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Risk factors associated with COVID-19 in obese patients treated at a hospital in Western Bahia

Fatores de risco associados à COVID-19 em pacientes com obesidade assistidos por uma instituição hospitalar do Oeste da Bahia

Abstract

Objective: To identify the risk factors associated with COVID-19 in patients with obesity. *Methods:* This is a retrospective study based on data collected from the medical records of hospitalized patients diagnosed with COVID-19 between January 2020 and February 2022. Information was collected on nutritional diagnosis based on anthropometric measurements of body weight and height, self-reported variables at admission by the patient or guardian, personal data, medical history, and clinical data. Statistical tests of association were used to verify the relationship between the independent variables and obesity, using Poisson regression models. *Results:* The prevalence of obesity was 40.2% in the 549 patients studied. An association was found between obesity and the number of comorbidities (p=0.001). Regarding the symptoms and clinical aspects of the patients, there was a significant association between obesity and the use of extracorporeal oxygenation (p=0.043). There was an inverse association between obesity and age, with obese patients being 1.88 times more likely to have cardiovascular diseases (95%CI 1.415; 2.500) and 1.31 times more likely to have respiratory distress (95%CI 1.046; 1.732). *Conclusions:* The number of comorbidities, coexistence of cardiovascular diseases, respiratory distress, and use of extracorporeal oxygenation were associated with obesity in these patients. In addition, it was found that the cases of COVID-19 and obesity in this group were mainly adults.

Keywords: COVID-19. Obesity. Risk factors. Hospitalization.

Resumo

Objetivo: Identificar os fatores de risco associados à COVID-19 em pacientes com obesidade. *Métodos:* Estudo retrospectivo, baseado no levantamento de dados de prontuários de pacientes hospitalizados, diagnosticados com COVID-19, entre janeiro de 2020 a fevereiro de 2022. Foram coletadas as informações sobre diagnóstico nutricional, a partir de informações de medidas antropométricas peso corporal e estatura, variáveis autorrelatadas na admissão pelo paciente ou responsável, dados pessoais, história e dados clínicos dos pacientes. Foram aplicados testes estatísticos de associação para

verificar a relação entre as variáveis independentes e a obesidade, por meio de modelos de regressão de Poisson. ***Resultados:*** Dos 549 pacientes estudados, a prevalência de obesidade foi de 40,2%. Identificou-se associação entre a obesidade e o número de comorbidades (p=0,001). Quanto aos sintomas e aspectos clínicos dos pacientes, constatou-se associação significativa entre a obesidade e o uso de oxigenação extracorpórea (p=0,043). Verificou-se associação inversa entre a obesidade e a faixa etária, 1,88 vezes mais chance de pacientes com obesidade apresentarem doenças cardiovasculares (IC95% 1,415; 2,500) e 1,31 vezes mais chance de apresentarem desconfortos respiratórios (IC95% 1,046; 1,732). ***Conclusões:*** O número de comorbidades, coexistência de doenças cardiovasculares, desconforto respiratório e o uso de oxigenação extracorpórea foram associados à obesidade nesses pacientes. Além disso, verificou-se que os casos de COVID-19 e obesidade nesse grupo afetaram sobretudo adultos.

Palavras-chave: COVID-19. Obesidade. Fatores de risco. Hospitalização.

INTRODUCTION

Among global public health concerns, obesity stands out. The World Health Organization (WHO) estimates that more than 1 billion people will be obese by 2030, raising concerns due to its multifactorial causes (genetic, social and economic, lifestyle) and associations with other chronic conditions such as cardiometabolic complications, respiratory diseases, diabetes mellitus and cancers.[1-3] The new WHO plan to end obesity cites this pathology as a risk factor four times greater for the development of severe COVID-19 in adults.[3]

The increase in the incidence of obesity, and consequently the morbidity and mortality associated with the disease, raises concerns about the management of these patients.[4] A systematic review and meta-analysis conducted by Yang et al.[5] identified obesity as a risk factor for hospitalization, ICU admission and use of mechanical ventilation in patients with COVID-19. This study also highlights the influence of different degrees of obesity on the clinical status of patients, suggesting that higher degrees of obesity increase the likelihood of adverse outcomes in these patients.

The study by Mapengo-Domingos et al.,[6] which analyzed information on 6,369 patients with COVID-19, found a high proportion of cardiovascular events and an association between obesity and the faster progression of COVID-19 in severe cases, especially in men with other comorbidities.

Other studies have reported a high prevalence of obesity among individuals hospitalized with COVID-19. In the American cohort study proposed by Pettit et al.,[7] 61.3% (n = 146) of patients hospitalized in an American healthcare facility were obese according to the body mass index criterion. An observational study in Germany identified morbid obesity as the strongest predictor of in-hospital mortality (risk ratio: 3.147) in patients infected with the virus.[8] In Brazil, Alves et al.[9] identified obesity in 52.9% (n = 63) of patients who died of COVID-19 in a hospital in Bahia.

There is a link between a worse prognosis and SARS-CoV-2 virus infection in the context of obesity. For this reason, studies aimed at understanding the relationship between the two pathological conditions are important in order to establish an effective treatment.[10] Therefore, the aim of this study was to identify the risk factors associated with COVID-19 in patients with obesity.

METHODS

This project was derived from a larger study entitled "Demographic, Epidemiological, Clinical and Nutritional Profile of Patients with Sars-Cov-2: A Retrospective Study of Adult and Elderly Patients Admitted to a Hospital Unit in the Municipality of Barreiras." This was based on a study of data contained in the medical records of patients diagnosed with COVID-19 and treated at a public health institution that is a reference for the treatment of the disease, in Barreiras, in the West of Bahia, from January 2020 to February 2022. The study was submitted to and approved by the Research Ethics Committee of the Federal University of Western Bahia, CAEE 56068221.0.0000.8060.

The information was collected between June 2022 and January 2023 and consisted of building a database with variables on the patients' nutritional diagnosis, personal data, clinical history, and clinical data.

For this study, the following inclusion criteria were used: medical records of patients over 18 years of age with information on the diagnosis of nutritional status. It should be noted that only information from patients or their guardians who agreed to participate by signing the free and informed consent form was

included in the study. For this study, the medical records of patients who did not have information on the diagnosis of nutritional status were excluded.

Information was collected from medical records on the patient's nutritional status, which was diagnosed based on anthropometric measurements of body weight and height, variables self-reported by the patient or guardian at admission. The World Health Organization cut-off points were used to classify nutritional status:[11] BMI <18.5kg/m^2 (underweight); BMI >18.5 to 24.9kg/m^2 (eutrophic); BMI ≥25 to 29.9kg/m^2 (overweight); and BMI >30.0kg/m^2 (obese).

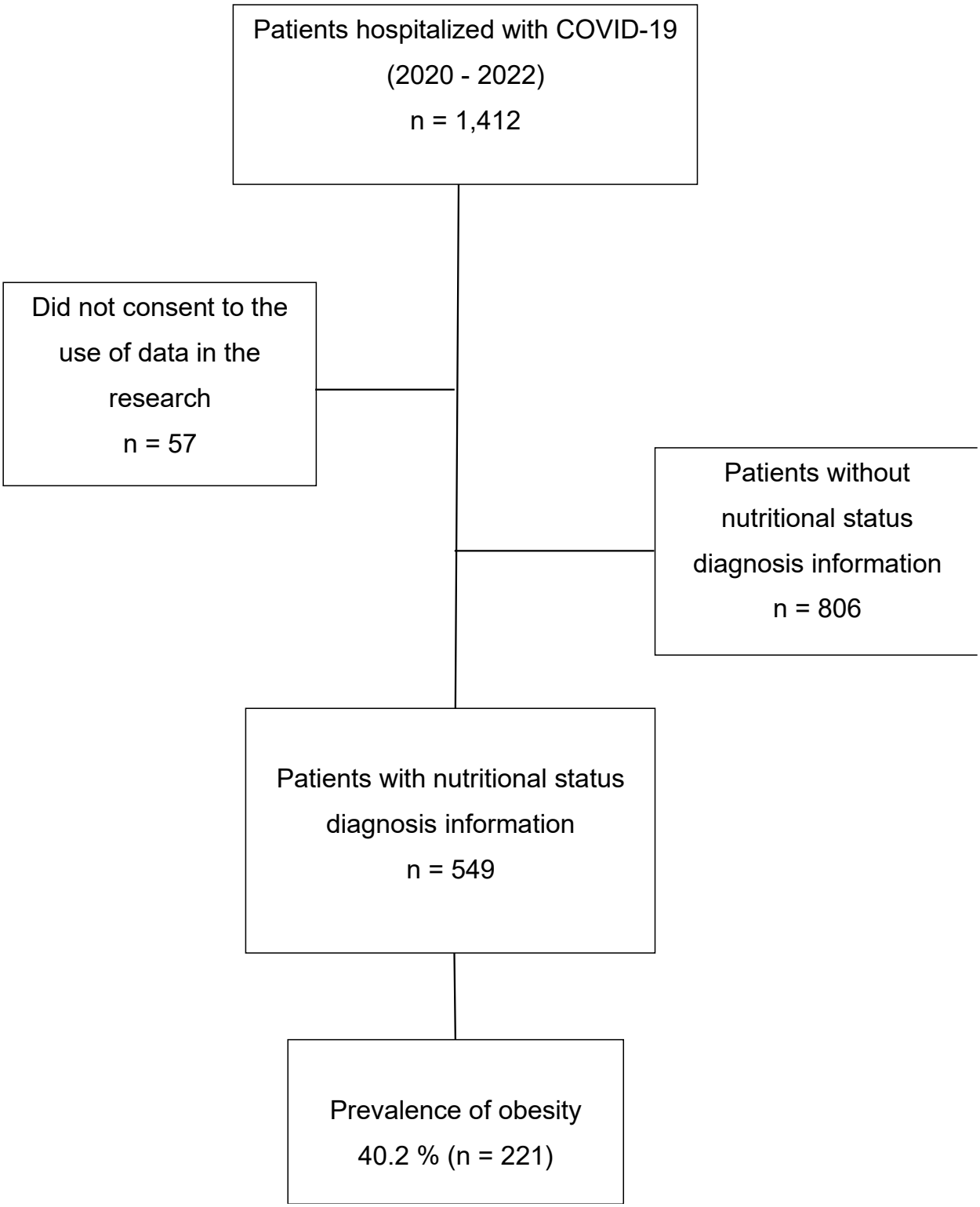
For personal data, the following variables were used: sex (categorized as male or female) and age group (categorized as 19-39, 40-59, and ≥60). Clinical history data included: length of stay (categorized as <5 days and ≥5 days), patient clinical outcome (discharge or disease-related death/transfer), coexisting diseases (diabetes, cardiovascular diseases, renal disease, respiratory diseases, and neoplasms), and number of comorbidities (presence of one, two, three, or none). As for clinical data, the following were assessed: body temperature above 38ºC, headache, respiratory distress, loss of smell, fatigue, cough, and use of extracorporeal oxygenation, categorized as yes or no.

The data were analyzed using Stata 13.1 software. Descriptive statistics (frequency) were first used for statistical treatment. The Chi-square test was used to verify the association between the nutritional diagnosis of obesity and the demographic, clinical and symptomatic variables. The association between the independent variables and obesity was verified using Poisson regression models. In the multiple model, variables with $p<0.20$ in the bivariate analysis were considered and only those with $p<0.05$ remained in the model.

RESULTADOS

Between 2020 and 2022, 1,412 individuals were treated at this healthcare facility, and data from 549 patients were collected for this study (Figure 1).

Figure 1. Fluxograma de respondentes da pesquisa.



Medical records were searched and cases with confirmed obesity were included. The prevalence of obesity was 40.2%. With regard to personal data, there was a predominance of male patients (56.11%). In terms of age, there was a predominance of individuals aged between 40 and 59 years old (52.04%), including patients with obesity. The mean age of these patients was 52.7 years (±15.3).

In terms of clinical history, the length of stay was ≥5 days for 64.71% of patients, with a mean hospital stay of 5.8 days, and 76.02% of the group had a clinical outcome of hospital discharge. Regarding the number of comorbidities, 34.84% of the patients had at least 1 disease. Among these diseases coexisting with COVID-19, the most common were cardiovascular diseases (49.77%), followed by diabetes (18.55%). It should be noted that there was an association between obesity and the number of comorbidities (p=0.001) and cardiovascular diseases (p<0.001) (Table 1).

Table 1. Personal data and clinical history of patients with obesity admitted to a public hospital for COVID-19. Barreiras, BA, 2020-2022.

Variable	Obesity N (%)	P-value
Sex		0.073*
Male	124 (56.11)	
Female	97 (43.89)	
Age group (years)		0.351**
18-39	47 (21.27)	
40-59	115 (52.04)	
≥60	59 (26.70)	
Length of stay (days)		0.599*
<5	78 (35.29)	
≥5	143 (64.71)	
Clinical outcome		0.179*
Discharge	168 (76.02)	
Death/transfer due to complications	53 (23.98)	
Number of comorbidities		**0.001****
1	77 (34.84)	
2	36 (16.29)	
3	8 (3.62)	
None	100 (45.25)	
Co-existing diseases		
Diabetes	41 (18.55)	0.356*
Cardiovascular diseases	110 (49.77)	**<0.001***
Renal disease	6 (2.71)	0.841*
Respiratory diseases	11 (4.98)	0.958*
Neoplasms	5 (2.26)	0.894*

*Pearson's Chi-square / **Linear trend Chi-square / Significant p-value in bold.

Regarding the patients' clinical data, there was a significant association between obesity and respiratory distress (p=0.014) and the use of extracorporeal oxygenation (p=0.043) (Table 2).

Table 2. Clinical data of patients with obesity admitted to a public hospital for COVID-19. Barreiras, BA, 2020-2022.

Variable	Obesity N (%)	P-value
Body temperature above 38ºC		0.126
No	204 (92.31)	
Yes	17 (7.69)	
Headache		0.173
No	126 (57.01)	
Yes	95 (42.99)	
Respiratory distress		**0.014**
No	81 (36.65)	
Yes	140 (63.35)	
Loss of smell		0.241
No	197 (89.14)	
Yes	24 (10.86)	
Fatigue		
No	130 (58.82)	0.106
Yes	91 (41.18)	
Cough		0.671
No	36 (16.29)	
Yes	185 (83.71)	
Use of extracorporeal oxygenation		**0.043**
No	28 (12.67)	
Yes	193 (87.33)	

*Pearson's Chi-square / Significant p-value in bold.

After multivariate analysis, there was an inverse association between obesity and age group and a positive association between obesity and diagnosis of cardiovascular diseases and respiratory distress. Patients with obesity were 1.88 times more likely to have cardiovascular diseases (95%CI 1.415; 2.500) and 1.31 times more likely to have respiratory distress (95%CI 1.046; 1.732) (Table 3).

Table 3. Multivariate analysis of the nutritional diagnosis of obesity in patients hospitalized for COVID-19 according to personal data and clinical history. Barreiras, BA, 2020-2022.

Variables	Adjusted Prevalence Ratio (95%CI)	P
Age group	0.803 (0.659; 0.980)	**0.031**
Cardiovascular diseases	1.88 (1.415; 2.500)	**<0.001**
Respiratory distress	1.314 (1.046; 1.732)	**0.044**

* P value: Poisson regression assuming significance at p<0.05.
Model adjusted for sex. Values with significant p are in bold.

DISCUSSION

This study sought to identify the risk factors associated with COVID-19 in obese patients hospitalized in a public health institution that was a reference in the treatment of the disease, located in Barreiras, Bahia. The results estimated a 40.2% prevalence of obesity among the patients, which was associated with the number of comorbidities, coexistence of a diagnosis of cardiovascular diseases, respiratory distress, and use of extracorporeal oxygenation. In addition, there was an inverse relationship between the nutritional diagnosis of obesity and the age group of the individuals.

The positive association between obesity and the number of comorbidities found in this study (p=0.001) corroborates the research conducted by Nagy et al.[12] in a Hungarian hospital, where the results showed that patients hospitalized with COVID-19 had an average of 2.4 underlying pathologies and their association with a worse disease prognosis. In Brazil in 2022, 66% of deaths from severe acute respiratory syndrome (SARS) due to COVID-19 occurred in individuals with at least one comorbidity, the most common being heart disease and diabetes.[13]

The presence of comorbidities alters the individual's metabolic pathways, increases the pro-inflammatory response, and affects the immune response and vascular processes, which are already compromised in cases of obesity, exacerbating inflammation and viral spread in COVID-19 patients.[14,15] In diabetes mellitus, the interaction between the virus and beta cells can contribute to hyperglycemia in COVID-19 patients and increase the likelihood of pancreatic islet destruction in the pro-inflammatory environment promoted by COVID-19, with the capacity to culminate in multiple organ failure.[16] In hypertension, the deregulation caused by the virus entering the cell can affect the renin-angiotensin-aldosterone system, unbalancing angiotensin-converting enzyme 2 (ACE2) and angiotensin-converting enzyme (ACE), thereby increasing blood pressure.[17,18]

The study group was found to be 1.88 times more likely to have cardiovascular disease (95%CI 1.415; 2.500). In contrast, the retrospective observational study conducted in Mexico by Vera-Zertuche et al.[19] in a national cohort of 71,103 patients from all 32 states of Mexico in the COVID-19 National Epidemiological Surveillance Study did not find any association between patients with this disease, obesity, and cardiovascular problems.

According to Li et al.,[20] the expression of angiotensin-converting enzyme 2 (ACE2) is increased in individuals with cardiovascular disease, explaining the susceptibility of obese individuals diagnosed with cardiovascular disease to worse outcomes in COVID-19. The enzyme acts as a facilitator in the process of virus entry into cells and tissues that express ACE2 (adipose, endothelial, myocardial and others), which are targets of the new coronavirus (SARS-CoV-2), causing the phenomenon known as cytokine storm, responsible for intensely increasing inflammation in the tissue, aggravating the pre-existing cardiovascular problem, but also generating pathologies such as myocardial damage, heart failure, and arrhythmias.[18,21,22]

Regarding the patients' clinical data, there was a significant association between obesity and respiratory distress (p=0.014) and the use of extracorporeal oxygenation (p=0.043). A cohort study conducted at a university hospital in France by Daviet et al.[23] evaluated 76 patients hospitalized with COVID-19 and treated with extracorporeal membrane oxygenation (ECMO) and concluded that obesity was a protective factor in patients requiring ECMO. The hypothesis for improved survival in obese patients may be early pulmonary insufficiency due to altered respiratory mechanics, resulting in the use of ECMO in cases of less lung parenchymal damage.[24] A study conducted by Thomson et al.[25] in an intensive care unit in London and a study by Moriconi et al.[26] in a hospital unit in Italy found an association between obesity, respiratory failure and the use of extracorporeal oxygenation in individuals with COVID-19, concluding that there were no

protective factors associated with obesity and extracorporeal oxygenation due to the exacerbation of the disease-related immune-inflammatory response.[25-27]

Another important finding was the inverse association between obesity and age group (p=0.031), indicating that the obese individuals infected with SARS-CoV-2 were young adults. Consistent with the retrospective multicenter observational study conducted in Greece, which evaluated the characteristics of 90 patients with severe COVID-19, the results indicated that obesity predominantly affected individuals aged 55 years or younger.[28]

In Brazil, the age group most affected by cases of severe acute respiratory syndrome was between 70 and 79 years, according to the *Epidemiological Bulletin* number 100 up to week 6 of 2022 (January 6 to February 12, 2022). However, the document points out that deaths from COVID-19 in obese individuals were most significantly prevalent in those under the age of 60.[29] The increase in the prevalence of obesity is already a global reality and projections are increasing every year.[30] The latest Brazilian National Health Survey, conducted by the Brazilian Institute of Geography and Statistics (IBGE) in 2019, indicates that the disease affected 25.9% of the population, with the highest prevalence in the 40-59 age group.[31]

Current work dynamics that favor sedentary lifestyles, including more screen time, changes in dietary patterns, including a reduction in fruit and vegetable consumption and an increase in ultra-processed foods and fast foods, are determining factors in obesity, especially among younger individuals.[32,33]

This study has some limitations. The fact that the data were collected from physical medical records used by the entire team of professionals working in the hospital could affect the understanding of the written information. In addition, nutritional status was classified using data collected from medical records without knowing how these data were obtained. It is worth highlighting as a strong point of the research, the pioneering nature of the study in the western region of Bahia, being one of the first to evaluate the factors associated with obesity and COVID-19, between March 2020 and February 2022, in a reference unit for the treatment of COVID-19 that served several municipalities in the western macro-region of Bahia.

CONCLUSION

In COVID-19, the number of comorbidities, coexistence of cardiovascular diseases, respiratory distress, and use of extracorporeal oxygenation are associated with obesity. In addition, it was found that the cases of COVID-19 and obesity in this group were mainly adults.

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Contributors

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