

Diet and Exercise: A Novel Cure for Asthma? - A Short Communications on a Non-Pharmacological Strategy

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Abbreviations: ACQ: Asthma Control Questionnaire; AQLQ: Asthma Quality of Life Questionnaire; BMI: Body Mass Index; DII: Dietary Inflammatory Index; GINA: The Global Initiative for Asthma; HIIT: High-Intensity Interval Training; HR: Heart Rate; ICS: Inhaled Corticosteroids; VO₂max: Maximal oxygen uptake

Introduction

Behavioral interventions with regular physical activity, weight loss and diet have repeatedly demonstrated preventive effects in a wide range of diseases. Furthermore, an unhealthy lifestyle is a known predictor for increased use of medication and also the leading risk factor for global mortality. As a result, interest is increasing in applying behavioral interventions as a supplement in both medical and surgical treatments. The Global Initiative for Asthma (GINA) suggests that asthma patients should be encouraged to be physically active and choose a healthy diet because of its general health benefits [1]. However, physical inactivity combined with an unhealthy diet lead to decreased disease control and should thus be taken into consideration when treating asthma [2]. Recent trials of diet and exercise in asthma indicate that dietary advice and exercise can potentially improve, not only general health, but also asthma related outcomes.

Asthma patients depend on their daily inhalation of medicine, and pharmacological treatment will probably

always be the primary treatment of asthma. However, despite medical treatment, some patients experience difficulties in controlling their asthma symptoms. One reason could be a sedentary lifestyle [2]. This short communication aims to provide the reader with an update on current evidence of exercise and diet for asthma.

Physical Activity

A number of studies shows that behavioral interventions, especially regular physical exercise, can improve asthma symptoms and health related quality of life [2]. Further, it may also reduce exacerbations, airway hyper reactivity [3] and airway inflammation [4]. Physical activity definitely increases cardiopulmonary fitness whereas it probably does not increase lung function [5]. However, a 12-year follow-up study showed that high levels of physical activity can counteract an accelerated decrease in lung function in asthma patients [6].

The fear of an exercise-induced asthma attack keeps many patients away from being physically active. Yet, there is little evidence to support that physical training should be hazardous for asthma patients. In fact, the results from recent asthma training-studies supports that this patient group can benefit from physical training and without being limited by exercised induced asthma attacks. Studies with asthma patients who undergo high-intensity interval training (HIIT) for 8-10 weeks showed no major serious events, and training at 80-90% of participants predicted maximal heart rate must be considered to be safe [7,8]. Previous exercise studies in asthma have mostly focused on interventions with

low and moderate intensity while only a few studies have tested HIIT. HIIT is often preferred among recreational athletes because it is less time consuming, but still superiorly effective. To date, there are no studies comparing the potential effect differences between high-intensity training with low and moderate intensity training on asthma outcome. Altogether, this means that the positive effects of HIIT, e.g. improved exercise capacity and maximal oxygen consumption, will benefit asthma patients to the same extent as healthy people. Nevertheless, asthma patients should be aware of exercise-induced symptoms due to bronchoconstriction before starting any kind of exercise and should be treated with controller medication (e.g. inhaled corticosteroids (ICS)) so that the airway hyperresponsiveness is under control. If asthma patients follow precautions and medical guidance, they can choose the type of exercise they feel most comfortable without worrying about symptoms.

Weight Loss

Most randomized controlled trials performed on the combination of diet and exercise primarily focus on adult overweight (BMI 25-30) and obese asthma patients (BMI >30). Obesity is a well-known risk factor for asthma, due to large abdominal mass which reduces lung volume and increased systemic low-grade inflammation. Obese asthma patients tend to struggle with a lot of symptoms and weight-loss is recommended to improve asthma control. It is important to consider that patients with obesity-related asthma often have late-onset asthma with severe symptoms. In addition, these patients differ in patho-physiology from more common asthma phenotypes and airway inflammation in obese asthma patients is primarily dominated by non-eosinophilic cells [9]. A study in obese adults with asthma found that a 5-10% weight loss improved asthma control and quality of life in the majority of the included patients. However, weight loss greater than 10% did not appear to contribute any further improvements in Asthma Control Questionnaire (ACQ) or Asthma Quality of Life Questionnaire (AQLQ) [10].

Diet

Eating healthy seems to impact symptoms and quality of life in asthma. Certain dietary components have been found to act as pro-inflammatory and thus potentially worsen inflammation, lung function and exacerbation rates in asthma patients [11]. Further, increased airway inflammation is found to be associated with a high fat and low fiber intake in adult patients with severe asthma [12]. Wood et al. found that asthma patients have a higher dietary inflammatory index (DII) compared to healthy controls [13] and point out that high consumption of

pro-inflammatory foods may be associated with worse asthma status. Studies have found that obese patients randomized only to dietary restriction intervention for 10 weeks showed improvements in asthma control and quality of life [10]. Similar randomized controlled trials with Mediterranean diet could not find the same effect when investigating non-obese adult asthma patients [14].

Combination of Physical Activity, Weight Loss and Diet

Scott et al. [10] showed that combining 10-weeks of exercise and dietary restrictions improved asthma control in obese patients. Studies suggest that there may be an association to be found between physical activity, diet and asthma independent of obesity [12]. Thus, diet and exercise must be considered in asthma treatment. This is supported by results from the EFFORT-study, a diet- and exercise intervention study including 149 non-obese asthma patients. Here, 8-weeks of combined diet (high protein, low glycemic index, isocaloric) and exercise (spinning training) significantly improved asthma control and quality of life. No changes were observed in airway hyper-responsiveness or airway inflammation [15].

Discussion

A general consideration in clinical trials with exercise interventions is the lack of information and transparency of the method. Studies often report a unique methodological procedure but give minimal information in terms of adherence to protocol, competencies of the instructor of the intervention and the exact content of the training, together with missing objective measurements to support that a chosen training intensity was fulfilled. This makes it challenging to evaluate the intervention quality. Similar challenges are found in dietary intervention studies making it difficult to extrapolate the results. In the study by Scott et al. [10] participants received a 12-week gymnasium membership with group supervision 1 h each week and participants attended the gymnasium at least 3 times per week, but information about training duration, specific content of the training and intensity are unknown. França-Pinto et al. [3] choose an intervention with 25 minutes of aerobic training twice a week for 12-weeks. All participants completed the 24 treatment sessions, but information about intensity and supervision is not clear. In the EFFORT study participants completed a mean of approximately 22 out of 24 training sessions, and each session of HIIT were supervised and HR-monitored to ensure that participants followed the given intensity [7]. In line with this, we suggest that future exercise studies follow a similar method to make the intervention reproducible and comparable.

Regarding interventions in asthma patient's compliance to ICS in connection with behavioral interventions is often not reported. This is a massive problem, since compliance is crucial to evaluate airway inflammation.

Even though changes in airway inflammation were statistically insignificant in the EFFORT intervention groups after 8 weeks, there are indications that the underlying mechanism in improved asthma control could be found in relation to decreased airway inflammation. The effect is suggested to be driven by the anti-inflammatory properties of exercise and diet on both systemic and local inflammation. Such findings are described in other studies, where moderate to severe, non-obese asthma patients presented a decrease in sputum eosinophil cell count and reduction in asthma symptoms after 12-weeks of aerobic training 1 hour weekly [4].

One reason for the major improvements on e.g. asthma outcome in clinical trials can be attributed to worse baseline characteristics and thus greater opportunity for achieving improvement. Studies have reported that patients with the highest degree of airway inflammation had the greatest improvements after exercise intervention [3,4]. Obviously, these differences may be difficult to demonstrate when subjects have limited levels of airway inflammation, e.g. due to well titrated treatment. This suggests that the effect is not only driven by the intervention, but baseline characteristics on the severity of the airway inflammation must be taken into consideration when interpreting the results.

One last, but yet an important question is how we manage to find the best interventions that are feasible and achievable for patients beyond the supervised intervention period. The EFFORT study was followed up after 1 year and found that VO₂max regressed to pre-intervention levels and there were no longer any significant between-group differences in asthma control [16]. It can be discussed whether or not implementing high-intensity interval training to this group of patients is unrealistic, and future studies are warranted in order to explore, why diet and exercise interventions are difficult to maintain despite improved endpoints.

In conclusion, the combined effect of a healthy lifestyle with both anti-inflammatory dietary properties and regular exercise is beneficial and improves asthma outcomes in obese and probably also non-obese asthma patients. If behavioral interventions are implemented to a non-pharmacological strategy in regular asthma treatments, adult asthma patients will be able to reduce asthma symptoms and improve quality of life after only a few months of intervention.

Further follow-up studies would be useful

when developing preventive and clinical recommendations for asthma rehabilitation.

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