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ORIGINAL ARTICLE

A STUDY OF ASSOCIATION OF BODY MASS INDEX WITH SEVERITY OF BRONCHIAL ASTHMA IN 132 PATIENTS

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ABSTRACT: As the prevalence of both obesity and severity of asthma are in increasing trend, we study association between body mass index (BMI) and asthma severity in cross sectional study. **OBJECTIVE:** To study association between Body mass index and Asthma severity **METHODOLOGY-** We included adults (age >13yrs), who are diagnosed as patients of asthma by Pulmonologist and who are non -smoker, without any other lung pathology, are not on long term systemic steroids. Total of 132 patients, divided into fallowing BMI categories: Underweight (BMI<18.5), Normal weight (BMI 18.5-25), Over weight and obese (BMI>25). Asthma severity measured using GINA severity classification. Data is collected and tabulated. **RESULTS:** 1) Comparing %FEV1of expected value of underweight (mean% FEV1of expected-70.57+/-13.78), and overweight and obese (mean% FEV1of expected-60.125+/-17.28) with normal weight (mean % FEV1 of expected-74.19+/-15.08); we find over weight and obese have significantly low %FEV1of expected (Z=3.97; P<0.001). 2) Scatter graph of % FEV1 of expected values against BMI indicate significant negative correlation(r= -0.249; p<0.01). 3) By applying chi-square test, there is significant association between overweight and obese with moderate to severe asthma(x2=14.01; p<0.001); also attributable risk (AR) found to be 49.01%. **CONCLUSION:** In asthmatic patient there is negative correlation between %FEV1of expected and BMI; Severity of asthma is more in over weight and obese patient; and obesity will be modifiable risk factor for severity of asthma.

KEYWORDS: Body Mass Index, FEV1 (Forced Vital Capacity in first second)

INTRODUCTION: Asthma is one of the most common non communicable diseases in human societies. This disease is reported to have an incidence of 5-10% in different societies. There are various genetic and environmental risk factors, the most important of which is a family history of Atopy. Other risk factors include high and low birth weights, premature birth, smoking mothers, salty food and obesity.(1)

Both asthma and obesity are chronic diseases with different features, exposing the individual to various social, economic, cultural and medical problems. Many risk factors have been identified for asthma attacks, and the relationship between changes in weight, especially obesity, and asthma has been proposed in view of the fact that there is an established relationship between BMI and decreased FEV1. Considering the ever-growing obesity even among youths and children, resulting from limited physical activity associated with industrial life and consumption of high-calorie food. However, it is not known which causes which, since changes in the respiratory physiology associated with obesity and reduced FVC are known to increase asthma, and, on the other hand, problems associated with asthma and increased asthma attacks during physical activity lead to limited activity in these patients, and hence their obesity.

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In this study, we investigated the effects of weight, in terms of BMI and its relationship with Spirometric findings in diagnosed asthma patients.

MATERIALS AND METHODS:

Study Population: One hundred and thirty two adult asthmatic patients from DR. SCGMC and Hospital, Nanded were enrolled in to study from June 2010 to May 2011.

Inclusion Criteria: We have included the patients who are already diagnosed cases of Bronchial asthma by Pulmonologist with 1) Age>13yrs 2) who are nonsmoker 3) without any other underlying lung pathology and 5)who are not on long term systemic steroids.

Exclusion Criteria: We have Excluded the patients with: 1) age < 13 yrs 2) Smokers 3)with any underlying lung pathology 4) who are on long term systemic steroids and also 5) Pregnant women.

Measurements: The body height and weight were measured using standard procedures and BMI was calculated from the following equation: BMI=weight (kg)/[height (m)]^2. Patients were considered to be obese if BMI was greater than 30 kg/m^2. Asthma severity was defined by using the asthma definitions of the GINA (the Guide for Asthma Management and Prevention guidelines) 2004 guidelines.[2] 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.

CLASS	SYMPTOMS	NOCTURNAL AWAKENING	% FEV1 OF PREDICTED	POST BRONCHODILATOR IN % FEV1
Intermittent	less than once a week	not more than twice a month	> 80% predicted	< 20%
Mild Persistent	more than once a week but less than once a day.	more than twice a month	> 80% predicted	< 20 – 30%
Moderate persistent	daily.	more than once a week	60-80% predicted	> 30%
Severe persistent	daily.	Frequent	< 60% predicted	> 30%

GINA CLASSIFICATION FOR SEVERITY OF ASTHMA

Statistical Analysis: Upon collection of the data, comparison of groups was performed using statistical tests, probability value (P) less than 0.05 were consider significant. Also correlation between % FEV1 of predicted was assessed using scatter diagram.

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OBSERVATIONS: One hundred and thirty two adults aged 14–70 yrs entered the study. The mean age of patients was 39.65+/- 15.28 yrs. Sixty three were males and remaining sixty nine were females. Patients divided into three groups according to their BMI as shown in the tables. By using statistical method it was confirmed that age and sex distribution was comparable between comparing groups.

Study population	Mean age +/- (S.D)	The level of significance compare to normal weight group	
		Value of Z	P value
Under weight (15 – 70yrs)	36.53 +/- (16.81)	0.92	> 0.05
Normal weight (14 – 69yrs)	39.74 +/- (13.97)	–	–
Overweight & obese (18 – 69yrs)	42.375 +/- (16.43)	0.79	> 0.05
Total (14 – 70yrs)	39.65 +/- (15.28)		

Study population: Age distribution

Z = Standard error of difference between two means.

Study population	male	female	total	The level of significance compare to normal weight group	
				Value of Z	P value
Under weight BMI > 18.5	18	12	30	1.59	> 0.05
Normal weight BMI 18.5 to 25	30	40	70	–	–
Overweight & obese BMI < 25	15	17	32	0.379	> 0.05
Total	63	69	**132**		

Study population: Sex distribution

Z = Standard error of difference between proportions.

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Patients are distributed for their severity of Asthma as shown in tables below:

	Intermittent	Mild persistent	Mod persistent	Severe asthma
Under weight 30	7 (23.33%)	6 (20%)	11 (36.67%)	6 (20%)
Normal weight 70	30 (42.86%)	11 (15.71%)	18 (25.71%)	11 (15.71%)
Over weight 32	4 (12.5%)	2 (6.25%)	8 (25%)	18 (56.25%)
Total 132	41	19	37	35

Severity of asthma with BMI

Then % FEV1 of expected of underweight group and that of overweight & obese group compared with normal weight group by using statistical test standard error of difference between two means. Also % FEV1of expected is plotted against BMI of patients using scatter diagram as shown in tables below –

Mean BMI in kg +/- (S.D)	Mean FEV1 +/- (S.D)	The level of significance compare to normal weight group	
		Value of Z	P value
Under weight 16.77 +/- (1.33)	70.57 +/- (13.78)	1.17	> 0.05
Normal weight 21.6 +/- (1.8)	74.19 +/- (15.08)	–	–
Overweight & obese 30.14 +/- (3.69)	60.125 +/- (17.28)	3.97	< 0.001
Over all 22.57 +/- (5.24)	69.95 +/- (16.3)		

Observed % FEV1 of expected

Z = Standard error of difference between two means.

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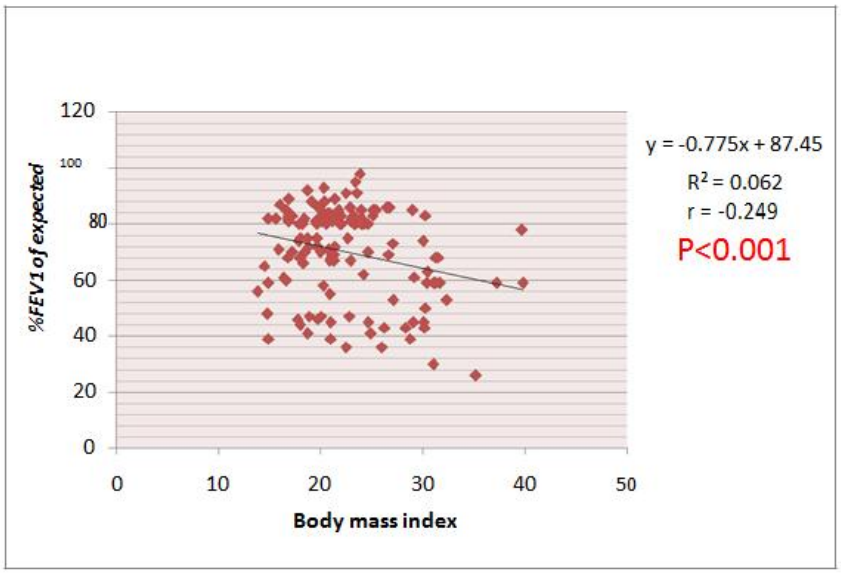

Scatter graph of %FEV1 of expected against BMI

In interest of applying CHI-SQUARE test for comparing groups qualitatively patients divided in to two part having intermittent to mild asthma and moderate to severe asthma using GINA guidelines, as shown in table below:

	Intermittent to mild asthma	Moderate to Severe asthma	Total	The level of significance compare to normal weight group	
				Value of X2	P value
Under weight	13	17	30	1.96	> 0.05
Normal weight	41	29	70	–	–
Over weight & obese	6	26	32	14.01	< 0.001
Total	60	72	132		

Using chi-square test

Attributable risk (AR) found to be 49.01%.

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RESULTS:

1. Comparing %FEV1of expected value of underweight (mean%FEV1of expected-70.57+/-13.78) and overweight and obese (mean%FEV1of expected-60.125+/-17.28) with normal weight (mean%FEV1of expected-74.19+/-15.08); we find overweight and obese have significantly low % FEV1of expected (Z=3.97; P<0.001).
2. Scatter graph of %FEV1 of expected values against BMI indicate significant negative correlation(r= -0.249; p<0.01)
3. By applying chi-square test, there is significant association between overweight and obese with moderate to severe asthma(x2=14.01; p<0.001); also attributable risk (AR) found to be 49.01%.

CONCLUSION: In asthmatic patients, there is a negative correlation between %FEV1of expected and BMI; Severity of asthma is more in overweight and obese patient; and obesity will be modifiable risk factor for severity of asthma.

DISCUSSION: Many epidemiologic studies have noted the striking increase in both obesity[3, 4] and asthma,[5] and both cross-sectional[6, 7, 8, 9] and longitudinal[10, 11] studies have attempted to document a link between these two chronic disorders.[12] 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 Mannino[13] 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 26.6kg/m2 in NHANES III, and the prevalence of obesity increased from 14.6 to 22.8%. In another study, Mishra et al.[14] 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 National Health and Nutrition Evaluation Survey Epidemiologic Follow-up Study (NHEFS), Stanley et al.[15] 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.

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.[16] 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.[17] 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.[18] 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 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.[10, 19] Exercise-induced asthma may also be an additional limiting factor forcing some asthmatics to reduce their physical activity and energy expenditure.

Another possible explanation for the increased obesity among asthmatics is that weight gain occurs as a side effect of steroid therapy. Akerman et al.[16] 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 exclude patients on oral steroids and we did not find any significant association between obesity and inhalational 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 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.[20, 21]

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. 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.

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