ASSOCIATION OF ASTHMA SEVERITY WITH BODY MASS INDEX AMONG ADULTS

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Abstract- Asthma is now recognized as a common cause of disability of great economic cost and preventable deaths. In this study we aimed to test our hypothesis based on the relationship between body mass index and bronchial asthma .Among the patients with acute asthma admitted to the emergency ward and pulmonology clinic, we sought to determine the prevalence of obesity, as well as the effect of body mass index (BMI) on asthma severity, in this high-risk group patients. To investigate the relation between body mass index and asthma severity, we conducted a descriptive cross-sectional study of 501 volunteered patients with bronchial asthma. To identify the severity of the asthma's situation, a questionnaire was prepared requesting the following information: age, sex, clinical signs and symptoms. After the participants answered to the questionnaire, all active or ex-smoker patients were excluded. A trained observer assessed airway reversibility, peak flowmetry and spirometry in asthmatic patients. The results showed that the dyspnea is the most common symptom in the asthmatic patients, recurrent episodic wheezing (95.7 %), cough (92.6 %), nasal polyp (29.7%) and dermatitis (16.2%). Mild persistent asthma (step 2) was the most common type of asthma severity classification (139; 27.74%) and 275 (54.87%) of asthmatic patients had normal weight (BMI, 19-25.9), 182 (36.34%) of patients were either overweight (BMI, 26 to 29.9) or obese (BMI > 30; 14.57%) and 44 (8.79%) were underweighted (BMI < 19). Between asthma severities and BMI was a indirect relationship, that there was a significant difference ($P < 0.05$). We observed negative association between BMI and asthma severity, but no association between the presence of recurrent nocturnal cough, nasal polyp, dermatitis and bronchial asthma.

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INTRODUCTION

Excess body fat is a health hazard affecting millions of people worldwide (1-3). Underweight is defined by a body mass index (BMI) of lower than 19kg/m^2, normal weight by a BMI: 19-25.9, overweight by a body mass index (BMI) of 26 to 29.9, and obesity by a body mass index ≥ 30kg/m (2, 4-7).

The National Health and Nutrition Examination Survey III (1988 -1994) estimated the prevalence of adult obesity in the United States as 18 to 23%, while more recent national survey data (1999), estimated 27%; furthermore the Behavioral Risk Factor Surveillance System indicates an obesity prevalence of 20% (8-11). In the United States, obesity costs approximately $99 billion, of which 52% is due to medical costs[11]. Asthma is another common, chronic disorder, and its prevalence also is rising in the United States and worldwide (12, 13).

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Between 1980 and 1994, the prevalence of self-reported asthma increased from 31 to 55 per 1,000 population. The concomitant rise in both obesity and asthma has led several groups to examine a possible causal relation between these conditions (14-22). Some groups have raised concerns that the "asthma" of obese may not be real, or that it may differ, on a pathophysiologic basis, from that of nonobese people. Specifically, these groups propose that "obese asthma" may not involve bronchial hyperresponsiveness or reversible airway obstruction but instead reflect dyspnea related to excess weight and subsequent misdiagnosis (19-24). The relationship between BMI and acute asthma is not known. To our knowledge, only one study used longitudinal data to address the relationship between obesity and asthma among adults. In that study, within a prospective cohort of 85, 911 female US nurses, Camargo *et al*, found that the BMI, as measured in 1991, strongly correlated with the risk of adult-onset asthma developing in the following 4 years.

In this prospective study, we determined the prevalence of obesity among 501 patients presenting with acute asthma to emergency and pulmonary disease clinics in Ekbatan educational hospital which is dependent to Hamadan University of Medical Sciences, and moreover examined the relationship between BMI and asthma severity in this high-risk population.

MATERIALS AND METHODS

We conducted a descriptive cross sectional study of 501 patients with bronchial asthma, who participated voluntarily in this study.

After the participants answered a questionnaire aimed at identifying their demographic characteristics like age, sex, smoking status coded as never smoked, former smoker, and current smoker in which quantity of cigarette smoking was calculated by pack-year. Asthma history, and details related to current asthma exacerbation, nocturnal and diurnal clinical signs and symptoms. To identify asthma severity, a trained observer assessed airway reversibility, peak flowmetry and spirometry in asthmatic patients. At least three acceptable maneuvers meeting American Thoracic Society (ATS) standards were required, with at least two reproducible forced expiratory volume in 1 second (FEV_1) and forced vital capacity (FVC) maneuvers within 5% of best required for each test (25). Airway responsiveness was performed in a standardized fashion, at least 4 hours after use of short acting and 24 hours after use of long acting bronchodilators or methylxanthine derivatives (14). Airway reversibility was evaluated by spirometry before and 15 minutes after inhalation of two puffs a Beta-adrenergic agonist (albuterol) as metered dose inhaler and equal or more than 15% increase in FEV1 was diagnostic for asthma (23, 24). Also peak expiratory flow (PEF) was used to assess acute asthma severity, and is expressed as percentage of the value, based on age, sex, race, and height (26); hanges in PEF are expressed as the relative change in percentage of predicted (*e.g.*, an improvement from 40% predicted to 70% predicted would be expressed as a change of 75%). According to National Asthma Education and Prevention program method asthmatic patients were categorized in 4 steps (4, 26-29) (Table 1).

After documentation of asthma diagnosis, volunteers were participated in this study. Inclusion criteria were physician newly diagnosis of acute asthma. BMI was used as a measure of excess body fat (2, 27). Underweight was defined by a body mass index (BMI) of lower than 19 kg/m^2, normal weight by a BMI: 19-25.9, overweight by a body mass index (BMI) of 26 to 29.9, and obesity by a BMI ± 30 kg/m (2, 4-6). The data were analyzed using statistical software (EPI 6).The different groups of participants were compared using the Chi square test and $P < 0.05$ was considered statistically significant.

RESULTS

The 501 patients had a mean age of 48 years, mean height was 161.96 centimeters, and mean weight of 65.36 kilograms. It was found out that the dyspnea is the most common symptom in asthmatic patients, recurrent episodic wheezing (95.7%), cough (92.6%), nasal polyp (29.7%) and dermatitis (16.2%). Mild persistent asthma (step 2) was the most common type of asthma severity classification (139; 27.74%) and 275 (54.87%) were normal

weighted (BMI, 19-25.9), 182 (36.34%) of patients were either over weighted (BMI, 26 to 29.9) or obese (BMI > 30; 14.57%) and 44 (8.79%) were underweighted (BMI < 19).

Between asthma severities and BMI was an indirect relationship, that there was a significant difference (P < 0.05). Table 2 shows the demographic characteristics of all asthmatic patients. Table 3 shows the body mass index (BMI) classification of these patients and the relationship between asthma severity and (BMI), with more than half of the patients were normal weighted (54.9%).

The obesity or overweight prevalence in this study of patients had referred to the Ekbatan hospital with acute asthma was significantly greater than the prevalence among adults from the general population using either of the obesity prevalence estimates: 36.34% vs 27% (P < 0.05) in 1999 national survey and 36.34% vs 27% (P < 0.05) in 2000 (8-10).

We observed negative association between BMI and asthma severity, but no association between the presence of recurrent nocturnal cough, nasal polyp, dermatitis and bronchial asthma.

Table 1. Stepwise asthma severity classification*

	Symptoms		
Step	**Day**	**Night**	**PEFR or FEV1 (PEFR variability)**
Step1: Mild intermittent	≤ 2 days/ week	≤ 2 nights/ months	≥80% (<20%)
Step2: Mild persistent	> 2 days/ week but<1 per day	> 2 nights/ month	≥80% (20-30%)
Step3: Moderate persistent	Daily	> 1 night/ weak	<60%-<80% (>30%)
Step4: Sever persistent	Continual	Frequent	≤60% (>30%)

Abbreviations: PEFR, peak expiratory flow rate; FEV1, forced expiratory volume in 1 second.
*According to National Asthma Education and Prevention program method.[29]

Table 2. Demographic characteristics

Characteristic	Mean	Median	Mode	Min.	Max.	SD*
Age (Year)	48	48	70	7	84	17.21
Weight (kg)	65.36	65	70	22	110	13.66
Height (cm)	161.96	163	170	125	191	13.81
BMI	14.75	24	24.22	13.5	42.20	4.82
Predicted %FEV1	63.18	66	78	12	98	19.44
Predicted %PEF	57.17	61	63	4	98	19.13
PEF Variability %	23.94	24	24	1	64	19.13
Reversibility %	17.12	16	16	15	66	13.66

Abbreviation: BMI, body mass index.
*Standard Deviation

Table 3. Relationship between asthma severity and body mass index (BMI), the BMI classification of these patients, with more than half of patients are normal weight (54.87%)*

BMI	STEP 1 (Mild intermittent)	STEP 2 (Mild persistent)	STEP 3 (Moderate persistent)	STEP 4 (Sever persistent)	Total
Underweight	4 (0.8%)	16 (3.19%)	11 (2.2%)	13 (2.6%)	44 (8.79%)
Normal weight	71(14.17%)	67 (13.36%)	76 (15.16%)	61 (12.18%)	275 (54.87%)
Overweight	36 (7.19%)	35 (7%)	23 (4.59%)	15 (2.99%)	109 (21.77%)
Obesity	17 (3.39%)	21(4.19%)	22 (4.4)	13 (2.59%)	73 (14.57%)
Total	128 (25.55%)	139 (27.74%)	132 (26.35%)	102 (20.36%)	501 (100%)

Abbreviation: BMI, body mass index.
* Data are given as number (percent).
X2=16.86; df= 9; P < 0.05.

DISCUSSION

Many epidemiologic studies have noted the striking increase in both obesity and asthma (5, 8-12). Moreover both cross-sectional and longitudinal studies have attempted to document a link between these two chronic disorders (29-33). Asthma and obesity tend to co-occur, but relatively few studies have linked obesity and asthma using body mass index (BMI).

This study has assessed BMI in Hamadan, a west province in Iran. Between asthma severities and BMI was a indirect relationship, that there was a significant difference ($P < 0.05$).We observed negative association between BMI and asthma severity, but no association between the presence of recurrent nocturnal cough, nasal polyp, dermatitis and bronchial asthma. This study has some potential limitations. As in most prior studies, the temporal relation between obesity and asthma cannot be established using this study design. Even though this subject was not our focus, but we noted that prospective studies of asthma incidence provide temporally correct evidence for a causal relation. Investigated the relationship between obesity and asthma in a prospective study of 4, 547 participants followed up for 10 years, and concluded that physical inactivity did not explain for the association between gain in BMI and the asthma found in women (17, 31-34). In addition, assessed the relationship between energy expenditure and asthma in 16, 813 patients, and determined that physical inactivity failed to explain the relationship between obesity and asthma (35). In this prospective study the prevalence of obesity among 501 patients presenting acute asthma to emergency and pulmonary disease clinics in the Ekbatan hospital in Hamadan was determined. Furthermore, asthma severity among theses patients was studied. The prevalence of obesity among asthmatic patients in this study was high, near the half of all patients with asthma were over weighted or obese. Over diagnosis of asthma among obese individuals would complicate the interpretation of the apparent relationship between obesity and asthma (36). Though bronchoprovocation studies would be inappropriate in the Emergency department setting; but we provided evidence that clearly demonstrates comparable airway reversibility in all BMI groups. Another potential limitation of our study is reliance on self-reported height and weight to calculate BMI in some patients. Studies that have examined the accuracy of self-reported height and weight to determine overweight and obesity prevalence among adults have shown that this approach may lead to an underestimation of the prevalence in men and women (37). In conclusion, we observed negative association between BMI and asthma severity, but no association between the presence of recurrent nocturnal cough, nasal polyp, dermatitis and bronchial asthma.

Conflict of interests

The authors declare that they have no competing interests.

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