

Prevalence and severity of asthma in obese adult candidates for bariatric surgery*

Prevalência e gravidade de asma brônquica em adultos obesos com indicação de cirurgia bariátrica

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Abstract

Objective: To determine the prevalence of asthma in a group of obese adult candidates for bariatric surgery and to evaluate the severity of asthma in this group of patients. **Methods:** This was a cross-sectional study involving 363 obese adults (body mass index ≥ 35 kg/m²) evaluated by a pulmonologist, using clinical evaluation as a diagnostic tool for asthma. All patients underwent clinical evaluation and spirometry and were divided into two groups (asthma and control). The patients with asthma were stratified by the severity of asthma. **Results:** The prevalence of asthma in the obese population studied was 18.5% (95% CI: 14.5-22.4). That prevalence was 20.4% (95% CI: 16.2-24.5) and 13.7% (95% CI: 10.1-17.2) in the women and the men, respectively. Asthma symptoms in the last twelve months were present in 8.0% (95% CI: 5.2-10.7), and the initial manifestation of asthma symptoms occurred during childhood/adolescence in 17.4% (95% CI: 13.5-21.3). In the asthma group, intermittent asthma was present in 29 patients (43.3%), mild persistent asthma in 7 (10.4%), moderate asthma in 25 patients (37.3%), and severe persistent asthma in 6 (9.0%). **Conclusions:** Using clinical evaluation as the diagnostic criterion, we found the prevalence of asthma to be high in this group of obese adults. Asthma was more common in females, and the initial manifestation of asthma symptoms more commonly occurred during childhood/adolescence. The severity of asthma in this group of obese adults was within the range of mean values predicted for the general population. Intermittent asthma, mild persistent asthma, and moderate persistent asthma predominated.

Keywords: Asthma; Cross-sectional studies; Spirometry; Respiratory function tests; Obesity, morbid.

Resumo

Objetivo: Determinar a prevalência de asma em um grupo de adultos obesos, candidatos a cirurgia bariátrica e avaliar a gravidade da asma neste grupo de pacientes. **Métodos:** Estudo transversal, envolvendo 363 pacientes obesos adultos (índice de massa corpórea ≥ 35 kg/m²) avaliados por um médico pneumologista, utilizando a avaliação clínica como instrumento diagnóstico de asma. Todos os pacientes foram submetidos à avaliação clínica e espirometria e foram divididos em dois grupos (asma e controle). Os pacientes com asma foram classificados conforme a gravidade da doença. **Resultados:** A prevalência de asma na população de obesos estudada foi de 18,5% (IC95%: 14,5-22,4). Essa prevalência nas mulheres e nos homens foi de 20,4% (IC95%: 16,2-24,5) e 13,7% (IC95%: 10,1-17,2), respectivamente. Havia sintomas de asma nos últimos doze meses em 8,0% (IC95%: 5,2-10,7), e houve manifestação inicial dos sintomas de asma na infância/adolescência em 17,4% (IC95%: 13,5-21,3). No grupo asma, asma intermitente estava presente em 29 pacientes (43,3%); asma persistente leve, em 7 (10,4%); asma moderada, em 25 (37,3%); e asma persistente grave, em 6 (9,0%). **Conclusões:** A prevalência de asma neste grupo de adultos obesos, utilizando-se a avaliação clínica como critério diagnóstico, mostrou-se elevada, com predomínio no sexo feminino e com manifestação inicial dos sintomas de asma na infância/adolescência. A gravidade da asma neste grupo de obesos adultos esteve entre os valores médios estimados para a população geral, com uma maior proporção de asma intermitente, asma persistente leve e asma persistente moderada.

Descritores: Asma; Estudos transversais; Espirometria; Testes de função respiratória; Obesidade; Obesidade mórbida.

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Introduction

Asthma is a chronic inflammatory disease of the lower airways that results from the interaction of genetic factors, environmental exposure to allergens and irritants, and other specific factors that lead to the development and persistence of symptoms.^(1,2) Obesity is also a chronic inflammatory disease, with systemic effects, and is an established risk factor for cardiovascular disease, obstructive sleep apnea-hypopnea syndrome (OSAHS), diabetes mellitus, musculoskeletal disease, and some types of cancer, as well as affecting lung function.⁽³⁻⁹⁾ Asthma and obesity have both become more prevalent in recent years, and obesity has reached epidemic proportions in developed countries.^(7,10,11) In Brazil, these two pathologies have become a public health problem, increasing health care costs in the public and private sectors.^(1,8)

Most studies of asthma prevalence have involved populations of children and adolescents and have been mainly based on the use of questionnaires, such as the International Study of Asthma and Allergies in Childhood (ISAAC) and the European Community Respiratory Health Survey (ECRHS). Both questionnaires reveal a wide variation in the prevalence of asthma symptoms among countries and even among regions within the same country, as has been observed in Brazil.^(12,13) In Brazil, there have been only a few studies of the prevalence of asthma in the adult population,⁽¹²⁻¹⁵⁾ and standardized questionnaires such as the ECRHS have not been used systematically in adults.⁽¹²⁾

The epidemiological study of asthma in adults poses certain challenges: determining the duration of the disease; taking into consideration the type and duration of treatment; quantifying occupational and environmental exposure; factoring in smoking history; and identifying comorbidities.⁽¹²⁾ The diagnosis of asthma is clinical, and the key to diagnosis is careful clinical history taking for respiratory symptoms that are suggestive of asthma, allowing a reasonable degree of diagnostic certainty or the making of an alternative diagnosis.^(1,2,16)

The failure of conventional clinical treatment of obesity (diet, physical activity, and use of medications) has led to a progressive increase in the rate of referral for surgical treatment of obesity.⁽⁸⁾ The prevalence of asthma in the

preoperative period of bariatric surgery in obese adults is unknown in Brazil. Therefore, the objective of the present study was to determine that prevalence, using clinical evaluation as a diagnostic tool, and to evaluate the severity of asthma in such patients.

Methods

This was an open cross-sectional study carried out between January of 2007 and June of 2010 at the Federal University of Sergipe University Hospital, located in the city of Aracaju, Brazil. The study was approved by the local research ethics committee, and all participants gave written informed consent.

The patients selected were referred from public or private institutions. All patients were referred to the obesity outpatient clinic of the Federal University of Sergipe University Hospital and were evaluated consecutively in accordance with the demand for treatment at that facility, where they underwent clinical evaluation and spirometry for the assessment of pulmonary risk related to surgical treatment of obesity. Patients under 18 years of age were excluded, as were those who did not undergo spirometry or were unable to do so. A structured questionnaire was used for assessing the following parameters: comorbidities; current or previous lung disease; dyspnea; physical activity; smoking; and patient referral source (private or public institution).

In Brazil, the estimated prevalence of asthma is 15-20% in children and adolescents^(1,17) and 5-10% in adults.^(13,14) However, we hypothesized that the prevalence of asthma has increased in the obese adult population. The parameters used for calculating sample size⁽¹⁸⁾ were as follows: an estimated prevalence of asthma of 20%; a 95% CI; a sample error of 5%; and a 10% increase in the sample size in order to compensate for losses. Therefore, the minimum sample size was determined to be 290 patients.

In accordance with the World Health Organization criteria, obesity was classified by body mass index (BMI), which was calculated as weight in kilograms divided by height in meters squared (kg/m^2). The indications for surgical treatment of obesity were based on the guidelines established by the World Health Organization and the Brazilian National Ministry of Health.^(7,8) Body weight was measured with subjects wearing light clothing and no shoes,

and height was measured with an anthropometer attached to the scale, which met the criteria for measuring weight in morbidly obese subjects.

We employed the clinical diagnostic criteria for asthma established in the Fourth Brazilian Guidelines for Asthma Management,⁽¹⁾ and the diagnosis was made by a pulmonologist at the initial visit. For the study sample, the prevalence of asthma was described as follows: by gender; by the presence of symptoms indicative asthma in the last twelve months; and by age at symptom onset (during childhood/adolescence, i.e., at ≤ 17 of age, or adulthood, i.e., at ≥ 18 of age).

In the evaluation of current or previous lung disease, patients were assessed for asthma, allergic bronchitis, emphysema, COPD, pneumonia, tuberculosis, and any other respiratory disease. The respiratory symptoms evaluated included wheezing, cough, phlegm, chest tightness, snoring, and dyspnea. The use of medications was also assessed. For symptomatic patients, the time since symptom onset was determined, as were the duration and characteristics of the symptoms. Using the questionnaire, we assessed the following comorbidities: asthma; COPD; OSAHS; arterial hypertension; coronary artery disease; heart failure; diabetes mellitus; hypothyroidism; musculoskeletal diseases (osteoarthritis of the spinal column, coxofemoral joint, or knees); depression; anxiety; gastroesophageal reflux disease; allergic rhinitis; and any other physician-diagnosed disease reported by the patient. Patients with comorbidities were asked about the time since diagnosis and about the medications used. Non-sedentary patients were defined as those who exercised regularly for at least 30 min three or more times a week.

Spirometry was carried out with a computerized spirometer (Microlab-3500; Micro Medical Ltd., Kent, England) before and after bronchodilator use (albuterol, 400 μ g), with the patient seated and wearing a nose clip. We used the reference spirometry equation devised by Hankinson et al.⁽¹⁹⁾ The patients performed at least three forced expiratory maneuvers, meeting the acceptability and reproducibility criteria currently recommended by the Brazilian Thoracic Association,⁽²⁰⁾ and the best of the three values was selected. The values are expressed in liters and in percentage of the predicted values.

For the statistical analysis, the patients were initially divided into two groups: asthma and control. For the asthma group patients, the spirometry results were then categorized as indicating the following: normal lung function; obstructive lung disease; obstructive lung disease with reduced FVC; mixed obstructive and restrictive lung disease; and presumptive restrictive lung disease. The severity of asthma was classified, on the basis of clinical parameters, in accordance with the Fourth Brazilian Guidelines for Asthma Management.⁽¹⁾

The statistical analysis was performed with the Statistical Package for the Social Sciences, version 15 (SPSS Inc., Chicago, IL, USA). The results obtained are expressed as number of cases (proportion) and as mean \pm standard deviation. We calculated 95% CIs for the prevalence estimates. The chi-square test and the Student's t-test, respectively, were used for testing differences among categorical variables and among continuous variables. The level of statistical significance was set at $p \leq 0.05$, and all statistical tests were two-tailed.

Results

A total of 374 obese adults residing in the state of Sergipe were referred for preoperative evaluation. Of those, only 11 patients (2.9%) were lost to follow-up, and none of the patients declined to participate. Therefore, the final study sample comprised 363 obese subjects.

Table 1 shows the general characteristics of the study population and compares patients in the asthma group with those in the control group. There were no differences between the groups in terms of demographic characteristics, anthropometric characteristics, patient referral source (private or public institution), smoking, presence of dyspnea, physical activity, or comorbidities.

The prevalence of asthma in the obese population studied was 18.5% (95% CI: 14.5-22.4). Of the 254 women and of the 109 men evaluated, 52 (20.4%; 95% CI: 16.2-24.5) and 15 (13.7%; 95% CI: 10.1-17.2) had asthma, respectively. Of the 363 obese patients studied, 29 (8.0%; 95% CI: 5.2-10.7) reported asthma symptoms in the last twelve months, corresponding to 43.3% of the 67 patients in the asthma group. The patient-reported onset of asthma symptoms was during childhood or

Table 1 – General characteristics of the study population and comparison between the two study groups.^a

| Variable | Asthma group | Control group | All | p |
|---|----------------|----------------|----------------|--------|
| | (n = 67) | (n = 296) | (n = 363) | |
| Female gender, n (%) | 52 (77.6) | 202 (68.2) | 254 (70.0) | 0.13* |
| Age, years | 37.61 ± 10.61 | 36.88 ± 11.25 | 37.01 ± 11.12 | 0.63** |
| White, n (%) | 41 (61.2) | 148 (53.0) | 189 (54.6) | 0.23* |
| Height, m | 1.63 ± 0.09 | 1.65 ± 0.09 | 1.64 ± 0.09 | 0.34** |
| Current weight, kg | 118.12 ± 19.75 | 120.19 ± 23.96 | 119.81 ± 23.23 | 0.51** |
| BMI, kg/m ² | 44.19 ± 6.21 | 44.22 ± 7.19 | 44.21 ± 7.01 | 0.98** |
| Private institution, n (%) | 53 (79.1) | 214 (72.3) | 267 (73.5) | 0.25* |
| Physical activity, n (%) | 17 (25.4) | 68 (22.9) | 85 (23.4) | 0.81* |
| Dyspnea, n (%) | 55 (82.1) | 192 (70.6) | 247 (72.9) | 0.06* |
| Smoking | | | | 0.47* |
| Nonsmoker, n (%) | 46 (68.7) | 209 (70.6) | 255 (70.2) | |
| Former smoker, n (%) | 18 (26.9) | 64 (21.6) | 82 (22.6) | |
| Current smoker, n (%) | 3 (4.5) | 23 (7.8) | 26 (7.2) | |
| Arterial hypertension, n (%) | 38 (56.7) | 171 (57.8) | 209 (57.6) | 0.87* |
| Diabetes, n (%) | 19 (28.4) | 56 (18.9) | 75 (20.7) | 0.08* |
| Musculoskeletal disease, n (%) | 44 (65.7) | 164 (55.4) | 208 (57.3) | 0.12* |
| Anxiety, n (%) | 35 (52.2) | 137 (46.3) | 172 (47.4) | 0.38* |
| Depression, n (%) | 10 (14.9) | 37 (12.5) | 47 (12.9) | 0.59* |
| OSAHS, n (%) | 6 (9.0) | 24 (8.1) | 30 (8.2) | 0.80* |
| Other comorbidities, ^b n (%) | 15 (22.4) | 55 (20.0) | 70 (20.5) | 0.66* |

BMI: body mass index; and OSAHS: obstructive sleep apnea-hypopnea syndrome.^aValues expressed as mean ± SD, except where otherwise indicated. ^bRhinitis, gastroesophageal reflux disease, COPD, heart failure, coronary insufficiency, and hypothyroidism. *Chi-square test. **Student's t-test.

adolescence in 63 patients (17.4%; 95% CI: 13.5-21.3) and during adulthood in 4 (1.1%; 95% CI: 0.02-2.10). Therefore, of the 67 asthma patients, 63 (94.0%) reported the onset of asthma symptoms during childhood or adolescence. Figure 1 describes the prevalence of asthma (with the respective 95% CIs) by gender, in the study population as a whole, by the presence of asthma symptoms in the last twelve months, and by the onset of asthma symptoms during childhood or adolescence.

Table 2 compares the asthma and control groups in terms of the spirometric variables. There were no significant differences between the groups in terms of pre- or post-bronchodilator FVC. Pre- and post-bronchodilator values for FEV₁, FEV_{25-75%}, and the FEV₁/FVC ratio were significantly lower in the asthma group (p ≤ 0.0001). In the asthma group, spirometry revealed the following: normal results in 39 patients (58.2%); presumptive restrictive lung disease in 16 (23.9%); obstructive lung disease in 6 (9.0%); mixed obstructive and restrictive lung disease in 4 (6.0%); and obstructive lung disease with reduced FVC in 2 (3.0%). Regarding the

spirometric variables in percentage of predicted, 36 patients (53.7%) had an FEV₁ ≥ 80%, 25 (37.3%) had an FEV₁ of 60-79%, 6 patients (9%) had an FEV₁ ≤ 60%, and all patients had a > 20% fall in FEV₁ after bronchodilator use. As previously mentioned, asthma severity was classified on the basis of clinical parameters. We found that, of the 67 patients in the asthma

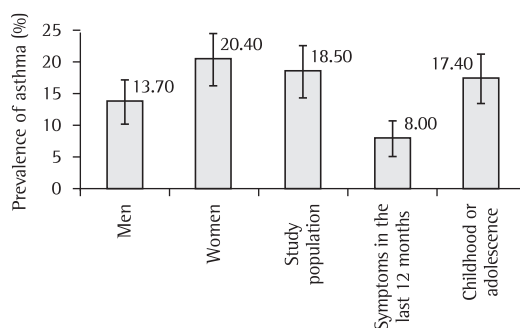


Figure 1 – Prevalence of asthma in the study population of obese adults: by gender; in the study population as a whole; by the presence of asthma symptoms in the last twelve months; and by the onset of asthma symptoms during childhood or adolescence. The vertical bars represent the 95% CI.

Table 2 – Spirometric variables of the study population and comparison between the two study groups.^a

| Variable | Asthma group (n = 67) | Control group (n = 296) | All (n = 363) | p* |
|---|--------------------------|----------------------------|------------------|--------|
| Pre-BD FVC (% of predicted) | 83.27 ± 12.66 | 86.21 ± 11.59 | 85.67 ± 11.83 | 0.07 |
| Post-BD FVC (% of predicted) | 84.66 ± 11.88 | 86.22 ± 11.51 | 85.93 ± 11.58 | 0.32 |
| Pre-BD FEV ₁ (% of predicted) | 79.54 ± 13.33 | 86.88 ± 12.03 | 85.53 ± 12.59 | 0.0001 |
| Post-BD FEV ₁ (% of predicted) | 83.22 ± 12.96 | 88.97 ± 11.91 | 87.92 ± 12.30 | 0.0001 |
| Pre-BD FEV ₁ /FVC | 78.36 ± 6.92 | 82.80 ± 5.25 | 81.98 ± 5.84 | 0.0001 |
| Post-BD FEV ₁ /FVC | 80.60 ± 6.68 | 84.52 ± 5.31 | 83.79 ± 5.78 | 0.0001 |
| Pre-BD FEF _{25-75%} | 81.01 ± 31.57 | 97.86 ± 26.28 | 94.75 ± 28.06 | 0.0001 |
| Post-BD FEF _{25-75%} | 89.81 ± 30.39 | 107.10 ± 26.34 | 103.91 ± 27.91 | 0.0001 |

BD: bronchodilator. ^aValues expressed as mean ± SD. *Student's t-test.

group, 29 (43.3%) had intermittent asthma; 7 (10.4%) had mild persistent asthma; 25 (37.3%) had moderate persistent asthma; and 6 (9.0%) had severe persistent asthma. Figure 2 shows the proportional distribution of the patients by asthma severity.

Discussion

Central to all definitions of asthma is the presence of respiratory signs and symptoms suggestive of the pathology. Such signs and symptoms are recognized through a careful clinical investigation, allowing asthma to be diagnosed with a reasonable degree of certainty and differential diagnoses to be excluded.^(1,2,16) There is no universally accepted definition that encompasses all of the various asthma phenotypes.^(12,16) In the absence of a gold standard for the diagnosis of asthma, clinical diagnosis remains the best method.^(1,2,16) The present study determined the previously unknown prevalence of asthma in a segment of the Brazilian population of obese adults, a population that has been growing at an alarming rate. Clinical evaluation was the primary diagnostic tool

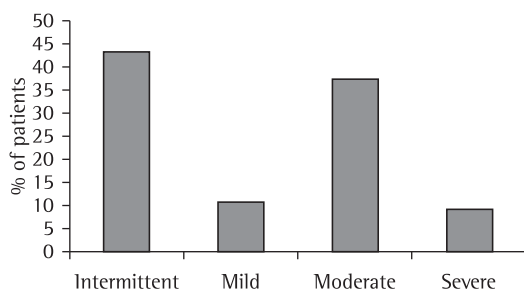


Figure 2 – Proportional distribution of patients in the study population of obese adults, by the severity of asthma.

employed, and, in all cases, the diagnosis was made by a pulmonologist at the initial visit.

Dyspnea, a major symptom evaluated in written questionnaires and in clinical practice for the diagnosis of asthma,^(1,2) is highly prevalent in the obese population.⁽²¹⁾ In our study, the prevalence of dyspnea was found to be 72.9%. Therefore, in obese subjects, there is a need for clinical evaluation by a physician, who should seek to identify other causes of dyspnea and to detail the presence, frequency, and remission of respiratory symptoms suggestive of asthma, given that such symptoms lack specificity.

The reported prevalence of asthma varies in function of the different definitions of asthma, the age of the population studied (juvenile or adult), and the instruments employed/parameters evaluated (written questionnaires, physician diagnosis, current symptoms, and cumulative asthma), thereby potentially explaining differences among countries and among regions within the same country.^(12,13,22)

In Brazil, the ISAAC, despite its great epidemiological value in the investigation of the prevalence of asthma, has been validated for use only in patients aged 6-14 years. However, its validation for use in adolescents justifies it being applied to adults. The ECRHS has not been validated for use in Brazil, where it has been used in only a handful of studies.^(13,15,23)

In Brazil, studies of the prevalence of asthma in adults have produced different results according to the diagnostic tool used. Madeira et al.⁽¹⁴⁾ found the prevalence of asthma in adults to be 7.3% in the Federal District of Brasilia. Macedo et al.,⁽¹³⁾ using different criteria for diagnosing asthma in adults, found the following prevalence rates: current symptoms, 6.0% (95% CI: 4.9-7.0); physician diagnosis,

12.9% (95% CI: 11.4-14.4); and cumulative asthma (self-reported at least once in their lifetime), 14.3% (95% CI: 12.7-15.8).

An inter-study comparison, using physician diagnosis as the diagnostic criterion for asthma in adults, revealed that the prevalence of asthma in our population of obese patients (18.5%) was higher than that reported in studies conducted in Brazil^(13,14)—in the city of Pelotas (12.9%) and in the Federal District of Brasília (7.3%)—as well as being considerably higher than that reported in a nationwide study of Bangladesh (3.5%).⁽²²⁾ However, when wheezing in the last twelve months was used as the diagnostic criterion, wheezing being considered the symptom that is most appropriate for use in estimating the prevalence of asthma,⁽²⁴⁾ the prevalence found in our study (8.0%) was similar to the rates reported in previous studies—6% in adults,⁽¹³⁾ as well as 5.3% in adults aged 15-44 years and 11% in adults aged 45 years or over.⁽²²⁾ These data underscore the important influence that the type of diagnostic criterion used has on the prevalence data related to asthma in adults.

Asthma can occur at any age, and the first symptoms more commonly appear during childhood or adolescence.^(1,2,16) In our study, we found that 94% of the asthma patients developed the disease during childhood or adolescence, and that, of the 4 patients (6%) who reported the onset of symptoms in adulthood, 3 were using beta blockers to treat arterial hypertension.

In our sample of obese adults, the prevalence of asthma was higher among the women. This could be explained theoretically by the higher prevalence of obesity and asthma in females,^(7,11) as well as by the fact that women seek medical treatment more frequently than do men and by the influence of hormones in women. However, further studies are needed in order to fully define and clarify the role of estrogen in influencing airway inflammation, as well as the interaction between estrogen and leptin in the brain, adipose tissue, and airways.⁽¹⁰⁾

The typical clinical presentation of asthma is not seen in all patients; obese patients might have respiratory symptoms suggestive of asthma because of obesity, but without meeting the pathophysiological criteria for asthma, and this causes diagnostic uncertainty; in such cases,

assessment of pulmonary function might be necessary.^(16,25)

Spirometry has become more widely available, and, because it is practical, inexpensive, and virtually risk-free, it is the ancillary test of choice for the diagnosis of asthma, characterizing airflow obstruction and the response to bronchodilator use.^(1,2,16) Due to their high sensitivity and high negative predictive value for confirming or excluding the diagnosis of asthma, challenge tests play an important role in diagnostic decision-making in clinical practice. Nevertheless, these tests have not been recommended for the epidemiological diagnosis of asthma, their use being reserved for patients with respiratory symptoms when the clinical diagnosis of asthma is inaccurate and spirometry results are normal.^(1,2,16,20)

In our sample, all patients were diagnosed by clinical criteria, and the spirometry results did not change the previously established prevalence of asthma, underscoring the idea that the diagnosis of asthma is substantiated by the presence of current or previous respiratory symptoms and explaining the absence of spirometry data from asthma prevalence studies. However, spirometry remains the method of choice for determining airflow limitation, confirming the diagnosis, determining severity, determining the level of control, and monitoring patients.^(1,2,16)

Even in the absence of lung disease, obesity has mechanical effects on the lungs, reducing lung volume, functional capacity, and the diameter of peripheral airways.^(5,6,10) In the evaluation of the spirometric variables in the two study groups, reductions were found in FEV₁, the FEV₁/FVC ratio, and FEF_{25-75%} were all found to be significantly lower in the asthma group (before and after bronchodilator use), providing evidence that, as expected, the obstructive impairment of pulmonary function was more severe in the obese subjects with concomitant obstructive lung disease.

In the analysis of the classification of the severity of asthma in our sample of obese subjects (all with a BMI \geq 35 kg/m²), we found that only 9% had severe persistent asthma, whereas 90% had intermittent, mild persistent, or moderate persistent asthma, rates that are similar to the mean values predicted for the general population in the literature, in which 60% of patients are classified as having

intermittent or mild persistent asthma, 25-30% are classified as having moderate asthma, and 5-10% are classified as having severe persistent asthma.⁽¹⁾ In the literature, there is some debate regarding the influence that increased BMI has on the severity of asthma. Pelegrino et al. showed no correlation between asthma severity and obesity.⁽²⁶⁾ In contrast, Akerman et al., evaluating obese subjects with a BMI ≥ 30 kg/m², showed a positive relationship between weight and asthma severity.⁽²⁷⁾

Failure of clinical treatments, as well as the psychological distress caused by obesity and the effect that obesity has on organ systems, explains the interest and willingness of obese subjects to undergo surgical treatment of obesity. This probably explains the fact that none of the patients invited declined to participate in our study.

Although studies show that obesity is an independent risk factor for asthma and recent studies suggest that obesity is also an independent risk factor for COPD, the basic mechanisms of this association in humans have yet to be established.⁽³⁾

The involvement of various asthma phenotypes, the chronic inflammatory response of asthma and obesity, and the influence that obesity hormones (leptin, adiponectin, resistin, cytokines, acute phase proteins, and other mediators) produced by the adipose tissue have on the relationship between asthma and obesity should be further clarified in future studies.^(3,4,9)

Our study has some limitations. First, because it was a cross-sectional study, we cannot establish an association between obesity and asthma, despite the chronic inflammatory condition and the increased prevalence of both diseases. Second, although the finding that the onset of asthma in obese adults more commonly occurred during childhood or adolescence is new in the literature, our study cannot establish a cause-and-effect relationship, it being impossible to determine whether obesity was preceded by asthma or whether asthma was preceded by obesity. Despite these limitations, our study draws attention to the high prevalence of asthma in a population of obese adults undergoing preoperative evaluation for bariatric surgery and underscores the value of clinical diagnosis based on simple and essential measures (history taking

and physical examination) for good medical practice.

In conclusion, using physician diagnosis as the diagnostic criterion for asthma, we found the prevalence of asthma to be high in a sample of adults with class II or III obesity (BMI ≥ 35 kg/m²) undergoing preoperative evaluation for bariatric surgery. Asthma was more common in females, and the onset of asthma symptoms more commonly occurred during childhood or adolescence. The severity of asthma in this group of obese adults was within the range of mean values predicted for the general population. Intermittent asthma, mild persistent asthma, and moderate persistent asthma predominated.

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