The Effect of Swimming on the Lung Functions in Healthy Young Male Population of Amritsar

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Article history: Received 12 September 2013; accepted 20 October 2013

Abstract

Aim of this research is to study the effects of swimming on the lung functions in adult male population of Amritsar. Many exercise physiologists study the effect of exercise on pathology, and the mechanisms by which exercise can reduce or reverse disease progression. The present study was undertaken to study the effects swimming on the lung functions. Pulmonary function tests (PFTs) of swimming trainees were compared with those of controls. We evaluated PFTs in 50 healthy subjects who participated in a 3 months of swimming plan. Pulmonary function tests were recorded before the commencement of swimming and at the end of swimming and compared the values so obtained with 50 healthy non-swimmers who were chosen as controls. The controls were the physiotherapy students from Khalsa College Amritsar. Both were in the age group of 18-20 years. The PFTs were carried out with a computerized spirometer “Med-Spiror”. The various data was collected, compiled, statistically analysed and valid conclusions were drawn. Higher lung volumes and flow rates were achieved in swimming trainees after their training period, as compared to their own values obtained before their training period and to those of controls. Regular exercise enhances physical capabilities and physiological responses of the human body and also in the lungs. The cause of improved of various respiratory functions and flow rates after swimming duration was better mechanical factors and lower airway resistance influenced during the training period.

Key words: Pulmonary; Expiration; Swimming; Pulmonary Function Test
Introduction

The thoracic and abdominal muscle strength plays an important role in pulmonary functions. Regular swimming produces a positive effect on the lung by increasing pulmonary capacity and thereby improving the functioning of lungs (Vaithiyanadane et al., 2012). Other studies carried among men and women engaged in various sports to compare respiratory functions found that sports person have better level of pulmonary function than sedentary people (Mehrotra et al., 1998). Further evidence shows that water exercise and swimming increase aerobic capacity, improve cardiovascular fitness and quality of life, and produce less airway resistance than do other types of vigorous physical activity, such as running and cycling (Wicher et al., 2010). K.D. Fitch et al. studied the effect of 5 month swimming training on school children with asthma and found improved lung function, and improved posture and fitness (Fitch et al., 1976).

The benefits of swimming are also due to the horizontal position of the body, which provides a more adequate and constant breathing pattern compared with other forms of exercise, and to the high humidity present in pools. Other reasons are Ventilation is restricted in/under water and external pressure is increased. Heat conductance of water is higher than that of air. Diaphragm is exposed to greater pressure during swimming than running (Sable et al., 2012).

Even in asthmatics lungs can function better in swimming because of the horizontal position of the body during swimming, which alters the breathing pathway compared with other forms of exercise (Weisel et al., 2009). A consistent high physical activity including swimming is associated with lower mortality, and delays decline in the pulmonary functions and therefore should be encouraged (Thaman et al., 2010).

Swimmers have greater pulmonary efficiency than non-swimmers. Pulmonary functions are generally determined by respiratory muscle strength, compliance of the thoracic cavity, airway resistance and elastic recoil of the lungs (Vaithiyanadane et al., 2012). The purpose of choosing swimmers instead of any other sports person was that previous studies have shown that effect of swimming is maximum as compared to any other sport on lungs.

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Material & methods

Pulmonary functions tests were done in subjects of age 18 to 20 years. Both swimmers and non-swimmers of the same age group were selected. The swimming trainees were the members of swimmers service club. The controls for this study were taken from the department of physiotherapy, Khalsa College, Amritsar after ethical clearance and informed consent. The subjects chosen for the study were divided into three groups as follows:

Group Ia: It included 50 healthy swimming trainees, at the beginning of their training period, from Service Club, Amritsar, Punjab.

Group Ib: It included the same 50 healthy swimming trainees, as in group Ia, but after their training period of 3 months duration.

Group II (controls): It included 50 healthy physiotherapy students of the same age group and sex, who did not perform regular exercise and were sedentary. Sedentary lifestyle was defined, as per Center for disease control and prevention; as no leisure time physical activity or activities done for less than 20 minutes or fewer than 3 times per week.

For this study parameters include FVC, FEV1, FEV1/FVC and MVV. Written consent was taken and the subject was asked to breath as per the instruction to record the parameters. Smokers, history of abdominal or thoracic surgery, pulmonary, cardiac disorders and neuromuscular disorders were excluded from the study.

Statistical methods

All data were presented as mean ± standard deviation. Pre and post-swimming spirometric values for the dependent variables were analyzed to determine if the distributions were normal using Kolmogorov-Smirnov (K-S) Normality test. A multivariate repeated test was used to compare two experimental and control groups and also within the group.
before and after the swimming training tenure. In addition, dependent t-test was used to verify the differences in pulmonary function test values in experimental and control groups and also within the group before and after the swimming training tenure of same duration. All the statistical analysis was performed with software Graphpad Instat (version 3.05) and the significant level was determined at $P<0.05$.

### Result

Mean values of respiratory parameters with standard deviation in group Ia and group Ib and physiotherapy students taken as controls (group II) are given in Table 1. Comparison of group Ia and group Ib revealed significantly higher values of lung function tests (Table 2). Comparison of group Ib and group II revealed significantly higher values of pulmonary function tests (Table 3).

### Discussion

In the present study, we found that there was a significant increase in the lung function parameters in swimmers when compared to the non-swimmers. This result is in concordance with the studies by Vaithiyanadane et al. (Vaithiyanadane et al., 2012). Mehorta PK et al. and Lakera SC et al. Mehorta PK et al. found that freestyle swimmers exhibited larger VC, FVC, FEV,
and MVV PEFR than controls (Mehrotra, et al, 1997). Our study result is supported by Lakhera et al. study in which swimming leads to improvement in the functional capacity of the respiratory muscles and hence lungs functions significantly improve (Lakhera, et al, 1984). Swimmers had the highest initial lung parameters (FVC and FEV1). In swimming, there is strenuous exercise of the respiratory muscles because of the pressure exerted by water against the chest wall and elevated airway resistance as the result of immersion comprises a conditioning stimulus. Moreover the requirement that inspirations must occur rapidly from functional residual capacity during short intervals between strokes is also fulfilled in swimming (Mahotra, et al, 2013). This could be explained on the basis of respiratory muscle strength, improved thoracic mobility and the balance between lung and chest elasticity which the swimmers may have gained from training in swimmers. Our results were also similar to previously published data on highly trained college swimmers by Magel et al. (Magel, et. al, 1967). Vaccaro et. al found that the FVC and FEV1 values of young male swimmers (13-16 years) were 10- 16% above normal (Vaccaro, et. al, 1980). Good swimmers tend to be above average for lung capacity. Training during adolescence increases vital capacity and total lung capacity due to the development of a broad chest and long trunk and this increased vital capacity helps swimmers maintain their buoyancy. The diaphragm and accessory muscles respond to physical training in the same way as other muscles, and it has been suggested that hypertrophy of the respiratory musculature may account for the higher values of FVC and FEV1 since these depend, in part, on the muscle power available (Stuart, et. al, 1959).

**Conclusion**

In conclusion, the current study has shown that, there is a significant positive relationship between swimming training and pulmonary function in healthy young men. The improvement in pulmonary function could be due to increased thoracic and abdominal muscle strength.

**Acknowledgements**

The authors are really thankful to the department of physiotherapy, Khalsa College, Amritsar for their kind cooperation. We are also grateful to Dr Monika Lalit for helping us in the statistical analysis.

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