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Review Article

Asthma and Physical Activity

Roldan E* and Munoz B
Department of Sports Medicine, Consultant Politécnico Colombiano Jaime Isaza Cadavid and Head of the Physical Activity and Health Research Group-SIAFYS, Medellin, Colombia

***Corresponding author:** Roldán E, Facultad de Educación Física, Recreación Y Deporte, Politécnico Colombiano Jaime Isaza Cadavid, Medellín, Colombia

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Abstract

Asthma is a high prevalence disease all around the world that compromise mainly children. It is cause of increased health cost and diminishes quality of life both in patients and in their families. Sedentary lifestyle is a risk factor in asthma; therefore, exercise gives some benefits to the asthmatic patient. However, 80% of asthmatics suffer Exercise-Induced Asthma (EIA), and that difficult exercise performance at the level required to get significant physiologic changes. The aim of this review is to discuss the benefits and risks of physical activity in asthmatics with respect to the Exercise-Induced Asthma (EIA), Exercise-Induced Bronchospasm (EIB), and swimming, training high-level athletes and end up with some recommendations for physical training in asthmatics

Keywords: Asthma; Physical activity; Exercise; Exercise-induced bronchoconstriction

Abbreviations

EIB: Exercise-Induced Bronchoconstriction; VO2max: Maximal Oxygen Consumption; EIA: Exercise-Induced Asthma

Introduction

Asthma is now one of the commonest chronic disorders in the world and its prevalence has increased very considerably in recent decades. The available data suggests that in most parts of the world, asthma prevalence is continuing to increase or remaining stable [1].

In Latin American countries, the prevalence of asthma ranged from 5.5 % to 28 % in children aged 13-14 years and from 4.1 % to 26.9 % in children aged 6-7 years [2].

The impact in quality of lifestyle of this illness is very important because those children have difficulty to do common activities like run, jump and play, because 80% of asthmatic suffers EIB [3]. That is the reason of why these children do not practice sports, also have limitation to assist in the physical activity classes, and added to asthma crisis, causes retard of academic performance. Besides, diminishes quality of life in the patient´s family because of time invested in child care and medication cost [4]. Even, it is well known that asthmatic children suffering from EIA will become passive and participate at a low level in physical activity and play [5].

There is a direct relation between poor physical activity practice and increased asthma prevalence in children, and that makes that sedentary lifestyle be considered a risk factor in asthma [6]. In a Systematic Review, the authors come to the following conclusion: "The available evidence that Indicates possible physical activity is a protective factor against asthma development. The heterogeneity Suggests that possible effects remain relevant hidden in critical periods of age, sex Differences, or extremes of levels of physical activity (e.g. sedentary) "[7].

On the other hand, they have found very much benefits of exercise in asthmatic population: improve in neuromuscular coordination and self-confidence; diminish in oxygen consumption in sub maximal exercise; increased expiratory ventilation that reduces EIB; diminish dyspnea perception because the strength of respiratory muscles, and also reduces hospitalization events [8,9]. A possible physiological explanation for these benefits, it could be that exercise training increases the efficiency of the respiratory system: and therefore spend less energy to breathe. Even, respiratory muscles gain more strength to support the work they have to do in an asthma attack. In a recent research has found that aerobic exercise training you reduce bronchial hyper-responsiveness, serum pro-inflammatory cytokines and asthma quality of life in Patients with Asthma [5,10].

This improvement is with the moderate-intensity exercise training (e.g. running or cycling) and it can be beneficial for allergic inflammation: these data open a new door on the possibility for exercise therapy for asthmatics is a comprehensive part of the prevention and therapy strategies for asthmatics. However, it has been shown that physical training programs in asthmatics improve cardiovascular fitness, but do not improve baseline lung function or bronchial hyperresponsiveness5 and a high percentage of asthmatics can do EIB/EIA, possibly by increased ventilation at high intensities [11]. Therefore the purpose of this review is to speak the exercise-induced asthma (EIA), Exercise-Induced Bronchospasm (EIB), swimming training, Asthma in high performance athletes and end with some recommendations when a physical training program is conducted in asthmatic people, fundamentally in children.

Exercise-Induced bronchoconstriction (EIB)

It is defined as a reversible obstruction of the bronchial airway presented after or during exercise. Previously, the terms exercise-induced asthma (EIA) and Exercise-Induced Bronchospasm (EIB) have been used interchangeably; however, some authors consider 2 separate entities that should be treated as such. EIA describes patients who have underlying asthma, and exercise is a trigger that exacerbates their asthma [12]. The term exercise-induced asthma is not widely used currently because exercise is not an independent risk factor for asthma but a trigger of bronchoconstriction in underlying asthma. It includes patients without chronic asthma but with bronchoconstriction associated with exercise (general populations with prevalence ranging between 8% and 20%) and patients with

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chronic asthma in which exercise induced bronchoconstriction (40% to 90% of asthma patients) [13].

The EIB occurs in 40% of people with atopic dermatitis and allergic rhinitis. It has a high prevalence (55%) in athletes, mainly in the Cross Country Ski and 12% in basketball [14].

The EIB leads to self-restriction of games and physical activity in asthmatics, and that means, a child with poor physical condition with impaired motor development, an increased risk of obesity and psychological disorders such as low self-esteem, poor group relations, nonparticipation in many common activities, and therefore a deterioration of the quality of life [15].

The EIB occurs when due to exertion, ventilation increases, and upper airways are not able to warm and humidify the air entering the bronchi, producing degranulation of mast cells, which release histamine, which triggers hyper responsiveness in airways and broncho-constriction. The bronchial epithelial cells, experimental exposure to a hyperosmolar medium or the cooling-rewarming process is capable of triggering an inflammatory cascade by increasing the expression of various chemokines and cytokines. This findings, have been confirmed also in exercising animals, where inflammatory changes in the airways have been found, how mice, sledge dogs and in experimental studies, suggesting this to be the primary lesion in asthma and EIB [5]. This response can be immediate or delayed. The immediate answer was presented between 6-8 minutes after intense exercise, and decreased lung function is maximum at 15 minutes. Recovery of lung function is between 30-60 minutes post-exercise. The late response occurs in 30% of patients with EIB, is more common in children, and impaired lung function occurs between 6-8 hours after the end of the exercise practice [16].

The coach, physical activity teacher or trainer of the child, can provide important data to the physician to help EIB diagnosis, since most of the time, crisis occur in their presence, and when the child comes to the doctor office, usually, there is no crisis. Therefore, it is important to suspect it, when the child or adult presents with intense exercise: cough, increased sputum, dyspnea, wheezing, excessive fatigue, abdominal pain, chest pain and poor performance.

There are factors that determine the severity of the EIB:

• Pre-existing bronchial hyperactivity.

• The longer duration and intensity of exercise.

• Environmental conditions such as cold, dryness, and pollution. However, the cold is not important when people are healthy and do not have EIB

• The elapsed time since last asthma attack

• Type of exercise, as running, cycling, football, basketball are more asthma crisis propitiator because of its intensity (greater than 75% VO2max), and hyperventilation. Also ice hockey and cross country skiing for the inspiration of cold and dry. by contrast, swimming, martial arts, athletics speed, wrestling, weight lifter, Volleyball, baseball and golf, have less possibility to develop EIB [17].

Swimming training for asthma

Although for many years there was talk of the benefits of swimming for asthmatics, before the 90s, there were few studies that mention swimming as a training method to improve symptoms in these patients [18-20].

In a systematic review they found eight randomized controlled trials (the literature search was conducted to July 2012) with a total of 262 participants with mild to severe stable asthma. They assess the impact of swimming training on asthma. The programmers for six to twelve weeks, involved two to six sessions per week, of 30 to 90 minutes. This review shows that swim training is well tolerated in children and adolescents with stable asthma, with an increase of 9.67 ml/kg/min in VO2max and improvement in lung function measured as FEV1, with a mean difference of 8.07% predicted. There was no evidence of adverse effects on asthma control [21].

The advantage of swimming, consists in that has been considered for many years as a safe and healthy sport activity for children with asthma, due to the humid air inhaled during swimming thus reducing the risk of EIA.5This could prevent the loss of moisture in the airways caused by hyperventilation, which is one of the triggers of the EIA.

In a study conducted with asthmatic children at a university in the city of Medellin, Colombia, was found that children who performed aerobic training in outdoor and heated air (experimental group), significantly improved their quality of life, compared with the control group which did not make any training. In this investigation was also found that in the heated pool there was very few episodes of EIB and in the experimental group decrease: consultations for emergencies, school absence, and the request for help by another person to care for children because asthma and economic expenditure on drugs [22].

In another publication, a considerable increase on cardio-pulmonary fitness, measured in METs (metabolic unit) in a group of asthmatic children who had physical training in swimming pool, compared with the control group, was observed. In addition, they suggest that exercise in a heated pool can be a preventive factor to take into account and avoid stress induced during training crisis, allowing greater intensity and thus further stimulus for better aerobic capacity [23]. The improvement in aerobic capacity in asthmatics, confirmed by two systematic reviews [24,17].

However, there are studies that reported a potential risk of asthma with an increased swimming pool attendance in children. Other studies have demonstrated the association between the variability of chlorinated swimming pools and the prevalence of childhood asthma [5]. In our opinion, the use of a heated outdoor pool might decrease the risk of exposure to chlorine because this is dispersed by the wind.

Asthma in high performance athletes

In 2008, the European Academy of Allergy and Clinical Immunology and the American Academy of Allergy, defined induced asthma Effort, such as that presented by exercise in an asthmatic patient, while the same clinical presentation in individuals without asthma was defined as EIB. However, these definitions are limited as there are different forms of expression and multiple phenotypes of asthma, with different clinical expressions and physiological parameters in the pathological range [25]. Haahtela et al. described two clinical forms of asthma, which have different pathophysiological mechanisms. Classical Asthma, characterized by the early onset in childhood, response to methacholine, atopy and signs of eosinophilic

inflammation of the airways; and a different phenotype with the onset of symptoms during sports career, bronchial responsiveness in eucapnic hyperventilation test and variable association with a topic markers and eosinophilic inflammation of the airways [26].

Aldred et al. suggest that some people have individual allergic to any type of allergen to be transported by air, such as pollen, and therefore are more likely to stimulate the antigen when they exercise, due to increased ventilation during physical exertion [27].

Olympic athletes have highest risk in asthma and allergy, mainly in high endurance sports like swimming, marathon and Winter sports. The increased risk is possibly attributed to high frequency of repeated physical strain and excessive ventilation and exposure to allergens and irritants in swimming pools, respectively [28].

Several hypotheses have been expressed about it. It is suggested that there may be an interaction between environmental factors where the person trains, among which would be the temperature, humidification and air quality, and personal risk factors such as genetic and neuroendocrine determinants. Some, suggest problems in the genes that determine the channels of water in the epithelium, the phenotype would be a person with hyperhidrosis problems, drooling and excessive tearing. Other suggest that a predominance of vagal effect on people trained, might suggest a greater susceptibility to bronchoconstriction mediated parasympathetic activity, which would explain the positive effect of inhaled ipratropium in athletes with EIB. On the other hand, talking about, immune, neuroendocrine problems including inflammatory markers and markers in lung damaged epithelium might be involved in greater individual susceptibility of some athletes that suffer the EIB. However, the Olympic Games show that asthmatic athletes have won very much medals during Olympic Games than athletes, demonstrating that the asthmatic athletes may compete on an equal level with their peers, without asthma [29]. Therefore, it is important to continue researching to clarify which are the mechanisms that make asthma more common in Olympians athletes, and propose relevant preventive and therapeutic measures [30].

Recommendations for a program of physical training in the asthmatic patient

Before prescribing a physical training program to an asthmatic individual, one must take into account the variability of the stages and severity of the disease, since while some are allowed to compete, in others produces a complete inability to exercise. In addition, exacerbations of the disease are different, with some minor, allowing return to training soon, while others end up hospitalized. Also important is the attitude and psychological aspects of the patient relative exercise, it is not surprising the adversity feeling due to the EIB [31].

In our opinion, is important to consider the following exercise tips for persons with Asthma, mostly in children:

• Exercise prescription by sports medicine doctor (mainly when moderate or severe asthma), in terms of frequency, intensity, progression and type of exercise [32].

• The duration of the training session should not be less than one hour Perform a prolonged warming and return to calm (at least 10-15 minutes) [32,33].

• For all patients with EIB, interval or combination warm-up exercise before exercise is recommended [34].

• To achieve physiological adaptations in the body, the exercise program should be at least 3 months duration, but with the possibility of giving continuity to do so indefinitely [17].

• Use Inhaler 10 minutes before exercise, in those suffering from EIB. In mild asthma a combination of an inhaled corticosteroid and a long and rapid-acting β2 agonist used on demand reducing EIB [35].

• Postpone exercise if asthma symptoms are not well-controlled of if you have a cold or respiratory infection [34]. The program should be flexible according to exacerbations of the disease and allow asthmatics may be absent while in the crisis and return when it is controlled.

• Take into account the principles of training provided, including the progressive increase of the load and an appropriate break time [36].

• Use caution in pools enclosed by the chlorine accumulation in the environment. (Possible allergen) [37].

• Restricting exercise in cold or dry air environments. In this case, cover nose and mouth with a mask [38].

• Have the inhaler close in case of any symptom of bronchospasm appears [39].

• It should include breathing exercises (pursed lips). Deconditioning in respiratory muscles causes fatigue and acute exacerbations [39].

• In children, it is important to use games that motivate them to perform the exercise and guarantee the continuity and motivation in the program [39].

• Intensity between 65 to 85% of maximum heart rate controlled heart rate monitor [40]. However there are studies that show good results with intermittent aerobic training program and anaerobic exercises alternated across different gait speeds (walking or running at different peace, team sports) [41].

• A frequency of 3 times per week.

• The duration of the training session should not be less than one hour [39].

Finally, the physical activity is useful in improvement symptoms, pulmonary function and mental health in asthmatic people [42]. Cardiopulmonary exercise and lower extremity muscle strength should be a priority in fitness programs for children with severe asthma. Swimming is often considered the sport of choice for asthmatics and those with a tendency to have EIB due to warm and humid weather [35,37].

Conclusion

Physical Activity is considered an important component in Asthma treatment; however, several factors have to be considered when the exercise program starts, because of risk of EIB. Also, there is high probability in some athletes to suffer bronco spasm secondary to effort, seems to be personal susceptibility, plus high training levels. Because of that, it is mandatory to investigate further more in a

multidisciplinary way, related to asthma and exercise, to enlighten the best way to handle these patients.

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