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Frequency and factors associated with sarcopenia prediction in adult and elderly patients hospitalized for COVID-19

Gisele Barbosa de Aguiar [a,*], Keila Fernandes Dourado [a], Maria Izabel Siqueira de Andrade [b], Ivanildo Ribeiro Domingos Júnior [c], João Araújo Barros-Neto [b], Sandra Mary Lima Vasconcelos [b], Marina de Moraes Vasconcelos Petribú [d], Cláudia Mota dos Santos [a], Mayana Wanessa Santos de Moura [a], Claudiane Barbosa de Aguiar [e], Maria Isabela Xavier Campos [f], Emerson Rogério Costa Santiago [c], José Hélio Luna da Silva [g], Shirley Kelly dos Santos Simões [h], Anna Carolina de Melo Rodrigues [h], José Carlos Domingues de França Filho [i], Natália Mayara Menezes de Souza [h], Thayná Menezes Santos [g]

[a] *Residency Program in Clinical Nutrition, Hospital Barão de Lucena, Academic Center of Vitória de Santo Antão, Federal University of Pernambuco (CAV/UFPE), Recife, Pernambuco, Brazil*
[b] *Faculty of Nutrition of the Federal University of Alagoas (UFAL), Maceió, Alagoas, Brazil*
[c] *Postgraduate Program in Nutrition, Federal University of Pernambuco (UFPE), Recife, Pernambuco, Brazil*
[d] *Federal University of Pernambuco, Academic Center of Vitória de Santo Antão, Nucleus of Nutrition, Vitória de Santo Antão, Pernambuco, Brazil*
[e] *Postgraduate Program in Morphotechnology, Department of Histology and Embryology, Federal University of Pernambuco (UFPE), Recife, Pernambuco, Brazil*
[f] *Hospital Barão de Lucena, Recife, Pernambuco, Brazil*
[g] *Postgraduate Program in Nutrition, Physical Activity and Phenotypic Plasticity (PPGNAFPF), Federal University of Pernambuco, Academic Center of Vitória de Santo Antão, Vitória de Santo Antão, Pernambuco, Brazil*
[h] *Hospital Miguel Arraes, Paulista, Pernambuco, Brazil*
[i] *Medicine Course at Faculdade Pernambucana de Saúde (FPS), Recife, Pernambuco, Brazil*

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ABSTRACT

Patients with COVID-19 may develop symptoms that interfere with food intake. Systemic inflammatory response associated with physical inactivity and/or immobilization during hospital stay can induce weight and muscle loss leading to sarcopenia and worsening the clinical condition of these patients. The present study identifies the frequency and factors associated with sarcopenia prediction in adult and elderly patients hospitalized for COVID-19. It is a cohort-nested cross-sectional study on adult and elderly patients admitted to wards and intensive care units (ICUs) of 8 hospitals in a northeastern Brazilian state. The study was conducted from June 2020 to June 2021. Sociodemographic, economic, lifestyle, and current and past clinical history variables were collected. Sarcopenia prediction was determined by the Strength, Assistance in walking, Rise from a chair, Climb stairs, and Falls (SARC-F) questionnaire compiled in the Remote-Malnutrition APP (R-MAPP). Patients were diagnosed with sarcopenia when the final score $\geq$ 4 points. The study included 214 patients with a mean age of 61.76 $\pm$ 16.91 years, of which 52.3 % were female and 57.5 % elderly. Sarcopenia prevailed in 40.7 % of the sample. Univariate analysis showed greater probability of sarcopenia in elderly individuals, nonpractitioners of physical activities, hypertensive patients, diabetic patients, and those hospitalized in the ICU. In the multivariate model, the type of hospital admission remained associated with sarcopenia prediction, where patients admitted to the ICU were 1.43 (95 % CI: 1.04; 1.97) more likely to have sarcopenia than those undergoing clinical treatment. Sarcopenia prediction was not associated with patient outcome (discharge, transfer, or death) (p = 0.332). The study highlighted an important percentage of sarcopenia prediction in patients with COVID-19, especially those admitted to the ICU. Additional investigations should be carried out to better understand and develop early diagnostic strategies to assist in the management of sarcopenic patients with COVID-19.

* Corresponding author at: Gisele Barbosa de Aguiar, Residency Program in Clinical Nutrition, Hospital Barão de Lucena, Academic Center of Vitória de Santo Antão, Federal University of Pernambuco (CAV/UFPE), Av. Caxangá, 3860, Recife, 50670-90, Pernambuco, Brazil.
E-mail address: giseleaguiar02@gmail.com (G.B. Aguiar).

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1. Introduction

Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2) infection is a significant threat to human life. This infection originated in China and rapidly evolved into a global pandemic, being responsible for high mortality rates due to its virulence (C. Wang et al., 2020; Wu and McGoogan, 2020; Zabetakis et al., 2020).

Patients with COVID-19 may develop symptoms that interfere with food intake. The most frequent symptoms are diarrhea, nausea, vomiting, hyporexia, anosmia, and ageusia (Guan et al., 2020). When associated with systemic inflammatory response of the infection - characterized by excessive release of proinflammatory cytokines such as interleukin 1 (IL-1), IL-6, IL-7, IL-8, IL-9, IL-10, tumor necrosis factor-α (TNF-α), interferon γ (IFN-γ) (Hu et al., 2021; Huang et al., 2020) - and with physical inactivity and/or immobilization during hospital stay, these symptoms can worsen nutritional status by inducing weight and muscle loss. This condition leads to sarcopenia and worsens the clinical condition of these patients (Wang et al., 2021).

Sarcopenia - a progressive and generalized muscle disorder determined by low muscle quantity or quality - leads to falls, fractures, physical disability, high health costs, and mortality (Cruz-Jentoft et al., 2019; Hsu and Kao, 2018). Clinical evidence demonstrates that patients with COVID-19 are at high risk of sarcopenia (Riesgo et al., 2021; Wierdsma et al., 2021) patients predicted to have sarcopenia show higher mortality rates than those classified as normal (Riesgo et al., 2021).

Researchers have associated a set of factors with a greater risk of sarcopenia in elderly patients: aging itself, which increases the production of reactive oxygen species; immunosenescence (Bajaj et al., 2021; Piotrowicz et al., 2021); presence of comorbidities; physical inactivity; and SARS-CoV-2-induced acute inflammation (Kirwan et al., 2020; Piotrowicz and Gąsowski, 2020). Of the harmful predictors of inflammation, high levels of C-reactive protein (CRP), IL-6, IL-1, and TNF-α are strong correlates of sarcopenia and frailty (Piotrowicz and Gąsowski, 2020).

In this context, considering that the disease limits physical contact and that most patients evolve with nutritional risk and weight loss, an innovative remote tool emerges as an alternative to assess the nutritional status of patients with COVID-19. This tool is named Remote-Malnutrition APP (R-MAPP) and was recently developed by Krznarić et al. (2020). It assesses nutritional status and muscle loss by combining the Malnutrition Universal Screening Tool (MUST) and the Strength, Assistance in walking, Rise from a chair, Climb stairs, and Falls (SARC-F) questionnaire, guiding nutritional diagnosis/monitoring and intervention.

Given the above, in light of the ongoing public health emergency and due to limited clinical evidence involving the new tool, the present study identifies the frequency and factors associated with sarcopenia prediction in adult and elderly patients hospitalized for COVID-19 in a northeastern Brazilian state.

2. Materials and methods

2.1. Study design, population, place, and period of research

This is a multicenter, cross-sectional study conducted with patients diagnosed with COVID-19. The patients were hospitalized in wards and intensive care units (ICUs) of 8 public hospitals in Pernambuco State, northeastern Brazil. These patients were part of the research group Nutrition and COVID-19 in Northeastern Brazil (GENSCoV-BR).The study took place from June 2020 to June 2021.

2.2. Sample and eligibility criteria

The sample was convenient and included 214 individuals hospitalized during the study period who had complete SARC-F data. All adult (≥18 years) and elderly (≥60 years) patients of both sexes hospitalized in wards and ICUs who had a diagnosis of COVID-19 confirmed by reverse transcription followed by polymerase chain reaction (RT-PCR) or laboratory serology were included. Pregnant women, postpartum women, children, and patients who did not have complete SARC-F data were excluded (Fig. 1).

2.3. Sociodemographic and economic variables

Sociodemographic and economic variables consisted of information on age, sex, date of birth, birthplace, origin, marital status, profession/occupation, and education. Individuals were socioeconomically stratified based on the Brazilian Economic Classification Criteria – CCEB (ABEP, 2018), which divides classes into categories: high (subcategory A), medium (subcategories B1 and C1), and low (subcategories C2, D, and E).

2.4. Lifestyle variables

Lifestyle assessment consisted of identifying alcohol consumption, smoking habits, and physical activity. For classification purposes, all individuals who reported using alcoholic beverages, albeit rarely (<1 time/month), were considered alcohol consumers; those who reported never having used alcoholic beverages were considered nonconsumers; and those who reported having suspended the use of alcoholic beverages for at least one month before the suspicion of COVID-19 were considered former consumers.

As for smoking, individuals who reported this practice were classified as smokers, regardless of frequency; those who had stopped smoking for at least one month were considered former smokers; and those who never used tobacco were considered nonsmokers (Bastos and Duquia, 2006).

Regarding the practice of physical activity, we followed the criteria of the American College of Sports Medicine and the American Heart Association. Thus, individuals who self-reported practicing moderate-intensity aerobic activity for at least 30 min/day 5 days a week or intense activities for at least 20 min/day 3 times a week were considered physically active (Haskell et al., 2007). These data were collected in the first remote contact with the patient.

2.5. Current and past medical history

Current and past medical history included information on comorbidities, records of clinical complications, time of evolution, and outcome (cure or death).

2.6. Sarcopenia prediction

To predict sarcopenia we used SARC-F compiled in a remote instrument (R-MAPP), which was proposed especially for patients with

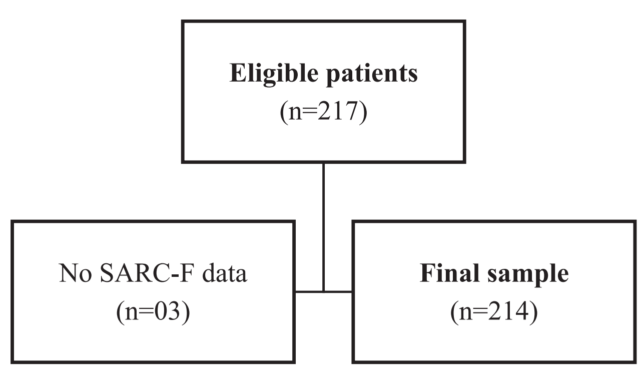

Fig. 1. Flowchart of patient inclusion in the study and final sample size.

COVID-19. This instrument consists of two validated clinical tools: MUST, which determines nutritional risk; and SARC-F, which determines loss of muscle mass and function (Krznarić et al., 2020).

Since R-MAPP considers the diagnosis of COVID-19 as a nutritional risk factor, all patients were eligible for the second stage of the instrument. This stage, comprising SARC-F, includes information on muscle strength, assistance in walking, ability to "rise up from a chair" and "climb stairs", and frequency of "falls". Each item has a score ranging from 0 to 2 points, depending on the difficulty presented by the patient (Krznarić et al., 2020). Sarcopenia was predicted according to the final SARC-F score. Thereby, individuals who presented a final SARC-F score (≥4 points) were predicted to have sarcopenia, and those with a final SARC-F score (<4 points) were predicted not to have sarcopenia (Krznarić et al., 2020).

2.7. Ethical aspects

This research was submitted to and approved by the Ethics Committee for Research with Human Beings (CEP) of the Health Sciences Center of UFPE under the Certificate of Presentation of Ethical Appreciation (CAEE) number 51514921.8.1001.5208. All researchers and proposing institutions were aware of and complied with the provisions of Resolution 466/2012.

2.8. Analysis and interpretation of data

The collected data were entered into an Excel® spreadsheet and analyzed using STATA software version 14.0 (Stata Corp. College Station, United States). Categorical variables were presented as absolute and relative frequencies, and continuous variables were presented as means followed by their respective standard deviations.

For univariate analysis we used simple Poisson regression. Associations between sarcopenia prediction and independent variables were expressed according to crude prevalence ratios (PR), their respective 95 % confidence intervals (95 % CI), and significance levels (p-value).

Then, associations that presented $p \leq 0.20$ underwent multivariate analysis by Poisson regression with robust variance adjustment. The variables were entered in the model according to the theoretical basis on the determining factors for sarcopenia. Only the variables that presented values of $p \leq 0.05$ remained in the final model.

3. Results

The study included 214 patients with a mean age of 61.76 ± 16.91 years, of which 52.3 % were female and 57.5 % elderly. Table 1 presents the sociodemographic and economic characteristics of the participants. Most of the sample consisted of patients of self-reported brown ethnicity (73.9 %, n = 156), with 8 years of schooling or more (58.4 %, n = 125), residing in the metropolitan region (56.5 %, n = 114), and belonging to lower social classes (C2/D and E) (68.2 %, n = 146).

In terms of lifestyle and clinical characteristics (Table 2), nonsmokers (77.1 %), nonconsumers (72.0 %), and subjects who did not practice physical activity (78.5 %) prevailed in the sample. The most frequent comorbidities were Systemic Arterial Hypertension (65.1 %), followed by diabetes *mellitus* (36.0 %). Most of the patients under study were discharged or transferred (81.7 %) and 18.3 % died.

Regarding sarcopenia prediction, the study revealed that (40.7 %) of the sample had a SARC-F score greater than or equal to 4 points, being likely to have sarcopenia.

Univariate analysis showed greater probability of sarcopenia in elderly patients, nonpractitioners of physical activities, and hypertensive, diabetic, and ICU patients (Table 3).

After statistical adjustments in the multivariate model (Table 4), the type of hospital admission remained associated with sarcopenia prediction. Patients admitted to the ICU were 1.43 (95 % CI: 1.04;1.97) more likely to have sarcopenia than those undergoing clinical treatment.

Table 1
Sociodemographic and economic characteristics of patients with COVID-19 in a northeastern Brazilian state - Pernambuco - 2020-2021

Variable	N = 214	%
Age (years)	61.76 ± 16.91	
Sex		
Male	102	47.7
Female	112	52.3
Age group		
Adult	91	42.5
Elderly	123	57.5
Skin color		
White	44	20.9
Brown	156	73.9
Black	11	5.2
Education		
<8 years of schooling	89	41.6
≥8 years of schooling	125	58.4
Residential area (n = 202)		
Metropolitan region	115	57.0
Pernambuco countryside	87	43.0
Economic class		
A/B/C1 (high/medium)	68	31.8
C2/D/E (low)	146	68.2

Socioeconomic classes: high (subcategory A), medium (subcategories B1 and C1), and low (subcategories C2, D, and E).
Former smokers: those who had stopped smoking for at least one month.
Alcoholism - Former consumers: those who reported having suspended the use of alcoholic beverages for at least one month before the suspicion of COVID-19.
Physical activity: active subjects were those who self-reported practicing moderate-intensity aerobic activity for at least 30 min/day 5 days a week or intense activities for at least 20 min/day 3 times a week.

In the sample under study, sarcopenia prediction was not associated with patient outcome (discharge, transfer, or death) ($p = 0.332$).

4. Discussion

Little is known about the frequency of sarcopenia in hospitalized coronavirus patients. According to Ramos et al. (2021), the catabolism caused by the viral infection associated with immobilization and hospital stay can decrease muscle mass and function in patients with COVID-19.

Therefore, with regard to sarcopenia prediction, the present study revealed a significant percentage (40.7 %) of individuals predicted to have sarcopenia. Wierdsma et al. (2021) conducted a prospective observational study with 407 patients hospitalized for COVID-19, 60 % of whom were admitted to the ICU. In that study, 73.0 % of patients were at high risk of sarcopenia according to SARC-F.

This event is due to ICU patients being at higher risk for sarcopenia prediction than ward patients, as revealed by our investigation. After statistical adjustments in the multivariate analysis, the present study showed that patients admitted to the ICU had 1.43 more predictions of sarcopenia ($p = 0.025$).

In a preliminary analysis of a study carried out in Spain with patients diagnosed with COVID-19 admitted to the ICU, Cuerda et al. (2021) found that at hospital discharge, 86.9 % of patients were at risk of sarcopenia as assessed by SARC-F. Patients at risk had a longer ICU stay, requiring further tracheostomy and invasive mechanical ventilation.

Thus, immobilization during ICU stay - associated with the stress of the disease, intubation time, and treatments used - may contribute to a more intense loss of mass and muscle function in ICU patients.

Another research revealed that increased risk of sarcopenia as assessed by SARC-F was a risk factor for serious illness in elderly patients with COVID-19 (Ma et al., 2021). When studying 932 patients with COVID-19, Ramos et al. (2021) found that at hospital discharge, 87.1 % of the sample was at risk of sarcopenia. Researchers have proposed different physiological mechanisms to explain the action of the virus on sarcopenia, one of which is the presence of the angiotensin-converting

Table 2
Lifestyle and clinical characteristics of patients with COVID-19 in a northeastern Brazilian state - Pernambuco - 2020-2021

Variable	N = 214	%
Smoking		
Smoker	11	5.1
Nonsmoker	165	77.1
Former smoker	38	17.8
Alcoholism		
Consumer	44	20.6
Nonconsumer	154	72.0
Former consumer	16	7.5
Physical activity		
Active	46	21.5
Inactive	168	78.5
Hypertension		
Yes	138	65.1
No	74	34.9
Diabetes		
Yes	76	36.0
No	135	64.0
SARC-F[a]		
Strength; how much difficulty do you have lifting and carrying 4.5 kg?		
None	89	41.6
Some	79	36.9
A lot/cannot do it	46	21.5
Assistance in walking; how much difficulty do you have crossing a room?		
None	118	55.1
Some	63	29.5
A lot, making use of support/cannot do it without help	33	15.4
Rise from a chair; how much difficulty do you have getting up from a chair or bed?		
None	121	56.5
Some	64	29.9
A lot/cannot do it without help	29	13.6
Climb stairs; how much difficulty do you have climbing a 10-step stair?		
None	81	37.9
Some	83	38.8
A lot/cannot do it without help	50	23.4
Falls; how many times have you fallen in the last year?		
None	169	79.0
1–3 falls	44	26.6
4 or more falls	1	0.5
Final score (mean ± sd)	3.0 ± 2.8	
≥4 points	87	40.7
<4 points	127	59.3
Outcome		
Discharge/transfer	170	81.7
Death	38	18.3

[a] SARC-F was compiled from R-MAPP.

Table 3
Prevalence of sarcopenia prediction, prevalence ratio, and confidence intervals according to sex, age group, lifestyle variables, comorbidities, and type of hospital admission of patients with COVID-19 in a northeastern Brazilian state - Pernambuco - 2020-2021

Independent variable	Sarcopenia Prediction		*p*-Value
	N (%)	PR ($CI_{95\%}$)	
Sex			
Female	44 (39.3)	Ref.	0.670
Male	43 (42.2)	1.07 (0.77;1.48)	
Age group			
Adult	26 (28.6)	Ref.	0.004*
Elderly	61 (49.6)	1.73 (1.19;2.51)	
Smoking			
No	82 (40.4)	Ref.	0.730
Yes	5 (45.4)	1.12 (0.57;2.19)	
Alcoholism			
Yes	16 (36.4)	Ref.	0.528
No	71 (41.8)	1.14 (0.74;1.76)	
Practice of physical activity			
Yes	13 (28.3)	Ref.	0.077*
No	74 (44.0)	1.55 (0.95;2.54)	
Hypertension			
No	21 (28.4)	Ref.	0.011*
Yes	66 (47.8)	1.68 (1.12;2.52)	
Diabetes			
No	44 (32.6)	Ref.	0.001*
Yes	42 (55.3)	1.69 (1.23;2.32)	
Type of admission			
Clinical	46 (34.8)	Ref.	0.005*
ICU	40 (54.8)	1.57 (1.14;2.15)	

ICU: intensive care unit; PR = prevalence ratio; 95 % CI = 95 % confidence interval; univariate analysis = Simple Poisson regression. Ref = reference (1.00).
* $p \leq 0.20$.

enzyme 2 in muscle tissue (Kumar, 2021). Furthermore, angiotensin I and II levels worsen proteolysis, decrease muscle regeneration, and increase muscle apoptosis in individuals with COVID-19 (Bahat, 2020).

In this context, elderly patients and patients with chronic diseases are at risk for loss of muscle mass and function (Barazzoni et al., 2020). Univariate analysis in the present study showed a greater prediction of sarcopenia in the elderly and in individuals diagnosed with hypertension and diabetes *mellitus*. However, this association did not remain significant in the final model.

In a cross-sectional study developed in Spain with 337 elderly patients hospitalized for COVID-19, Riesgo et al. (2021) revealed a high prediction of sarcopenia (80.2 %). The authors also reported significantly higher mortality in patients at risk of sarcopenia ($p = 0.04$). This event differs from the results of our research, in which mortality was not associated with sarcopenia prediction.

Regarding sociodemographic characteristics, elderly patients prevailed in the sample under study. Participants had a mean age of 61.76 ± 16.91, and 52.3 % of them were female. This finding is in line with the research by Zhao et al. (2021), who studied 413 patients hospitalized for COVID-19 in China and revealed that the mean age of the participants was 60.31 ± 12.68 years. Age itself is a risk factor for clinical complications of COVID-19, which when associated with the presence of comorbidities and low immunity contributes to the worsening of symptoms leading to hospitalization. This fact explains the higher percentage of elderly people in the sample.

In the study by Fang et al. (2020) patients with severe and critical COVID-19 were older and had longer treatment time, lower cure rate, and higher mortality. Another study showed that older age was an independent risk factor for death in patients with COVID-19 (Imam et al., 2020).

Still regarding sociodemographic characteristics, 56.5 % of the patients under study lived in the metropolitan region and 68.2 % were from lower social classes. This may be due to the fact that the hospitals in which the study was conducted are public, located in the metropolitan region, and assist individuals registered in the Unified Health System (SUS).

Lifestyle data showed a predominance of nonsmokers (77.1 %) and nonconsumers of alcoholic beverages (72.0 %). Such an event may have occurred because most of the sample was composed of women and because previous comorbidities and treatment limited these habits. These findings corroborate those revealed by Zhong et al. (2021), who show 84.6 % and 73.6 % of the infected patients under study as being nonsmokers and nonalcoholics, respectively.

Table 4
Prevalence ratio both crude and adjusted to the effects of explanatory variables on sarcopenia prediction in patients with COVID-19 in a northeastern Brazilian state - Pernambuco - 2020-2021

Independent variable	Sarcopenia prediction				*p*-Value
	Crude analysis		Adjusted analysis		
	PR	$CI_{95\%}$	PR	$CI_{95\%}$	
Age group					
Adult	Ref.		Ref.		
Elderly	1.73	(1.19;2.51)	1.36	(0.91;2.03)	0.123
Practice of physical activity					
Yes	Ref.		Ref.		
No	1.55	(0.95;2.54)	1.18	(0.73;1.90)	0.489
Diabetes					
No	Ref.		Ref.		
Yes	1.69	(1.23;2.32)	1.34	(0.95;1.89)	0.087
Hypertension					
No	Ref.		Ref.		
Yes	1.68	(1.12;2.52)	1.19	(0.77;1.85)	0.426
Type of admission					
Clinical	Ref.		Ref.		
ICU	1.57	(1.14;2.15)	1.43	(1.04;1.96)	0.025*

ICU: intensive care unit; PR = prevalence ratio; 95 % ci = 95 % confidence interval.
Multivariate model = Poisson regression with robust variance adjustment (adjusted for sex). Ref = reference (1.00).
* $p \leq 0.05$.

Regarding the practice of physical activity, the present study showed an expressive percentage (78.5 %) of inactive individuals. A study carried out in California with (n = 48,440) patients with COVID-19 showed that 14.4 % of the sample consisted of inactive patients. These subjects were 2.49 times more likely to die and 1.73 times more likely to be admitted to ICUs than active individuals (Sallis et al., 2021). In line with the above, Yan et al. (2020) found that in infected patients, physical inactivity correlated with an increased risk of worsening COVID-19.

Regarding the clinical characteristics of the present investigation, hypertensive patients prevailed, followed by diabetic patients. This result agrees with data from Fang et al. (2020), D. Wang et al. (2020), Ye et al. (2020), and Zhao et al. (2021) who also reported hypertension and diabetes as the most common comorbidities when studying patients hospitalized for SARS-CoV-2 in China.

Polymorbidity is common in the elderly. The sample under study had a greater number of elderly people, justifying the prevalence of the pathologies revealed. These results are also consistent with findings from previous evidence, according to which SARS-CoV-2 patients with comorbidities were older than those without comorbidities (Fang et al., 2020). Ye et al. (2020) demonstrated that the presence of comorbidity in individuals with COVID-19 correlated with worse clinical outcomes. The greater the number of comorbidities, the greater the risk of serious adverse outcomes. A retrospective study carried out in China with 1280 patients diagnosed with COVID-19 indicated that comorbidities prolonged treatment time for patients with mild COVID-19; in turn, it increased the mortality rate and reduced the cure rate for critically ill patients (Fang et al., 2020).

The presence of comorbidities associated with COVID-19 infection is important risk factors for loss of muscle mass and function (sarcopenia). This is due to increased protein catabolism caused by systemic inflammation, reduced physical activity, inadequate nutrient intake, and prolonged immobilization during hospitalization, especially in ICU patients (Wang et al., 2021).

Reports show that that muscle loss, characterized by muscle fiber denervation at the neuromuscular junction, occurs within two to three days of inactivity (Narici et al., 2020). Interestingly, loss of muscle mass after 10 days of absolute rest was approximately 6 %; after 30 days, it was approximately 10 % (Cava and Carbone, 2021).

In this context, the measures imposed by the pandemic and the limitation of medical resources have challenged the diagnosis of sarcopenia in patients with COVID-19 (Wang et al., 2021). Thus, identification of the risk of sarcopenia through simple and remote instruments can help in early treatment and in improving the prognosis of this population. The findings of the present study highlight the presence of a higher risk of predicting sarcopenia in patients with SARS-CoV-2 hospitalized in ICUs. Furthermore, this study demonstrates the importance of developing and/or implementing public health policies on programs to prevent sarcopenia in isolation situations caused by public health emergencies.

This research had some limitations. One example is the SARC-F questions, which may have been influenced by memory biases since information was self-reported. In addition, the absence of studies using R-MAPP has limited in-depth discussion of the results.

In view of the above, the new R-MAPP instrument proved to be a practical method to identify sarcopenia prediction in patients with COVID-19. More studies should be performed using this tool to assist in the early identification of sarcopenia in individuals with that infection. Future research should aim at implementing timely and appropriate nutritional care strategies, thus avoiding worse prognosis as well as worse clinical outcomes.

5. Conclusions

The study showed an important percentage of sarcopenia prediction in patients with COVID-19, especially those admitted to the ICU.

The results of the present study justify the need for additional investigations to better understand and develop early diagnostic strategies to assist in the treatment of sarcopenic patients with COVID-19.

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CRediT authorship contribution statement

- Gisele Barbosa de Aguiar: conception of the study design, data collection, analysis and interpretation of results, and writing of the manuscript.
- Keila Fernandes Dourado: conception of the study design, coordination of data collection, interpretative analysis of the results, and review of the manuscript.
- Maria Izabel Siqueira de Andrade: conception of the study design, statistical analysis, and review of the manuscript.
- Ivanildo Ribeiro Domingos Júnior: data collection.
- João Araújo Barros Neto: conception of the study design, coordination of data collection, and review of the manuscript.
- Sandra Mary Lima Vasconcelos: coordination of the study.
- Marina de Moraes Vasconcelos Petribú: coordination of data collection.
- Cláudia Mota dos Santos: review of the manuscript.
- Mayana Wanessa Santos de Moura: data collection.
- Claudiane Barbosa de Aguiar: review of the manuscript.
- Maria Isabela Xavier Campos: data collection.
- Emerson Rogério Costa Santiago: data collection.
- José Hélio Luna da Silva: data collection.
- Shirley Kelly dos Santos Simões: data collection.
- Anna Carolina de Melo Rodrigues: data collection.
- José Carlos Domingues de França Filho: review of the manuscript.
- Natália Mayara Menezes de Souza: data collection.

- Thayná Menezes Santos: data collection.

Declaration of competing interest

The authors declare no conflicts of interest.

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