

Obesity, abdominal circumference and control of asthma symptomatology

Obesidade, circunferência abdominal e controle da sintomatologia da asma

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ABSTRACT

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Introduction: Asthma and obesity are common health problems. **Objectives:** To assess the prevalence of obesity and abdominal obesity in a sample of asthmatic patients from the Pulmonology Clinic at the Faculdade de Ciências Médicas de Minas Gerais and to correlate with the control of asthma symptoms. **Methods:** 74 patients with asthma, aged 18 years or more, were evaluated between March and July 2010. We assessed the body mass index (BMI), abdominal circumference (AC) and the Asthma Control Questionnaire (ACQ-5) for these patients. **Results:** The sample consisted of 57 women (77.0%) and 17 men (23.0%); 83.8% were above the recommended AC and 44.6% were obese. There was a significant positive correlation between the total ACQ-5 score and AC ($p = 0.006$) and BMI ($p = 0.015$). Cutoff points of - 0.75 and 1.50 in relation to the categorized ACQ-5 score were proposed. Considering the first cutoff point for the ACQ-5, there was a significant association with BMI ($p = 0.023$) and AC ($p = 0.034$). There was no significant association with any of the measurements with the second cut-off point of the average ACQ-5 score. **Conclusions:** We found a high prevalence of obesity and abdominal obesity in a population of asthmatic individuals and a possible influence of these findings in the control of asthma symptoms.

Key words: Obesity; Abdominal Circumference; Asthma.

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RESUMO

Introdução: asma e obesidade são problemas frequentes de saúde. **Objetivos:** avaliar a prevalência de obesidade e obesidade abdominal em amostra de pacientes asmáticos do Ambulatório de Pneumologia da Faculdade de Ciências Médicas de Minas Gerais e correlacioná-las com o controle da sintomatologia da asma. **Métodos:** 74 pacientes com asma, com idade igual ou superior a 18 anos, foram avaliados entre março e julho de 2010. Foram analisadas nesses pacientes as medidas do índice de massa corpórea (IMC), da circunferência abdominal (CA) e o Questionário de Controle da Asma (ACQ-5). **Resultados:** a amostra era constituída por 57 mulheres (77,0%) e 17 homens (23,0%); 83,8% apresentavam CA acima do recomendado e 44,6% eram obesos. Houve correlação positiva significativa entre o escore total do ACQ-5 e a CA ($p=0,006$) e IMC ($p=0,015$). Em relação ao escore categorizado do ACQ-5, foram propostos dois pontos de corte - 0,75 e 1,50. Considerando o primeiro ponto de corte para o ACQ-5, verificou-se significativa associação com o IMC ($p=0,023$) e com a CA ($p=0,034$). Não foi verificada significativa associação com algum dos índices com o segundo ponto de corte no escore médio do ACQ-5. **Conclusões:** constatou-se elevada prevalência de obesidade e obesidade abdominal em população de asmáticos e provável influência destas no controle da sintomatologia da asma.

Palavras-chave: Obesidade; Circunferência Abdominal; Asma.

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INTRODUCTION

Asthma is a chronic inflammatory disease characterized by hyperresponsiveness of the lower airways and variable airflow limitation, reversible spontaneously or with treatment¹⁻³. Its clinical representation includes recurring wheezing attacks, dyspnea, chest tightness and coughing, particularly at night and in the morning upon awakening.^{1,2}

Obesity and overweight are defined as abnormal or excessive accumulation of fat in the body, which can be harmful to health⁴ due to its association with chronic degenerative diseases and major metabolic changes.⁵

In the last decades there has been a coincident significant increase in the prevalence of asthma and obesity both in children and in adults.^{3,6-8}

Obesity can worsen the symptoms of bronchial asthma due to changes in respiratory mechanics, decreased functional residual capacity and in the volume of secondary currents, as well as a sedentary lifestyle and limited ability to perform physical activities. Obesity can also increase the risk of gastroesophageal reflux, which can, in turn, raise airway hyperresponsiveness in asthma patients.^{3,7,9-12} The inflammatory changes described in obese people are also likely to interfere with the clinical manifestations of bronchial asthma, such as an increase in TNF- α and in other pro-inflammatory cytokines, including IL-4, IL-5 and IL-6.^{3,7,9-11,13}

Nonetheless, the relation between obesity and asthma remains controversial. Several studies have shown that the association between high body mass index (BMI) values and asthma incidence is significantly higher for women than men.^{3,9,12} Obesity is a significant risk factor for the incidence of bronchial asthma for both sexes.³

Exceeding abdominal obesity may be an important risk factor for bronchial asthma.¹⁴ BMI is used as a measure of adiposity in clinical and epidemiological studies because it is easy to obtain, given that it is based on anthropometric data like weight and height, both easy to obtain and reproduce.⁵ The following are also used as measures of abdominal obesity: abdominal circumference (AC) and waist-height ratio, because these reflect values of the visceral fat deposits, which are metabolically diverse from other fats in the organism. Increase in abdominal circumference (> 88 cm) has been associated with increased prevalence of bronchial asthma, even in women with normal BMI.¹⁴

This study aimed at assessing the prevalence of obesity and abdominal obesity and its possible influ-

ence on symptomatology control in a sample of patients with bronchial asthma.

PATIENTS AND METHODS

A sample of 74 patients diagnosed with bronchial asthma and without any other pneumopathy was selected between March and July 2010, including both sexes, all aged 18+. Patients were selected in consecutive order of appointment at the Pulmonology Outpatient Clinic, part of the Afonso Silvano Brandão Clinic at the Faculdade de Ciências Médicas de Minas Gerais.

The research project was approved by the Ethics Committee on Human Research of the Hospital Universitário São José (HUSJ). Patients who did not agree to take part in the study were not included, and those who did signed the Informed Consent Form.

BMI is the World Health Organization (WHO) internationally adopted predictor of obesity, and is calculated by dividing the individual's weight (in kilograms) by the height (in meters) squared. Obesity was classified following the Overweight and Obesity Guidelines Project (2004) developed for the Brazilian population, which is divided into underweight (BMI <18.5 kg/m²), normal weight (BMI between 18.5 and 24.9 kg/m²), overweight (BMI between 25.0 and 29.9 kg/m²), and obese (BMI \geq 30 kg/m²).¹⁵

AC is a simple but representative method for calculating fat accumulated in abdomen, which better reflects visceral fat content and also has a strong association with total body fat.¹⁵ AC measurements were performed at the midpoint point between the lower costal margin and the iliac crest, facing frontwards. The criteria recommended in the Overweight and Obesity Guidelines (2004)^{15,16} show that AC \geq 94 cm for men and \geq 80 cm for women represents an increased risk of metabolic complications associated with obesity in caucasian men and women.

The *Asthma Control Questionnaire* (ACQ-5) was used to assess symptoms control of bronchial asthma and has been validated in clinical studies in Brazil.¹⁷ The ACQ-5 was administered to all patients by a trained interviewer who oversaw the process in an adequate environment. Patients answered the questions without the aid of other and the interviewer introduced the questionnaire without inducing responses.

The study of the correlations between questions in the ACQ-5 score and BMI and AC measurements was performed using Spearman's rank order correla-

tion coefficient.¹⁸ The scores obtained using the ACQ-5 and the BMI and AC measurements were analyzed using Fisher's Exact Test, given the high number of categories. The confidence interval (CI) was 95% and the significance level was 5%.

RESULTS

The number of women and men assessed was of 57 (77.0%) and 17 (23.0%), respectively. The average age was 54 ± 16, varying from 18 to 88 years of age.

The average AC value was 99±15 cm, ranging from 66 to 149 cm. The average BMI value among patients with bronchial asthma was 29±6 kg/m², varying from 17 to 49 kg/m². AC values above the recommended were observed in 83.8% of the studied population and obese BMI levels were observed in 44.6% (Table 1).

Table 1 - Distribution of patients with bronchial asthma and no other respiratory diseases, of both sexes and aged 18+ years, according to abdominal circumference and body mass index, followed at the Pulmonary Clinic at the Faculdade de Ciências Médicas de Minas Gerais, between March and July 2010

Parameters	Value	n	%
AC	Adequate	12	16,2
	High (> 94 M and 80 F)	62	83,8
	Total	74	100,0
BMI	Low weight (< 18,5)	1	1,4
	Normal weight (18.5 to 24.9)	19	25,7
	Overweight (25.0 to 29.9)	21	28,4
	Obesity (> 30.0)	33	44,6
	Total	74	100,0

There was a significant positive correlation between total ACQ-5 score and AC (p = 0.006) and BMI (p = 0.015). (Table 2).

Cutoff points of - 0.75 and 1.50 were proposed in relation to the ACQ-5 score categories. We excluded from the BMI analysis the low weight group because there was only one individual in it. Considering the first cutoff point for the ACQ-5 and a significance level of 5%, there was a significant association both for the BMI categories (p = 0.023) and for the AC categories (p = 0.034) (Table 3). The proportion of subjects with average ACQ-5 scores above the 0.75 cut-off point tended to increase with BMI, reaching 84.8% of the group classified as obese. That proportion went from

42%, in the group with AC within the recommended range, to 76%, in the group with high AC. There was no significant association between the second cutoff point for the ACQ-5 average score and categorized BMI (p=0.301) or categorized AC (p=0.061)(Table 4).

Table 2 - Spearman Correlation of items in the questionnaire and measurements of BMI, AC and age of patients with bronchial asthma and no other respiratory diseases, of both sexes and aged 18+ years, followed at the Pulmonary Clinic at the Faculdade de Ciências Médicas de Minas Gerais, between March and July 2010

		AC (cm)	BMI (kg/m ²)	Age (years)
P1	r	0,137	0,095	0,220
	P value	0,243	0,421	0,060
P2	r	0,175	0,148	0,202
	P value	0,136	0,207	0,085
P3	r	0,284	0,272	-0,006
	P value	0,014	0,019	0,963
P4	r	0,121	0,135	0,066
	P value	0,302	0,252	0,574
P5	r	0,360	0,348	-0,085
	P value	0,002	0,002	0,469
Average ACQ	r	0,314	0,281	0,122
	P value	0,006	0,015	0,302
AC (cm)	r		0,905	0,201
	P value		0,000	0,085
BMI (kg/m ²)	r			0,134
	P value			0,254

DISCUSSION

There was a high prevalence of obesity and abdominal obesity in this sample of patients with bronchial asthma at the Pulmonology Outpatient Clinic of the Afonso Silvano Brandão Clinic at the Faculdade de Ciências Médicas de Minas Gerais, which possibly influenced the control of their symptoms. There was no significant correlation between age and any other items in the questionnaire, nor with the body measurements.

In assessing the correlation between BMI and AC with the control of bronchial asthma symptoms through ACQ-5 score, there was a significant positive association between increased BMI and AC with ACQ-5 at the cutoff point of 0.75. There was no significant association between any of the measurements at the 1.50 cutoff point and either of the indices.

Table 3 - Association between the ACQ-categorized score with a cutoff point of 0.75 and the categorized BMI and AC of patients with bronchial asthma and no other respiratory diseases, of both sexes and aged 18+ years, followed at the Pulmonary Clinic at the Faculdade de Ciências Médicas de Minas Gerais, between March and July 2010

		ACQ ≤ 0.75		ACQ > 0.75		Total	
		n	%	n	%	n	%
WHO category BMI	Normal weight (18.5 to 24.9)	7	36,8	12	63,2	19	100,0
	Overweight (25.0 to 29.9)	10	47,6	11	52,4	21	100,0
	Obesity (≥ 30.0)	5	15,2	28	84,8	33	100,0
	Total	22	29,7	52	70,3	74	100,0
Fisher exact test: p value = 0.023							
WHO category AC	Adequate	7	58,3	5	41,7	12	100,0
	High (≥ 94 M and 80 F)	15	24,2	47	75,8	62	100,0
	Total	22	29,7	52	70,3	74	100,0
Fisher exact test: p value = 0.034							

Table 4 - Association between the ACQ-categorized score with cutoff point of 1.50 and categorized BMI and AC of patients with bronchial asthma and no other respiratory diseases, of both sexes and aged 18+ years, followed at the Pulmonary Clinic at the Faculdade de Ciências Médicas de Minas Gerais, between March and July 2010

		ACQ ≤ 1.50		ACQ > 1.50		Total	
		n	%	n	%	n	%
WHO category BMI	Normal weight (18.5 to 24.9)	9	47,4	10	52,6	19	100,0
	Overweight (25.0 to 29.9)	13	61,9	8	38,1	21	100,0
	Obesity (≥ 30.0)	13	39,4	20	60,6	33	100,0
	Total	36	48,6	38	51,4	74	100,0
Fisher exact test: p value = 0.301							
WHO category AC	Adequate	9	75,0	3	25,0	12	100,0
	High (≥ 94 M and 80 F)	27	43,5	35	56,5	62	100,0
	Total	36	48,6	38	51,4	74	100,0
Fisher exact test: p value = 0.061							

When it was validated in English, the ACQ-5 score included two cutoff points to discriminate between controlled bronchial asthma from uncontrolled bronchial asthma; the score of 0.75, used in clinical practice, had a negative predictive value of 0,85 (meaning that if the score is ≤ 0.75, there is an 85% chance that bronchial asthma is well controlled), and the score of 1.50, used in clinical studies, with a positive predictive value of 0.88 (meaning that if score is ≥ 1.50, there is an 88% chance that bronchial asthma is uncontrolled).¹⁷

The pathophysiology involving the overlap of obesity and bronchial asthma remains unknown. Several mechanisms are involved, and the following are considered especially significant: low tolerance to physical activity, alterations in respiratory mechanics and a propensity for gastroesophageal reflux, all of which can occur among obese individuals.³

BMI has been used to verify possible associations between obesity and bronchial asthma symptoms^{5,19} obtained through a questionnaire, and the presence of obstructive respiratory disorder detected by spirometry. An increase in the prevalence of bronchial asthma symptoms was found among obese patients, with no increase in the prevalence of obstructive disorders, suggesting as possible reason for the increased prevalence of bronchial asthma diagnoses among obese individuals the complaints of dyspnea and limitations regarding physical activity, both present in this group.

Associations between obesity and bronchial asthma have only recently been found, in the wake of sufficient increase in the prevalence of obesity so as to allow studies with large population samples, which can record statistically significant associations between the two.²⁰ It is believed that these associations

arise from differences in the lifestyles of obese and non-obese individuals, as well as from differences in the types of food ingested. Obese individuals are also more exposed to tobacco and to household allergens, due to the fact that they spend more time at home^{5,20}

Obese individuals with dyspnea and wheezing are frequently diagnosed as having bronchial asthma, even when there is no airway obstruction, reduced airflow rates or hyperresponsiveness of the airways.^{5,21} Obesity seems to be a risk factor for the respiratory symptoms arising from changes in respiratory mechanics, with no evidence of airway obstruction or bronchial hyper-reactivity. Those symptoms appear to act as confusing factors for the definition of a bronchial asthma diagnosis in these patients.^{3,21}

Adult bronchial asthma, unlike childhood asthma, has a high prevalence in women,³ which concurs with the findings in this study, in which 77.0% of the patients were women. It seems that estrogen and other female hormones may be important in the etiology of bronchial asthma, possibly by modulation of Th2 cytokine production.¹⁴

Measurements that determine thoracoabdominal fat distribution might be more appropriate than BMI when assessing the influence of obesity in the respiratory system.³ Corroborating the study made by Behren *et al.*¹⁴, this research shows that an increase in AC was associated with the prevalence of bronchial asthma, even for women with a normal BMI.

The most significant limitation of this study was the inclusion of patients who were, in some moment of their treatments, under chronic corticotherapy. Corticosteroids cause weight gain and increased abdominal circumference, which can constitute a secondary adverse factor in the development of the bronchial asthma.

CONCLUSIONS

This study suggests, in agreement with evidence found in literature, that obesity and increased abdominal circumference negatively interfere in the adequate control of bronchial asthma symptoms.

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