LPdS, RCdES, LDD, SP, ALSM, DNdM. Co-authors responsible for the stages of final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: CMMM, CCDL, OBM, ELdS, RWT, FdMM, AAG, VH, RMdSC, PMS, TMF. Name of guarantor: OAM.

Funding We thank the Conselho Nacional de Desenvolvimento Científico e Tecnológico (grant number INCT/CNPq 465482/2014–7), Financiamento e incentivo à Pesquisa do Hospital de Clínicas de Porto Alegre (grant number FIPE/HCPA 2020–0576 received by OAM), the 'Coordenação de Aperfeiçoamento de Pessoal de Nível Superior'—Brazil (CAPES) and the Research Support Fund (Fundo de Apoio à Pesquisa da Sociedade de Reumatologia do Rio Grande do Sul) of Rheumatology Society of the Rio Grande do Sul.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study was approved by the institutional review boards of HCPA (number: 2020-0576) and HC-UFMG (number: 189-2017). The declaration of Helsinki principles was followed and all subjects gave written informed consent. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer-reviewed.

Data availability statement Data are available upon reasonable request. All data relevant to the study are included in the article or uploaded as supplementary information.

ORCID iD
Emerson Pena http://orcid.org/0000-0002-0864-683X

REFERENCES

1 Kiriakidou M, Ching CL. Systemic Lupus Erythematosus. *Ann Intern Med* 2020;172:ITC81–96.
2 Di Battista M, Marcucci E, Elefante E, *et al*. One year in review 2018: systemic lupus erythematosus. *Clin Exp Rheumatol* 2018;36:763–77.
3 Fortuna G, Brennan MT. Systemic lupus erythematosus: epidemiology, pathophysiology, manifestations, and management. *Dent Clin North Am* 2013;57:631–55.
4 Pena É, Dos Santos LP, do Espírito Santo RC, *et al*. Systemic lupus erythematosus: a systematic review with meta-analysis on muscle strength, muscle mass, and physical function. *Clin Rheumatol* 2023;42:1237–48.
5 Pena E, Dória LD, Pilotti S, *et al*. *Sarcopenia em pacientes com Lúpus Eritematoso Sistêmico: Um estudo transversal*. Lume - Repositório Digital Da Universidade Federal Do Rio Grande Do Sul, 2022.
6 Andrews JS, Trupin L, Schmajuk G, *et al*. Muscle Strength and Changes in Physical Function in Women With Systemic Lupus Erythematosus. *Arthritis Care Res (Hoboken)* 2015;67:1070–7.
7 Plantinga L, Tift BD, Dunlop-Thomas C, *et al*. Geriatric Assessment of Physical and Cognitive Functioning in a Diverse Cohort of Systemic Lupus Erythematosus Patients: A Pilot Study. *Arthritis Care Res (Hoboken)* 2018;70:1469–77.
8 Cruz-Jentoft AJ, Bahat G, Bauer J, *et al*. Sarcopenia: revised European consensus on definition and diagnosis. *Age Ageing* 2019;48:16–31.
9 Santo RC do E, Baker JF, Santos LPD, *et al*. Sarcopenia in Immune-Mediated Rheumatic Diseases-Review. *J Clin Rheumatol* 2023;29:354–62.
10 Kirk B, Cawthon PM, Arai H, *et al*. The Conceptual Definition of Sarcopenia: Delphi Consensus from the Global Leadership Initiative in Sarcopenia (GLIS). *Age Ageing* 2024;53:afae052.
11 Santos MJ, Vinagre F, Canas da Silva J, *et al*. Body composition phenotypes in systemic lupus erythematosus and rheumatoid arthritis: a comparative study of Caucasian female patients. *Clin Exp Rheumatol* 2011;29:470–6.
12 Bilici R, Candemir B, Satış H, *et al*. Frequency of sarcopenia in Turkish women with systemic lupus erythematosus. *Lupus Sci Med* 2024;11:e001204.
13 Sumantri S, Seto E, Rengganis I. Muscle strength, not muscle mass, determines the health-related quality of life in Indonesian women with systemic lupus erythematosus. *Lupus Sci Med* 2023;10:e001025.
14 Weber D, Long J, Leonard MB, *et al*. Development of Novel Methods to Define Deficits in Appendicular Lean Mass Relative to Fat Mass. *PLoS One* 2016;11:e0164385.
15 Cawthon PM, Visser M, Arai H, *et al*. Defining terms commonly used in sarcopenia research: a glossary proposed by the Global Leadership in Sarcopenia (GLIS) Steering Committee. *Eur Geriatr Med* 2022;13:1239–44.
16 Beaudart C, Rizzoli R, Bruyère O, *et al*. Sarcopenia: burden and challenges for public health. *Arch Public Health* 2014;72:45.
17 Ji T, Li Y, Ma L. Sarcopenic Obesity: An Emerging Public Health Problem. *Aging Dis* 2022;13:379–88.
18 Veronese N, Demurtas J, Soysal P, *et al*. Sarcopenia and health-related outcomes: an umbrella review of observational studies. *Eur Geriatr Med* 2019;10:853–62.

19 Cuschieri S. The STROBE guidelines. *Saudi J Anaesth* 2019;13:S31–4.
20 Instituto Brasileiro de Geografia e Estatística - IBGE. *Censo Brasileiro de 2022*. 2022.
21 Higgins SC, Adams J, Hughes R. Measuring hand grip strength in rheumatoid arthritis. *Rheumatol Int* 2018;38:707–14.
22 Peolsson A, Hedlund R, Oberg B. Intra- and inter-tester reliability and reference values for hand strength. *J Rehabil Med* 2001;33:36–41.
23 Dodds RM, Syddall HE, Cooper R, *et al*. Grip strength across the life course: normative data from twelve British studies. *PLoS One* 2014;9:e113637.
24 Nuttall FQ. Body Mass Index: Obesity, BMI, and Health: A Critical Review. *Nutr Today* 2015;50:117–28.
25 Shepherd JA, Ng BK, Sommer MJ, *et al*. Body composition by DXA. *Bone* 2017;104:101–5.
26 Treviño-Aguirre E, López-Teros T, Gutiérrez-Robledo L, *et al*. Availability and use of dual energy X-ray absorptiometry (DXA) and bio-impedance analysis (BIA) for the evaluation of sarcopenia by Belgian and Latin American geriatricians. *J Cachexia Sarcopenia Muscle* 2014;5:79–81.
27 Maeda SS, Albergaria B-H, Szejnfeld VL, *et al*. Official Position of the Brazilian Association of Bone Assessment and Metabolism (ABRASSO) on the evaluation of body composition by densitometry-part II (clinical aspects): interpretation, reporting, and special situations. *Adv Rheumatol* 2022;62:11.
28 Gladman DD, Ibañez D, Urowitz MB. Systemic lupus erythematosus disease activity index 2000. *J Rheumatol* 2002;29:288–91.
29 Petri M, Orbai A-M, Alarcón GS, *et al*. Derivation and validation of the Systemic Lupus International Collaborating Clinics classification criteria for systemic lupus erythematosus. *Arthritis Rheum* 2012;64:2677–86.
30 Leong KP, Kong KO, Thong BYH, *et al*. Development and preliminary validation of a systemic lupus erythematosus-specific quality-of-life instrument (SLEQOL). *Rheumatology (Oxford)* 2005;44:1267–76.
31 Freire EAM, Bruscato A, Leite DRC, *et al*. Translation into Brazilian Portuguese, cultural adaptation and validatation of the systemic lupus erythematosus quality of life questionnaire (SLEQOL). *Acta Reumatol Port* 2010;35:334–9.
32 Balsamo S, da Mota LMH, de Carvalho JF, *et al*. Low dynamic muscle strength and its associations with fatigue, functional performance, and quality of life in premenopausal patients with systemic lupus erythematosus and low disease activity: a case-control study. *BMC Musculoskelet Disord* 2013;14:263.