Rev Port Pneumol. 2017;xxx(xx):xxx-xxx

revista portuguesa de
PNEUMOLOGIA
portuguese journal of pulmonology

www.revportpneumol.org

BRIEF COMMUNICATION

Comparison of lung diffusing capacity in young elite athletes and their counterparts

B. Lazovic[a,f,*], M. Zlatkovic-Svenda[b,f], J. Grbovic[c], B. Milenković[c,f], S. Sipetic-Grujicic[d,f], I. Kopitovic[e], V. Zugic[c,f]

[a] *University Clinical Hospital Center ''Zemun'', Pulmonology Unit, Serbia*
[b] *Institute of Rheumatology, School of Medicine, Belgrade, Serbia*
[c] *Clinic for Lung Disease, Clinical Center of Serbia, Belgrade, Serbia*
[d] *Institute of Epidemiology, Faculty of Medicine, Serbia*
[e] *The Institute for Pulmonary Diseases of Vojvodina, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia*
[f] *University of Belgrade School of Medicine, Belgrade, Serbia*

Received 25 April 2017; accepted 28 September 2017

KEYWORDS
Athletes;
Diffusing capacity;
Transfer coefficient

Abstract
Background: The influence of exercise on the pulmonary function is controverse, some studies have reported no sports influence, while the others have found positive correlation.
Aim: To evaluate and compare the sports influence on pulmonary function: spirometry (VC, FVC, FEV1, FEV1/FVC), lung diffusing capacity (DLCO) and coefficient of the CO gas transfer (KCO) in two elite athletes groups and healthy sedentary controls.
Method: Equally divided into aerobic and anaerobic group, 60 elite athletes were recruited, as well as 43 age-matched, healthy sedentary controls. All of the participants performed basic anthropometric measurements, spirometry, DLCO and KCO at rest. Kruskal-Wallis one way ANOVA test was used to determine differences between groups; Mann-Whitney *U* test was used for inter-groups differences and Pearson coefficient for pulmonary variables and anthropometric parameters correlation. Statistical analyses were performed using the SPSS computer statistic program, version 20.
Results: No differences were found in pulmonary characteristics (spirometric function values, DLCO and KCO) in athletes and non-athletes at rest, as well as between aerobics and anaerobics. There were no correlations between the anthropometric parameters and the investigated respiratory function tests. DLCO (%) correlated positively with height in athletes playing anaerobic type of sport (karate and taekwondo) ($p = 0.036$; $r = 0.544$), and negatively in sedentary control group ($p = 0.030$; $r = -0.560$). Regarding KCO, no differences were found.

* Corresponding author.
E-mail address: lazovic.biljana@gmail.com (B. Lazovic).

https://doi.org/10.1016/j.rppnen.2017.09.006

Conclusion: Spirometry indices and DLCO are not influenced either by aerobic or anaerobic training type, so benefits of sports on pulmonary indices or DLCO was not confirmed.

Introduction

Single breath carbon monoxide diffusing capacity (DLCO) is one of the most valuable clinical tests for the pulmonary function assessment in clinical medicine and one of the most widely used tests for the pulmonary gas exchange, measuring the inspired and expired carbon monoxide partial pressure difference.[1,2] It reflects alveolo-capillary membrane properties, particularly the movement of oxygen from the alveoli into the red blood cells, demonstrating the capillary gas uptake.[1] In healthy individuals, DLCO is mainly predicted by height, gender and age.

Studies examining pulmonary function and DLCO in athletes are scarce and heterogeneous with some contradictory results. Some studies have shown no significant differences in the respiratory function between physically trained individuals and their age-matched sedentary controls, while others have found larger lung volumes in some particular types of sport, such as swimming.[2]

In order to add information about the influence of sport on DLCO, to define sport disciplines in terms of the health benefit, to document the effects of training on the pulmonary function and eventually add new follow-up measurements in sports, we have investigated the lung diffusing capacity in young elite athletes and their age-matched non-athletic, sedentary controls. Athletes were divided into two groups according to their different sport disciplines which cover two totally divergent ways of training: aerobic and anaerobic.

Materials and methods

Participants

A total of 103 persons were investigated (all men, since there were no women in the examined professional sport disciplines). The sport group included 60 young elite athletes, divided into two groups according to the type of the sport involved: 30 elite football players (aerobics) and 30 karate and taekwondo players (anaerobics), aged (mean (SD)) 20.7 (4.1) and 21.9 (4.3) years, respectively. Control group consisted of 43 age-matched sedentary counterparts, aged 21.5 (3.4) years. Elite athlete was typically described as an 'athlete who is systematically being trained for a minimum of five years and at least 15 hours a week, and has been competing in international level tournaments'. Average training period for athletes was 12.4 (4.3) years with 19.1 (0.4) hours per week for football players and 11.6 (2.4) years and 19.1 (2.1) hours for karate and taekwondo players. Exclusion criteria were: past or current smoking, as well as any known chronic respiratory or cardiovascular disease. None of the athletes suffered from exercise-induced asthma, according to self-reports. Control group participants were not routinely engaged in any type of sport.

Ethical approval

The research protocol was approved by Institutional Review Board for medical ethics and complied with the Declaration of Helsinki guidelines. All participants had given written informed consent before the inclusion.

Pulmonary data

All experiments were performed using the same spirometer and analyzed with integrated software (MasterScreen Diffusion, Viasys HealthCare, Germany). The calibration of spirometar was checked on daily basis according to the American Thoracic Society/European Respiratory Society (ATS/ERS) criteria. All participants rested in sitting position for 10 minutes before performing pulmonary function tests (PFT). First, the (relaxed) vital capacity (VC) was determined. After taking a series of normal breaths, the participants exhaled fully, following by a full inhalation. Several maneuvers of VC were performed and in some cases additional measurements were required, until the two highest VCs did not differ by more than 150 ml. After determination of VC, the lung diffusing capacity for carbon monoxide (DLCO) was established as described before. A simulator test was performed daily, and the system was recalibrated before each individual test. During the test, the participants were asked to start with normal respiration, followed by a relaxed exhalation up to the residual volume and a quick inhalation to $\geq$90% VC from the gas source with 0.3% carbon monoxide. During the test participants were asked to exhale after 9–11 s. The interval between trials was $\geq$4 minutes. DLCO was presented unadjusted and as the percentage of the predicted value (% DLCO pred). DLCO per alveolar volume (VA) gives the coefficient of CO transfer (KCO), which was also presented as the predicted percentage KCO (KCO pred). After completion of DLCO measurements, participants were asked to perform maximal forced inspiratory and expiratory maneuvers after a short period of normal breathing to construct flow-volume curves. This procedure was repeated until the criteria set out by the ATS/ERS were met. We measured the following parameters: vital capacity-VC (measured in liters-L), forced vital capacity-FVC (L), forced expiratory volume in the first second-FEV1 (L), Peak