Medical Laboratory Journal
Online ISSN: 2538-4449
Golestan University of Medical Sciences

Original Article

Effect of Short-Term Continuous Aerobic Exercise with Vitamin D Supplementation on high-sensitivity C-reactive protein, Lactate Dehydrogenase and Creatine Kinase in Asthmatic Women

Maryam Parvizifar
Department of Exercise Physiology, Faculty of Sport Sciences, Shahid Chamran University of Ahvaz, Ahvaz, Iran

Mohsen Ghanbarzadeh
Department of Exercise Physiology, Faculty of Sport Sciences, Shahid Chamran University of Ahvaz, Ahvaz, Iran

Saied Shakerian
Department of Exercise Physiology, Faculty of Sport Sciences, Shahid Chamran University of Ahvaz, Ahvaz, Iran

Heshmatollah Tavakol
Associate Professor of Department of Internal Medicine, School of Medicine, Jundishapur University of Medical Sciences, Ahvaz, Iran

Corresponding author: Maryam Parvizifar

Tel: +989171492025

Email: m.parvizi.114@gmail.com

Address: Faculty of Sport Sciences, Shahid Chamran University of Ahvaz, Ahvaz, Iran

Received: 2020/06/01
Revised: 2020/07/13
Accepted: 2020/09/09

DOI: 10.29252/mlj.15.4.28

ABSTRACT

Background and objectives: As a chronic inflammatory airway disease, asthma can increase level of markers of inflammation and muscle damage. In this study, we aimed to evaluate the effects of short-term continuous aerobic exercise combined with vitamin D supplementation on high-sensitivity C-reactive protein (hs-CRP), lactate dehydrogenase (LDH) and creatine kinase (CK) levels in asthmatic women.

Methods: In this study, 30 overweight (body mass index=26.97± 1.24 kg/m^2) women with mild to moderate asthma were purposefully selected.. The subjects received a vitamin D tablet with a daily dose of 1000 IU for six weeks. The training protocol consisted of two sessions of Balke treadmill test (one session before and one session after the vitamin D supplementation). Blood samples were taken before and immediately after the exercise and before and after vitamin D supplementation. Repeated measures ANOVA was used to evaluate changes in the levels of hs-CRP, CK and LDH.

Results: The variables were not significantly affected by the exercise and vitamin D supplementation ($P>0.05$).

Conclusion: It seems that a single session of short-term aerobic exercise and six weeks of vitamin D supplementation do not significantly affect hs-CRP, CK and LDH levels in asthmatic women.

Keywords: Exercise, Vitamin D, C-Reactive Protein.

INTRODUCTION

Asthma is caused by the release of various mediators and cytokines following pulmonary vasoconstriction and narrowing of the arteries, which lead to enlargement of the right ventricle and impaired cardiac function with increased pulmonary pressure (1). Airway inflammation is usually caused by pathogens or exposure to toxins, pollutants, irritants and allergens. Studies show that obesity is a prelude to asthma and the risk of developing asthma increases with obesity (2, 3). Obesity also causes inflammation in various body parts, including the airways (4). On the other hand, the mechanical effect of obesity on the respiratory system can affect the contractile power of the smooth muscle of the bronchial trunk inducing bronchial hyperreactivity (5). Obesity also negatively affects lung function by reducing the strength of the respiratory muscles, increasing the resistance of the airways and reducing the volume of the lungs (6). On the other hand, research has demonstrated high levels of systemic inflammation in people with asthma and respiratory problems compared to healthy people (2). Several studies have shown the relationship between the levels of inflammatory markers high-sensitivity C-reactive protein (hs-CRP), creatine kinase (CK), lactate dehydrogenase (LDH) and shortness of breath (7). Physical inactivity is also associated with mild chronic inflammation and the development of inflammatory processes in many chronic diseases (8). Therefore, regular exercise can be considered as a basic and important mean of improving the symptoms of asthma as well as the quality of life asthmatic patients (9, 10). Aerobic exercise has beneficial effects on the lungs and blood vessels (11).

Researchers believe that vitamin D supplementation can improve symptoms of asthma (12). Vitamin D can be metabolized by airway cells and exert immunomodulatory effects by controlling expression of cytokines, production of antimicrobial peptides, differentiation of dendritic cells and activation of T cells (13). Most studies have shown the beneficial effects of vitamin D on inflammatory cytokines in chronic diseases (14). In a study by Kang et al. (2018), vitamin D supplementation reduced inflammatory markers in children with asthma (15). Another study found that vitamin D can reduce respiratory infection, prevent asthma attacks and steroid resistance, reduce osteoporosis and control chronic asthma (16). Therefore, the aim of this study was to determine the effect of vitamin D supplementation on some indicators of pulmonary function, hs-CRP, CK and LDH in women with asthma.

MATERIALS AND METHODS

This study was a quasi-experimental and applied study on 30 overweight (body mass index=26.97± 1.24 kg / m^2) females with mild to moderate asthma. These subjects had mild to moderate bronchial asthma with a baseline capacity of 3.23±0.9 per minute (at the discretion of a physician) for at least two years. In addition, at least three months had passed since the subjects last experienced a relapse. The research was approved by the ethics committee of Shahid Chamran University (code: Ir.medilam.rec.1396.0240377881).

Fasting blood samples were taken in four stages: before and immediately after the exercise and before and after vitamin D supplementation. Serum was separated by centrifugation at 3,500 rpm and was placed at -70 °C until analysis. Serum level of hs-CRP levels was measured using a commercial enzyme-linked immunosorbent assay (ELISA, Biomerica, Germany). Serum levels of CK and LDH were measured using Pars Azmoun kits (Iran) and spectrophotometry.

Inclusion criteria included having mild to moderate asthma for at least two years, no asthma attack in the past three months, lack of vitamin D deficiency, age range of 40-50 years, not having regular activity in the last six months, not taking vitamin D supplements in the last six months and no history of cardiovascular disease, high blood pressure and musculoskeletal disorders. Unwillingness to continue participation in the study, participating in sports activities outside the study protocol, experiencing an asthma attack or recurrence during training, hospitalization, inability to perform deep tail maneuvers and changing the dose of medication outside the doctor's prescription were considered as the exclusion criteria.

Ambient temperature fluctuated between 22 and 24 °C. First, the subjects warmed up for 10 minutes. Subjects received a vitamin D tablet with a daily dose of 1000 IU for six weeks (12). After six weeks of vitamin D supplementation, the Balke treadmill test was performed again. Blood samples were taken from the subjects before and after the Balk test. Table 2 describes the details of the Balke treadmill test.

The exercise intensity was set based on the target heart rate. The maximum oxygen consumption (VO_2max) of the subjects was indirectly calculated using the following formula: VO_2max = 1.38 (time) +5.22. Table 1 shows the details of the Balke test.

Collected data were expressed as mean ± standard deviation. Data analysis was performed in SPSS software (version 23) and Microsoft Excel (2016). Normality of the data was investigated using the Shapiro-Wilk test. Repeated measures ANOVA was used to analyze the data. All statistical studies were carried out at significance level of 0.05.

Table 1- Details of the Balke treadmill test performed by women with asthma

Step	Time (min)	Gradient (%)	Speed (km/h)
1	0-1	0	5.5
2	1-2	2	5.5
3	2-3	3	5.5
4	3-4	4	5.5
5	4-5	5	5.5
6	5-6	6	5.5
7	6-7	7	5.5
8	7-8	8	5.5
10	8-9	10	5.5
11	10-11	11	5.5
12	11-12	12	5.5
13	12-13	13	5.5
14	13-14	14	5.5
15	14-15	15	5.5

RESULTS

Table 2 presents the characteristics of the study subjects.

Based on the results, serum levels of hs-CRP, LDH and CK did not change significantly after vitamin D supplementation and the exercise training compared to pretest (Table 3).

Table 2- Physical and anthropometric characteristics of the subjects

Variable	Mean ± standard deviation
Age (year)	48.88 ± 2.57
Height (cm)	165.50 ± 16.43
Weight (kg)	75.75 ± 4.26
Body fat percentage	25.00 ± 4.19
Body mass index (kg/m^2)	26.97 ± 1.24
VO_{2max} (ml/kg/min)	25.98 ± 2.01

Table 3- Comparison of serum levels of hs-CRP, CK and LDH in different study stages

Test steps / Indicators	Sampling stages				P-value
	Baseline	After performing the Balk test and before taking vitamin D supplement	Before performing the Balke test and after taking vitamin D supplement	After performing the Balke test and taking vitamin D supplement	
hs-CRP	0.87±0.03	0.86±0.12	1.00±0.02	1.20±0.12	0.08
CK	73.93±4.10	76.90±3.3	68.12±4.01	70.6±4.25	0.11
LDH	206.25±12.04	219.64±23.11	204.30±14.69	218.10±9.98	0.79

DISCUSSION

Our results show that serum levels of hs-CRP, CK and LDH did not change significantly after the intervention (17). Inconsistent with our findings, Vahdatpour et al. (2016) reported that an acute extraverted exercise session increased muscle damage and inflammatory indices (hs-crp, CK and LDH) in overweight girls (18). Muscle cell damage and membrane disruption leads to an increase in the serum concentration of CK and LDH (19). Gaeini et al. claimed that the inflammatory markers do not increase after exercise and sedation (20). Black et al. also reported that running on a treadmill at 60-85% of VO_2max results in an increase in the inflammatory indices (21). Inconsistent with our findings, Choi et al. (2013) reported that high-intensity exercise significantly increased CK and LDH levels (22). In the present study, the levels of inflammatory indicators did not change significantly after aerobic activity and vitamin D supplementation. A study by Dadrass et al. (2019) showed that vitamin D supplementation following resistance exercise decreased CRP in men with type 2 diabetes (23). Another study found that taking vitamin D and calcium supplements along with vibration exercise reduced CK and hs-CRP levels in male mice (24). Another study reported that eight weeks of vitamin D supplementation and exercise could reduce inflammatory and muscle damage indices in mice (25). In a study by Saremi and Parastesh, 12 weeks of aerobic exercise improved lung function in obese men, which was associated with a reduction in inflammatory markers (26). These discrepancies may be related to the differences in the type of exercise, length of the training period, measurement method and the conditions that affect the inflammatory markers (27).

CONCLUSION

The findings indicate that the levels of inflammatory and muscle damage indices are not affected by short-term aerobic activity and six weeks of vitamin D supplementation.

ACKNOWLEDGMENTS

This article is based on a dissertation approved by the Shahid Chamran University of Ahvaz. We would like to express our sincere gratitude to all those who have contributed to this study.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding publication of this article.

REFERENCES

1. Patel S, Ram U, Ram F, Patel SK. *Socioeconomic and demographic predictors of high blood pressure, diabetes, asthma and heart disease among adults engaged in various occupations: evidence from India*. J Biosoc Sci. 2020 ;52(5):629-649. [DOI:10.1017/S0021932019000671] [PubMed] [Google Scholar]

2. Aghasafari P, George U, Pidaparti R. *A review of inflammatory mechanism in airway diseases*. Inflamm Res. 2019 ;68(1):59-74. [DOI:10.1007/s00011-018-1191-2] [PubMed] [Google Scholar]

3. Gold DR, Damokosh AI, Dockery DW, Berkey CS. *Body-mass index as a predictor of incident asthma in a prospective cohort of children*. Pediatric pulmonology. 2003;36(6):514-21. [View at Publisher] [DOI:10.1002/ppul.10376] [PubMed] [Google Scholar]

4. Saremi A. *The Effect of 12 weeks of aerobic training on lung function and serum leptin levels in obese men.* scientific journal of ilam university of medical sciences. 2014;22(1):139-46. [Google Scholar]

5. Cvejoska-Cholakovska V, Kocova M, Velikj-Stefanovska V, Vlashki E.*The Association between Asthma and Obesity in Children–Inflammatory and Mechanical Factors.* Open access Macedonian journal of medical sciences. 2019; 7(8), 1314. [DOI:10.3889/oamjms.2019.310] [PubMed] [Google Scholar]

6. Dixon A, Peters U. *The effect of obesity on lung function. Expert review of respiratory medicine*. 2018; 12(9), 755-767. [DOI:10.1080/17476348.2018.1506331] [PubMed] [Google Scholar]

7. Khoo AL, Chai LY, Koenen HJ, Sweep FC, Joosten I, Netea MG, et al. *Regulation of cytokine responses by seasonality of vitamin D status in healthy individuals.* Clin Exp Immunol. 2011 ;164(1):72-9. [View at Publisher] [DOI:10.1111/j.1365-2249.2010.04315.x] [PubMed] [Google Scholar]

8. Flynn MG, Markofski MM, Carrillo AE. *Elevated Inflammatory Status and Increased Risk of Chronic Disease in Chronological Aging:* Inflamm-aging or Inflamm-inactivity? Aging Dis. 2019 1;10(1):147-156. [DOI:10.14336/AD.2018.0326] [PubMed] [Google Scholar]

9. Riahi S, Maleki M, Riyahi F, Mousavi H. *Asthma and Exercise Activity; a Systematic Review Study*. Health Research Journal. 2017; 2(1):57-66. [DOI:10.18869/acadpub.hrjbaq.2.1.57] [Google Scholar]

10. Asl Mohammadi Zadeh M, Ghanbarzadeh M, Habibi A, Nikbakht M, Shakeriyan S, Baghernia R, et al. *Effects of exercise with lower and upper extremities on respiratory and exercise capacities of asthmatic patients.* Koomesh. 2013;15(1):89-101. [Google Scholar]

11. Ferdowsi MH, Saiiari A, Valizadeh R, Gholamie A. *The effect of eight week aerobic exercise on airway trachea indexes (FEV1, FVC, FEV1. FVC & FEF25-75) and vo2max level in overweighed male students of Ahvaz Payam Noor University*. Procedia-Social and Behavioral Sciences. 2011;15:2848-52. [DOI:10.1016/j.sbspro.2011.04.201]

12. Rooney MR, Harnack L, Michos ED, Ogilvie RP, Sempos CT, Lutsey PL. *Trends in Use of High-Dose Vitamin D Supplements Exceeding 1000 or 4000 International Units Daily*, 1999-2014. JAMA. 2017 20;317(23):2448-2450. [DOI:10.1001/jama.2017.4392] [PubMed] [Google Scholar]

13. Ramos-Martínez E, López-Vancell MR, Fernández de Córdova-Aguirre JC, Rojas-Serrano J, Chavarría A, et al. *Reduction of respiratory infections in asthma patients supplemented with vitamin D is related to increased serum IL-10 and IFNγ levels and cathelicidin expression*. Cytokine. 2018 ;108:239-246. [View at Publisher] [DOI:10.1016/j.cyto.2018.01.001] [PubMed] [Google Scholar]

14. Neyestani TR, Nikooyeh B, Alavi-Majd H, Shariatzadeh N, Kalayi A, Tayebinejad N, et al. *Improvement of vitamin D status via daily intake of fortified yogurt drink either with or without extra calcium ameliorates systemic inflammatory biomarkers, including adipokines, in the subjects with type 2 diabetes*. J Clin Endocrinol Metab. 2012 ;97(6):2005-11. [PubMed] [Google Scholar]

15. Kang Q, Zhang X, Liu S, Huang F. *Correlation between the vitamin D levels and asthma attacks in children: Evaluation of the effects of combination therapy of atomization inhalation of budesonide, albuterol and vitamin D supplementation on asthmatic patients.* Exp Ther Med. 2018 ;15(1):727-732. [DOI:10.3892/etm.2017.5436] [PubMed] [Google Scholar]

16. Razavi Majd Z, Nazarali P, Hanachi P, Kordi M. *Effect of a course of aerobic exercise and consumption of vitamin D supplementation on respiratory indicators in patients with asthma.* Qom University of Medical Sciences Journal. 2012; 6(4):74-80. [Google Scholar]

17. Wu AC, Tantisira K, Li L, Fuhlbrigge AL, Weiss ST, Litonjua A; *Childhood Asthma Management Program Research Group. Effect of vitamin D and inhaled corticosteroid treatment on lung function in children*. Am J Respir Crit Care Med. 2012 15;186(6):508-13. [DOI:10.1164/rccm.201202-0351OC] [PubMed] [Google Scholar]

18. Vahdatpour H, Shakrian S., Alizadeh A. and Tabatabai R. *Short-term effect of ginger supplementation on hs-CRP and serum creatinine kinase in response to extraversion and dehydration of overweight girls*. Jundishapur Journal of Medical Sciences. 2016 ;15(5):542-550. [View at Publisher]

19. Tanabe Y, Chino K, Ohnishi T, Ozawa H, Sagayama H, Maeda S, et al. *Effects of oral curcumin ingested before or after eccentric exercise on markers of muscle damage and inflammation.* Scand J Med Sci Sports. 2019 ;29(4):524-534. [View at Publisher] [DOI:10.1111/sms.13373] [PubMed] [Google Scholar]

20. Gaeini a, Hashemi n, Kordi m, Abbasi d. *effect of physical fitness on responses of inflammatory factors in patients with metabolic syndrome and healthy persons after an exhaustive exercise*. 2010; 18(3): 161-174. [Google Scholar]

21. Black CD, Herring MP, Hurley DJ, O'Connor PJ. *Ginger (Zingiber officinale) reduces muscle pain caused by eccentric exercise*. J Pain. 2010 ;11(9):894-903. [View at Publisher] [DOI:10.1016/j.jpain.2009.12.013] [PubMed] [Google Scholar]

22. Choi M, Park H, Cho S, Lee M. *Vitamin D3 supplementation modulates inflammatory responses from the muscle damage induced by high-intensity exercise in SD rats.* Cytokine. 2013 ;63(1):27-35. [View at Publisher] [DOI:10.1016/j.cyto.2013.03.018] [PubMed] [Google Scholar]

23. Dadrass A, Mohamadzadeh Salamat K, Hamidi K, Azizbeigi K. *Anti-inflammatory effects of vitamin D and resistance training in men with type 2 diabetes mellitus and vitamin D deficiency: a randomized, double-blinded, placebo-controlled clinical trial*. J Diabetes Metab Disord. 2019 24;18(2):323-331. [DOI:10.1007/s40200-019-00416-z] [PubMed] [Google Scholar]

24. Naghii MR, Darvishi P, Ebrahimpour Y, Ghanizadeh G, Mofid M, Hedayati M, et al. *Effect of combination therapy of fatty acids, calcium, vitamin D and boron with regular physical activity on cardiovascular risk factors in rat.* J Oleo Sci. 2012;61(2):103-11. [DOI:10.5650/jos.61.103] [PubMed] [Google Scholar]

25. Batatinha HAP, Rosa Neto JC, Krüger K. *Inflammatory features of obesity and smoke exposure and the immunologic effects of exercise*. Exerc Immunol Rev. 2019;25:96-111. PMID: 30753132. [PubMed] [Google Scholar]

26. Saremi A, Parastesh M. *The Effect Of Weight-Loss Program On Lung Function And Systemic Inflammation In Obese Men.* Yafteh Journal. 2010;112(8):3045-52. [Google Scholar]

27. Carrillo AE, Flynn MG, Pinkston C, Markofski MM, Jiang Y, Donkin SS, et al. *Vitamin D supplementation during exercise training does not alter inflammatory biomarkers in overweight and obese subjects*. Eur J Appl Physiol. 2012 ;112(8):3045-52. [DOI:10.1007/s00421-011-2279-3] [PubMed] [Google Scholar]

How to Cite:
Parvizifar M, Ghanbarzadeh M, Shakerian S, Tavakol H[Identification of Mycobacterium tuberculosis and Rifampin Resistance in Pulmonary and Extra-pulmonary Clinical Specimens Using the Gene Xpert MTB/RIF Assay]. mljgoums. 2021; 15(4):28-32 DOI: 10.29252/mlj.15.4.28