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WEIGHT LOSS FOR CHILDREN AND ADULTS WITH OBESITY AND ASTHMA: SYSTEMATIC REVIEW

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Abstract

Introduction: *Asthma, a widespread respiratory condition affecting 339 million people globally, is closely associated with obesity, which is on the rise worldwide. This review examines the impact of weight loss on asthma in individuals dealing with obesity, drawing from randomized controlled trials in both children and adults.* ***Method:*** *This study followed the 2020 PRISMA guidelines to ensure research alignment with necessary standards for accuracy. Articles were retrieved from databases including PubMed database in October 2023.* ***Result:*** *The search strategy produced a total of 14 results. Upon reviewing the titles and abstracts, we identified 8 papers that met the criteria for inclusion. Initially, 8 articles were excluded from consideration as they were written in a review format. After a thorough evaluation of the full-text papers, we ultimately included five papers in the final analysis, consisting of prospective analysis, cross-sectional study, retrospective analysis, experimental study, and secondary analysis to a randomized control trial.* ***Conclusion:*** *Diet significantly impacts respiratory health in non-overweight/non-obese children, while obesity is linked to severe asthma exacerbations, emphasizing the need for further research and public health campaigns. Short-term dietary interventions in obese asthmatic children successfully reduce calorie intake and sugar consumption, but improvements in other dietary aspects may take time, and physical activity plays a crucial role in weight loss, especially in those with lower baseline lung function. Adding exercise to weight loss interventions in obese adults with asthma yields multiple benefits, including reduced depression symptoms and improved asthma control, and moderate weight loss can delay dynamic hyperinflation, enhancing quality of life and clinical control, underscoring the significance of lifestyle interventions in managing asthma across different age groups.*

Keywords: *asthma, adult asthma, children, obesity, weight loss*

INTRODUCTION

Asthma is a prevalent, chronic respiratory condition characterized by inflammation of the airways, heightened airway responsiveness, elevated mucus production, and varying degrees of airflow restriction and narrowing. The worldwide incidence of asthma has surged to 339 million people, and if current trends persist, it is projected to affect 400 million individuals by 2025. In Australia, approximately 11.2% of the population grapples with asthma, while in the United States, the prevalence is slightly lower at 7.7%. The surge in asthma prevalence worldwide has mirrored the rising rates of obesity. In adults, obesity is defined as a body mass index (BMI) exceeding 30 kg/m², while in children, the World Health Organization (WHO) Child Growth Standards are used, with obesity defined as children under 5 years old having weight-for-height more than 3 standard deviations above the median and children aged 5-19 exceeding 2 standard deviations.[1,2]
Asthma elevates the risk of obesity by 1.5-1.7 times, but there is also evidence suggesting that obesity independently increases the risk of asthma, particularly in susceptible individuals. The likelihood of developing asthma is 50% higher in adults who are overweight or obese, with obesity being accountable for approximately 250,000 new cases of asthma in adult Americans each year. Similarly, the incidence of asthma is 20% higher in overweight children, and the risk of asthma is doubled in obese children. The precise mechanisms linking asthma and obesity are not yet fully understood. However, it is proposed that factors such as increased inflammation in the airways and throughout the body, abnormal immune regulation, greater mechanical strain on the lungs, changes in the microbiome, genetic predisposition, and hormonal changes may play a role in this association.[2]
The concept of "obese asthma" has been proposed as a distinct asthma subtype characterized by more severe symptoms, reduced responsiveness to inhaled corticosteroids, and a higher prevalence among adult women, often with late-onset asthma. However, epidemiological studies have highlighted the diverse impact of obesity on asthma risk and severity. Obesity appears to be a significant factor in patients with nonatopic asthma, both in children and adults, suggesting that it influences asthma through non-eosinophilic airway inflammation. Furthermore, the age at which asthma first appears may alter the relationship between obesity and asthma, and there have been reports of inconsistent sex-based differences in the link between body fat and asthma in both children and adults.[3]
The efficacy of lifestyle interventions designed to promote weight loss and enhanced fitness in managing various chronic conditions is well-established. Even a modest reduction in body weight can lead to significant improvements in an individual's overall health, and weight control plays a crucial role in lowering the risk of conditions associated with obesity. Nevertheless, it's only recently that research has started to hone in on the impact of weight loss specifically on asthma in the context of obesity. Previous reviews on this subject have predominantly included a limited number of non-controlled studies and have seldom incorporated randomized controlled clinical trials (RCTs).[3] In this review, we systematically evaluate the current body of evidence derived from RCTs concerning the effects of weight loss on both children and adults grappling with obesity and asthma.

METHODS

Protocol

By adhering to the guidelines outlined in the 2020 Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA), researcher of this study ensured its alignment with the necessary standards. This was carried out to guarantee the accuracy of the conclusions drawn from the investigation

Criteria for Eligibility

To be included in the research, published articles had to meet specific criteria. They had to be research papers written in English that specifically addressed weight loss for children and adults with obesity and asthma. The studies had to adhere to the following conditions: the research papers needed to have been published after 2018 but within the relevant timeframe for this systematic review. Articles falling into categories such as editorials, lacking a DOI, review articles that had already been published, or those duplicating previously published journal papers were excluded from consideration.

Search Strategy

We conducted a comprehensive literature search using PubMed and Google Scholar, focusing on studies published from 2018 to 2023. The search terms employed were as follows: ("weight loss" [MeSH Terms] OR ("weight" [All Fields] AND "loss" [All Fields]) OR "weight loss" [All Fields]) AND ("asthma" [MeSH Terms] OR "asthma" [All Fields]). Additionally, we cross-referenced relevant articles to identify any additional studies. The evaluation of study quality, design, interventions, and results was carried out independently by researchers, with any discrepancies resolved through discussion and consensus. Additionally, both researchers extracted and compared results from all studies, with the potential for a meta-analysis if deemed feasible.

Inclusion and exclusion criteria

The inclusion criteria for studies were as follows: 1) Randomized Controlled Trials (RCTs), 2) interventions explicitly aimed at weight loss as defined by the original study authors and confirmed during our review, 3) involving individuals, both children and adults, with asthma who were either overweight or obese, 4) reporting sufficient data for the evaluation of outcomes and study quality, and 5) published in English. Exclusion criteria encompassed: 1) Studies that were not randomized or controlled, 2) studies involving participants without asthma, 3) studies involving participants who were not overweight or obese, and 4) studies with insufficient data to assess changes among overweight/obese individuals with asthma.

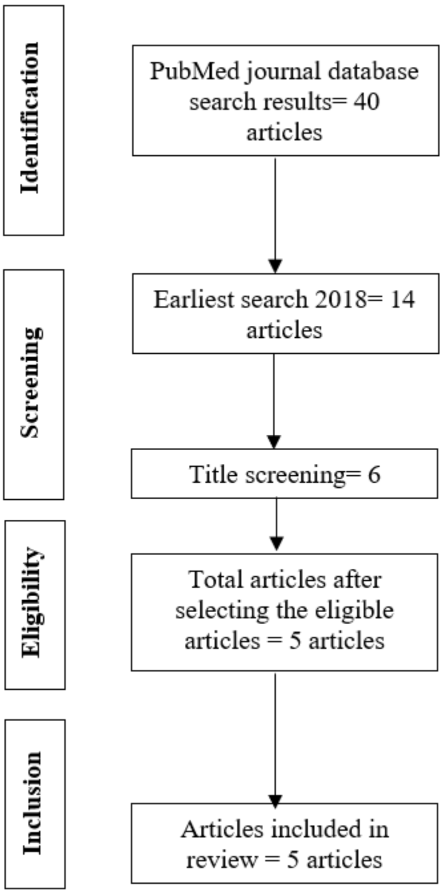

Figure 1. Article search flowchart

Data retrieval

The authors conducted a rigorous review of relevant studies, selecting those meeting specific criteria for inclusion. They focused on English-language, original, and unpublished papers, ensuring a narrowed, high-quality selection. The findings were analysed for key information, including study details, authors, dates, locations, and methodologies, aligning with the study's objectives.

Author	Origin	Method	Sample Size	Result
Silva et al.,[4] 2019.	Brazil	Prospective study.	Forty-two asthma patients were enrolled in a weight loss program (diet, psychological support, and exercise) and were subsequently divided into two groups according to the percentage of weight loss: a ≥5% group (n = 19) and a <5% group (n = 23).	Before and after the intervention, DH and EFL (constant load exercise), health-related quality of life (HRQoL), asthma control, quadriceps muscle strength and endurance, body composition, and lung function were assessed. Both groups exhibited a decrease of ≥10% in inspiratory capacity (DH) before intervention, and only the ≥5% group showed clinical improvement in DH compared with the <5% group postintervention (−9.1 ± 14.5% vs.−12.5 ± 13.5%, respectively). In addition, the ≥5% group displayed a significant delay in the onset of both DH and EFL and a clinically significant improvement in HRQoL and asthma control.
Rodrigues et al.,[5] 2023.	Porto, Portugal.	Cross-sectional study	This cross-sectional analysis comprised 660 children: 49.1% females, 7–12 years old.	Adherence to theMD was assessed through the alternate Mediterranean score (aMED). Higher scores represent a healthier diet (0–8). Airway inflammation was assessed measuring exhaled fractional nitric oxide (eNO). Two categories of BMI were considered: non-overweight/non-obese (p < 85th) and overweight/obese (p 85th). The associations between diet and airway inflammation were estimated using logistic regression models. Higher scores of the aMED were associated with decreased odds of having eNO 35 ppb, but only in non-overweight/non-obese children (OR = 0.77; 95% CI, 0.61–0.97).

				For overweight/obese children, the previous association was not significant (OR = 1.57, 95% CI, 0.88–2.79).
Freitas, et al.[6] 2018.	Sao paulo, Brazil.	Experimental study.	Fifty-five grade II obese adults with asthma	After 3 months, the WL + E group presented a significant increase in daily step counts (3068 T 2325 vs 729 T 1118 steps per day) and the number of asthma symptom–free days (14.5 T 9.6 vs 8.6 T 11.4 dImonthj1) compared with theWL + S group. The proportion of participants with improvements in depression symptoms (76.4% vs 16.6%) and a lower risk of developing obstructive sleep apnea (56.5% vs 16.3%) was greater in the WL + E group than that in the WL + S group (P G 0.05). Significant improvements in sleep efficiency (6.6% T 5.1% vs 1.3% T 4.7%) and latency (j3.7 T 5.9 vs 0.2 T 5.6 min) were also observed in the WL + E group.
Luthe et al.,[7] 2018.	US.	Retrospective cohort study	Adult patients (age 18-54 years) who had an unplanned hospitalization with a principal diagnosis of asthma, defined by the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis code of 493.xx.	Among the 72,086 patients hospitalized for asthma exacerbation, 24% were obese. Obesity was associated with a significantly higher risk of any mechanical ventilation use (8.3% vs. 5.0%; adjusted OR 1.77; 95%CI 1.63-1.92; P<0.001) driven by the higher risk of NIPPV use (7.2% vs. 3.4%; adjusted OR 2.14; 95%CI 1.96-2.35; P<0.001). Likewise, obese patients were more likely to have a hospital LOS of ≥3 days compared to non-obese patients (59.4% vs. 46.5%; adjusted OR 1.37; 95%CI 1.32-1.43; P<0.001).
Eslick et al.,[8] 2020.	Italy	Secondary analysis study to a randomized controlled trial.	Obese children (body mass index (BMI) z-score 1.64 standard deviation score (SDS)), aged between 8–17 years, with stable asthma	Following the intervention, the body mass index (BMI) z-score decreased (D = 0.18 0.04; p < 0.001), %energy from protein increased (D = 4.3 0.9%; p = 0.002), and sugar intake decreased (D = 23.2 9.3 g; p= 0.025). Baseline lung function and physical activity level were inversely associated with D% fat mass. The DBMI z-score was negatively associated with physical activity duration at baseline. Dietary intervention is e ective in achieving acute weight loss in obese asthmatic children, with significant improvements in diet quality and body composition.

RESULT

The search strategy produced a total of 14 results. Upon reviewing the titles and abstracts, we identified 8 papers that met the criteria for inclusion. Initially, 8 articles were excluded from consideration as they were written in a review format. After a thorough evaluation of the full-text papers, we ultimately included five papers in the final analysis, consisting of prospective analysis, cross-sectional study, retrospective analysis, experimental study, and secondary analysis to a randomized control trial.

In a 2019 prospective study by Silva et al[4], 51 initially enrolled patients faced various challenges leading to a final cohort of 42 asthma patients. These participants were categorized into two groups, based on their weight loss achievements: those with ≥5% weight loss (n = 19) and those with <5% weight loss (n = 23), exhibiting similar baseline characteristics before the intervention. Their average age was 47.4 ± 7.8 years, and they were characterized by Grade II obesity (BMI: 37.9 ± 2.5 kg/m²) and reduced lung function (ERV: 26 ± 23% of predicted).

Both groups also had comparable durations for submaximal exercise tests and exhibited similar levels of dynamic hyperinflation post-test. The ≥5% group showed a reduced mean percentage change in inspiratory capacity post-intervention, although this difference from the <5% group was not statistically significant. Similarly, the presence of expiratory flow limitation (EFL) was similar between the two groups. Among the ≥5% group, those experiencing dynamic hyperinflation (DH) post-intervention had a delayed onset of both DH and EFL compared to the <5% group. Tidal volume and respiratory rates at the exercise peak were similar before the intervention for both groups. Following the intervention, the ≥5% group experienced a significant increase in tidal volume, with no significant difference in respiratory rates between the two groups. [4]

Before the intervention, both groups exhibited similar health-related quality of life (HRQoL) and asthma control. However, the ≥5% group demonstrated substantial improvements in all domains of the Asthma Quality of Life Questionnaire (AQLQ) and the Asthma Control Questionnaire (ACQ) post-intervention, with significant differences in AQLQ domains related to activity limitations, symptoms, and total scores. There was no significant difference in the ACQ score post-intervention. [4]

The ≥5% group achieved a significantly higher mean percentage of weight loss compared to the <5% group post-intervention, accompanied by a greater reduction in waist circumference. Both groups saw reductions in various body composition metrics, but the ≥5% group experienced significantly greater reductions in these variables. Pulmonary function, quadriceps muscle strength, endurance, and air trapping exhibited no significant differences between the groups before or after the intervention. [4]

Following the intervention, the ≥5% group displayed a reduction in airway inflammation and changes in various biomarkers, while also exhibiting increased levels of specific proteins and anti-inflammatory biomarkers. Moreover, the ≥5% group had elevated vitamin D levels compared to the <5% group. [4]

In exploring the relationship between body composition and changes in inspiratory capacity, a moderate negative correlation was found between waist circumference and inspiratory capacity in the ≥5% group, while no significant association was observed in the <5% group. A moderate negative correlation between inspiratory capacity and trunk fat mass was identified in the ≥5% group, but no such correlation was evident in the <5% group. [4]

In a cross-sectional study conducted by Rodrigues et al. [5] spanning from 2014 to March 2015, 1602 school children aged 7 to 12 years from public schools in Porto, Portugal, were examined. Out of the 858 children providing informed consent for clinical procedures, 660 (76.9%) had complete nutritional data for the aMED score analysis. The average age of the participants was 8.68 (0.77) years, with 49.1% (n = 324) being girls, and 25.6% (n = 169) categorized as overweight or obese children. Airway inflammation was observed in 13% (n = 86) of children, indicated by eNO levels ≥35 ppb. Differences between children with and without airway inflammation were noted, including variations in age, obesity/overweight classification, MUFA/SFA ratio, and atopy. Additionally, differences in total energy intake (TEI) and parental education were identified between overweight/obese and non-overweight/non-obese children. Overweight/obese children had higher energy intake and parents with lower educational levels.

Following adjustments for multiple factors, such as age, sex, atopy, breastfeeding, parental education level, tobacco exposure at home, and total energy intake, higher aMED scores were not significantly associated with airway inflammation (OR = 0.84; 95% CI 0.69–1.02). However, non-overweight/non-obese children with higher aMED scores had lower odds of having eNO levels ≥35 ppb (OR = 0.77; 95% CI 0.61–0.97). The fit of the logistic regression models was evaluated using the Hosmer-Lemeshow test, resulting in a chi-square value of 12.91 with a p-value of 0.115 for the non-overweight/non-obese model and a chi-square value of 5.50 with a p-value of 0.704 for the overweight/obese model. Under a significance level of 5%, we cannot reject the null hypothesis, concluding that both models are appropriately adjusted. [5]

In a 2018 experimental study by Freitas et al. [6], 51 participants were analyzed after some attrition, with 25 in the WL + S group and 26 in the WL + E group. At the outset, both groups had similar baseline characteristics in terms of anthropometric data, asthma medication, lung function, and physical activity levels. Only about 17.4% of the participants in both groups met the physical activity recommendation of 10,000 steps per day initially. After three months of intervention, the WL + E group significantly increased daily step counts, with 41.7% achieving the recommendation, whereas the WL + S group remained relatively unchanged.

Before the intervention, both groups spent around 25.6 ± 15.2 minutes daily on moderate to vigorous physical activity (MVPA). After three months, the WL + E group significantly increased MVPA time compared to the WL + S group. Moreover, 91.6% of the WL + E group and 65.2% of the WL + S group met the MVPA guideline after the intervention. Regarding BMI and muscle strength, the WL + E group exhibited substantial improvements in both areas compared to the WL + S group. More participants were reclassified to a lower obesity class in the WL + E group. [6]

Regarding asthma symptoms, the WL + E group experienced a greater increase in asthma symptom-free days, and the intervention effect favored this group. Participants in both groups initially showed a high risk of obstructive sleep apnea (OSA). After the intervention, the WL + E group had a significantly reduced risk of OSA, with more participants improving in the snoring category compared to the WL + S group. Sleep efficiency improved in the WL + E group, with exercise participants achieving the threshold for normal sleep[6].

The analysis revealed linear associations between physical fitness, daily steps, depression symptoms, and comorbidities. Exercise training was shown to be superior in improving physical activity and asthma and obesity-related comorbidities. Multiple linear regression indicated that depression symptoms were independently associated with improved physical activity and fitness, while the reduction in OSA risk was associated with physical fitness, and asthma symptom-free days and improved sleep efficiency were associated with changes in daily physical activity. [6]

In 2018, a study by Luthe et al.[7] identified 72,086 patients hospitalized for asthma exacerbation in eight U.S. states between January 2010 and December 2013. The patients had a median age of 43 years (range 33-49 years), with 70.2% being female, and 44.7% identified as non-Hispanic white. Notably, 24.3% of these patients were classified as obese. The characteristics of patients varied significantly based on their obesity status. Obese patients were more likely to be female, Medicare beneficiaries, and residing in lower-income areas, all with p-values less than 0.001. Additionally, obese patients had a higher prevalence of comorbidities such as congestive heart failure, depression, and diabetes, again with p-values less than 0.001 when compared to non-obese patients.

Obesity was significantly associated with an increased risk of overall mechanical ventilation use (8.3% vs. 5.0%; unadjusted odds ratio 1.89; 95% confidence interval 1.76-2.03; p<0.001). This association remained statistically significant even after adjusting for various potential confounding factors at the patient level, including age, sex, race/ethnicity, primary insurance, income quartiles, patient comorbidities, hospital location, and calendar year. Furthermore, when considering overall mechanical ventilation, obesity was linked to a higher risk of non-invasive positive pressure ventilation (NIPPV) in both unadjusted (7.2% vs. 3.4%; unadjusted odds ratio 2.53; 95% confidence interval 2.32-2.75; p<0.001) and adjusted (adjusted odds ratio 2.14; 95% confidence interval 1.96-2.35; p<0.001) models.

However, no statistically significant association was observed with the risk of invasive mechanical ventilation use in the adjusted model (p=0.12). [7]

Regarding hospital length of stay (LOS), obese patients were more likely to have a hospital LOS of ≥3 days compared to non-obese patients (59.4% vs. 46.5%; adjusted odds ratio 1.37; 95% confidence interval 1.32-1.43; p<0.001). Although the number of asthma-related deaths was limited (n=116), resulting in limited statistical power, there was no significant difference in in-hospital mortality between the obese and non-obese groups (0.15% vs. 0.16%, respectively; p=0.97). [7]

In sensitivity analyses, these findings remained consistent when stratified by age, sex, and race/ethnicity, except for a lower risk of invasive mechanical ventilation use among obese men. Despite some statistically significant interactions of obesity with age and sex due to the large sample size, there was no substantial heterogeneity (or clinically meaningful interactions) across different age, sex, and race/ethnicity strata. Similarly, the associations were also consistent across median household income and patient residence strata. [7]

Additionally, consistent with the primary analysis, the analysis modeling hospital LOS as a count variable also revealed that obese patients had a significantly longer hospital LOS. This corresponded to a 24% increase (95% confidence interval 22%-27% increase) in the unadjusted model and a 13% increase (95% confidence interval 11%-16% increase) in the adjusted model. Finally, in the analysis utilizing the stabilized inverse probability weighting (IPW) method, the results remained consistent with the primary analysis, indicating a causal association between obesity and the severity of acute asthma exacerbation. [7]

A secondary analysis of a group of obese children with physician-diagnosed asthma who participated in a 10-week dietary intervention trial was conducted by Eslick et al[8] in 2020. These participants were mainly individuals with mild asthma, displaying normal lung function within the range of 80-120% of predicted values. A closer look at the baseline characteristics revealed that the majority of the participants were male and had a history of atopic conditions.

Complete sets of pre- and post-intervention data on anthropometrics and body composition were available for 27 participants. After the intervention, significant reductions in various anthropometric and body composition measurements were observed (p-value ≤ 0.001). Additionally, there was a noteworthy increase in lean mass, amounting to 1.9% following the intervention. Data on diet quality were available for 16 participants both before and after the intervention. Post-intervention, there was a significant increase in the mean percentage of energy derived from protein (16.2 ± 3.1 versus 20.5 ± 3.7, p < 0.001) and a significant decrease in absolute sugar intake (in grams) (115.3 ± 34.6 versus 92.2 ± 29.4, p = 0.025. There was a tendency towards reduced energy intake and a lower percentage of energy from fat. Notably, at the outset, the average dietary intake of fiber, Vitamin A, potassium, and calcium fell below the recommended levels specific to age and gender. These inadequacies persisted even after the intervention. The intake of saturated fat, as a percentage of total fat intake, remained relatively high at around 38% and did not change post-intervention. The intervention did not lead to significant alterations in plasma carotenoid and tocopherol concentrations. Similarly, there were no notable differences in total red blood cell membrane fatty acids or individual fatty acids among the participants post-intervention. The change in fat mass percentage (Δ% fat mass) was negatively associated with baseline % predicted FEV1 (r = -0.429, p = 0.026) and baseline METs (r = -0.454, p = 0.023). Furthermore, the baseline duration of physical activity (in minutes per week) was inversely associated with the change in BMI z-score (ΔBMI z-score) (r = -0.445, p = 0.023). [8]

DISCUSSION

The major finding of the present study is that obese patients with asthma who lost at least 5% of their body weight presented a clinically relevant improvement in dynamic hyperinflation during submaximal exercise after intervention. In addition, they presented a delay in the onset of both dynamic hyperinflation (DH) and expiratory flow limitation (EFL) during the submaximal exercise test and an improvement in health-related quality of life (HRQoL). The group that lost more weight also presented a decrease in fat mass, body mass index, and waist circumference. Finally, the reduction in circumference may partially explain the reduction in dynamic hyperinflation. These results suggest that a minimum decrease of 5% in body weight is required to improve respiratory mechanics during exercise in obese patients with asthma.[4]

At baseline, 70% of our obese patients with moderate to severe asthma presented dynamic hyperinflation, a result that is quite similar to those described by Ferreira et al. (72.2%). Previous studies have also shown that both asthma and obesity are generally associated with DH, reflected by a progressive increase in the end-expiratory lung volume (EELV) above the relaxation volume of the respiratory system. If obesity is related to DH, weight loss may have a positive effect on breathing mechanisms. [4]

We speculate that the clinical improvement in DH found in the 5% weight loss group may have occurred through two different mechanisms. First, weight loss may have improved diaphragmatic mobility by decreasing the restriction of the rib cage imposed by adipose tissue. This hypothesis is supported by a moderate negative linear correlation between the reduction in dynamic hyperinflation (change in the inspiratory capacity) with the reduction in both waist circumference and trunk fat mass. Another possible explanation for the clinical improvement in DH in the 5% group may be the reduction either in airway inflammation or in inflammatory biomarkers secondary to weight loss. [4]

Another important result of the present study is that asthmatic patients who lost 5% of their body weight significantly delayed the onset of DH after the intervention. Although the total duration of the submaximal exercise test (Tlim) was not different between groups, patients who lost more weight were able to exercise longer without presenting DH. These findings could have positive effects on adherence to physical activity during daily life and may improve health-related quality of life. [4]

The results of the present study suggest that programs for obese individuals with asthma should prioritize weight loss of at least 5% because this change can reduce dynamic hyperinflation and airway inflammation as well as improve the quality of life. Weight loss is a difficult task to achieve and requires a multidisciplinary team. Previous studies have suggested that a more pronounced weight loss (7%) seems to have an important role in increasing physical activities of daily living. The results of this study confirm previous findings demonstrating that weight loss improves asthma control and has important repercussions in the improvement of respiratory mechanics during exercise.[5]

Some limitations of the present study should be considered, including the gender imbalance among participants, the specific cut-off of 5% for weight loss, and a lack of standardization in the reduction of inspiratory capacity. Additionally, it would be important for future studies to evaluate the involvement of other variables related to body fat and dynamic hyperinflation, such as the level of inflammatory mediators.[5]

In another study, it was found that adherence to a Mediterranean diet may reduce airway inflammation in school-aged children, particularly among those who are not overweight or obese. Previous studies have also suggested a beneficial effect of the Mediterranean diet on respiratory health, including lower exhaled nitric oxide levels and modulation of inflammatory mediators associated with respiratory health.[5]

Fiber and fats in the diet can influence gut microbiota, resulting in changes in the production of short-chain fatty acids. The Mediterranean diet includes components such as whole grains, fruits, legumes, nuts, and vegetables, which are essential sources of fiber and other beneficial nutrients. Improved dietary patterns have been associated with lower airway inflammation, and a healthy diet may reduce pro-inflammatory cytokines, thereby decreasing nitric oxide production and airway inflammation. It's important to note that the combination of various nutrients and phytochemicals in the Mediterranean diet may contribute to lower airway inflammation levels.[5]

The study also suggests that a higher adherence to the Mediterranean diet is crucial for the development of mechanisms against inflammation and for maintaining a healthy body weight, particularly in non-overweight or non-obese individuals. The study highlights the need to consider dietary patterns in the prevention and management of respiratory conditions. Furthermore, another study revealed that exercise training in combination with a weight loss lifestyle intervention improved dynamic lung hyperinflation, sleep efficiency, reduced depression symptoms, and lowered the risk of developing obstructive sleep apnea (OSA) in obese adults with asthma. The exercise program not only increased aerobic fitness but also encouraged participants to adopt a healthier lifestyle by increasing physical activity levels.[5]

Obesity is associated with worse asthma outcomes, and the combination of exercise and weight loss plays an important role in improving clinical asthma control, lung function, airway inflammation markers, and vitamin D levels.[3] The study emphasizes the importance of non-pharmacological interventions, including exercise, in the treatment of obese adults with asthma. Obesity-related respiratory symptoms during daily activities can be improved by regular physical exercise, leading to a reduction in psychosocial comorbidities and better management of asthma symptoms.[6,7]

Finally, in a large-scale study, it was observed that obesity is associated with higher acute severity of asthma exacerbation in hospitalized adult patients. Obese patients experienced higher rates of mechanical ventilation use and longer hospital length of stay (LOS) compared to non-obese patients. While no significant difference was found in in-hospital mortality between the two groups, the data suggest that obesity contributes to increased acute severity in asthma exacerbation. The mechanisms underlying this association may include increased systemic inflammation, airway obstruction, reduced corticosteroid responsiveness, and the presence of comorbidities.[6,9]

In study of obese asthmatic children undergoing a 10-week dietary weight loss program, researcher assessed diet quality, nutritional biomarkers, and the relationship between baseline characteristics and weight loss outcomes. After the intervention, diet quality improved, marked by increased protein intake and reduced sugar consumption. However, no significant changes were observed in micronutrient intake, plasma carotenoids, or fatty acids. Interestingly, children with better baseline lung function and higher physical activity levels lost more body fat and experienced greater reductions in BMI z-scores. The intervention successfully led to a 3.4% weight loss and a 0.18 SDS reduction in BMI z-score over 10 weeks, comparable to previous studies in overweight/obese asthmatic children. Additionally, waist circumference and fat mass significantly decreased. Dietary records revealed inadequacies in micronutrient intake, particularly vitamin A, fiber, calcium, and potassium, which remained unchanged post-intervention. The study primarily targeted energy reduction and overall diet quality, limiting the scope of dietary change in this short-term study.[8]

Saturated fat intake remained high, which could be addressed in longer interventions due to its association with cardiovascular disease risk. Vitamin E intake decreased, likely due to dietary changes. Notably, nutritional biomarkers like carotenoids and tocopherols did not change despite dietary improvements, highlighting the need for longer interventions to promote micronutrient enhancements. Children with better lung function and higher physical activity levels achieved greater weight loss, while those with more severe asthma may face barriers to lifestyle changes. Future interventions should consider the specific needs of these subgroups, potentially incorporating asthma education to facilitate safe exercise practices.[8,10]

CONCLUSION

In summary, dietary choices greatly influence respiratory health in non-overweight/non-obese children, emphasizing the need for balanced, nutrient-rich diets. Obesity is linked to severe asthma exacerbations, necessitating further research and public health campaigns to address this issue. Short-term dietary interventions in obese asthmatic children successfully reduce calorie intake and sugar consumption, but improvements in other dietary aspects take time. Physical activity plays a crucial role in weight loss, with those with lower baseline lung function requiring additional support. Adding exercise to weight loss interventions in obese adults with asthma yields multiple benefits, including reduced depression symptoms and improved asthma control. Moderate weight loss in obese asthmatic patients can delay dynamic hyperinflation, enhancing quality of life and clinical control. These findings underscore the significance of lifestyle interventions and dietary changes in managing asthma and related conditions across different age groups.

REFERENCES

[1]. World Health Organization. Asthma fact sheet. 2017 [Accessed 2018 Sep 2]. Available from: http://www.who.int/mediacentre/factsheets/fs307/en/.

[2]. Peters U, Dixon AE, Forno E. Obesity and asthma. *J Allergy Clin Immunol.* 2018;141:1169–1179.

[3]. Okoniewski W, Lu KD, Forno E. Weight Loss for Children and Adults with Obesity and Asthma. A Systematic Review of Randomized Controlled Trials. Ann Am Thorac Soc. 2019 May;16(5):613-625. doi: 10.1513/AnnalsATS.201810-651SR. PMID: 30605347; PMCID: PMC6491056.

[4]. Silva, A. G., Freitas, P. D., Ferreira, P. G., Stelmach, R., Pinto, R. M. C., Salge, J. M., … Carvalho, C. R. F. (2018). Effects of weight loss on dynamic hyperinflation in women obese asthmatics. Journal of Applied Physiology. doi:10.1152/japplphysiol.00341.2018

[5]. Rodrigues M, de Castro Mendes F, Padrão P, Delgado L, Paciência I, Barros R, Rufo JC, Silva D, Moreira A, Moreira P. Mediterranean Diet and Airway Inflammation in School-Aged Children. Children (Basel). 2023 Jul 29;10(8):1305. doi: 10.3390/children10081305. PMID: 37628304; PMCID: PMC10453938.

[6]. Freitas PD, Ferreira PG, Silva AG, Stelmach R, Carvalho-Pinto RM, Fernandes FL, Mancini MC, Sato MN, Martins MA, Carvalho CR. The Role of Exercise in a Weight-Loss Program on Clinical Control in Obese Adults with Asthma. A Randomized Controlled Trial. Am J Respir Crit Care Med. 2017 Jan 1;195(1):32-42. doi: 10.1164/rccm.201603-0446OC. PMID: 27744739.

[7]. Eslick S, Jensen ME, Collins CE, Gibson PG, Hilton J, Wood LG. Characterising a Weight Loss Intervention in Obese Asthmatic Children. Nutrients. 2020 Feb 17;12(2):507. doi: 10.3390/nu12020507. PMID: 32079331; PMCID: PMC7071161.

[8]. Luthe SK, Hirayama A, Goto T, Faridi MK, Camargo CA Jr, Hasegawa K. Association Between Obesity and Acute Severity Among Patients Hospitalized for Asthma Exacerbation. J Allergy Clin Immunol Pract. 2018 Nov-Dec;6(6):1936-1941.e4. doi: 10.1016/j.jaip.2018.02.001. Epub 2018 Feb 14. PMID: 29452277; PMCID: PMC7723818.

[9]. Watchorn D, Madden A, O'Shea D, Dunican EM, Butler MW. Weight Loss in Individuals with Obesity and Asthma. Ann Am Thorac Soc. 2019 Jul;16(7):933-934. doi: 10.1513/AnnalsATS.201902-151LE. PMID: 30969796; PMCID: PMC6600830.

[10]. Rebecca F. McLoughlin, Bronwyn S. Berthon, Lisa G. Wood, Weight loss in obese children with asthma – is it important?, Paediatric Respiratory Reviews, Volume 37, 2021, Pages 10-14, ISSN 1526-0542, https://doi.org/10.1016/j.prrv.2020.02.007.