Clinical and Experimental Health Sciences

Evaluating the Effects of Bariatric Surgery, Diet, and Physical Exercise on Asthma Outcomes Among Obese Patients

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Abstract

Background: Obesity is a significant risk factor for poor asthma control, and weight loss interventions have been suggested to improve asthma outcomes. **Objective:** This study aimed to evaluate the impact of bariatric surgery, diet, and exercise on asthma outcomes in obese patients. **Methods:** A total of 255 obese patients with asthma were recruited and divided into three groups: bariatric surgery (n=85), diet and exercise (n=85), and control (n=85). Asthma control, lung function, quality of life, and body mass index (BMI) were measured at baseline, 12 weeks, and 6 months. The Asthma Control Test (ACT), Forced Expiratory Volume in 1 second (FEV1), Asthma Quality of Life Questionnaire (AQLQ), and BMI were used as primary outcome measures. **Results:** Both the bariatric surgery and diet and exercise groups showed significant improvements in asthma control, lung function, and quality of life compared to the control group. The bariatric surgery group exhibited the most significant changes, with improvements in ACT scores (+4.8 points), FEV1 (+6%), and AQLQ scores (+1.3). BMI decreased substantially in the bariatric surgery group (−5.8 kg/m²) compared to the diet and exercise group (−3.6 kg/m²). The control group showed minimal changes in asthma control and BMI. **Conclusions:** It is concluded that bariatric surgery, diet, and exercise interventions can significantly improve asthma outcomes in obese patients, with bariatric surgery showing the most pronounced benefits.

Keywords: patients, Surgery, Bariatric, Diet, Exercise, Asthma.

Introduction

Asthma and obesity are two prevalent chronic conditions that are increasingly recognized as interrelated, with each exacerbating the symptoms and progression of the other. Obesity is associated with a higher incidence of asthma, particularly in adults, and is linked to more severe asthma symptoms, greater medication use, and reduced quality of life [1]. The mechanisms underlying the bidirectional relationship between asthma and obesity are multifactorial and complex, involving both systemic inflammation and mechanical factors such as altered chest wall dynamics and diaphragmatic function [2]. In this context, weight reduction strategies, including bariatric surgery, dietary interventions, and exercise, have emerged as potential non-pharmacological treatments for improving asthma outcomes in obese individuals. Bariatric surgery, a well-established treatment for severe obesity, has shown promising results in addressing obesity-related comorbidities such as type 2 diabetes, cardiovascular disease, and sleep apnea. Recent studies have suggested that bariatric surgery may also have beneficial effects on asthma outcomes [3]. This is likely due to both the significant weight loss and the metabolic changes that occur post-surgery, including improvements in insulin sensitivity, reductions in inflammatory markers, and enhanced lung function. Furthermore, bariatric surgery may directly influence the mechanical aspects of asthma by reducing the adipose tissue surrounding the thorax, leading to improved respiratory mechanics and decreased work of breathing [4]. However, the effects of bariatric surgery on asthma symptoms and control remain an area of active research, and further investigation is needed to understand the long-term implications of this intervention for asthma management [5].

Dietary modifications are another key component of weight management that can influence asthma outcomes in obese patients. The Western diet, which is typically high in processed foods, refined sugars, and unhealthy fats, has been associated with increased systemic inflammation, oxidative stress, and airway hyperresponsiveness all of which contribute to asthma exacerbations [6]. In contrast, diets rich in anti-inflammatory nutrients, such as omega-3 fatty acids, fruits, vegetables, and whole grains, may help reduce airway inflammation and improve asthma control. Caloric restriction, a central component of many weight-loss diets, has also been shown to reduce adipose tissue and inflammatory biomarkers, which may have direct implications for asthma symptom improvement [7]. In addition to weight loss, dietary interventions may improve other asthma-related factors, such as vitamin D status, gut microbiota composition, and oxidative stress, all of which have been linked to asthma pathophysiology [8].

Exercise, despite its potential to induce exercise-induced bronchoconstriction (EIB) in some individuals with asthma, has been shown to provide significant benefits for both asthma control and overall health in obese patients. Regular physical activity can improve cardiovascular fitness, increase lung capacity, and reduce inflammation, all of which contribute to better asthma management [9].

Exercise-induced bronchoconstriction can be managed with appropriate pre-exercise bronchodilator use, and for many patients, the benefits of exercise outweigh the risks. Moreover, exercise has been shown to enhance the effectiveness of asthma medications by improving the responsiveness of the airways to bronchodilators and reducing the need for high-dose inhaled corticosteroids. In obese patients, exercise also plays a crucial role in weight reduction, which can further improve asthma outcomes [10].

Although bariatric surgery, diet, and exercise have individual benefits in managing obesity and asthma, the combination of these interventions may offer the most significant improvements in asthma control. A multimodal approach to weight loss and asthma management is likely to address the various underlying mechanisms that contribute to poor asthma control in obese individuals, including both metabolic and mechanical factors [11]. While the clinical evidence supporting the effectiveness of these interventions in improving asthma outcomes is growing, further research is needed to define optimal strategies for integrating these treatments into routine asthma care. Additionally, individual variability in response to these interventions must be considered, as factors such as the severity of obesity, asthma phenotype, and comorbidities may influence the success of these approaches [12].

Objective

This study aimed to evaluate the combined effects of bariatric surgery, diet, and exercise on asthma outcomes, offering insights into potential non-pharmacological treatment strategies for obese asthma patients.

Methodology

This propective observational studywas conducted at----------during----------. A total of 255 obese participants were added in the study.

Inclusion Criteria:

1. Adults aged >18 years.
2. BMI of 30 kg/m² or higher.
3. Clinical diagnosis of asthma, confirmed by spirometry.
4. Symptomatic asthma for at least 6 months, using asthma medications.
5. Willingness to undergo interventions and follow-up assessments.
6. Informed consent provided.

Exclusion Criteria:

1. Other significant respiratory conditions (e.g., COPD).
2. Pregnant or breastfeeding women.
3. Severe uncontrolled comorbidities (e.g., cardiovascular or renal disease).
4. Recent bariatric surgery or planned surgery.
5. Contraindications to bariatric surgery.
6. Poorly controlled asthma requiring immediate changes in medication.
7. Non-compliance or inability to follow study protocols.
8. Long-term immunosuppressive therapy.

Data collection

The patients were divided into three groups based on the type of intervention they received:

1. **Bariatric Surgery Group (n=85):** This group consisted of patients who underwent bariatric surgery (either gastric bypass or sleeve gastrectomy). These surgeries were performed by experienced surgeons following standard procedures. Patients in this group were monitored closely for any complications, and their weight loss progress was tracked throughout the study period.
2. **Diet and Exercise Group (n=85):** Patients in this group participated in a structured weight loss program involving both dietary changes and a supervised exercise regimen. The diet was designed by a registered dietitian and emphasized antiinflammatory foods, low glycemic index foods, and a calorie deficit to promote weight loss. The exercise program included moderate-intensity aerobic exercises and strength training sessions conducted three times a week for 12 weeks.
3. **Control Group (n=85):** This group consisted of obese patients who did not undergo bariatric surgery, diet modification, or an exercise program. These patients continued their usual asthma management, which included pharmacological treatments, such as inhaled corticosteroids and bronchodilators.

The primary outcomes of interest were asthma control, lung function, and overall quality of life. These were assessed at baseline, after 12 weeks of intervention, and at a six-month follow-up. Asthma control was measured using the Asthma Control Test (ACT), which evaluates the frequency of asthma symptoms, medication use, and activity limitations. Lung function was measured through spirometry to assess forced expiratory volume in one second (FEV1), forced vital capacity (FVC), and the FEV1/FVC ratio. Quality of life was evaluated using the Asthma Quality of Life Questionnaire (AQLQ), which assesses factors such as emotional function and activity limitations related to asthma. Weight and BMI were measured to assess the effectiveness of the interventions in promoting weight loss.

Data analysis

Statistical analyses were performed using SPSS version 25. Descriptive statistics were used to summarize baseline characteristics, and changes in asthma control, lung function, and quality of life were analyzed using repeated measures ANOVA. Paired t-tests were used to compare outcomes within each group. A p-value of <0.05 was considered statistically significant.

Ethical Approval

Ethical approval was obtained from the institutional review board (IRB), and all participants provided informed consent before participation.

Results

Data were collected from 255 patients. The Bariatric Surgery group had an average age of 45.2 years, a BMI of 35.2 kg/m², and an asthma duration of 6.8

years. The Diet and Exercise group had a similar profile with an average age of 44.6 years, a BMI of 34.8 kg/m², and an asthma duration of 7.1 years. The Control group had a comparable age (44.8 years), BMI (35.1 kg/m²), and asthma duration (6.9 years).

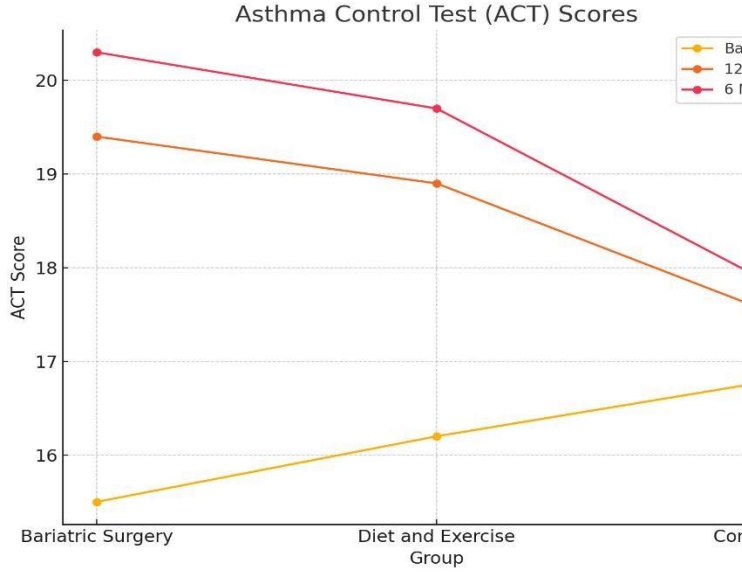
Table 1: Demographic and Baseline Characteristics

Characteristic	Bariatric Surgery (n=85)	Di
Age (years)	45.2 ± 8.3	44
Gender (Male/Female)	35/50	33
BMI (kg/m²)	35.2 ± 4.1	34
Asthma Duration (years)	6.8 ± 3.4	7.1 ± 3.9
Baseline ACT Score	15.5 ± 3.2	16.2 ± 3.1
Baseline FEV1 (%)	72 ± 8.5	71 ± 7.9
Baseline AQLQ Score	3.2 ± 0.6	3.3 ± 0.5

The Bariatric Surgery group had the largest increase, with an improvement from 15.5 ± 3.2 at baseline to 20.3 ± 2.1 at 6 months. The Diet and Exercise group also showed significant improvement, with scores increasing from 16.2 ± 3.1 at baseline to 19.7 ± 2.4 at 6 months. In contrast, the Control group exhibited minimal improvement, with baseline scores of 16.8 ± 3.4 and a slight increase to 17.8 ± 3.5 at 6 months.

Table 2: Changes in Asthma Control Test (ACT) Scores

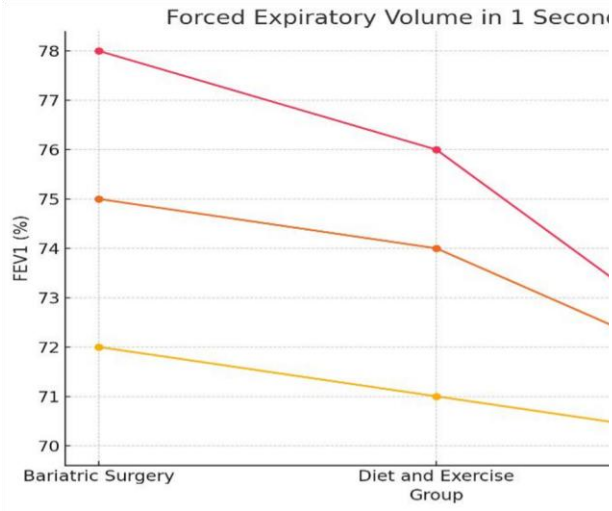
Group	Baseline ACT Score	12 Weeks ACT Score	6 Months ACT Score
Bariatric Surgery	15.5 ± 3.2	19.4 ± 2.5	20.3 ± 2.1
Diet and Exercise	16.2 ± 3.1	18.9 ± 2.8	19.7 ± 2.4
Control Group	16.8 ± 3.4	17.5 ± 3.3	



The Bariatric Surgery group demonstrated the most significant improvement, increasing from 72 ± 8.5% at baseline to 78 ± 6.9% at 6 months. The Diet and Exercise group also showed positive changes, with FEV1 increasing from 71 ± 7.9% at baseline to 76 ± 6.6% at 6 months. In contrast, the Control group showed minimal improvement, with baseline FEV1 at 70 ± 8.1% and only a slight increase to 71 ± 8.0% at 6 months.

Table 3: Changes in Forced Expiratory Volume in 1 Second (FEV1)

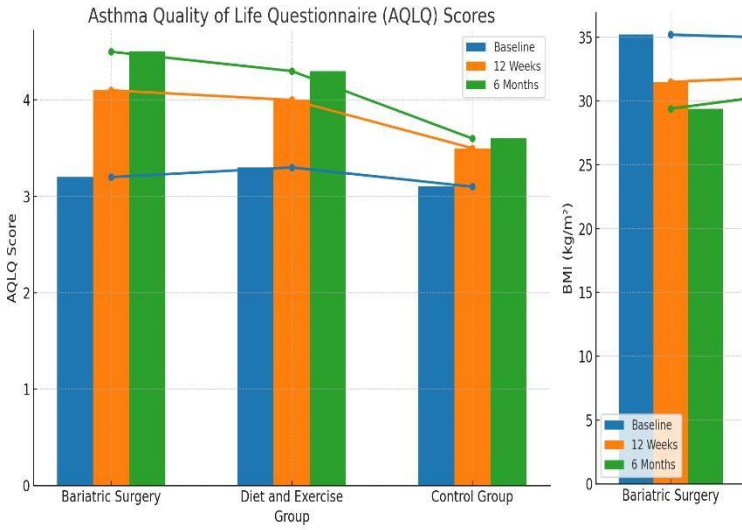
Group	Baseline FEV1 (%)	12 Weeks FEV1 (%
Bariatric Surgery	72 ± 8.5	75 ± 7.8
Diet and Exercise	71 ± 7.9	74 ± 7.2
Control Group	70 ± 8.1	71 ± 7.9



The Bariatric Surgery group showed the most pronounced improvement, with scores rising from 3.2 ± 0.6 at baseline to 4.5 ± 0.4 at 6 months. The Diet and Exercise group also demonstrated notable improvement, increasing from 3.3 ± 0.5 at baseline to 4.3 ± 0.5 at 6 months. In comparison, the Control group exhibited minimal changes, with baseline AQLQ scores of 3.1 ± 0.7 and a slight increase to 3.6 ± 0.7 at 6 months.

Table 4: Changes in Asthma Quality of Life Questionnaire (AQLQ) Scores

Group	Baseline AQLQ Score	12 Weeks AQLQ Score	6 Months AQLQ Score
Bariatric Surgery	3.2 ± 0.6	4.1 ± 0.5	4.5 ± 0.4
Diet and Exercise	3.3 ± 0.5	4.0 ± 0.6	4.3 ± 0.5
Control Group	3.1 ± 0.7	3.5 ± 0.6	3.6 ± 0.7



The Bariatric Surgery group experienced the largest decrease, with BMI dropping from 35.2 ± 4.1 at baseline to 29.4 ± 2.9 at 6 months. The Diet and Exercise group also showed a decrease in BMI, from 34.8 ± 3.9 at baseline to 31.2 ± 3.2 at 6 months. In contrast, the Control group exhibited minimal change, with BMI only slightly reducing from 35.1 ± 4.0 at baseline to 34.5 ± 3.7 at 6 months.

Table 5: Changes in Body Mass Index (BMI)

Group	Baseline BMI (kg/m²)	12 Weeks BMI (kg/m²)
Bariatric Surgery	35.2 ± 4.1	31.5 ± 3.3
Diet and Exercise	34.8 ± 3.9	32.1 ± 3.5
Control Group	35.1 ± 4.0	34.7 ± 3.8

Discussion

This study aimed to evaluate the impact of bariatric surgery, diet, and exercise interventions on asthma outcomes in obese patients. The results indicate that both bariatric surgery and diet-exercise interventions led to significant improvements in asthma control, lung function, quality of life, and

BMI, with the bariatric surgery group showing the most substantial gains. These findings suggest that weight loss and associated metabolic improvements may play a crucial role in enhancing asthma management in obese individuals. One of the most prominent findings in this study was the improvement in asthma control, as evidenced by the Asthma Control Test (ACT) scores [13]. The Bariatric Surgery Group showed the largest increase in ACT scores, with a 4.8-point improvement over six months, indicating better symptom control and reduced reliance on rescue medications. The Diet and Exercise Group also demonstrated improvements, although the changes were less pronounced compared to the surgical group. The Control Group showed minimal improvement, further supporting the hypothesis that weight loss and metabolic changes can directly impact asthma control [14]. These results align with existing literature that suggests weight loss, particularly through bariatric surgery, can reduce airway inflammation and improve lung function, potentially offering a complementary strategy to traditional asthma therapies [15].

Lung function, measured by forced expiratory volume in one second (FEV1), improved across all groups, with the bariatric surgery group showing the most significant improvement. The increase in FEV1 in the bariatric surgery group (6%) suggests that weight loss, by reducing abdominal adiposity and improving respiratory mechanics, may enhance lung function [16]. This is consistent with studies indicating that obesity is associated with mechanical changes in the respiratory system, such as increased chest wall stiffness and diaphragm dysfunction, which can impair pulmonary function. Weight reduction through surgery or diet and exercise may reverse some of these mechanical restrictions, leading to better lung function and improved breathing. Quality of life, as assessed by the Asthma Quality of Life Questionnaire (AQLQ), also showed significant improvements in both intervention groups, with the bariatric surgery group experiencing the most notable gains [17]. These findings are consistent with previous studies that report enhanced quality of life following bariatric surgery, likely due to both physical improvements (e.g., better lung function and reduced asthma symptoms) and psychological benefits (e.g., improved selfesteem and reduced anxiety related to obesity). The improvements observed in the Diet and Exercise Group, though somewhat smaller, still reflect the importance of lifestyle modifications in improving the overall well-being of obese asthma patients [18].

Body Mass Index (BMI) was significantly reduced in both intervention groups. The Bariatric

Surgery Group experienced a more substantial reduction in BMI, with an average decrease of 5.8 kg/m^2 over six months, compared to 3.6 kg/m^2 in the Diet and Exercise Group [19]. This finding is expected, given that bariatric surgery leads to more significant and sustained weight loss compared to dietary changes and exercise alone [20]. The reduction in BMI in both groups underscores the role of weight management in improving asthma outcomes. As obesity is a known risk factor for worsening asthma, achieving and

maintaining a healthy weight is crucial for asthma control [21-23]. While the results of this study are promising, there are several limitations that must be acknowledged. The observational design of the study limits the ability to draw causal conclusions, and the absence of randomization may introduce selection bias. Additionally, the relatively short follow-up period of six months may not capture the long-term effects of these interventions on asthma outcomes. Future studies with longer follow-up, randomized controlled trials, and larger sample sizes are needed to confirm these findings and explore the long-term sustainability of these interventions.

Conclusion

It is concluded that bariatric surgery, diet, and exercise interventions can significantly improve asthma outcomes in obese patients. The bariatric surgery group demonstrated the most substantial improvements in asthma control, lung function, quality of life, and BMI, highlighting the potential of weight loss and metabolic changes to enhance asthma management. The diet and exercise group also showed notable improvements, although the changes were less pronounced compared to the surgical group. **References**

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