

Prevalence of obesity and relationship with body mass index and symptoms of asthma in adolescents

Savio Roberto V. de Carvalho¹, Elisangela V. de Assis², Ubiraidys A. Isidório³, Marta L. V. de Melo⁴, Fernando H. Sousa⁵, Ankilma Andrade do Nascimento⁶, Vitor E. Valenti⁷, Luiz Carlos de Abreu⁴

¹ Faculty Santa Maria, Cajazeiras, PB, Brazil.

² Faculty of Medicine of ABC, Santo Andre, SP, Brazil.

³ Cruzeiro do Sul University, Sao Paulo, SP, Brazil.

⁴ School of Public Health, USP, Sao Paulo, SP, Brazil.

⁵ University Estadual Paulista Júlio de Mesquita Filho, Faculty of Science, Bauru, SP, Brazil.

⁶ University of Franca, Franca, SP, Brazil.

⁷ Department of Speech Pathology, Faculty of Philosophy and Sciences, Paulista State University, Marília, SP, Brazil.

Abstract

To investigate the relationship between Body Mass Index (BMI) and asthma symptoms in adolescents between 13 and 14 years, to estimate the prevalence of obesity in this age group. This is a cross-sectional study with a quantitative approach which was rated the Body Mass Index (BMI) and applied the Questionnaire International Study of asthma and Allergies in Childhood (ISAAC) phase III (asthma module) to determine the prevalence of asthma and related symptoms, as well as its severity in 85 teenagers. According to the assessment of asthma in relation to BMI, it was found that there were significant findings, as well as in males and females. However, the association between BMI and asthma symptoms, there was a significant association to present as disturbed sleep and impaired speech.

Conclusions: In this sample the prevalence of obesity was low, this fact may have contributed to the nonsignificant findings between asthma and BMI.

Key words: Obesity; Body Mass Index; Asthma.

Introduction

Asthma is a chronic inflammatory disease having as main characteristic the airway hyperresponsiveness associated with variable airflow limitation that may be reversible either spontaneously or with treatment [1]. It is one of the most common childhood diseases, chronic respiratory disease constituting the most commune among children and adolescents. According to the Department of

the Unified Health System (DATASUL) asthma in 2005 was responsible for 18.7% of hospitalizations for problems respiratórios [2].

Predisposing factors for the onset of asthma symptoms are numerous, among them stand out respiratory infections, exposure to environmental allergens, family history of asthma, breastfeeding and drug use. Respiratory infections of viral origin are regarded as the most important factor in the onset of symptoms in children under five years. Among the most important environmental pollutants are exposure to passive smoke and carbon dioxide [3].

From the 90's various research has been pointing an association between increased body mass index (BMI) and the prevalence of asthma. This association was seen initially in children and adults in more recently. Longitudinal studies indicate a relationship between the rise in obesity and the incidence of asthma [1].

Obesity has been recognized as a health problem that can trigger other diseases and have a chronic character [4]. In Brazil, its prevalence varies according to the region of the country. In studies Abrantes et al. [5] observed a prevalence of obesity in children aged 8.2 to 11.9%, and teens of 6.6 and 8.4% in the Northeast and Southeast, respectively. Other studies conducted in the cities of São Paulo (SP) and Salvador (BA) found a prevalence of obesity of 10.5 schoolchildren in public schools and 15.8% in students from private schools [6].

With the increasing prevalence of obesity and asthma several surveys began investigating the relationship between these two diseases by age.

Obesity presents associated with various comorbidities (diabetes mellitus, cardiovascular disease, dyslipidemia, among others) and asthma by having shortness of breath and chest pain hinders the activities of everyday life and eventually results in sedentarism [6].

Asthma and obesity are conditions that pose public health problems, which some studies suggest obesity as a risk factor for asthma and vice versa. How to find the existence of this relationship is still under discussion, we realized the need and importance of studying a possible association of these two diseases, because only by knowing the causes and repercussions of both cause in people's lives is that actions of health promotion can be drawn, benefiting not only the individual but the whole community.

The present study aims to identify the prevalence and symptoms of asthma and to investigate the relationship between Body Mass Index (BMI) and asthma symptoms in adolescents between 13 and 14 years, to estimate the prevalence of obesity in this age group.

Methods

This study is a cross-sectional quantitative held in two public schools in the city of Cajazeiras - PB developed in May April and May 2012. It was initially made contact with teens to explain the objectives and procedures of the research and deliver the terms of consent (IC) for parents and / or guardians to sign. In another day it was performed the anthropometric measurements and it was applied the questionnaire on asthma in a private room at the school by two trained researchers. Only adolescents who gave informed consent signed by the responsible role in the research. To determine the prevalence of asthma and related symptoms it was applied the ISAAC phase III (asthma module).

We interviewed 85 adolescents 13-14 years, 54, 2% were female and 45.8% male. The 85 teenagers who participated in the study were divided into four groups: 4.8% undernourished, eutrophic 69, 4%, 17.6% overweight and 8.2% obese.

The study included adolescents of both genders, aged between 13 and 14 years and excluded adolescents who had respiratory diseases. Anthropometric measurements were used a digital scale

(brand: G-Tech/Glass 200; manufacturer: Tech) to evaluate the weight capacity of 180 kg and sensitivity of 100g, a stadiometer aluminum (brand: Sanny) to measure the height. BMI (kg/m²) was calculated and compared to the values used by NCHS, and nutritional status according to the recommendations of the World Health Organization (WHO), in which individuals with a BMI below the fifth percentile were classified as malnourished; eutrophic with BMI at or above the fifth percentile and below 85, overweight with a BMI at or above the 85th percentile and below 95, and obese with a BMI at or above the 95th percentile. To determine the prevalence of asthma and related symptoms, as well as its severity was used the ISAAC phase III (asthma module) [8]. This research follows the Resolution 196/96 regulating the human research in Brazil and was approved by the Ethics Committee of the Faculdade Santa Maria, under the Protocol 04638112.7.0000.5180.

The data were recorded in the database of the computer program SPSS (Statistical Package for Social Sciences) for Windows, version 15.0, and analyzed using descriptive and inferential statistics. For descriptive procedures were presented gross and relative measures (frequencies and percentages), measures of central tendency (mean and median) and variability (standard deviation and range). The statistical inference procedures, in turn, were performed by calculating the odds ratio (odds ratio), which estimates the risk of certain characteristic occurs through another (in this case, asthma based on BMI) and by means of Chi-square test, which identifies associations between variables. Finally, for the interpretation of the information, we adopted a confidence interval of 95% and a significance level of 5% ($p < 0,05$).

Results

To calculate the odds ratio (odds ratio) of presenting features and symptoms of asthma based on BMI, participants were divided into two groups: those with more than 50 percentile (higher standard group) and those with percentile or less 50 (group criteria below). Participants who were normal weight had less chance, odds ratio (OR) of less than 1, having been diagnosed with asthma have wheezing after exercise presented, have filed nocturnal

Table 1. Evaluation of wheezing / asthma based on BMI

Variables	Esp.	Percentile>50		Percentile ≤ 50		OR	IC 95%	
		F	%	f	%		Min.	Max.
Wheezing sometimes	Yes	11	12.9	7	8.2	1.71	0.59	4.97
	No	32	37.6	35	41.2			
Wheezing in the last 12 months	Yes	5	5.9	4	4.7	1.25	0.31	5.01
	No	38	44.7	38	44.7			
Some crisis	Yes	4	4.8	4	4.8	0.94	0.22	4.07
	No	39	46.4	37	44.0			
Disturbed sleep	Yes	6	7.1	3	3.5	2.10	0.49	9.05
	No	37	43.5	39	45.9			
Impaired speech	Yes	3	3.5	1	1.2	3.07	0.30	30.81
	No	40	47.1	41	48.2			
Asthamever	Yes	4	4.7	6	7.1	0.61	0.16	2.35
	No	39	45.9	36	42.4			
Wheezing after exercise	Yes	6	7.1	9	10.6	0.59	0.19	1.84
	No	37	43.5	33	38.8			
Nocturnal cough	Yes	12	14.1	13	15.3	0.86	0.33	2.19
	No	31	36.5	29	34.1			

Legend: Esp.: Specification, OR: odds ratio, CI: confidence interval.

Table 2. Evaluation of wheezing / asthma based on BMI in males and females

Variables		Percentile>50		Percentile ≤ 50		OR	IC 95%	
		Yes (%)	No (%)	Yes (%)	No (%)		Min.	Max.
Wheezingsometimes	Male	7.7	48.7	2.6	41.0	2.52	0.23	26.72
	Female	17.4	28.3	13.0	41.3	1.94	0.54	6.95
Wheezing in the last 12 months	Male	5.1	51.3	2.6	41.0	1.60	0.13	19.27
	Female	6.5	39.1	6.5	47.8	1.22	0.21	6.80
Some crisis	Male	5.1	51.3	2.6	41.0	1.60	0.13	19.27
	Female	4.4	42.2	6.7	46.7	0.73	0.11	4.89
Disturbed sleep	Male	7.7	48.7	0.0	43.6	-	-	-
	Female	6.5	39.1	6.5	47.8	1.22	0.21	6.80
Impaired speech	Male	2.6	53.8	0.0	43.6	-	-	-
	Female	4.3	41.3	2.2	52.2	2.52	0.21	30.01
Asthamever	Male	7.7	48.7	10.3	33.3	0.51	0.09	2.68
	Female	2.2	43.5	4.3	50.0	0.57	0.04	6.82
Wheezing after exercise	Male	10.3	46.2	7.7	35.9	1.03	0.19	5.41
	Female	4.3	41.3	13.0	41.3	0.33	0.06	1.86
Nocturnal cough	Male	10.3	46.2	7.7	35.9	1.03	0.19	5.41
	Female	17.4	28.3	21.7	32.6	0.92	0.28	3.03

Legend: Esp.: Specification, OR: odds ratio, CI: confidence interval.

cough and had to have made some crisis. However, since their confidence intervals were maximum greater than 1, these results can not be considered significant statistical point of view. These same findings were observed in other variables, so that a BMI lower or higher than the median of the 50th percentile is not a risk factor for presenting all the

characteristics and symptoms investigated. Descriptive and inferential data are detailed in Table 1.

In order to check these symptoms by taking as basis the gender of the participants also have calculated the chances of developing such symptoms as a function of BMI percentile. These previous results which were not observed significant chan-

Table 3. Association between BMI and asthma symptoms and characteristics

Variable	Esp.	Malnourished $x < 5$		Eutrophic $5 \leq x < 85$		Overweight $85 \leq x < 95$		Obese $x > 95$		p
		f	%	f	%	f	%	f	%	
Wheezing sometimes	Yes	0	0.0	12	14.1	3	3.5	3	3.5	0.37
	No	4	4.7	47	55.3	12	14.1	4	4.7	
Wheezing in the last 12 months	Yes	0	0.0	5	5.9	3	3.5	1	1.2	0.52
	No	4	4.7	54	63.5	12	14.1	6	7.1	
Some crisis	Yes	0	0.0	5	6.0	2	2.4	1	1.2	0.82
	No	4	4.8	53	61.3	13	15.5	6	7.1	
Disturbed sleep	Yes	0	0.0	4	4.7	2	2.4	3*	3.5	0.02*
	No	4	4.7	55	64.7	13	15.3	4	4.7	
Impaired speech	Yes	0	0.0	1	1.2	1	1.2	2*	2.4	0.01*
	No	4	4.7	58	68.2	14	16.5	5	5.9	
Asthma ever	Yes	1	1.2	7	8.2	1	1.2	1	1.2	0.77
	No	3	3.5	52	61.2	14	16.5	6	7.1	
Wheezing after exercise	Yes	1	1.2	10	11.8	1	1.2	3	3.5	0.21
	No	3	3.5	49	57.6	14	16.5	4	4.7	
Nocturnal cough	Yes	0	0.0	20	23.5	3	3.5	2	2.4	0.41
	No	4	4.7	39	45.9	12	14.1	5	5.9	

Legend: Esp: specification; Desnut.: Malnourished; Eutrof: eutrophic.; *: Significant ($p < 0.05$).

ces between variables in participants males and females (Table 2).

Association between asthma symptoms and BMI

Nutritional status, in each corresponding group, was also assessed in terms of asthma symptoms. It was found that wheezing present, is sometimes in the past 12 months or after exercise, as well as having presented the crisis, having been diagnosed with asthma and provide nighttime cough are not associated with nutritional status statistical criteria, since with $p > 0.05$. However, there was a significant association to present as disturbed sleep ($p < 0.02$) and impaired speech ($p < 0.01$). That is, participants that have these characteristics are associated with the upper 95 percentile, or obesity. However, it emphasizes the importance of replication of such information with larger sample, since most of the subjects in this study belonged to the group of normal weight, having low effective sample the other groups. These data are detailed in Table 3.

Discussion

The relationship between BMI and asthma has tornadobastante evident through clinical and expe-

perimental studies. There are several methods proposed to explain the relationship between obesity and asthma, but there is no conclusive answer. According to the results of the Household Budget Survey (HBS) from 2008 to 2009 conducted by IBGE in partnership with the Ministry of Health the weight of Brazilians has increased in recent years. The proportion of boys and young men 10-19 years old overweight increased from 3.7% (1974-75) to 21.7% (2008-09) and among girls and young women the growth of overweight was 7.6% to 19.4%. weight gain in adolescents 10 to 19 years was continued for the last 34 years, being more visible in males as their index rose from 3.7% to 21, 7%. Among the young statistics from 7.6% to 19% between 1974-75 and 2008-09. Since obesity has become less intense, but with an upward trend, from 0.4% to 5.9% among boys and young men, and from 0.7% to 4.0% in the genre feminine [9]. In this survey the prevalence of obesity was very low (8.2%), however, overweight had the highest percentage (17.6%).

In the last two decades there has been a significant increase in rates of obesity, which has coincided with a high prevalence of asthma in all world [4]. The association between asthma and obesity is common among children and adolescents. Some studies indicate that the gain or loss of weight may

be responsible for triggering and the severity of asma [9].

Asthma and obesity are diseases that have a high prevalence etiologies, clinical phenotypes and different gravities, having a strong environmental, genetic and inflammatory. In recent decades epidemiological studies have theorized that there is a relationship between the two diseases, since there was an increase in prevalence of both in the same period [11]. According Shore [12] asthma obesity is strongly influenced since this increases the prevalence, incidence and possibly the severity of asthma.

According Story [13] the association between asthma and obesity can arise due to common etiologies such as inflammation of the airways, the mechanical effect of obesity on lung volume changes in hyperresponsiveness of the airway, as well as changes in the practice of physical and diet. To Shore [12] the biological basis of this relationship still includes the action of adipokines, such as tumor necrosis factor-alpha, leptin and adiponectin. The leptin level is increased in asthmatic children compared to healthy subjects [14].

Adipose tissue is an endocrine organ responsible for releasing a multitude of factors, including adipokines that are linked to immunity and inflammatory response and show an increase in their levels in cases of obesity, characterized by a state of mild chronic inflammation [15].

With obesity is a greater production of adipokines that promote repercussions in various bodily functions such as the immune system in the control of food intake, energy balance, among others. Adipokines may exert antagonistic actions in the inflammatory process, may cause an imbalance between pro-and anti-inflammatory responses by inducing inflammatory or hypersensitivity [16].

In studies Cassolet al. [17] found a positive association between a BMI below the 95th percentile and the prevalence of wheezing ever (OR = 0.83, 95% CI 0.61 to 0.99, $p < 0.05$), and wheezing with exercise (OR = 0.74, 95% CI: 0.55-0.99, $p < 0.05$), compared to a BMI at or above the 95th percentile. However, in studies of Cunha et al.[18], there were no statistically significant differences between the students in any of the ISAAC questions, in which the age of 13 was selected because of evidence of remission of asthma symptoms in puberty demonstrated in some studies.

Casagrande et al. [19] claim, in his research, that the total number of school children who had wheezing at least once in their lifetime was 55.2% ($n = 1,829$), while 31.2% ($n = 1,033$) responded positively to the question of wheezing in the last 12 months, considered asthmatic. According to the study of Breda et al. [2] the prevalence of severity of asthma symptoms nighttime waking was 2.1%; wheezing episodes in the last 12 months, one to three seizures was 8.1%; with four or more seizures was 3.3% and 3.7% limitation of speech.

In studies Fatuch and Rosario Filho [20] women with BMI > 30 have a 1.8 times greater risk of having asthma than non-obese women, a finding that does not occur in men. According to Pellegrino et al. [21], different from childhood to adult asthma is more prevalent in women, which is in accordance with that observed in the same study in which 72.5% of the patients were women.

According to studies by Dutra et al. [22] noted the relationship between BMI and the incidence of asthma, since this correlation is more aimed at women. Furthermore, we observed higher levels of leptin in obese women compared to obese men. In the present study it was found that there was a significant relationship between the variables and the adolescent male and female.

Cunha et al.[18] found significant results in the investigation of disturbed sleep for one or more nights and difficulty speaking due to wheezing reported fact only 1% of the responses to both. In studies Lima et al.[23] 8.5% of students reported having sleep disturbance due to wheezing and 3.9% had difficulty speaking due to wheezing in the last year. Participants in this study were overweight or obese does not. However, in this study we observed a significant association to present as disturbed sleep and impaired speech, and participants who had these characteristics are associated with obesity group with percentile higher than 95, while the other variables are not associated nutritional status to statistical criteria. Saraiva et al. [1] explain that obesity increases the risk of gastro-oesophageal reflux and sleep disorder, in turn, can cause or worsen asthma.

Conclusion

There was no association of asthma symptoms with BMI nor a statistically significant difference

in the relationship between obesity and asthma for all inquiries by the ISAAC phase III. There was significant disruptive sleep and impaired speech due to wheezing.

References

1. Saraiva SA, Xisto DG, Dias CM, Silva JRL, Rocco PRM. Entendendo os mecanismos relacionados a obesidade e asma. *Pulmão (Rio J)*. 2007; 16: 39-43.
2. Breda D, Freitas PF, Pizzichini E, Agostinho FR, Pizzichini MMM. Prevalência de sintomas de asma e fatores de risco associados em adolescentes escolares de 13 e 14 anos dos municípios de Tubarão e Capivari de Baixo, Santa Catarina, Brasil. *CadSauPubl*. 2009; 25: 2497-2506.
3. Sarinho ESC, Sarinho S, Ferreira OS, Brito WP, Filho ASA, Cartaxo CGB. Fatores de risco para asma infantil em Fernando de Noronha: Estudo do tipo caso-controle. *J Pediatr*. 2005; 71: 270-272.
4. Basso DF, Corso AC, Kupek TE. Associação entre obesidade e asma. *RevCiênc Méd*. 2007; 16: 221-231.
5. Abrantes MM, Lamounier JA, Colosimo EA. Prevalência de sobrepeso e obesidade em crianças e adolescentes das regiões sudeste e nordeste. *J Pediatr*. 2002; 78: 335-340.
6. Camilo DF, Ribeiro JD, Toro ADC, Baracat ECE, Filho AAB. Obesidade e asma: associação ou coincidência? *JPediatr*. 2010; 86: 6-14.
7. National Center For Health Statistics (NCHS). Centers For Disease Control And Prevention. Atlanta, GA: Department of Health and Human Services at: www.cdc.gov/growthcharts. Accessed: 08/02/2009.
8. Asher MI, Keil U, Anderson HR, Beasley R, Crane J, Martinez F, et al. International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. *EurRespir J*. 1995; 8: 483-91.
9. Instituto Brasileiro de Geografia e Estatística. POF 2008-2009: desnutrição cai e peso das crianças brasileiras ultrapassa padrão internacional. www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=1699&id_pagina=1. Accessed: 10/07/2012.
10. Rodrigues JC, Takahashi A, Olmos FMA, Souza JB, BussamraMHF, CardieriJMA. Efeito do índice de massa corpórea na gravidade da asma e na reatividade brônquica induzida pelo exercício em crianças asmáticas com sobrepeso e obesas. *Rev Paul Pediatr*. 2007; 25: 207-13.
11. Camilo DF, Ribeiro JD, Toro ADC, Baracat ECE, Barros Filho AA. Obesity and asthma: association or coincidence? *J Pediatr*. 2010; 86: 6-14.
12. Shore SA. Obesity and asthma: lessons from animal models. *J Appl Physiol*. 2007; 102: 516-528.
13. Story RE. Asthma and obesity in children. *Curr Opin-Pediatr*. 2007; 19: 680-684.
14. Fatuch MO, Rosário Filho NA. Relação entre obesidade e asma. *J Pediatr*. 2005; 28: 84-88.
15. Trayhurn P, Wang B, Wood I.S. Hypoxia in adipose tissue: a basis for the dysregulation of tissue function in obesity? *Br J Nutr*. 2008; 100: 227-235.
16. Prado WL, Lofrano MC, Oyama LM, Dâmas AR. Obesidade e adipocinas inflamatórias: implicações práticas para a prescrição de exercício. *Rev Bras Med Esporte*. 2009; 15: 378-383.
17. Cassol VE, Rizzato TM, Teche SP, Basso DF, Hirakata VN, Maldonado M, Colpo E, et al. Prevalência e gravidade da asma em adolescentes e sua relação com índice de massa corporal. *J Pediatr*. 2005; 81: 305-309.
18. Cunha MR, Vasconcelos CCS, Barbosa AR, Xavier TT. Sintomas asmáticos em escolares de 8 e 13 anos. *Ver Saúde*. 2006; 2: 12-20.
19. Casagrande RRD, Pastorino AC, Souza RGL, Leone C, Solé D, Jacob CMA. Prevalência de asma e fatores de risco em escolares da cidade de São Paulo. *RevSaúdePúbl*. 2008; 42: 517-23.
20. Fatuch MOC, Rosário Filho NA. Relação entre obesidade e asma. *Revbraalerg.Imunopatol*. 2005; 28: 84-88.
21. Pelegrino NRG, Gaganello MM, Sanchez FF, Padovani CR, Godoy I. Relação entre o índice de massa corporal e a gravidade da asma em adultos. *JornBrasPneumol*. 2007; 33: 641-646.
22. Dutra MC, Arnoni CP, Sousa CA, Lago ERJ, Fronza FCAO, Pagani LG, et al. Relação entre obesidade e asma: uma revisão atualizada. *Rev Bras Obes Nutr e Emagr*. 2009; 3: 424-431.
23. Lima WL, Lima EVNCL, Costa MRSR, Santos AM, Silva AAM, Costa ES. Asma e fatores associados em adolescentes de 13 e 14 anos em São Luís, Maranhão, Brasil. *Cad. Sau. Publ*. 2012; 28: 1046-1056.

Corresponding Author
Luiz Carlos de Abreu,
School of Public Health,
Sao Paulo,
Brazil,
E-mail: luizcarlos@usp.br