

Association between Asthma Severity and Obesity in Two Asthma Clinics in Tehran

Sanaz Tavasoli¹, Hassan Heidarnazhad^{1,2}, Anooshirvan Kazemnejad³, and Sara Miri¹

¹Immunology, Asthma and Allergy Research Institute, Tehran University of Medical Sciences, Tehran, Iran

²National Research Institute of Tuberculosis and Lung Disease, Shahid Beheshti University of Medical Sciences, Tehran, Iran

³Department of Biostatistics, School of Medical Sciences, Tarbiat Modarres University, Tehran, Iran

ABSTRACT

The prevalence of both obesity and asthma has increased in recent years. Thus we decided to investigate the relation between obesity and asthma severity.

We undertook a cross-sectional study in outpatient asthma clinics of 2 tertiary hospitals in Tehran. Obesity was defined as a body mass index greater than 30. Asthma severity was defined by using the Guide for Asthma Management and Prevention 2004 guidelines, according to patients' clinical and/or spirometerical parameters. Active cigarette smoking patients and patients with a history of other lung diseases were excluded.

A total of 116 individuals, aged 16-83 years with a mean age of 46.57 ± 15.05 years, met the entry criteria. There were 73 females and 43 males. The prevalence of obesity in our study population was 29.3%. The Spearman correlation coefficient between asthma severity and body mass index was $r = 0.275$ ($p = 0.001$). Mean body mass index of females and males were 28.95 ± 5.41 and 25.17 ± 4.17 , respectively. Mean body mass index of females with asthma was significantly higher than males ($p < 0.0001$). The odds ratios for obesity were 8.650, 8.746, and 22.491 for mild, moderate and severe persistent asthma, respectively, compared to patients with mild intermittent asthma.

With increasing asthma severity, we observed higher occurrence of obesity in adults. The association of asthma severity with obesity suggests that obesity may be a potentially modifiable risk factor for asthma or asthma exacerbation.

Key words: Asthma; Body mass index; Obesity

INTRODUCTION

During the last 3 decades, the incidences of both obesity and asthma have shown a steady rise, with the incidence of asthma more than tripling during this period. Currently, it is estimated that 97 million adults in the United States are overweight (BMI of 25 to 29.9

kg/m²) or obese (BMI of 30 kg/m²) and 5.3% of US adults are affected by asthma.¹

Although the prevalence of asthma in adult populations in Iran is not known exactly,² but, according to the International Study of Asthma and Allergies in Childhood (ISAAC) study, the prevalence of asthma related symptoms in school children aged 13-14 years is between developed and developing countries.³ Recent epidemiological studies have revealed that the prevalence of obesity, overweight, and metabolic syndrome in Iran is equal to or higher than Europe and United States.⁴ In Tehran Lipid and

Corresponding Author: Hassan Heidarnazhad, MD;
National Research Institute of Tuberculosis and Lung Disease,
Massih Daneshvari Hospital, Tehran, Iran. Tel: (+98 21), Fax: (+98
21) 2228 5777, E-mail: heidarnazhad@nritld.ac.ir

Association between Asthma and Obesity

Glucose Study (TLGS), 40% of the adult study populations in Tehran, were overweight and 23.1% of them were obese.⁴ In addition, in a recent survey of blood donors in Tehran, 47% of the studied adult Iranian population were overweight and 24% of them were obese.⁴ Considering such a wide range of morbidity related to obesity and asthma, the financial burden associated with these disorders in Iran is considerable, both in terms of direct and indirect costs.

Recent studies have suggested that these two common conditions may be associated. However, most of these studies were done in children or in limited population groups.⁵⁻⁷ An association between asthma and overweight or obesity was first reported in adults in the 1980s.⁸ Few of these studies looked at the relation between BMI and asthma severity.⁹⁻¹¹ The objective of our study was to examine the relation between BMI and asthma severity in outpatient asthma clinics of 2 tertiary hospitals in Tehran.

MATERIALS AND METHODS

Study Population

One hundred and sixteen adult asthmatic patients of outpatient department of two tertiary hospitals (Milad and Fayaz bakhsh Hospitals, Tehran) were enrolled into the study from June 2005 to September 2005.

Inclusion and Exclusion Criteria

Adults aged 16 and over with pulmonologist diagnosed asthma, were included in the study. Active cigarette smokers and patients with evidence of any chronic lung diseases other than asthma were excluded.

Measurements

The body height and weight were measured using standard procedures and BMI was calculated from the following equation: $BMI = \text{weight (kg)} / [\text{height (m)}]^2$.

Patients were considered to be obese if BMI was greater than 30 kg/m². Asthma severity was defined by using the asthma definitions of the GINA (the Guide for Asthma Management and Prevention guidelines) 2004 guidelines.¹² These guidelines categorize asthma severity into four categories based on clinical symptoms, medication usage, and pulmonary function results. Patients were considered as either being mild intermittent, mild persistent, moderate persistent, or

severe persistent asthmatics. Mean BMI was calculated for each group.

Statistical Analysis

The Spearman correlation test was used to evaluate the relationship between asthma severity and BMI. Using logistic regression analysis, we calculated the odds ratio and 95% confidence interval of obesity occurring in patients categorized as having persistent asthma (mild, moderate, or severe) versus patients categorized as having mild intermittent asthma. SPSS software version 10.5.5 (SPSS Inc., Chicago, IL, USA) was used for all statistical analysis. P value <0.05 was considered as significant.

RESULTS

One hundred sixteen adults aged 16-83 years entered the study. The mean age of patients was 46.57±15.05 years. Seventy-three of the subjects (63%) were female and 43 (37%) were male. The mean length of time having diagnosis with asthma was 89.09±103.29 with a range of 0 to 600 months. Body mass index ranged between 15.57 m² and 41.62 kg/m², with a mean BMI of 27.54. The mean BMI of different asthma severity groups are shown in (Table 1). The prevalence of obesity in our study population was 29.3%. Mean BMI of females and males were 28.95±5.41 and 25.17±4.17, respectively. Mean BMI of females with asthma was significantly higher than males (p <0.0001).

Asthma severity frequency among the patients was as follows: 32 (27.6%) patients had mild intermittent asthma, 41 (35.3%) patients had mild persistent asthma, 38 (32.8%) patients had moderate persistent asthma,

Table 1. Comparing BMI in different asthma severity groups.

Asthma severity	Number of patients (mean BMI)		
	Normal	Over weight	Obese
Mild intermittent	13 (21.31)	17 (27.11)	2 (33.43)
Mild persistent	11 (22.39)	15 (27.66)	15 (32.52)
Moderate persistent	9 (20.81)	15 (27.46)	14 (34.39)
Severe persistent	2 (21.64)	-	3 (37.89)

Table 2. Odds ratios of obesity occurring in persistent versus mild intermittent asthma.

Asthma severity	Number of obese /total patients (% obese)	Odds ratio of obesity (relative to mild intermittent asthma)	95% Confidence interval for odds ratio of obesity	Significance (p value)
Mild intermittent	2/32 (6.3%)	–	–	–
Mild persistent	15/41 (36.6%)	8.650	1.807-41.407	p=0.007
Moderate persistent	14/38 (36.8%)	8.746	1.809-42.277	p=0.007
Severe persistent	3/5 (60%)	22.491	2.275-22.345	p=0.008
All persistent	32/84 (38.1%)	9.227	2.064-41.242	p=0.004

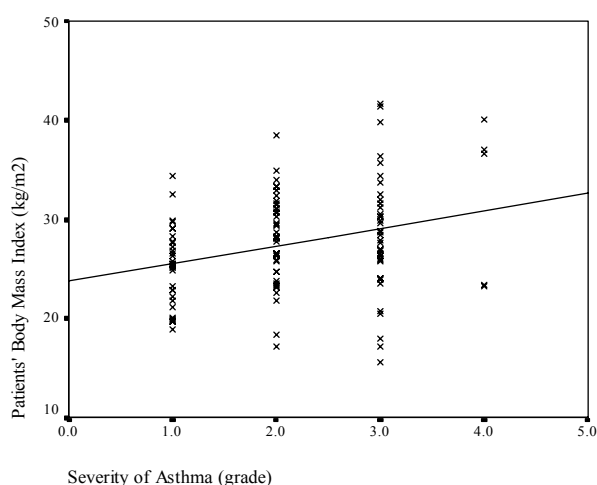


Figure 1. Relationship between asthma severity and patients' Body Mass Index (BMI). 1: Mild, 2: Mild persistent, 3: Moderate persistent, 4: Severe persistent.

and 5(4.3%) patients had severe persistent asthma. There was a significant relationship between worsening severity of asthma and increasing BMI ($r=0.275$, $p=0.001$) (Figure 1).

The odds ratios for obesity were 8.650, 8.746, and 22.491 for mild, moderate and severe persistent asthma, respectively, compared to patients with mild intermittent asthma.

Having all persistent asthmatic patients in one group comparing to patients with mild intermittent asthma, the odds ratio for obesity was found to be 9.22 (Table 2). Twenty four patients (20.7%) reported using steroid drug at the time of study with a range of 5-60 mg prednisone per day. Among them, only 6 patients (25%) were obese. There was not a significant difference in obesity prevalence between oral steroid users and patients not taking oral steroids ($p=0.186$).

DISCUSSION

The results of this study showed that with increasing asthma severity, we have higher occurrence of obesity in a group of asthmatic patients (Figure 1). Patients with mild, moderate and severe persistent asthma had a 8.650, 8.746 and 22.491 fold increase in the risk of having obesity respectively, compared to patients with mild intermittent asthma (Table 2).

Many epidemiologic studies have noted the striking increase in both obesity^{1,13} and asthma,¹⁴ and both cross-sectional^{7,8,15,16} and longitudinal^{5,17} studies have attempted to document a link between these two chronic disorders.⁹ The temporal trends in the prevalence of obesity among people with asthma have been described recently in the United States. Using data from National Health and Nutrition Examination Survey (NHANES) I (1971-1975), II (1976-1980), and III (1988-1994), Ford and Mannino¹⁸ examined changes in the prevalence of obesity during the period covered by these surveys. Among people with current asthma, age-adjusted mean body mass index increased from 26.1 kg/ m² in the NHANES I to 28.0 kg/ m² in NHANES III, and the age-adjusted prevalence of obesity increased from 21.3 to 32.8%. Among people without asthma, age-adjusted mean body mass index increased from 25.4 kg/ m² in NHANES I to 26.6 kg/ m² in NHANES III, and the prevalence of obesity increased from 14.6 to 22.8%. In another study, Mishra et al.¹⁹ found a strong positive association between obesity and asthma prevalence in 82464 non-pregnant adult women in India.

The association between obesity and asthma remained strong and statistically significant even when the effects of other selected risk factors and potential confounders were controlled. In the cohort of the

Association between Asthma and Obesity

National Health and Nutrition Evaluation Survey Epidemiologic Follow-up Study (NHEFS), Stanley et al.²⁰ examined the relationship between BMI and asthma in 14407 subjects aged 25-74 with doctor-diagnosed asthma. At baseline and at follow-up, increasing BMI was associated with increased prevalence of asthma. During the observation interval, however, no increased incidence of asthma associated with increasing BMI was noted. These results suggest that asthma development may be a point on the trajectory of chronic obesity disease or asthma appears with obesity as a concurrent disorder.

The subject was also investigated in children and adolescents. To investigate the relationship between asthma and obesity a medical record of 171 children and adolescents, was reviewed by Gennuso et al.⁷ They concluded that asthma is a risk factor for obesity in children and adolescents.

Although all these studies are attempted to show a relation between asthma prevalence and obesity, our study suggests a relationship between the degree of asthma severity and obesity, which had been reported by limited studies before. Akerman et al.¹¹ undertook a retrospective medical record review of 143 adult patient records at an inner-city academic asthma center. They found that the prevalence of obesity was significantly increased with increasing asthma severity ($p < 0.0002$). Thomson et al.⁹ determined the prevalence of obesity and the relation of body mass index (BMI) to asthma severity among 572 adult patients presenting to the emergency department with acute asthma. They found that three of four asthmatic patients were either overweight or obese. Luder et al.⁶ studied 209 black and Hispanic children with the single diagnosis of asthma, in comparison with 1017 control black and Hispanic children. They found that the prevalence of overweight was significantly higher in children with moderate to severe asthma than in their peers and the risk of overweight based on a BMI in the 85th percentile or greater was significantly associated with more severe asthma symptoms.

Many factors may cause this association between asthma and obesity. One hypothesis suggests that the obesity may be the result of reduced energy expenditure due to the low level of physical activity, during childhood and adulthood, in patients with asthma.^{5,21} Exercise-induced asthma may also be an additional limiting factor forcing some asthmatics to reduce their physical activity and energy expenditure.¹¹

Another possible explanation for the increased obesity among asthmatics is that weight gain occurs as a side effect of steroid therapy. Akerman et al.¹¹ showed that the prevalence of obesity in the patients on long-term oral steroids was 100%, however only a small proportion of the patients with asthma took oral steroid for prolonged period. In our study, we did not find any significant association between obesity and consumption of oral steroids. It may be due to the fact that our data about steroid using was a cross-sectional data at the time of study and not long term steroid using. Most of the patients did not remember their past steroid using and we did not have any medical records of the matter, thus a cohort study of the effect of long term steroid using is needed in larger population of patients due to wide variation in drug regimen.

The relation between obesity and asthma could be investigated from other aspect, that obesity may cause or increase, the risk of developing asthma. Cross-sectional studies indicate an increased prevalence of asthma in the obese.^{8,19,22,23} Nearly all prospective studies demonstrate a positive association between BMI and the development of asthma and airway hyper-responsiveness, respectively.^{5,23-26} In these studies weight gain occurred before the new onset of asthma or asthma symptoms suggesting a true relation between both conditions. Camargo and colleagues⁵ reported a significant association between overweight development and new-onset asthma in the US Nurses Health Study. The hypothesis that obesity plays a direct role in the persistence of asthma symptoms is also supported by the fact that weight reduction in obese patients with asthma improves lung function and symptoms, at least among adults.^{27,28}

There are some limitations to the conclusions that can be drawn from our study. We report association between asthma and obesity. Similar to other published studies, the question of causality could not be reached. It remains to be determined if asthma causes obesity, if obesity causes asthma, or if obesity is an independent phenomenon that affects adversely on respiratory mechanics and causes asthma-like PFT abnormalities and symptoms. We may also be dealing with a cycle of obesity and asthma worsening in tandem in susceptible patients.¹¹ A prospective study in large sample must be done in order to follow up the obese asthmatic patients who are on regulatory diet regimen to understand whether weight reducing has any impact on improving asthma symptoms and lung function.

In summary, we found that the prevalence of obesity increases with worsening asthma severity in a population of adult asthmatic patients. On the basis of our study and other studies, it appears that obesity may be a potentially modifiable risk factor for asthma or for asthma related symptoms.

Thus control of weight with weight reduction measures may improve the disease control and quality of life in asthmatic patients.

ACKNOWLEDGEMENT

We would like to thank Dr. Zahra Pourpak for her kind review of the study and this article and Dr. Mitra Sahebazamani for her kind review of this article.

REFERENCES

1. Flegal KM, Carroll MD, Kuczmarski RJ, Johnson CL. Overweight and obesity in the United States: prevalence and trends, 1960–1994. *Int J Obes Relat Metab Disord* 1998; 22(1):39-47.
2. Boskabady MH, Kolahejdoz GH. Prevalence of asthma symptoms among the adult population in the city of Mashhad (north-east of Iran). *Respirology* 2002; 7(3):267-72.
3. Worldwide variation in prevalence of symptoms of asthma, allergic rhinoconjunctivitis, and atopic eczema: ISAAC. The International Study of Asthma and Allergies in Childhood (ISAAC) Steering Committee. *Lancet* 1998; 351(9111):1225-32.
4. Malekzadeh R, Mohamadnejad M, Merat SH, Pourshams A, Etemadi A. Obesity Pandemic: An Iranian Perspective. *Arch Iran Med* 2005; 8(1):1-7.
5. Camargo CA Jr, Weiss ST, Zhang S, Willet WC, Speizer FE. Prospective study of body mass index, weight change, and risk of adult-onset asthma in women. *Arch Intern Med* 1999; 159(21):2582–8.
6. Luder E, Melnik TA, DiMaio M. Association of being overweight with greater asthma symptoms in inner city black and Hispanic children. *J Pediatr* 1998; 132(4):699-703.
7. Gennuso J, Epstein LH, Paluch RA, Cerny F. The relationship between asthma and obesity in urban minority children and adolescents. *Arch Pediatr Adolesc Med* 1998; 152(12):1197-2000.
8. Negri E, Pagano R, Decarli A, La Vecchia C. Body weight and the prevalence of chronic disease. *J Epidemiol Community Health* 1988; 42(1):24-9.
9. Thomson CC, Clark S, Camargo CA, MARC Investigators. Body mass index and asthma severity among adults presenting to the emergency department. *Chest* 2003; 124(3):795-802.
10. Schaub B, Mutius E. Obesity and asthma, what are the links?. *Curr Opin Allergy Clin Immunol* 2005; 5(2):185-93.
11. Akerman MJ, Calacanis CM, Madsen MK. Relationship between asthma severity and obesity. *J Asthma* 2004; 41(5):521-6.
12. Pocket Guide for Asthma Management and Prevention Updated from the NHLBI/WHO Workshop Report: Global Strategy for Asthma Management and Prevention NIH Publication No.02-3659, 2004.
13. Mokdad AH, Bowman BA, Ford ES, Vinicor F, Marks JS, Koplan JP. The continuing epidemics of obesity and diabetes in the United States. *JAMA* 2001; 286(10):1195-200.
14. Woolcock AJ, Peat JK. Evidence for the increase in asthma worldwide. *Ciba Found Symp* 1997; 206:122-34.
15. Sin DD, Jones RL, Man SF. Obesity is a risk factor for dyspnea but not for airflow obstruction. *Arch Intern Med* 2002; 162(13):1477-1481.
16. Schachter LM, Salome CM, Peat JK, Woolcock AJ. Obesity is a risk for asthma and wheeze but not airway hyperresponsiveness. *Thorax* 2001; 56(1):4-8.
17. Chen Y, Dales R, Tang M, Krewski D. Obesity may increase the incidence of asthma in women but not in men: longitudinal observations from the Canadian National Population Health Surveys. *Am J Epidemiol* 2002; 155(3):191-7.
18. Ford ES, Mannino DM. Time trends in obesity among adults with asthma in the United States: findings from three national surveys. *J Asthma* 2005; 42(2):91-5.
19. Mishra V. Effect of obesity on asthma among adult Indian women. *Int J Obes Relat Metab Disord* 2004; 28(8):1048-58.
20. Stanley AH, Demissie K, Rhoads GG. Asthma development with obesity exposure: observations from the cohort of the National Health and Nutrition Evaluation Survey Epidemiologic Follow-up Study (NHEFS). *J Asthma* 2005; 42(2):97-99.
21. Castro-Rodriguez JA, Holberg CJ, Morgan WJ, Wright AL, Martinez FD. Increased incidence of asthma like symptoms in girls who become overweight or obese during the school years. *Am J Respir Crit Care Med* 2001; 163(6):1344-9.
22. Celedon JC, Palmer LJ, Litonjua AA, Weiss ST, Wang B, Fang Z, et al. Body mass index and asthma in adults in

Association between Asthma and Obesity

- families of subjects with asthma in Anqing, China. *Am J Respir Crit Care Med* 2001; 164(10 Pt 1):1835-40.
23. von Mutius E, Schwartz J, Neas LM, Dockery D, Weiss ST. Relation of body mass index to asthma and atopy in children: the National Health and Nutrition Examination Study III. *Thorax* 2001; 56(11):835-8.
24. Gilliland FD, Berhane K, Islam T, McConnell R, Gauderman WJ, Gilliland SS, et al. Obesity and the risk of newly diagnosed asthma in school-age children. *Am J Epidemiol* 2003; 158(5):406-15.
25. Gold DR, Damokosh AI, Dockery DW, Berkey CS. Body-mass index as a predictor of incident asthma in a prospective cohort of children. *Pediatr Pulmonol* 2003; 36(6):514-21.
26. Chinn S, Jarvis D, Burney P; European Community Respiratory Health Survey. Relation of bronchial responsiveness to body mass index in the ECRHS. *European Community Respiratory Health Survey. Thorax* 2002; 57(12):1028-33.
27. Stenius-Aarniala B, Poussa T, Kvarnstrom J, Gronlund EL, Ylikahri M, Mustajoki P. Immediate and long term effects of weight reduction in obese people with asthma: randomised controlled study. *BMJ* 2000; 320(7238):827-32.
28. Hakala K, Stenius-Aarniala B, Sovijarvi A. Effects of weight loss on peak flow variability, airways obstruction, and lung volumes in obese patients with asthma. *Chest* 2000; 118(5):1315-21.