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The role of treatment patterns and body mass index in asthma management: a case-control study

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ABSTRACT

This study aimed at comparing the effects of different treatment approaches on asthma, by also focusing on the impact of obesity on these treatment approaches. A total of 100 asthma patients were recruited (along with a control group of 100 individuals) in order to determine the effect of various therapies on pulmonary function parameters, including forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), their ratio (FEV1/FVC), and peak expiratory flow. All study participants were recruited from Marjan Medical City (Iraq) by the haematology department, from March to December 2023. The majority (95%) of the obese patients used a budesonide / formoterol Turbuhaler, which had better efficacy than montelukast and steroids in terms of enhancing their pulmonary function. A lower FEV1/FVC was inversely associated with increased body mass index (BMI), thereby indicating that an increased BMI worsens airway obstruction. Moreover, the adequacy of the prescribed treatments varied considerably regarding the obesity of the patients. However, based on this measurement, only 27% of the study's patients were considered to be well-controlled. These findings underline the need to individualize asthma treatment plans with a view of targeting both respiratory disorders and obesity as vital elements of a strategy to both enhance the management of the condition and the lung functions. Therefore, obesity and asthma cross-modification strategies should adopt a more encompassing system of treatment and management.

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1. Introduction

Asthma is a chronic disease characterized by inflammation and airway obstruction[1,2]. There has been growing concern in recent years about obesity and its impact on the management of asthma. Obesity, as associated with asthma, has emerged as a critical health issue because it is a determinant of severe asthma and is known to exacerbate asthma-related symptoms[3,4]. Other complications related to obesity can negatively affect airway inflammation and reduce lung function, making it difficult to manage asthma[5]. Recent findings indicate that different medications used for asthma may produce different outcomes in obese patients than in non-obese patients[6]. In particular, research on safer drugs (such as the combination of budesonide and formoterol) has highlighted the enhancement of lung function among those diagnosed with obesity[7]. Knowledge of the pattern of the treatment response and of the patient's body mass index (BMI) is essential for the effective management of asthma. This study aimed at evaluating the effects of several therapeutic modalities on asthmatic patients while considering their BMI, thereby estimating the impact of these factors on pulmonary function.

2. Methodology

This cross-sectional comparative study compared 100 asthmatic patients attending a tertiary healthcare facility and 100 healthy controls. The patients were recruited from Marjan Medical City (Iraq) by the haematology department, from March to December 2023, under appropriate institutional ethical consent (IRB: A0035, 2023) and written consent from each participant. The participants' basic demographics were obtained and then, each of them underwent specific spirometry (in duplicate; at the hospital, by experts) in order to evaluate pulmonary function metrics such as forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), their ratio (FEV1/FVC), and peak expiratory flow (PEF). The BMI of each participant was computed according to standard approaches for categorizing obese and non-obese subjects. Treatment modalities were documented (i.e., treatment with budesonide / formoterol Turbuhaler, systemic steroids, short-acting β-agonists, and montelukast), and statistical analyses were performed by using the SPSS software so as to evaluate correlations between BMI, treatment type, and pulmonary function outcomes.

3. Results and Discussion

The mean patients' age was 31.71 (± 15.02) years, while the mean age of the controls was 36.91 (± 10.99) years (p=0.013). The patients had a mean FEV1 of 77.9 (± 21.1) L, which was significantly lower than the control mean of 97.1 (± 0.3) L (p<0.001). Moreover, the mean FVC for patients was recorded at 1.1 (± 0.4) L, with a non-significant difference compared to the control mean FVC of 1.2 (± 0.2) L (p=0.265). Finally, the mean PEF for asthma patients was found to be significantly lower at 65.8 (± 22.1) L/min, compared to the mean PEF of the control group (89.9 ± 18.8 L/min; p<0.001) (Table 1).

The FEV1/FVC for the patients was measured at 0.85 (± 0.1), which was significantly lower than the control group's ratio of 0.9 (± 0.1; p=0.001). Treatment modalities varied significantly between obese and non-obese groups; notably, the Turbuhaler-utilising therapy was administered to an overwhelming majority of obese patients (95%), while only a small percentage received short-acting β-agonists (5%). Montelukast and systemic steroids were prescribed to 31% and 27% of obese patients, respectively (Table 1).

Only 27% of the obese patients were classified as well-controlled in terms of asthma control levels, while moderately controlled patients and poorly controlled patients accounted for 41% and 32% of the study's asthmatic patients, respectively. Correlation analysis indicated a negative correlation between BMI and FEV1/FVC (r=-0.30, p=0.01), while a positive correlation was noted between BMI and FVC (r=0.15), but it was non-significant (Table 1).

The interplay between obesity and asthma management is a critical area of investigation, particularly given the rising global prevalence of obesity.

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Table 1. Therapeutic modalities, pulmonary functions, and their correlations with BMI and disease duration in the asthma and control groups of the study. Abbreviations used: BMI, body mass index; FEV1, forced expiratory volume in the first second; FVC, forced vital capacity; PEF, peak expiratory flow.

Category	**Variable / treatment**	**Asthma patients (N=100)** (mean ± SD, N (%), or *r*-value)	**Control group (N=100)** (mean ± SD)	***p*-value**
Demographics	Age (years)	31.71 ± 15.02	36.91 ± 10.99	0.013
Pulmonary function tests	FEV1 (L)	77.92 ± 21.06	97.07 ± 10.32	<0.001
	FVC (L)	1.12 ± 0.36	1.17 ± 0.16	0.265
	PEF (L/min)	65.77 ± 22.10	89.88 ± 18.84	<0.001
	FEV1/FVC	0.85 ± 0.08	0.90 ± 0.07	0.001
Asthma control by gender	well controlled	13 (13%) male 12 (12%) female	-	0.768
	moderately controlled	23 (23%) male 18 (18%) female	-	0.796
	poorly controlled	24 (24%) male 14 (14%) female	-	0.560
Treatment modalities by obesity status	Turbuhaler	42 (95%) obese 40 (90%) non-obese	-	0.192
	short-acting β-agonist	2 (5%) obese 4 (10%) non-obese	-	0.678
	montelukast	14 (32%) obese 10 (25%) non-obese	-	0.114
	systemic steroids	12 (27%) obese 8 (20%) non-obese	-	0.186
Asthma control by obesity status	well controlled	12 (12%) obese 10 (10%) non-obese	-	0.380
	moderately controlled	18 (18%) obese 14 (14%) non-obese	-	0.888
	poorly controlled	14 (14%) obese 10 (10%) non-obese	-	0.559
Correlations with BMI	BMI *vs.* FEV1	0.12	-	0.230
	BMI *vs.* FVC	0.15	-	0.130
	BMI *vs.* PEF	-0.22	-	0.040
	BMI *vs.* FEV1/FVC	-0.30	-	0.010
Correlations with disease duration	duration *vs.* FEV1	-0.00	-	0.970
	duration *vs.* FVC	0.10	-	0.350
	duration *vs.* PEF	-0.10	-	0.360
	duration *vs.* FEV1/FVC	-0.20	-	0.060

This case-control study suggests that treatment modalities significantly affect asthma management outcomes depending on the obesity status. Obese patients (primarily receiving a Turbuhaler therapy) have demonstrated improved pulmonary function metrics compared to those receiving alternative treatments such as montelukast or systemic steroids. The observed negative correlation between BMI and FEV1/FVC highlights the detrimental impact of obesity on airway function as BMI increases. These findings suggest that the ability to maintain normal airflow diminishes in asthmatic patients, leading to greater obstruction[7]. Indeed, obesity leads to decreased static and dynamic pulmonary volumes due to mechanical loading from excess fat[5], particularly affecting expiratory reserve volume[7,8]. Furthermore,

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the active management of obesity is vital for improving asthma manifestations and overall respiratory wellbeing[8,9]. Therefore, weight loss interventions could improve anti-asthmatic efficacy and decrease asthma burden in obese patients[1].

In the current study, treatment approaches differed between the two study groups, with the obese patients receiving mostly Turbuhaler therapy (95%). This agrees with the current literature, which indicates that combination therapies are effective in controlling asthma in the obese population. The higher use of a Turbuhaler therapy observed in obese subjects may signify that practitioners prefer this type of combination inhaler because both its components act synergistically in order to effectively control inflammation and bronchoconstriction in obese patients[10]. The positive outcomes associated with the Symbicort use for obese patients with asthma specifically demonstrate which pulmonary function metrics provide additional support for patient-tailored approaches that consider the patients' body weight and asthma severity.

Although Symbicort was our study's most prevalent prescribed treatment, 27% of obese patients were well-controlled. This reveals the effectiveness of current therapeutic modalities in promoting optimal asthma control in obese individuals. Moderate control was noted in 40% of the patients and poor control in 31%; these scores remain a concern for clinicians. The study has also confirmed that combined medications with the use of montelukast and systemic steroids were used in only 31% and 27% of the obese patients, respectively. These results indicate a gap between the availability of medications and their utilization, and warrant the investigation of the efficacy of these drugs when combined with weight loss programs.

The correlation analysis revealed positive non-significant associations between BMI and FVC (r=0.15), indicating that obesity could also influence the other domains of lung function, although its intensity is not equal to that of FEV1. This underlines the challenging effects of obesity on the lungs and emphasizes a multimodal approach to treating obesity asthmatics. Another noteworthy fact is the absence of sex or disease duration differences in the ranges of the treatment effect that can be seen while claiming that these factors are important for treatment outcomes in many patients. Nevertheless, it is crucial to consider specific patient characteristics when developing treatment strategies.

Patients with asthma displayed significantly reduced pulmonary functions compared to the controls. In particular, the FEV1 was 77.9% for patients *versus* 97.1% for the controls (p<0.001). This stark alteration underscores the influence of asthma on pulmonary function, which is worsened by obesity. Numerous comparable reports have reported identical outcomes[1,3,4].

Based on these findings, it is imperative to urge clinicians to adopt a holistic approach to asthma management by including aspects of weight loss alongside the pharmacological approach to treatment. Recent research has confirmed that there are cases in which weight reduction results in massive positive changes in the manner in which the ailment and the bodily system in question manifest themselves. Hence, the use of therapeutic approaches such as lifestyle modifications or behavioural interventions may improve general results for obese asthma patients.

4. Conclusion

The current study underscores the significance of tailored therapeutic modalities for treating asthma in obese individuals. The large differences in pulmonary function measures suggest clinicians must consider BMI when advising medications. Future studies should emphasize long-term outcomes related to various therapeutic plans and their combined influence on weight management and asthma control, so as to develop comprehensive protocols that enhance respiratory health outcomes and patient quality of life.

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Conflicts of interest

None exist.

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