

Research Article

The effects of detraining following a regular exercise program on plasma resistin concentrations in asthmatic patients

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Abstract

Background: The purpose of this study was to investigate the effects of regular exercise and the following detraining on plasma resistin concentration in patients with asthma. Climate change and reduced rainfall have caused allergies and respiratory diseases to develop in different people, resulting in 8.9% of adults suffering from asthma by 2025, and 400 million by 2050. Asthma prevalence or symptoms increase as a result of the secretion of some adipokines, such as the hormone resistin. Detraining results when there is insufficient training stimulus, causing the loss of training-induced adaptations. Training cessation or insufficient training can alter the detraining characteristics.

Materials and Methods: In the present study, 30 available asthmatics were randomly divided into control and exercise groups. For three months, the exercise group followed a regular training regimen that included three 90-minute sessions each week. Each training session included 60 to 85% of the patients' maximum heart rate on the treadmill or pedaling on an ergometer. The control group did not do any physical exercise in addition to their normal routines throughout the same time period. Blood samples were drawn before the first session, 2 days, and 1 month after the last sessions.


Results: Serum resistin levels were not affected by the three-month regular training program or one-month detraining period. They did not differ significantly in the control group either ($P > 0.05$).

Conclusion: Despite the benefits of regular exercise being beneficial for all individuals, asthma symptoms in asthmatics were relatively reduced, although these changes were not significant.

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1. Introduction

Globally, the World Health Organization (WHO) declares air pollution to be on par with smoking and unhealthy eating habits in regards to the potential threat to human health, and estimates that there are 7 million deaths annually caused by air pollution (1). One of the causes of cardiorespiratory problems is air pollution, and it increases the risk of asthma. The disease of asthma is characterized by chronic inflammation of the airways in the respiratory tract that is the result of genetics and environmental factors (2). The disease includes shortness of breath, wheezing, and coughing, also known as asthma triplets (3).

According to the WHO, approximately 339 million people are suffering from asthma in the world, and by 2025, the number will reach 400 million. In Iran, approximately 10.9% of children and adolescents and 8.9% of adults have asthma, while the world population has reached 339 million, and this figure is expected to reach 400 million by 2025 (4, 5). There are 13.8 million disability-adjusted life years lost annually because of asthma, equal to 18% of the total global disease burden (6). According to the global initiative for asthma (GINA) report in 2017, 1–16% of the population in 112 countries is affected by asthma symptoms. Based on this report, it is estimated that 300 million people worldwide suffer from asthma, which leads to 346,000 deaths every year (7). Tehran was the most polluted city in the world on April 10th, 2022, and pollution levels have increased in Iran's major cities (8).

Clinical research has been undertaken in recent years, resulting in the identification of numerous chemicals and molecules, such as mediators and inflammatory factors, that cause chronic conditions (9, 10). Cytokines are a type of hormone that consists of a collection of water-soluble protein molecules that transmit messages between cells. Adipocyte cells in the human body create adipocytokines, also known as adipokines, which are cytokines that are transported across the body via the bloodstream (9, 11, 12). The prevalence or rise in clinical symptoms of asthma is linked to the release of specific adipokines, such as the hormone resistin (13-15). Certain adipokines involved in appetite suppression, energy balance, insulin sensitivity, energy metabolism, and homeostasis are secreted by adipose tissue, and these adipokines are involved in the development of obesity and related diseases such as diabetes, hypertension, inflammatory diseases, and asthma (16, 17). Asthma is the most prevalent respiratory disease, and the number of asthmatics admitted to hospitals has soared in recent years (3, 18).

Chazenk et al. (2019) conducted a meta-analysis and reported that physical activity is beneficial to mental and physical wellbeing (19). Other studies have shown the advantages of exercise and physical training for asthmatics (18, 20-22).

However, exercise is among the most common triggers of asthma, known as bronchoconstriction due to exercise, despite obesity as one of the causes of the condition. According to Odege and Isa (2020), resistin may reduce the risk of developing asthma, but its impacts on the airways may trigger or aggravate asthma (21). A study in 2007 found that 8 weeks of aerobic exercise did not affect resistin concentrations (23). Furthermore, Jamurtas et al. (2006) found that a sub-maximal training session had no effect on resistance levels for up to 48 hours after ceasing physical exercise (24). Evidence has shown that resistin has a role in the prevalence of asthma, and its levels in asthmatics are substantially greater than in healthy people (13, 25). Additionally, some research has suggested that higher resistin concentrations are linked to higher levels of asthma severity (13, 26, 27). Some studies have also reported the same equal concentrations of resistin in healthy people and people with asthma. Following 8 weeks of physical exercise, resistin concentrations significantly decreased both during exercise (28) and with a proper diet (29). Dehghani et al. (2016) found that after 10 weeks of exercise, resistin concentrations decreased significantly (30), while increasing resistin concentrations after exercise (31), or no change in resistin concentrations (32), was also reported.

There is a discrepancy between the results of previous studies when comparing these factors between asthmatics and healthy individuals. Asthmatics are less likely to exercise than healthy people, and few studies have examined the effects of exercise and physical activity on blood resistin concentrations in asthmatics. Hence, since physical activity plays a significant role in preventing and reducing diseases, this study will examine how 12 weeks of regular exercise impacts the resistin concentrations in people with asthma after exercise and following detraining.

2. Materials and Methods

Subjects

In this study, 30 male adult asthmatics (age = 39 ± 5 years, BMI = 29.06 ± 3 Kg.m⁻²) participated by accessible sampling and were randomly separated into exercise and control groups. Inclusion criteria for the study group were having a history of asthma for at least 2 years. None of the participants reported engaging in any type of exercise (more than once per week) before engaging in the study. The exclusion criteria included medication that alters carbohydrate metabolism, diabetes, a lack of exercise ability, and a history of hypertension or heart disease. A written and verbal explanation of the study's benefits was provided to all asthmatics before they signed a consent form.

Research Design

This study aimed to investigate the effects of regular exercise and the following detraining on plasma resistin concentration in patients with asthma. The research design of this study (Figure: 1) was carried out in three stages. According to the proposal submission of the Parand Branch/Islamic Azad University, this study was approved by the Ethics Committees at the Central Department of Islamic Azad University (No. 73/178599).

Protocol of the Study

The first stage was participant recruitment, where the spirometry test was performed (Minispire, Italy) to evaluate lung function and asthma severity. During a spirometry test, the respiratory system is evaluated by taking a medical history, conducting physical examinations, and testing pulmonary function. Before participating in the spirometry test, all participants were asked to refrain from consuming tea, coffee, and other airways dilator foods. The first blood sampling was after the spirometry test, and then for the second stage, they were divided into two groups of the study. In addition, they were asked to avoid any physical activity 48 hours before each blood sampling. The exercise group participated in regular exercise for 3 days during 12 weeks.

The participants completed a 10-minute warm-up and exercised at a relative maximum heart rate of 60 to 80% controlled by a heart rate monitor (Polar, Finland). The exercise each day involved walking, running, or cycling on an ergometer for 25 to 40 minutes. Following each exercise, they cooled down for 10 minutes. At the end of the second stage was the second blood sampling at 48 hours after the last exercise session. In the third stage, there was a month of detraining for the exercise group, and then, after that, a final blood sample was drawn. All asthmatics in the control group were barred from contributing to any type of exercise participation during the study.

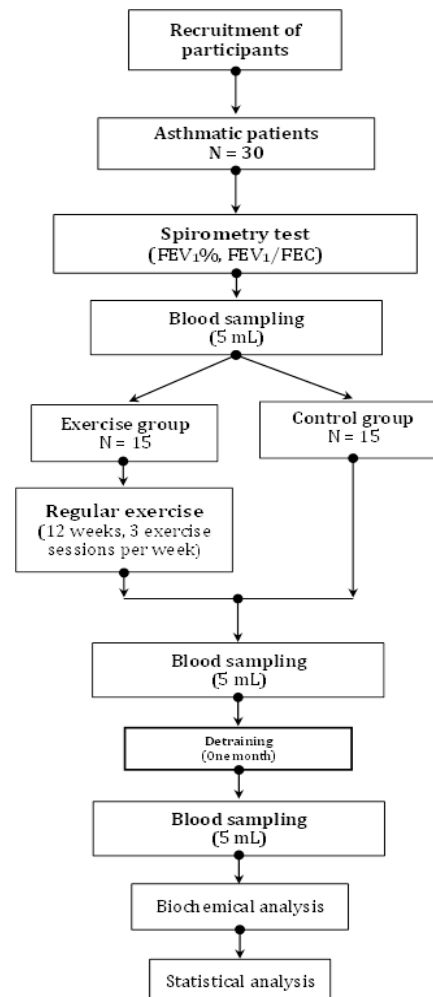


Figure 1: Research design

Laboratory Assessments

To assess the serum concentration of the resistin, blood samples (5 mL) were taken between 8:00 am to 9:00 am after 10 to 12 hours overnight fast from the brachial vein in a sitting position. Following centrifugation and serum separation, blood samples were stored at -80°C to measure serum resistin concentrations. The serum concentrations of resistin were measured by sandwich enzyme-linked immunosorbent assay (Mediagnost, E-50 ELISA kit, Germany) with a sensitivity of 0.012 ng/dL and coefficients of change for endometrial and exogenous changes of 6.8% and 5%, respectively.

Statistic calculations were performed using the IBM SPSS Software version 26 at a significance level of 0.05. Standard deviations (SD) and means were used to represent the distribution of the values of all variables. The Shapiro-Wilk test was used to test the hypothesis that the variables analyzed were normally distributed. An independent sample t-test was used to detect group mean difference at baseline. Pre- to post-training changes were determined by two-tailed t-tests.

3. Results

The serum resistin concentration of the participants during the study is shown in Figure: 2. At baseline, no significant differences were found between the exercise and control groups. After 12 weeks of regular exercise, the resistin serum concentrations in the exercise group decreased 48 hours after the last exercise session when compared with the baseline.

Resistin (ng/dL)	Exercise group			Control group		
	Baseline	After 12-week exercise	After 1 month of detraining	Baseline	After 12-week exercise	After 1 month of detraining
	5.71±1.1	4.33±1.2	5.03±1.3	5.41±0.8	5.23±0.15	5.01±1.3

Figure 1: The changes of the serum concentrations of resistin after 12 weeks regular exercise and the following detraining (N=30).

However, these changes were not significant. The concentrations of serum resistin did not decrease significantly over the 48 hours following the 12-week regular exercise or the baseline levels after a one-month detraining period.

4. Discussion

The current study was designed to determine the effects of regular exercise and the following detraining on serum resistin concentrations in asthmatic patients. Increased mucus production and reconfiguration of the lung epithelium, airway blockage, and airway overreaction are all linked to the development of asthma and its prevalence related to airway inflammation. Inflammation's role in the pathogenesis of asthma has attracted much interest in recent years. Asthma, according to the WHO is a chronic inflammatory illness of the respiratory tract in which certain cells play a key role in its prevalence. Although knowledge of the major mechanisms underlying the prevalence of asthma and inflammatory responses is still lacking, the issue has always been whether asthmatic inflammation is restricted to airway inflammation. As a result, a few studies have indicated a relationship between inflammatory cytokines in the blood and the severity of asthma or the patients' respiratory capacity once they participated in an exercise program regularly (33). A comparison of serum cytokine concentrations in active asthma patients in exercise programs versus inactive patients revealed that sedentary patients have higher serum concentrations of resistin than active patients (34).

Many chemicals in the body, including cytokines, are produced and secreted as a result of exercise. The results of the current study have shown that the serum resistin concentrations after 12-week regular exercise in asthmatics were reduced, which is consistent with the findings of earlier reports (30, 32, 35). Kadoglou et al. (2007) studied the effect of regular exercise on cytokine levels in overweight subjects with diabetes, which showed a significant reduction in resistin concentrations (36). Nakhaei et al. (2016) have also reported a reduction of serum resistin concentrations after exercise (37). Numerous studies have been published regarding physical training and exercise and their effects on the degree of resistance levels, including the type, duration, and intensity of exercise, as well as the effect on the participants' health situation. Obesity, overweight, and other illnesses related to metabolic syndrome raise resistin concentrations (32). Therefore, increasing resistin synthesis and secretion decreases or eliminates metabolic diseases, whereas some results have shown that reducing resistin lowers fasting insulin and glucose concentrations. It can be identified that serum concentrations of resistin in asthmatics are lower in active patients than in sedentary ones. Although the findings were not significant, however, these results support the idea that systemic inflammation has a role in the prevalence or incidence of asthma.

Detraining is identified as the lack of physiological and behavioral exercise-induced adaptation, and it has a wide range of consequences that are dependent on the type of previous exercise performed, such as resistance, aerobic, or mixed exercises. The serum concentrations of resistin in active asthmatics of this study had a non-significant change after one month of detraining. In accordance with the present results, previous studies have shown that resistin concentrations reductions after exercise.

Lin et al. (2008) reported that the serum resistin levels were significantly decreased with detraining (38). Abbasi et al. (2012) have also shown that the resistin serum concentrations were not changed significantly during the detraining period (17). But, Nakhaei et al. (2016) have indicated that serum resistin concentrations increased after the detraining phase (37). Increased adipose tissue around the lungs has a dramatic influence on the mechanical characteristics of the lung, resulting in significantly lower tidal breathing volumes.

Although spirometry is unchanged, a decrease in tidal functional residual capacity causes an increase in airway resistance during tidal breathing, increasing the risk of expiratory flow restriction, particularly during bronchoconstriction or supine position. As a result, the interaction between obesity's mechanical consequences and illness is likely to have substantial therapeutic implications, such as increased respiratory clinical signs in asthmatic patients that are unlikely to be improved by traditional medication.

Meanwhile both asthma and obesity are considered by inflammation, a common inflammatory pathway has been proposed as a plausible explanation for the frequent association of the two diseases (39, 40). In reality, obese people have higher levels of inflammatory indicators such cytokines. In obesity situation, the prevalence of systemic inflammation has been related to an increased risk of cardiovascular disease and type 2 diabetes. Adipocytes and macrophages are among the many cell types found in white adipose tissue. Adipocytes release a number of proteins known as adipokines, such as resistin. Thus, adipose tissue has been considered an active secretory organ that sends out and responses to signals that control hunger, energy expenditure, insulin sensitivity, the endocrine and reproductive systems, bone metabolism, inflammation, and immunity.

5. Conclusion

It is concluded that 12 weeks of regular exercise may affect inflammation in asthma patients. However, the reductions in serum concentrations of resistin were not significant after the 12-week regular exercise and as well as after one month of detraining. The results of the other studies have confirmed the inflammation effectiveness in asthmatics. As a result, no clear explanation for how regular exercise affects resistin concentrations can be proposed, although exercise specificity and target populations appear to be amongst the most important considerations in producing inconsistent results.

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Compliance with ethical standards

Conflict of interest the authors declare that there is no conflict of interest.

Ethical approval the research was conducted with regard to the ethical principles.

Informed consent Informed consent was obtained from all participants.

Author contributions

Conceptualization: D.T.; Methodology: D.T.; Software: D.T.; Validation: D.T.; Formal analysis: D.T.; Investigation: D.T.; Resources: D.T.; Data curation: D.T.; Writing - original draft: D.T.; Writing - review & editing: D.T.; Visualization: D.T.; Supervision: D.T.; Project administration: D.T.; Funding acquisition: D.T.;

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