

Original Article

Relationship between body mass index and asthma severity in adults*

Nilva Regina Gelamo Pelegrino¹, Márcia Maria Faganello², Fernanda Figueirôa Sanchez³,
Carlos Roberto Padovani⁴, Irma de Godoy⁵

Abstract

Objective: Elevated values of body mass index (BMI) have been associated with higher prevalence of asthma in adults. The aim of the present study is to evaluate the association between obesity and asthma severity. **Methods:** Medical records of two hundred patients older than 20 years of age were evaluated retrospectively. Asthma severity was established after the evaluation of the medical history and diagnosis recorded, spirometry results and the medicines prescribed. BMI was calculated and patients were classified as obese when the BMI was $\geq 30 \text{ kg/m}^2$. **Results:** 23% of the patients presented intermittent asthma, 25.5% presented mild persistent asthma, 24% presented moderate persistent asthma, and 27.5% presented severe persistent asthma. Values of BMI $\leq 29.9 \text{ kg/m}^2$ were observed in 68% of the patients and in 32% the BMI was $\geq 30 \text{ kg/m}^2$. The odds ratio of the correlation between obesity and asthma severity was 1.17 (95% CI: 0.90-1.53; $p > 0.05$). **Conclusions:** In the sample evaluated in this study no correlation between obesity and asthma severity was found for either gender.

Keywords: Asthma; Body mass index, Sex distribution; Obesity.

* Study conducted at the Botucatu School of Medicine, *Universidade Estadual Paulista* – UNESP, Paulista State University – Botucatu, Brazil.

1. Medical Resident in the Pulmonology Department of the Botucatu School of Medicine. *Universidade Estadual Paulista* – UNESP, Paulista State University – Botucatu, Brazil.

2. Professor of Physiotherapy at the Unisalesiano de Lins Salesian University, Araçatuba, Brazil.

3. Professor of Cardiorespiratory Physiotherapy at the Auxiliary Salesian Catholic University Center, Araçatuba, Brazil.

4. Full Professor of Biostatistics at the *Universidade Estadual Paulista* – UNESP, Paulista State University – Botucatu, Brazil.

5. Tenured Professor in the Pulmonology Department of the Botucatu School of Medicine. *Universidade Estadual Paulista* – UNESP, Paulista State University – Botucatu, Brazil

Correspondence to: Nilva Regina Gelamo Pelegrino. Rua Bartolomeu de Gusmão, 2-102, Apto 23, CEP 17017-336, Jardim América, Bauru, SP, Brasil.

Tel 55 14 3103-7777. E-mail: nilvap@itelefonica.com.br

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Introduction

Asthma is a chronic inflammatory disease characterized by lower airway hyperresponsiveness and by variable airflow limitation that can resolve spontaneously or through treatment.⁽¹⁾ This illness is a serious public health problem worldwide, and its prevalence has increased in recent decades, mainly in urban centers, which might be due to changes in lifestyle.⁽²⁾

Since the 1990s, various studies have shown a correlation between an increase in body mass index (BMI) and asthma prevalence,^(2,3) initially in children⁽⁴⁾ and, more recently, in adults.^(3,5) Longitudinal studies have shown that obesity and the incidence of asthma increase in parallel.⁽⁶⁻⁸⁾

Changes in the respiratory mechanics, reductions in the functional residual capacity and in the tidal volume secondary to obesity, as well as a sedentary lifestyle and a limited ability to perform physical activities, all of these related to obese individuals, can cause worsening of the asthma symptoms.⁽⁹⁾ Obesity might also increase the risk of gastro-esophageal reflux, which promotes airway hyperresponsiveness in individuals with asthma.⁽⁷⁾

Inflammatory alterations described in obese individuals have recently been mentioned as factors that might interfere with clinical manifestations of asthma in these individuals.⁽¹⁰⁾ The inflammatory condition unique to obese individuals, including an increase in tumor necrosis factor alpha and other pro-inflammatory cytokines, such as interleukin (IL)-4, IL-5 and IL-6, determines the superimposition of these inflammatory mechanisms on those involved in asthma. This increases the influence on airway muscle contractility.^(7,10)

However, the correlation between obesity and asthma remains controversial. Various studies have shown that the association between elevated BMI and asthma incidence is significantly stronger in women than in men.^(11,12) However, other studies have shown that obesity is a significant risk factor for the incidence of asthma in both genders.⁽¹³⁻¹⁵⁾

A study that evaluated the influence of weight loss on the pulmonary function of individuals with asthma showed an improvement in bronchial obstruction indices in those who lost weight when compare to a control group of obese asthma patients who did not take part in the weight control program.⁽¹⁶⁾ These data were confirmed in a study

that monitored a program of weight loss in asthmatic women and confirmed an improvement in pulmonary function, regardless of changes in airway hyperresponsiveness.⁽¹⁷⁾

Differences in asthma severity, in the general characteristics of the individuals studied and in the outcomes assessed might explain the diversity in the results of the studies investigating the association between obesity and asthma.⁽⁶⁾

In a bibliographic review, we found no national data on the association between obesity and asthma severity. Therefore, the aim of this study was to determine whether there is a correlation between BMI and the severity of asthma in individuals evaluated at a university hospital in Brazil.

Patients and methods

A retrospective study was conducted through the analysis of the reports of patients from the Asthma outpatient clinic of the Paulista State University School of Medicine at Botucatu. A total of 200 asthma patients were studied. All were over the age of 20, and none presented any additional respiratory diseases.

Asthma severity was classified according to the criteria of the Brazilian Consensus on Asthma Management⁽¹⁾ as intermittent, mild persistent, moderate persistent or severe persistent. For the classification, we used the degree of severity established by the physician in charge of the patient and confirmed through the analysis of data regarding clinical history, physical examination, spirometry results and medication prescribed.

Gender, age, height, smoking habit, body weight, bronchodilator spirometry and prescribed medication were recorded. The BMI was calculated⁽¹⁸⁾ on the basis of weight and height [weight (kg) / height (m)²] and classified according the World Health Organization as normal/overweight (BMI \leq 29.9 kg/m²) or obese (BMI \geq 30 kg/m²).

The Committee for Ethics in Human Research of the Paulista State University School of Medicine at Botucatu approved the research project.

Statistics

The study of the association between asthma severity and obesity was conducted using the Goodman test^(20,21) for contrasts between and within multinomial proportions. Logistic regression anal-

ysis was used for analyzing the associations among obesity, asthma severity and gender. The results are presented as odds ratios (ORs) and 95% confidence interval (95% CI). The level of significance adopted was 5%.

Results

The general characteristics of the patients studied according to BMI value are presented in Table 1. The mean age of the 200 patients was 46 ± 15 years, with a range of 20-80 years. A total of 72.5% were women, and 35% were smokers. In relation to disease severity, 46 (23%) presented intermittent asthma, 51 (25.5%) presented mild persistent asthma, 48 (24%) presented moderate persistent asthma, and 55 (27.5%) presented severe persistent asthma. Among the 154 patients with persistent asthma, 118 (59%) were using inhaled corticosteroids, and 3 (1.5%) were using oral corticosteroids. There were 47 asthma patients who made no use of any regular medication, and the remaining 153 used short-acting or long-acting β_2 -agonists on a regular or intermittent basis.

The mean BMI among the asthma patients studied was 28 ± 6 kg/m², ranging from 18 to 51 kg/m²; 68% of the patients presented a BMI ≤ 29.9 kg/m², and 32% presented a BMI ≥ 30 kg/m². The mean BMI was 26 ± 4 kg/m² among the men and 29 ± 6 kg/m² among the women.

Table 2 presents the result of the logistic regression that was employed in order to determine whether the prevalence of obesity was related to asthma

severity. The OR of the correlation between obesity and asthma severity was 1.17 (95% CI: 0.90-1.53; $p > 0.05$). For each degree of increase in asthma severity, the OR for obesity increases 0.157 on average. Table 3 shows the result of the Goodman test, which evaluated the probability of obesity according to gender and asthma severity. We observed that, although there is a trend toward an increase in obesity as asthma severity increases, for both genders, the percentage difference was not statistically significant. The logistic regression used in order to evaluate the association between obesity and asthma severity among women also revealed no statistically significant difference. Therefore, no correlation between obesity and asthma severity was established in the sample studied.

Discussion

The results of the present study show no correlation between obesity and asthma severity. Although there was an increase in the OR for obesity associated with an increase in asthma severity, the difference. When the groups were divided according to gender, no significant difference was found between men and women.

In as study with a design similar to that used in the present investigation, 143 adult asthma patients considered obese when BMI ≥ 30 kg/m² were evaluated.⁽³⁾ The authors found a positive correlation between the increase in obesity and the worsening of asthma severity. Certain differences between our study and that of those authors⁽³⁾ can

Table 1 - Distribution of patients according to body mass index.

Variable	Normal/Overweight (n = 135)	Obese (n = 65)
Age (years) ^a	45 \pm 15	48 \pm 14
Male, n (%)	42 (31)	13 (20)
Female, n (%)	93 (69)	52 (80)
Body mass index (kg/m ²) ^a	24.8 \pm 3.1	34.3 \pm 4.5
Short-acting β_2 -agonist		
regular use, n (%)	8 (5)	1 (1)
intermittent use, n (%)	18 (12)	2 (3)
Long-acting β_2 -agonist, n (%)	5 (4)	2 (3)
β_2 -agonist + inhaled corticosteroid, n (%)	58 (42)	35 (54)
Inhaled corticosteroid, n (%)	20 (14)	5 (9)
Systemic corticosteroid, n (%)	2 (1)	1 (1)
Smoker, n (%)	48 (35)	22 (16)

^aMean \pm standard deviation.

Table 2 – Logistic regression for obesity in relation to asthma severity.

Asthma severity	Obese/total (% obese)	Odds ratio	p
Intermittent	13/46 (20.0)	0.3749	0.2727
Mild persistent	15/51 (23.1)	0.4387	0.3049
Moderate persistent	16/48 (24.6)	0.5132	0.3392
Severe persistent	21/55 (32.3)	0.6005	0.3752

at least partially explain the discrepant results: the prevalence of obesity among the individuals with asthma studied was greater than that observed in our study (55% vs. 32%) and the use of systemic corticosteroids was more common (16% vs. 1.5%)

Other studies evaluated the correlation between obesity and asthma without evaluating the severity of the underlying disease.⁽²²⁻²⁴⁾ Some authors⁽¹²⁾ evaluated the correlation between BMI and the diagnosis of asthma (102 patients), chronic bronchitis (299 patients) and pulmonary emphysema (72 patients). Values of BMI ≥ 18.5 kg/m² and < 25 kg/m² were considered normal, whereas a BMI ≥ 28 kg/m² was considered indicative of obese status. In that study, the authors observed that the percentage of obese patients among asthma patients was 30.4%, and the probability of being obese was significantly higher among asthma patients than among those with chronic bronchitis or emphysema. The correlation remained significant after adjustment for other risk factors, such as age, history of atopy and smoking, and was stronger among women.

Populational studies^(5,13) evaluated the correlation between BMI values and the diagnosis of asthma among men and women and showed the correlation of asthma with higher and lower BMI values, with no defined cut-off point. A group of researchers⁽⁵⁾ evaluated 5524 individuals older than 18 years of age and showed that the prevalence of asthma is higher in women with BMI > 25 kg/m². Among men, the prevalence was higher in those with BMI < 22 kg/m² as well as in obese men (BMI ≥ 30 kg/m²). In another study,⁽¹³⁾ 7109 individuals were evaluated, of which 51% were men and 49% women. The prevalence of asthma was higher in underweight women (BMI < 16 kg/m²) and obese women (BMI ≥ 30 kg/m²). However, the analysis, after being adjusted for factors such as family history of asthma, age, presence of atopy and smoking, showed a higher risk of asthma for men and women with a BMI < 16 kg/m² or > 30 kg/m². In a study

involving 309 adult patients (65% women),⁽¹⁴⁾ the authors observed that obesity (BMI ≥ 30 kg/m²) was a significant risk factor for the development of asthma in both genders, even when adjusted for the presence or absence of atopy in skin tests.

Indices that determine the distribution of fat in the thoracic-abdominal region can be more appropriate than the BMI for evaluating the influence of obesity on the respiratory system. In a study⁽²⁵⁾ that evaluated the influence of BMI, the waist and hip circumference and the relationship among these in the symptoms of the disease in 533 asthma patients (25% males), the authors showed that women presenting BMI of 25-27 kg/m² and a waist circumference of 80-85 cm presented higher prevalence of asthma symptoms. The ratio between the waist and hip circumference, the circumference of the waist > 90 cm and the BMI > 30 kg/m² were not associated with higher prevalence of asthma in either gender in a statistically significant manner. Therefore, the authors suggest that asthma symptoms are associated with body weight, regardless of the distribution of fat in the body.⁽²⁵⁾

Consequently, the results of studies evaluating the correlation between the diagnosis of asthma and the BMI values are controversial. Furthermore, they do not allow the establishment of cut-off points for the nutritional indicators potentially associated with higher prevalence of the disease. There are few data referring to the correlation between obesity and asthma severity, and further studies are needed.

The physiopathology involving the superimposition of obesity on asthma remains unknown. Various mechanisms are involved. Those staunchly defended by some authors include low tolerance for physical activity, changes in respiratory mechanics and predisposition to gastroesophageal reflux, all of which occur in obese patients.⁽⁹⁾ Along these lines, an epidemiological study⁽²⁾ evaluating 1971 adults between 17 and 73 years of age showed that obese patients (BMI > 35 kg/m²) presented a reduction in the forced expiratory volume in the first second

Table 3 - Estimated probability of obesity by gender and asthma severity.

Gender	Asthma severity			
	Intermittent	Mild persistent	Moderate persistent	Severe persistent
Male	0.199	0.224	0.25	0.278
Female	0.307	0.338	0.371	0.406

p > 0.05 for all.

(FEV₁), as well as in forced vital capacity (FVC). There was also a higher prevalence of wheezing and dyspnea, despite the lack of a significant difference in the FEV₁/FVC ratio, the peak expiratory flow and bronchial hyperreactivity following the inhalation of histamine, when compared to the group with a normal BMI (18.5–24.9 kg/m²). Therefore, the authors conclude that obesity is a risk factor for respiratory symptoms attributable to changes in the respiratory mechanics of these individuals, with no real evidence of airway obstruction or bronchial hyperreactivity. The authors also suggest that these symptoms are confounding factors for the definition of the diagnosis of asthma in these patients.⁽²⁾

The distribution of asthma severity in the patients evaluated in the present study was similar to the average estimated in literature,⁽¹⁾ except for severe persistent asthma above the estimated average: 27.5% in our study, compared to 5–10% in literature. This difference is probably due to the fact that the university hospital serves the entire region and receives cases of greater clinical complexity. Unlike asthma in children, asthma in adult patients presents higher prevalence in women,^(26,27) which is in accordance with that observed in our study, in which 72.5% of asthma patients were women.

The rate of compliance with medical treatment was 78.5%, comparable to data in the literature⁽²⁷⁾ showing that approximately 50% of the patients fail to adhere to regular treatment. This is normally due to poor perception of the symptoms of the disease, lack of access to educational programs about the disease and difficulties in management, as well as to the high cost of medication.⁽²⁸⁾

In conclusion, our study did not show a higher prevalence of greater asthma severity in obese patients. Nor did we find any statistically significant difference in the correlation between obesity and asthma severity according to gender. Therefore, the causal relationship between obesity and asthma severity remains controversial, and additional studies

are needed in order to improve understanding of the correlation between the two illnesses.

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