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The impact of aerobic exercise training on adult asthmatics' airway inflammation, lung function and asthma control: Systematic review

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Abstract

Study aim: To assess how aerobic exercise training affects airway inflammation, lung function, and asthma management in adult asthmatics.

Method: The paper complies with the reporting requirements stated in the PRISMA declaration. RCTs comparing aerobic exercise training regimens versus no intervention were taken into consideration. We searched the online databases (EMBase, CINAHL, Medline, and Cochrane). We searched via several datasets from 2011 to 2018.

Result: In this systematic review, six publications were included. A low-calorie diet, ambiguous aerobic exercise training, indoor cycling, treadmill exercise, breathing exercises, gym membership, intermittent personal training sessions, diet adjustment, and treadmill exercise are among the interventions employed. FEV1 was used to assess the lung's outcome function, while ACQ, ACQ5, and ACQ6 were used to test the asthma control outcome. Breathing methods, nutrition modification, education, and fake workouts and low-calorie meals are some of the interventions for the controls.

Conclusion: The results of the study show that aerobic exercise training improves asthma management and lung function but has no effect on indicators of localized airway inflammation.

Keywords: Aerobic exercise; Asthma; Airway inflammation; Lung function

1. Introduction

One of the most prevalent chronic illnesses is asthma. While most patients find that inhaled anti-asthma medicine works, there are negative effects to these medications (1). Moreover, not every adult who suffers from asthma takes their prescription asthma medicine as directed. This is caused by a number of factors, including cost and side effect anxiety, forgetfulness, and noncompliance (2). This emphasizes the necessity of non-pharmacological asthma treatment methods. Recent research indicates that regular exercise may serve as an alternative to or in addition to medication asthma therapy (3). According to Carson et al. (2013)'s meta-analysis, asthmatic individuals tolerate exercise training (4). It is yet unknown, nevertheless, if consistent fitness training may effectively relieve the symptoms of persistent asthma.

Although earlier trials have only involved obese individuals with asthma, behavioral therapies that include diet and exercise training have been shown to enhance clinical outcomes in asthma. Observational research, however, indicates

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that asthma outcomes are related to food composition, physical activity levels, and asthma outcomes even in the absence of obesity (5,6). This begs the question of whether non-obese persons with asthma can benefit from treatments aimed at improving their sedentary lifestyle and poor nutrition. It has been discovered that exercise training improves airway inflammation, airway hyperresponsiveness (AHR), and asthma management .Nonetheless, the majority of research has relied on low- and moderate-intensity training exercise regimens (7,8).

Children, adolescents, and adults were included in earlier systematic reviews and meta-analyses examining the impact of exercise training on asthma-related outcomes. This provided three distinct groups with varying phenotypes and possible responses to exercise training (4,9,10). The purpose of this study was to investigate how exercise training affected lung function, quality of life, inflammatory biomarkers, and asthma management in a weight-loss program.

2. Method

The PRISMA statement's reporting standards are adhered to in the paper. We considered RCTs that compared training programs for aerobic exercise to no intervention. Studies were also accepted if the sole component of the intervention that separated the two groups was the aerobic activity. Only information comparing the control group to the aerobic exercise training group was retrieved in the event of multiple treatments. Research with sham and placebo control groups were also accepted.

Adults with asthma diagnoses were the study participants. Research involving people with physician-diagnosed asthma‖ who did not have records of a positive bronchial provocation test or reversibility to beta2-agonists qualified for inclusion. Studies involving persons with asthma who received aerobic exercise instruction were considered. All forms of aerobic exercise, including as cycling, stair-stepping, rowing, walking, and running were acceptable, as were both supervised and unsupervised therapies. online databases (Medline, CINAHL, EMBase, and Cochrane) were searched. We looked through databases between 2011 and 2018. The phrases labor capacity, physical, training, rehabilitation, fitness, exercise, and aerobic were employed in a systematic search. Reference lists from recovered papers were examined, and lists from the previous five years' worth of systematic reviews were closely examined. Aerobic exercise training was not explicitly detected by this search. But it found a wide range of exercise research. Based on the above mentioned qualifying requirements, studies were included.

Data was extracted by all authors in a predesigned Google sheet with access for all authors to avoid information missing or duplication. Data extraction form include (Citation, inclusion criteria, intervention, sample size, control intervention, outcome, and main findings).

3. Result and discussion

We included 6 articles in this systematic review (Fig 1). Studies were conducted in 2017 (2 studies), 2014, 2013, 2012 and 2011. Interventions used include; hypo caloric diet and vague aerobic exercise (AE) training; cycling indoors; exercise on a treadmill and breathing techniques; membership at a gym, sporadic personal training sessions, and diet modification; and exercise on a treadmill, instruction. Outcome function of lung was measured using FEV1, and outcome of asthma control measured using ACQ, ACQ5 and ACQ6. Intervention for the controls include; phony workouts and low-calorie diets; breathing techniques; diet intervention; and breathing exercises and education (Table 1).

According to the methodological features of the comparisons, participant assignment was done at random in all six research. Five studies reported adequate allocation concealment. Because participants could not be blindfolded from the exercise training intervention, no study had appropriate blinding protocols. Five (45%) of the included studies had registered procedures that were pre-specified. Every study that was included considered one of the predetermined results for managing asthma.

The results of this comprehensive analysis indicate that AE training improves lung function and asthma management, but has little effect on indicators of airway inflammation. Therefore, the findings suggest that exercise training can effectively manage symptoms even in the absence of decreased inflammation. When determining whether to propose a treatment, it is essential to consider patient-reported outcomes in order to make research patient-centered.

Unlike Carson et al.'s earlier study and meta-analysis (4), we only included individuals who had asthma. This is significant to us since adult and pediatric asthma frequently differ from one another. Haldar et al.'s phenotypic cluster

analysis (7) provided an example of this, describing persons with asthma who fit the late-onset phenotype, which is characterized by low inflammation, and severe symptoms. However, children with asthma frequently had high inflammation, early start of symptoms, and good response to inhaled corticosteroids as a therapy. Compared to Carson et al., who observed no exercise effect on lung function, we discovered an increase in lung function following an exercise intervention, corroborating this assertion (4).

A weight-loss program was implemented for both the control group and intervention group in one of the trials that independently demonstrated a clinically meaningful change in asthma control following a training intervention (11). This raises the prospect that weight-loss therapies involving nutrition and exercise in addition to activity alone may be more successful. The multi-arm trial by Toennesen et al. (12) provides additional evidence for this. It shown that the only group that substantially improved asthma control over the control group was the one that got both diet and high-intensity interval training.

According to study by Toennesen et al., non-obese people with asthma benefit from an 8-week behavioral intervention that includes high-intensity interval exercise together with a low-GI, high-protein diet to enhance asthma management and quality of life. In terms of asthma control and quality of life (Qol), patients in the exercise and diet groups also had modest improvements; however, when compared to changes in the control group, the impact sizes were neither statistically significant nor above the minimally meaningful difference. The results of França et al., 2015 (8) and Mendes et al., 2010 (13) randomized controlled trials pertaining to the effects of exercise training on asthma control, AHR, and inflammation can be compared with the findings of Toennesen et al.'s study (12).

In comparison to patients who underwent the same weight-loss program without exercise training, the França et al. study shows that exercise training in conjunction with a weight-loss program leads to greater weight-loss and improvements in aerobic capacity and strength, which in turn results in better clinical control of asthma and an improved health-related Qol. Along with increases in lung function, vitamin D levels, anti-inflammatory biomarkers, and a decrease in inflammatory mediators, patients who exercised also saw these benefits. These findings bolster the idea that managing weight is crucial for the treatment of asthma in obese individuals (14,15) and show that exercise provides extra anti-inflammatory benefits that help these patients' asthma control.

After three months of first-line weight-loss therapy, participants in the França et al. research who combined exercise with nutritional and psychological support had a 7% drop in body weight and a clinical improvement in their asthma management. Clinical benefits in asthma have also been seen in earlier research (10,15) after a weight-loss program. In the Dias Junior et al. (15) research, patients who used anti-obesity medications lost almost 10% of their body weight after six months, whereas Scott et al. (16) found that patients who used meal replacements, like shakes or liquids, lost roughly 8.5% of their body weight.

According to a 2010 research by Mendes et al., persons with moderate-to-severe persistent asthma benefit from an AE program in terms of improved asthma-specific HRQoL, decreased levels of anxiety and depression, and reduced asthma symptoms. These benefits were correlated with baseline values, indicating that patients who had lower psychosocial baselines at the beginning showed more improvement.

According to Mendes et al.'s 2010 study, patients' physical limits, psychosocial dimensions, frequency of symptoms, and aerobic conditioning all improved exclusively in those who underwent AE. Previous randomized controlled trial assessing these advantages (17) did not involve AE alone; instead, it included patients with COPD and other forms of intervention.

Patients' health related QoL is hampered by insomnia, anger, and anxiety brought on by asthma symptoms. On the other hand, patients' health related QoL is on par with or better than the population average when they are symptom-free (18). There is a substantial link between subjective perceptions of asthma severity and health related QoL, according to several research (18,19). Remarkably, we saw a significant relationship between days without asthma symptoms and improvements in the psychosocial health related QoL domain in the training group.

According to Mendes et al.'s (2010) study, patients' baseline levels of anxiety and depression were greater than those of the general population. Only those who participated in AE shown a decrease in these baseline levels. It appears that increasing physical fitness might lessen patients' dread of an acute crisis without affecting their impression of asthma as a chronic condition, as seen by the drop in state anxiety without affecting trait anxiety seen in training group. Prior research has demonstrated that people with asthma who experience depressive symptoms have worse disease management and lower adherence to prescribed medication (20,21). Mendes et al. found a positive correlation between

the baseline values and the reduction in anxiety and depression levels brought on by exercise training, indicating that patients with higher levels of psychosocial distress might benefit more from aerobic training.

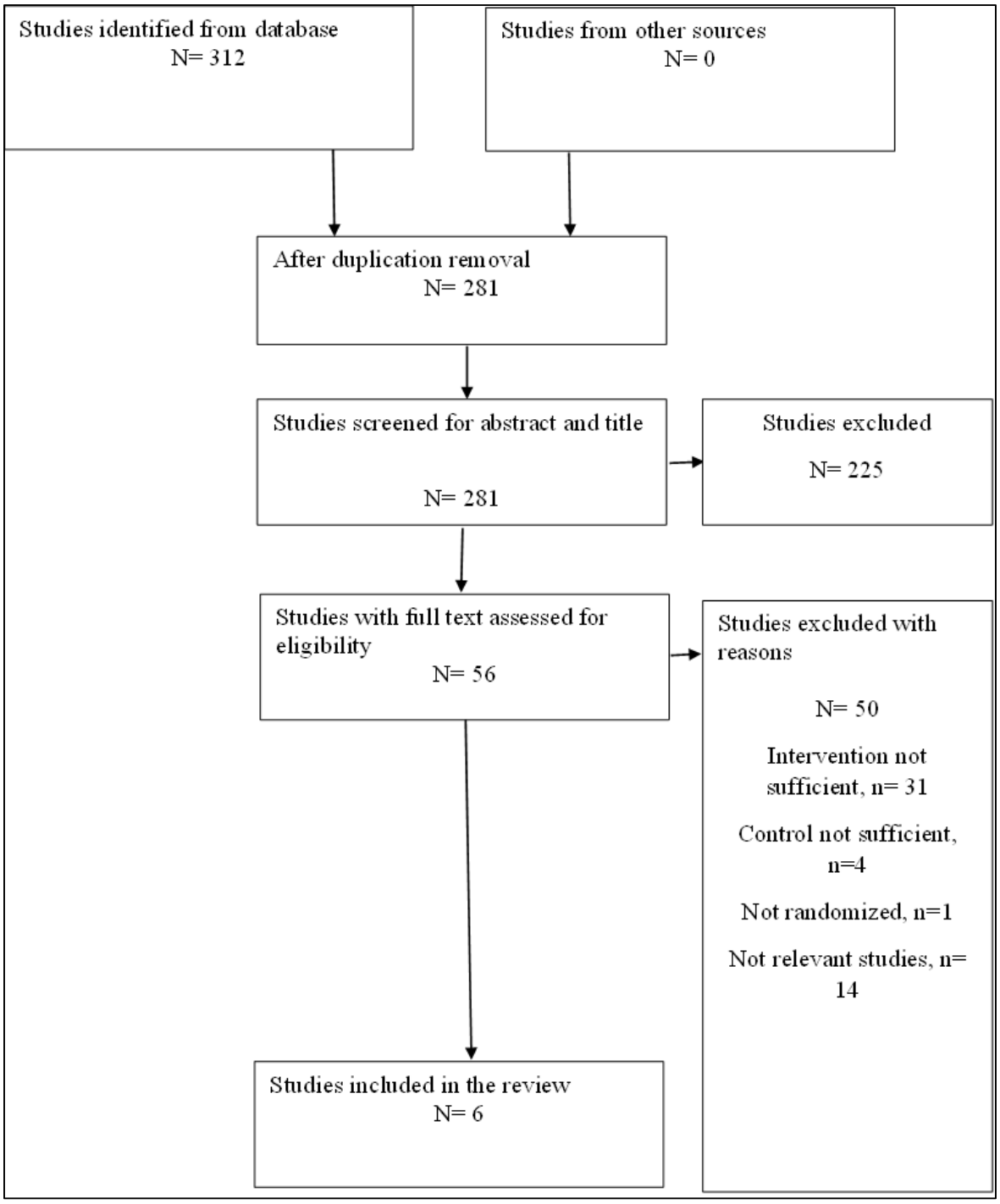

Figure 1 Consort chart of selection process

Table 1 Characteristics of the included studies

Citation	Inclusion criteria	Intervention	Sample size	Control intervention	Outcome (function of Lung and asthma control)
Freitas et al., 2017 (11)	Signs of the airways and ICS preventive care. Based on the 2006 GINA study, the diagnosis was made.	Hypocaloric diet and vague AE training Time frame: three months occurrence: twice a week Sure, supervision 50–75% of maximum oxygen consumption	Intervention, n= 28 Control, n= 27	Phony workouts and low-calorie diets	FEV1 ACQ
Tønnesen et al., 2017 (12)	Airway hyper response or symptoms that are reversible to beta2-agonists.	Cycling indoors Time frame: eight weeks Frequency: thrice weekly Yes, supervision intensity: 90% of maximum intensity may be reached by high intensity interval training.	Intervention, n= 36 Control, n= 38	No intervention	FEV1 Acq-5
França et al., 2014 (8)	Signs of the airways and ICS preventive care. Based on the 2006 GINA study, the diagnosis was made.	Exercise on a treadmill and breathing techniques Time frame: 12 weeks occurrence: twice a week Sure, supervision Intensive training based on the anaerobic threshold is called intensity.	Intervention, n= 30 Control, n= 28	Breathing techniques	FEV1 *ACQ-6*
Scott et al., 2013 (16)	The diagnosis of asthma by the physician and the recording of hyperresponsive airways.	Membership at a gym, sporadic personal training sessions, and diet modification 12 weeks in length; 3 times a week in frequency	Intervention, n= 14 Control, n= 18	*Diet intervention*	FEV1 *ACQ*
Boyd et al., 2012 (22)	Symptoms of the airways and positive beta2-agonist reversibility. based on the NAEPP recommendations from 2002.	Walking Time: Twelve Weeks Frequency: thrice weekly HRmax is the intensity.	Intervention, n= 10 Control, n= 9	*No intervention*	FEV1 *ACQ*
Mendes et al., 2011 (13)	Signs of the airways and ICS preventive care. GINA-report	Exercise on a treadmill, instruction, and breathing techniques Time frame: 12 weeks occurrence: twice a week	Intervention, n= 34 Control, n= 34	breathing exercises and education	FEV1 Not reported

4. Conclusion

According to the study's findings, AE training enhances lung function and asthma control but has no impact on markers of localized airway inflammation. Consequently, the results imply that physical activity can successfully control symptoms even in the absence of reduced inflammation.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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