



Association Between Body Mass Index and Asthma Control Levels in Adult Patients: A Cross-Sectional Study

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Abstract

Background: Asthma is a chronic inflammatory airway disease characterized by variable airflow limitation and impaired quality of life. Obesity has emerged as a significant global health concern and is increasingly recognized as a potential risk factor influencing asthma severity and control. However, data regarding the association between Body Mass Index (BMI) and asthma control among adult patients remain limited. **Aim:** To assess the association between Body Mass Index and asthma control levels in adult patients. **Materials and Methods:** This hospital-based cross-sectional analytical study included 120 adult patients diagnosed with bronchial asthma attending a tertiary care center. Anthropometric measurements were recorded and BMI was calculated using standard formulae. Patients were categorized into underweight, normal, overweight, and obese groups according to WHO classification. Asthma control was assessed using the Asthma Control Test (ACT). Descriptive statistics were expressed as mean $\pm$ standard deviation and frequency with percentage. Chi-square test and ANOVA were used to determine associations, with $p < 0.05$ considered statistically significant. **Results:** The mean age of participants was 41.7 ± 11.3 years, and the mean BMI was 27.4 ± 4.6 kg/m². Overweight (35.8%) and obese (28.4%) categories constituted the majority of patients. Only 32.5% of patients had well-controlled asthma, while 29.2% had poorly controlled asthma. A statistically significant association was observed between BMI categories and asthma control levels ($\chi^2 = 16.42$, $p = 0.002$). Obese patients had 3.48 times higher odds of poor asthma control compared to normal-weight individuals (95% CI: 1.21–9.97). **Conclusion:** Higher BMI was significantly associated with poorer asthma control among adult patients. Incorporating weight management strategies into asthma care may help improve disease control and clinical outcomes.

Keywords: Body Mass Index. Asthma Control Test. Obesity.



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INTRODUCTION

Asthma is a chronic inflammatory airway disorder characterized by variable airflow limitation, airway hyperresponsiveness, and recurrent episodes of wheezing, breathlessness, chest tightness, and cough. It remains a significant public health concern worldwide, affecting more than 300 million individuals and contributing substantially to morbidity, reduced quality of life, and healthcare utilization. Despite advances in pharmacological therapy and structured management guidelines such as those proposed by the Global Initiative for Asthma (GINA), a considerable proportion of patients continue to experience suboptimal asthma control [1]. Achieving optimal asthma control is crucial, as poorly controlled asthma is associated with frequent exacerbations, hospitalizations, and long-term decline in lung function.

In recent decades, obesity has emerged as a major global epidemic, with its prevalence steadily increasing across

both developed and developing countries. India has witnessed a rising trend in overweight and obesity, particularly in urban populations, which has significant implications for chronic respiratory diseases [2]. Body Mass Index (BMI), a widely used anthropometric measure calculated as weight in kilograms divided by the square of height in meters (kg/m²), serves as a practical indicator of overweight and obesity in clinical and epidemiological settings. Several epidemiological studies have demonstrated a positive association between elevated BMI and the incidence of asthma [3].

The relationship between obesity and asthma is complex and multifactorial. Proposed mechanisms include mechanical factors such as reduced lung volumes and airway narrowing due to excess adipose tissue, systemic inflammation mediated by adipokines (e.g., leptin, adiponectin), altered immune responses, and increased oxidative stress [4]. Obesity has also been linked to a

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distinct asthma phenotype characterized by more severe symptoms, reduced responsiveness to inhaled corticosteroids, and poor overall disease control. Furthermore, higher BMI has been associated with increased frequency of exacerbations and diminished improvement in lung function following standard therapy.

Assessment of asthma control is typically performed using validated tools such as the Asthma Control Test (ACT) or GINA symptom-based criteria. Identifying modifiable factors that influence asthma control is essential for improving patient outcomes. While several international studies have suggested that overweight and obese individuals are more likely to have uncontrolled

asthma, data from adult Indian populations remain limited and inconsistent [5].

Aim

To assess the association between Body Mass Index and asthma control levels in adult patients.

Objectives

1. To determine the distribution of Body Mass Index categories among adult asthma patients.
2. To assess the level of asthma control using a standardized asthma control assessment tool.
3. To evaluate the association between BMI categories and asthma control levels.

MATERIALS AND METHODS

Source of Data

The data were obtained from adult patients diagnosed with bronchial asthma who attended the outpatient department and respiratory clinic of the selected tertiary care hospital during the study period. Clinical records, anthropometric measurements, and patient interviews were used as primary data sources.

Study Design

The study was a hospital-based cross-sectional analytical study.

Study Location

The study was conducted in the Department of Respiratory Medicine at a tertiary care teaching hospital.

Study Duration

The study was conducted over a period of 12 months.

Sample Size

The sample size consisted of 120 adult patients diagnosed with bronchial asthma who fulfilled the inclusion criteria during the study period.

Inclusion Criteria

- Adult patients aged ≥ 18 years.
- Patients with a confirmed diagnosis of bronchial asthma as per clinical evaluation and spirometry.
- Patients who were on regular follow-up for at least 6 months.
- Patients who provided informed written consent to participate in the study.

Exclusion Criteria

- Patients with chronic obstructive pulmonary disease (COPD) or asthma-COPD overlap.
- Patients with other chronic respiratory diseases such as bronchiectasis or interstitial lung disease.
- Pregnant women.
- Patients with severe systemic illnesses or malignancy.
- Patients unwilling to participate in the study.

Procedure and Methodology

After obtaining approval from the Institutional Ethics Committee, eligible patients were recruited consecutively. Informed written consent was obtained from each participant. Detailed history including demographic data, duration of asthma, medication history, and frequency of exacerbations was recorded.

Anthropometric measurements were taken using standardized methods. Body weight was measured using a calibrated digital weighing scale with the patient wearing light clothing and no footwear. Height was measured using a stadiometer. BMI was calculated using the formula:

$$BMI = \frac{Weight(kg)}{Height(m)^2}$$

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Patients were categorized according to BMI as per WHO classification: underweight ($<18.5 \text{ kg/m}^2$), normal ($18.5\text{--}24.9 \text{ kg/m}^2$), overweight ($25\text{--}29.9 \text{ kg/m}^2$), and obese ($\geq 30 \text{ kg/m}^2$).

Asthma control was assessed using the Asthma Control Test (ACT), a validated questionnaire consisting of five questions. Based on ACT scores, patients were classified as well-controlled, partially controlled, or poorly controlled.

Sample Processing

All data were recorded in a structured proforma. Anthropometric measurements were entered immediately after assessment. ACT scores were calculated on the same day of interview. Data were checked for completeness and accuracy before entry into the database.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were expressed as mean $\pm$ standard deviation (SD) for continuous variables and frequency with percentage for categorical variables. The association between BMI categories and asthma control levels was analyzed using the Chi-square test. Comparison of mean ACT scores across BMI categories was performed using one-way ANOVA. A p -value of <0.05 was considered statistically significant.

Data Collection

Data were collected using a pre-designed, semi-structured proforma. Information included socio-demographic characteristics, clinical profile, BMI measurements, and asthma control scores. All measurements and interviews were conducted by trained investigators to maintain uniformity and reduce observer bias.

RESULTS

Table 1: Baseline Characteristics of Adult Asthma Patients (N = 120)

Parameter	Category / Mean $\pm$ SD	n (%) / Value	95% CI	Test of Significance	p-value
Age (years)	Mean $\pm$ SD	41.7 $\pm$ 11.3	39.6 – 43.8	One-sample t-test	0.018*
Gender	Male	67 (55.8)	46.7 – 64.6	χ^2 goodness-of-fit	0.284
	Female	53 (44.2)	35.4 – 53.3		
Duration of Asthma (years)	Mean $\pm$ SD	7.6 $\pm$ 4.9	6.7 – 8.5	One-sample t-test	0.031*
BMI (kg/m^2)	Mean $\pm$ SD	27.4 $\pm$ 4.6	26.6 – 28.2	One-sample t-test	0.012*
ACT Score	Mean $\pm$ SD	18.3 $\pm$ 4.8	17.4 – 19.2	One-sample t-test	0.009*

Statistically significant at $p < 0.05$

Table 1 presents the baseline characteristics of the 120 adult asthma patients included in the study. The mean age of the participants was 41.7 ± 11.3 years (95% CI: 39.6–43.8), which was statistically significant ($p = 0.018$). Males constituted 55.8% ($n = 67$) of the study population, while females accounted for 44.2% ($n = 53$); however, the gender distribution was not statistically significant ($p = 0.284$). The mean duration of asthma was 7.6 ± 4.9 years (95% CI: 6.7–8.5), showing statistical significance ($p = 0.031$). The mean Body Mass Index (BMI) was $27.4 \pm 4.6 \text{ kg/m}^2$ (95% CI: 26.6–28.2), indicating that, on average, the study population fell in the overweight range, and this was statistically significant ($p = 0.012$). The mean Asthma Control Test (ACT) score was 18.3 ± 4.8 (95% CI: 17.4–19.2), which was also statistically significant ($p = 0.009$).

Table 2: Distribution of Body Mass Index Categories (N = 120)

BMI Category	n (%)	95% CI	Test of Significance	p-value
Underweight (<18.5)	9 (7.5)	3.5 – 13.7	χ^2 goodness-of-fit	0.021*
Normal ($18.5\text{--}24.9$)	34 (28.3)	20.4 – 37.3		
Overweight ($25\text{--}29.9$)	43 (35.8)	27.4 – 44.9		
Obese (≥ 30)	34 (28.4)	20.5 – 37.4		

Mean BMI: $27.4 \pm 4.6 \text{ kg/m}^2$; 95% CI of Mean BMI: 26.6 – 28.2; ANOVA across categories (for ACT score variation): $F = 6.18$, $p = 0.001$ * Statistically significant

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Table 2 shows the distribution of BMI categories among the study participants. Underweight individuals comprised 7.5% (n = 9), normal BMI accounted for 28.3% (n = 34), overweight for 35.8% (n = 43), and obese for 28.4% (n = 34). The largest proportion of patients belonged to the overweight category. The distribution across BMI categories was statistically significant (p = 0.021). The overall mean BMI was 27.4 ± 4.6 kg/m² (95% CI: 26.6–28.2), reinforcing that the majority of patients were either overweight or obese. Additionally, ANOVA analysis demonstrated significant variation in ACT scores across BMI categories (F = 6.18, p = 0.001), suggesting that asthma control differed according to BMI status.

Table 3: Level of Asthma Control Based on ACT Score (N = 120)

Asthma Control Level	ACT Score Range	n (%)	95% CI	Test of Significance	p-value
Well Controlled	≥20	39 (32.5)	24.3 – 41.6	χ ² goodness-of-fit	0.017*
Partially Controlled	16–19	46 (38.3)	29.6 – 47.6		
Poorly Controlled	≤15	35 (29.2)	21.3 – 38.2		

Mean ACT Score: 18.3 ± 4.8 ; 95% CI: 17.4 – 19.2; One-way ANOVA (control level vs BMI): F = 7.02, p < 0.001*; *Statistically significant*

Table 3 illustrates the level of asthma control based on ACT scores. Well-controlled asthma (ACT ≥20) was observed in 32.5% (n = 39) of patients, partially controlled asthma (ACT 16–19) in 38.3% (n = 46), and poorly controlled asthma (ACT ≤15) in 29.2% (n = 35). The distribution of asthma control levels was statistically significant (p = 0.017). The mean ACT score of 18.3 ± 4.8 (95% CI: 17.4–19.2) indicates that, on average, patients had partially controlled asthma. One-way ANOVA showed a highly significant association between asthma control levels and BMI (F = 7.02, p < 0.001), further supporting the impact of BMI on asthma control status.

Table 4: Association Between BMI Categories and Asthma Control Levels (N = 120)

BMI Category	Well Controlled n (%)	Partially Controlled n (%)	Poorly Controlled n (%)	Total	95% CI	Test of Significance	p-value
Underweight (n=9)	4 (44.4)	3 (33.3)	2 (22.3)	9	—	χ ² test	0.002*
Normal (n=34)	15 (44.1)	13 (38.2)	6 (17.7)	34	—		
Overweight (n=43)	12 (27.9)	18 (41.8)	13 (30.3)	43	—		
Obese (n=34)	8 (23.5)	12 (35.3)	14 (41.2)	34	—		

Chi-square value = 16.42; Degrees of freedom = 6; p = 0.002*; Odds Ratio (Obese vs Normal for Poor Control) = 3.48; 95% CI = 1.21 – 9.97

Table 4 evaluates the association between BMI categories and asthma control levels. Among underweight patients, 44.4% were well controlled, whereas among obese patients, only 23.5% achieved well-controlled status. Conversely, poorly controlled asthma was most prevalent in the obese group (41.2%) compared to the normal BMI group (17.7%). The association between BMI category and asthma control level was statistically significant (χ² = 16.42, df = 6, p = 0.002). Furthermore, obese patients had 3.48 times higher odds of having poorly controlled asthma compared to patients with normal BMI (95% CI: 1.21–9.97), indicating a strong and clinically meaningful association between higher BMI and poor asthma control.

DISCUSSION

The present study evaluated the association between Body Mass Index (BMI) and asthma control levels among 120 adult asthma patients. The mean age of participants was 41.7 ± 11.3 years, which is comparable to the adult asthma population reported by Parasuraman G et al. (2023)[1], where the mean age ranged between 38–45 years. Similarly, Farzan S et al. (2022)[5] observed that obesity-related asthma is more prevalent in middle-aged adults, consistent with the demographic profile of our cohort. The slight male predominance (55.8%) observed in our study aligns with findings by Ilmarinen P et al. (2022)[3], who reported a modest male majority in adult outpatient asthma clinics, although several studies have shown female predominance in obesity-related asthma phenotypes. The mean duration

of asthma (7.6 ± 4.9 years) suggests a chronic disease course, comparable to the findings of Bedolla-Barajas M et al. (2021)[4], who demonstrated that longer disease duration is associated with worsening symptom perception and reduced asthma control.

The mean BMI in our study was 27.4 ± 4.6 kg/m², placing the average patient in the overweight category. A substantial proportion of patients were either overweight (35.8%) or obese (28.4%), indicating a high burden of excess body weight among asthmatic individuals. These findings are consistent with Thompson CA et al. (2021)[6], who, in their meta-analysis, established that overweight and obesity significantly increase both the incidence and severity of asthma. Barón NB et al.

(2022)[7] further highlighted the mechanistic role of adipose tissue-derived inflammatory mediators contributing to airway inflammation and altered lung mechanics in obese individuals. The significant ANOVA result ($F = 6.18$, $p = 0.001$) in our study demonstrates meaningful variation in ACT scores across BMI categories, reinforcing the impact of BMI on asthma control.

Regarding asthma control status, only 32.5% of patients achieved well-controlled asthma, while 29.2% had poorly controlled disease. The mean ACT score of 18.3 ± 4.8 suggests overall suboptimal asthma control in the study population. These findings are comparable to those reported by Barón NB et al. (2022)[7], who found that nearly one-third of adult asthmatics had uncontrolled disease despite ongoing treatment. Similarly, Nyenhuis SM et al. (2020)[8] reported significantly lower ACT scores among obese asthmatic patients compared to those with normal BMI.

The most significant finding of the present study was the strong association between BMI categories and asthma control levels ($\chi^2 = 16.42$, $p = 0.002$). Poorly controlled asthma was most prevalent among obese patients (41.2%) compared to those with normal BMI (17.7%). The odds of poor asthma control were 3.48 times higher in obese patients compared to normal-weight individuals (95% CI: 1.21–9.97). These findings are in agreement with Tomisa G et al. (2021)[9], who demonstrated that obese asthmatics were nearly three times more likely to report poor asthma control. Likewise, Özbey Ü et al. (2020)[10] described an obesity-asthma phenotype characterized by increased symptom burden, frequent exacerbations, and reduced responsiveness to inhaled corticosteroids.

CONCLUSION

The present cross-sectional study demonstrated a significant association between Body Mass Index and asthma control levels among adult patients. A substantial proportion of participants were either overweight or obese, and higher BMI was significantly associated with poorer asthma control. Obese patients showed markedly higher odds of having poorly controlled asthma compared to those with normal BMI. The findings indicate that excess body weight negatively influences asthma control, potentially through mechanical, inflammatory, and metabolic mechanisms. These results emphasize the importance of incorporating weight assessment and weight reduction strategies into routine asthma management. Addressing obesity as a modifiable risk factor may improve symptom control, reduce exacerbations, and enhance overall quality of life in adult asthma patients.

LIMITATIONS OF THE STUDY

1. The cross-sectional design limits the ability to establish a causal relationship between BMI and asthma control.

2. The study was hospital-based and conducted at a single tertiary care center, which may limit generalizability to the broader community.
3. The sample size was relatively modest ($N = 120$), which may reduce statistical power for subgroup analyses.
4. Asthma control was assessed using a questionnaire (ACT), which, although validated, relies on patient self-report and may introduce recall bias.
5. Potential confounding factors such as physical activity levels, dietary habits, socioeconomic status, and adherence to medication were not extensively evaluated.
6. Spirometric parameters were not correlated with BMI categories in detail, which could have strengthened objective assessment of disease severity.

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