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Respiratory Medicine

ASSOCIATION BETWEEN BMI, DEMOGRAPHY AND RESPIRATORY SYMPTOMS IN BRONCHIAL ASTHMA AMONG COLLEGE STUDENTS

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ABSTRACT **Background:** The Indian Study on Epidemiology of Asthma, Respiratory Symptoms and Chronic Bronchitis in Adults (INSEARCH) estimated the national burden of asthma at 17.23 million with an overall prevalence of 2.05%. Given this context, there's a need for a study focusing on demographic factors and their influence on asthma prevalence, healthcare utilization, and mortality rates. This study should explore the impact of variables such as gender, age, race, and geographic location on asthma outcomes. **Aim & Objective:** The aim and objective the study is to investigate and establish a correlation between body mass index (BMI) and respiratory symptoms among college students and to assess the morbidity of bronchial asthma patients with increasing weight. **Methods:** The research was conducted at DR. KNSMIMS, Barabanki- 225001, involving 200 college students aged 18 years and above from diverse academic backgrounds. The study included assessments of their symptoms, body weight (in kilograms), height (in centimetre's), comprehensive examinations focusing on the respiratory system, as well as pulmonary function tests (PFT), chest X-rays, and basic blood investigations to diagnose bronchial asthma. A total of 200 patients were divided in to the following BMI classes according to Indian population standard. 61 normal (BMI class I – 18.5 to 22.9), 10 overweight (BMI class II – 23 to 24.9) and 29 obese patients (BMI class III ≥ 25). Based on Global initiative for Asthma (GINA) severity classification, patients were divided in to 4 categories, 17 patients in Class I – mild intermittent asthma, 39 in Class II – mild persistent asthma, 24 in Class III – moderate persistent asthma and 20 in Class IV – severe persistent asthma. Patients were assessed by history, pulmonary function tests (FVC, FEV1, FEV1/FVC ratio, PEFR) and SpO2. C-reactive protein was done to assess the correlation with body mass index. **Results:** Compared with normal weight asthmatic patients obese individuals were most likely to have missed working days, life threatening events, low SpO2, low FEV1/FVC ratio and high C-reactive protein. They were more likely to have severe persistent asthma than non-obese individuals. **Conclusion:** In our study, obesity has significant association with severity of asthma. It increases the burden to life very much. So, in treatment plan of obese asthmatics, weight reduction strategy must be included with other measures.

KEYWORDS : Body Mass Index, Respiratory Symptoms, Bronchial Asthma.

INTRODUCTION

Asthma, characterized by recurrent episodes of symptoms such as coughing, wheezing, chest tightness, and breathlessness, is a chronic inflammatory condition of the airways. It affects approximately 5% of the global population[1]. The Indian Study on Epidemiology of Asthma, Respiratory Symptoms and Chronic Bronchitis in Adults (INSEARCH) estimated the national burden of asthma at 17.23 million with an overall prevalence of 2.05%. [2] The recent Global Burden of Disease (GBD, 1990˙2019) estimated the total burden of asthma in India as 34.3 million, accounting for 13.09% of the global burden. It also attributed that there were 13.2 per thousand deaths due to asthma in India. [3]. Asthma accounted for 27.9% of disability-adjusted life years (DALYs) in the Indian population. [4] Asthma is a persistent inflammation of the lower respiratory tract causing hypoxia. According to GINA, it is a diverse condition primarily marked by chronic airway inflammation. The diagnosis is based on a history of respiratory symptoms including wheezing, breathlessness, chest tightness, and cough, which fluctuate in severity and frequency, along with intermittent airflow limitation during exhalation.[5].

Respiratory symptoms can arise from obesity even if there's no underlying lung disease. [6] Breathlessness can be experienced due to obesity and being overweight, regardless of one's level of physical fitness, even after accounting for Forced Vital Capacity (FVC).[7]

Obesity also affects other measures of lung function, including gas transport and static lung volumes. [8]

Asthma, a chronic inflammatory condition affecting the airways, is defined by reversible airway obstruction. [9] Rather than a singular ailment, asthma is better understood as a diverse clinical syndrome, showcasing multiple endotypes with shared symptoms but distinct underlying mechanisms and causes. This diversity is evidenced by variations in pathological, clinical, and physiological characteristics among individuals. [10]

Schatz et al. found that increased BMI was an independent predictor of inadequate asthma control. [11]

Several other studies have corroborated these findings, demonstrating that lung function assessed via spirometry was inferior in participants with asthma and obesity compared to those with asthma and normal weight. [12'13]

All cases of mild intermittent and persistent asthma are initially treated with short-acting beta-2 agonists. If symptoms persist despite this treatment, inhalational corticosteroids are initiated, with LABA added subsequently if necessary. A stepwise approach is recommended for the management of f chronic asthma. Given this context, there's a need for a study focusing on demographic factors and their influence on asthma prevalence, healthcare utilization, and mortality rates. This study should explore the impact of variables such as gender, age, race, and geographic location on asthma outcomes.

Aim & Objective

The aim and objective the study is to investigate and establish a correlation between body mass index (BMI) and respiratory symptoms among college students and to assess the morbidity of bronchial asthma patients with increasing weight.

MATERIALS AND METHOD

The prospective study was carried out at the Department of Respiratory Medicine, Dr. KNSMIMS, Barabanki, spanning a duration of 18 months from July 2022 to December 2023. Approval for the trial was obtained from the medical college's ethics committee, and written informed consent was obtained from all participants. The study population was recruited from the premises of Dr. KNS Memorial Institute of Medical Sciences, Barabanki, UP, following the application of specific inclusion criteria like Asthma diagnosis for a duration of more than 6 months, History of allergies (e.g., dust, food, Mold, pets, skin diseases, allergic rhinitis, etc.), Relevant family history of bronchial asthma (parental factors). All patients in the two categories were analyzed using the Chi-square test and t-test for significance. Spirometry method is used for studying various aspects of pulmonary functions. It measures airflow from fully inflated lungs over time in litres. Parameters such as Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), and Peak Expiratory

Flow Rate (PEFR) are calculated by spirometry. spirometry may be performed in a sitting or standing position. The sitting position is considered safe, but in obese subjects, the standing position may be preferred. Patients are instructed and demonstrated the spirometry procedure; Spirometry is recorded fifteen to thirty minutes after administration of short- acting beta-2 agonists. Calculation of percentage improvement is done based on the recorded spirometric values. Good bronchodilator reversibility is indicated by improvement in FEV1 by 200 ml and >12% of previous values Data were inputted into Microsoft Excel and then analyzed through SPSS Version 21.0. The information was presented through tables and charts. Qualitative data underwent Chi-square tests, while quantitative data underwent t-tests and ANOVA tests to ascertain significance, with a threshold of P value < 0.05 deemed as significant.

RESULTS

1. Gender & BMI Distribution

CLASS OF BMI		GENDER		Total
		MALE	FEMALE	
I	Count	62	60	61
	% within Class of BMI	50.8%	49.2%	100.0%
	% within Gender	73.8%	51.7%	61.0%
II	Count	8	12	10
	% within Class of BMI	40.0%	60.0%	100.0%
	% within Gender	9.5%	10.3%	10.0%
III	Count	14	44	29
	% within Class of BMI	24.1%	75.9%	100.0%
	% within Gender	16.7%	37.9%	29.0%
	Total	84	116	100

In our study, Female is the overall highest group (n=60). In class I gender ratio is 1:1. Gender ratio in class II is 1:1.5. Gender ratio in class III is 1:2. Male group is highest in class I (n=62)

2. Age & BMI Distribution

BMI CLASS		AGE IN YEARS				TOTAL
		20-25	26-30	31-35	36-40	
I	Count	64	14	22	22	61
	% within Class of BMI	52.5%	11.5%	18.0%	18.0%	100.0%
	% within Age in years	88.9%	88.9%	88.9%	88.9%	61.0%
II	Count	4	4	2	10	10
	% within Class of BMI	20.0%	20.0%	10.0%	50.0%	100.0%
	% within Age in years	5.6%	13.3%	6.3%	15.2%	10.0%
III	Count	4	12	8	34	29
	% within Class of BMI	6.9%	20.7%	13.8%	58.6%	100.0%
	% within Age in years	5.6%	5.6%	5.6%	5.6%	29.0%
	Total	72	30	32	66	100

In three group of BMI, highest is class I. Among the class I, highest age group is between 20-25 years (n=64). Among the study, least number of patients involved in class II and age group between 31-35 years (n=2)

3. Correlation Between Age & Severity Of Asthma

Age in years		Severity Class of Asthma				Total	P value
		I	II	III	IV		
20-25	Count	16	30	20	6	36	0.612
	% within Age in years	22.2%	41.7%	27.8%	8.3%	100.0%	
	% within Severity Class of Asthma	47.1%	38.5%	41.7%	15.0%	36.0%	Not signi-ficant
26-30	Count	4	14	4	8	30	
	% within Age in years	13.3%	46.7%	13.3%	26.7%	100.0%	
	% within Severity Class of Asthma	11.8%	17.9%	8.3%	20.0%	15.0%	
31-35	Count	6	12	8	6	16	
	% within Age in years	18.8%	37.5%	25.0%	18.8%	100.0%	
	% within Severity Class of Asthma	17.6%	15.4%	16.7%	15.0%	16.0%	
36-40	Count	8	22	16	20	66	
	% within Age in years	12.1%	33.3%	24.2%	30.3%	100.0%	
	% within Severity Class of Asthma	23.5%	28.2%	33.3%	50.0%	33.0%	
	Total	34	78	48	40	200	

In this study, the higher number of patients are in the age group between 20-25 years (n=15). Chi square test was applied to evaluate the significance between age group and severity of bronchial asthma. There was no significant difference (p=0.65) was found between the two variables.

4. Distribution Of Severity Of Bronchial Asthma

CLASS	NUMBER	PERCENTAGE%
I-Mild intermittent	34	17
II- Mild persistent	78	39
III- Moderate persistent	48	24
IV- Severe persistent	40	20
Total	200	100

Out of 200 patients, who were divided into four class of severity of asthma, a greater number of patients came under class II (n=78). Least number of patients came under class I (n=34)

5. Correlation Between Gender & Severity Of Asthma

GENDER		SEVERITY CLASS OF ASTHMA				Total	P Value
		I	II	III	IV		
Male	Count	28	40	6	10	42	
	% within						
	Gender	33.3%	47.6%	7.1%	11.9%	100.0%	
	% within						
	Severity Class of Asthma	82.4%	51.3%	12.5%	25.0%	42.0%	<0.001 SIGNI-FICANT
Female	Count	6	38	42	30	58	
	% within						
	Gender	5.2%	32.8%%	36.2%	25.9%	100.0%	
	% within						
	Severity						
	Class of Asthma	17.6%	48.7%	87.5% %	75.0%	58.0%	
	TOTAL	34	78	48	40	100	

Out of 200 patients studied, majority of male patients came under the asthma severity class II & I and majority of female patients came under asthma severity class III & II. Among the asthma severity class III & IV, majority of them was females. It showed significant (p=<0.001) correlation between gender and severity of asthma.

Correlation Between BMI & Severity Of Asthma

CLASS OF BMI		SEVERITY CLASS OF ASTHMA				TOTAL	P Value
		I	II	III	IV		
I	Count	26	64	28	4	122	
	% within						
	Class of	21.3%	52.5%	23.0%	3.3%	100.0%	
	BMI						
	% within						
	Severity	76.5%	82.1%	58.3%	10.0%	61.0%	
	Class of						
	Asthma						
II	Count	4	8	6	2	20	
	% within Class of	20.0%	40.0%	30.0%	10.0%	100.0%	<0.001
	BMI						SIGNI-FICANT
	% within						
	Severity	11.8%	10.3%	12.5%	5.0%	10.0%	
	Class of						
	Asthma						
III	Count	4	6	14	34	58	
	% within						

	Class of BMI	6.9%	10.3%	24.1%	58.6%	100.0%
	% within Severity	11.8%	7.7%	29.2%	85.0%	29.0%
	Class of Asthma					
	Total	34	78	48	40	200

In our study, the majority of patients with BMI class III came under class IV of asthma severity. Chi square applied showed significance (p=<0.001). It implies that obese patients are at increased risk of developing bronchial asthma.

6. Correlation Between FEV1/FVC Ratio & Severity Of Asthma

FEV1/FVC		SEVERITY CLASS OF ASTHMA				Total
		I	II	III	IV	
< 0.5	Count	0	0	2	24	26
	%within FEV1/FVC	0%	0%	7.7%	92.3%	100.0%
	%within Severity Class of Asthma	0%	0%	4.2%	60.0%	13.0%
0.5-0.7	count	2	20	26	16	84
	%within FEV1/FVC	2.4%	23.8%	54.8%	19.0%	100.0%
	%within Severity Class of Asthma	5.9%	25.6%	95.8%	40.0%	42.0%
>.07	Count	32	58	0	0	90
	%within FEV1/FVC	35.6%	64.4%	0%	0%	100.0%
	%within Severity Class of Asthma	94.1%	74.4%	0%	0%	45.0%
	Total	34	78	48	40	200

7. Correlation Between C-reactive Protein & BMI

CLASS OF BMI		C-REACTIVE PROTEIN (mg/L)		TOTAL
		Increased	Normal	
I	Count	6	116	122
	% within Class of BMI	4.9%	95.1%	100.0%
	% within C Reactive Protein (mg/L)	8.3%	90.6%	61.0%
II	Count	14	6	20
	% within Class of BMI	70.0%	30.0%	100.0%
	% within C Reactive Protein (mg/L)	19.4%	4.7%	10.0%
III	Count	48	6	58
	% within Class of BMI	89.7%	10.3%	100.0%
	% within C Reactive Protein (mg/L)	72.2%	4.7%	29.0%
	Total	72	128	200

In this study, out of 200 patients 36 patients had elevated C- reactive protein. Among this majority came under BMI Class III (72%). Chi square test showed significant (p=<0.001) correlation between the two variables. It implies that with increasing BMI, there is increase in C-reactive protein also.

8. Morbidity And Severity Of Bronchial Asthma

S. No.	MORBIDITY	SEVERITY OF ASTHMA				BMI		
		I	II	III	IV	I	II	III
1	Previous life-threatening event	0	0	4	8	2	2	8
2	Missed working days	0	2	12	22	6	6	48

In our study, patients with previous life-threatening event and missed working days came under asthma severity class IV and BMI class III.

DISCUSSION

About 65% of adults worldwide aged 20 and above are overweight or obese, marking a 10% increase in obesity prevalence compared to previous decades. Recent data from the National Health and Nutrition Examination Survey III suggests adult obesity prevalence ranges from 18% to 23%, while the Behavioural Risk Factor Surveillance System estimates it at 20%. The rise in asthma prevalence parallels that of obesity, leading to numerous studies reporting an association between obesity and higher asthma rates. Research indicates obesity as a risk factor for asthma, supported by various meta- analyses. Obesity also correlates with bronchial hyperresponsiveness, and studies suggest weight loss can improve asthma outcomes.

Studies by Akerman et al., Saint-Pierre et al., and Lavoie et al. show the increased risk and poor control of asthma in obese adults. Camargo et al. found a strong correlation between BMI measured in 1991 and the risk of adult-onset asthma in subsequent years. In a study involving 200 asthmatic patients aged 20-40 confirmed via spirometry, obese patients (BMI class III) were significantly associated with severe persistent and moderate persistent asthma. Class IV asthma severity patients with BMI class III exhibited more morbidity, including decreased working days and life-threatening events.

Chen et al. observed a stronger association between obesity and non-allergic asthma, particularly in women. Our study also found a significant relationship between female gender and class IV asthma severity, with a majority of female patients falling under BMI class III. Delgado et al. identified obesity as a pro-inflammatory condition, with elevated levels of C-reactive protein and other inflammatory markers. Similarly, our study revealed a significant increase in C-reactive protein levels among obese individuals.

Obese individuals with asthma, in contrast to those with normal weight, exhibited higher rates of missed working days, life-threatening events, lower SpO2 levels, reduced FEV1/FVC ratio, and elevated C-reactive protein levels. They were also more prone to severe persistent asthma compared to non- obese counterparts. Our study underscores the significant correlation between obesity and asthma severity, emphasizing the considerable impact on quality of life. Hence, the management plan for obese asthmatics should incorporate weight reduction strategies alongside other interventions.

CONCLUSION

This research a review of large number of studies on the relationship between obesity and asthma with various research designs. Although the inclusion of investigations with variant research methods may compromise the validity of the evidence; by conducting this review we provide a comprehensive integration of contemporary studies focusing on the relationship between obesity and asthma in student's populations. Data from this review provide ongoing evidence that there is a positive relationship between high BMI and asthma in children. The nature of the association appears to be complex; however, with studies identifying linear, U-shape and dose-dependent relationships between BMI and asthma. Meta-analyses in adult student populations, most longitudinal studies reviewed agreed that students who were overweight or obese in early life have an increased risk of newly diagnosed asthma in the future. Respiratory symptoms in obese individuals should be objectively investigated in order to confirm or rule out asthma as a cause. If the presence of asthma is confirmed, personalized asthma treatment can provide better symptom control. Despite the role of genetic factors in these diseases, obesity prevention and treatment can minimize complications. Government policies and public health policies should work in concert to encourage lifestyle changes and healthy behaviors.

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