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COMPARATIVE STUDY OF PULMONARY FUNCTION TESTS IN YOUNG FREESTYLE SWIMMERS AND SEDENTARY POPULATION

Physiology

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ABSTRACT

Introduction: The present study was undertaken to evaluate the effects of swimming on lung functions. Pulmonary function tests (PFTs) of young freestyle swimmers were compared with those of sedentary individuals. Swimming works the heart, lungs and muscles. This trains the body to use oxygen more efficiently, which is generally reflected in declines in resting heart rate and respiratory rate. The thoracic and abdominal muscle strength plays an important role in pulmonary functions and diffusing lung capacity. So the current study compares to test whether lung functions are modified by swimming.

Material and Methods: The present study was carried out at tertiary health care centre of Mumbai on 60 subjects of age group 18 – 25 years after the informed and written consent by forming 2 groups. The study group, comprising of 30 swimmers, practicing for at least 3 months regularly with one session of 30-60 minutes duration per day and minimum three days in a week. The control group comprised of 30 subjects who are sedentary individuals. Respiratory rate, breath holding time, FVC, FEV1, and FEV1/FVC was measured using computerized pulmonary testing machine. The various data was collected, compiled, statistically analysed and parameters were compared using unpaired t test.

Results: There was a significant difference in the mean and standard deviation of pulmonary function test parameters between two groups with better lung function parameters in swimmers group ($p<0.0001$).

Conclusion: Regular exercise enhances physical capabilities and physiological responses of the human body. The cause of improved respiratory functions and flow rates after swimming was increased pulmonary capacity and thereby improving the lung functioning. Swimmers have greater pulmonary efficiency than non-swimmers which acts as a predictor of performance.

KEYWORDS

Swimming, Exercise, Sedentary

INTRODUCTION:-

Recreational swimming is a good way to relax, while enjoying a full-body workout. Swimming is primarily an aerobic exercise due to the long exercise time, requiring a constant oxygen supply to the muscles, except for short sprints where the muscles work anaerobically. As with most aerobic exercise, swimming is believed to reduce the harmful effects of stress. Swimming can improve posture and develop a strong lean physique, often called a "swimmer's build." Swimming differs in several important aspects from walking or running. One obvious difference entails the expenditure of energy to maintain buoyancy while simultaneously generating horizontal movement by using arms and legs, either in combination or separately. In general, during submaximal exercise like swimming, tidal volume increases and respiratory rate decreases. Aerobic exercise like swimming reduces the ventilator equivalent for oxygen during submaximal exercise and lowers the percentage of the total energy demand attributable to respiration. The reduced oxygen consumption by the ventilatory musculature enhances endurance by reducing the fatiguing effects of exercise on the ventilatory musculature adding oxygen supply for the active muscles1,2.If anyone performs any activity like swimming, he will be successfully shifting his body system from rest to active state. If he continues this activity several times, then his body gets adapted to that particular activity in a better way. Swimming engages practically all muscle groups. The water pressure on the thorax makes the respiration difficult. The respiratory muscles are the vital organ by which oxygen is delivered to the red blood cells and concomitantly carbon dioxide is removed and expelled into the environment and play crucial role during exercise3,4. Many researchers stated that the respiratory system can impact the strength and exercise performance in healthy humans5,6,7,8,9,10. Regular swimming produces a positive effect on the lung by increasing pulmonary capacity and thereby improving the functioning of lungs11. Men and women engaged in various sports to compare respiratory functions found that sports person have better level of pulmonary function than sedentary people12. A consistent high physical activity including swimming is associated with lower mortality, and delays decline in the pulmonary functions and therefore should be encouraged13. Swimming has an immediate effect on improving the indicators of large airway functions like vital capacity (VC), forced vital capacity (FVC), forced expiratory volume at first second (FEV1)14. In this study efforts have been made to evaluate quantitatively the effect of swimming on pulmonary functions. Regular swimming practice should produce a positive effect on the lungs by increasing pulmonary capacity and thereby improving the lung functioning.

MATERIAL & METHODS:

The present study was carried out at the Department of Physiology, Seth GS Medical College & KEM Hospital Mumbai, on 60 subjects of age group 18 – 25 years after the informed and written consent and fulfilling the inclusion criteria. The ethical committee was informed about the nature of the study and a permission to conduct the study was obtained. Subjects with history of any valvular heart diseases, who have undergone any major surgery like abdominal, cardiac and pulmonary, with history of any neuromuscular disorders and skeletal abnormalities were excluded. The subjects chosen for the study were divided into two groups as follows. The study group was comprising of swimmers, practicing for at least 3 months regularly with one session of 30-60 minutes duration per day and minimum three days in a week. The control group comprised of 30 subjects who are sedentary individuals. Prior to testing required pre-test instructions were given and test was properly explained and demonstrated. Respiratory rate and breath holding time was measured. The Pulmonary function tests FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume in one second), FEV1/FVC were measured using computerized pulmonary testing machine manufactured by MEDGRAFICS (CPFS/D USB MedGraphics preVent™ Pneumotach). The data was collected, compiled, statistically analysed and parameters were compared using unpaired t test. A p value less than 0.05 was considered to be statistically significant.

RESULTS:

TABLE1: Comparison of Pulmonary Function Test parameters between Swimmers and Sedentary individuals

	Group	N	Mean	Std. Deviation	P value
Respratory Rate	Subject	30	10.33	0.95	<0.0001
	Control	30	15.10	1.09	
Breath Holding Time	Subject	30	64.47	8.13	<0.0001
	Control	30	47.80	7.41	
FVC	Subject	30	4.68	0.22	<0.0001
	Control	30	4.13	0.28	
FEV1	Subject	30	3.82	0.29	<0.0001
	Control	30	3.28	0.28	
FEV1/FVC	Subject	30	81.23	3.73	<0.0001
	Control	30	79.03	2.71	

The present study shows that among swimmers and sedentary controls, swimmers have significantly decreased Respiratory rate and significantly higher values (P<0.0001) of Breath holding time, Forced vital capacity (FVC), Forced expiratory volume in first second (FEV1). FEV1/FVC was also significantly more in swimmers than controls as shown in **Table 1.**

DISCUSSION AND CONCLUSION:

In our study, there was a significant increase in the lung function parameters in swimmers when compared to the sedentary individuals, thereby confirming that regular swimming has a facilitating effect on the lungs. Similar results have been obtained by other workers in this field[15,16,17,18]. The ability of the individual to inflate and deflate his lungs depends upon the strength of the thoracic and abdominal muscles, posture of the individual and the elasticity of the lungs[19]. Regular swimming practice may tend to alter the elasticity of the lungs and chest wall which leads to improvement in the lung function of swimmers[20]. In the present study, it is observed that there is significant increase in Forced vital capacity (FVC) in swimmers than controls; these findings can be explained on the basis of better endurance of respiratory muscles and increase strength of accessory muscles of expiration. Forced expiratory volume in first second (FEV1) was significantly higher in swimmers than controls and this is in agreement with other earlier studies[21,22]. Our study also shows FEV1/FVC ratio is significantly high in swimmers than sedantary. Such higher value might be due to the beneficial effect of swimming training on pulmonary efficiency. Mehorta PK et al found that freestyle swimmers exhibited larger VC, FVC, FEV, and MVV than controls[23]. This could be explained on the basis of better function of respiratory muscle strength, improved thoracic mobility and the balance between lung and chest elasticity which the swimmers may have gained from regular practice [24]. 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[25]. So this study shows the importance of physical exercise like swimming performed regularly as a hobby or leisure activity helps to improve the pulmonary functions and will lead to a well rounded fitness programme.

REFERENCES

1. Beveqard S. Freschuss & Strandel I. Circulatory adaptation to arm and leg exercise in supine and sitting position. Journal of Applied Physiology 1966; 21: 37-41.
2. Victor L.Katch, Frank L. Katch, William D.Mcardle Exercise Physiology (Energy, Nutrition and Human performance), 6th edition, (LIPPINCOTT WILLIAMS AND WILKINS) 2007, 166-171,478-486.
3. Ratnovsky, A., Elad, D., & Halpern, P. (2008). Mechanics of respiratory muscles. Respiratory Physiology & Neurobiology, 163(1-3),89.doi:10.1016/j.resp.2008.04.019.
4. Amonette, W., & Dupler, T. (2002). The effects of respiratory muscle training on VO2 max, the vantilatory threshold and pulmonary function. Journal of Exercise Physiology, 5 (2), 29-35.
5. Boutellier, U., Büchel, R., Kundert, A., & Spengler, C. (1992). The respiratory system as an exercise limiting factor in normal trained subjects. European 41 Journal of Applied Physiology and Occupational Physiology, 65(4), 347-353.
6. Markov, G., Spengler, C. M., Knöpfli-Lenzin, C., Stuessi, C., & Boutellier, U. (2001). Respiratory muscle training increases cycling endurance without affecting cardiovascular responses to exercise. European Journal of Applied Physiology, 85(3-4), 233-239.
7. Nicks, C., Farley, R., Fuller, D., Morgan, D., & Caputo, J. (2006). The effect of respiratory muscle training on performance, dyspnoea, and respiratory muscle fatigue in intermittent sprint athletes. Medicine & Science in Sports & Exercise. 38 (5), 381.
8. Stuessi, C., Spengler, C. M., Knöpfli-Lenzin, C., Markov, G., & Boutellier, U. (2001). Respiratory muscle endurance training in humans increases cycling endurance without affecting blood gas concentrations. European Journal of Applied Physiology, 84(6), 582-586.
9. Suzuki, S., Yoshiike, Y., Suzuki, M., Akahori, T., Hasegawa, A., & Okubo, T. (1993). Inspiratory muscle training and respiratory sensation during treadmill exercise. Chest, 104(1), 197-202.
10. Volianitis, S., McConnell, A. K., Koutedakis, Y., McNaughton, L., Backx, K., & Jones, D. A. (2001). Inspiratory muscle training improves rowing performance. Medicine and Science in Sports and Exercise, 33(5), 803-809.
11. Vaithiyanadane,V., Sugapriya,G., Saravanan, A., & Ramachandran, C. (2012). Pulmonary function test in swimmers and non-swimmers- a comparative study. Int J Biol Med Res, 3(2), 1735-1738.
12. Mehrotra, P. K, Varma, N., & Tiwari, S. (1998).Pulmonary function in Indian sportsmen playing different sports. Indian J Physiol Pharmacol, 42(3), 412-416.
13. Thaman, R. G, Arora, A. P. K., & Bachhel, R.(2010). Effect of Physical Training on Pulmonary Function Tests in Border Security Force Trainees of India. J Life Sci, 2(1), 11-15.
14. Prateek K Mehrotra, Narsingh Verma, Rajkumar Yadav,Sunita Tewari, Neerja Shukla. Study of Pulmonary Functions in Swimmers of Lucknow city Indian J Physiol Pharmacol 1997; 41(1): 83–86.
15. Cotes JE, Dabbs JM, Hall AM, Lakhera SC, Saunders MJ, Malhotra MS. Lung function of healthy young men in India: contributory roles of genetic and environmental factors.Proc R Soc Lond 1975; B191:413-25
16. Das SK, Ray A. Predicted form of forced vital capacity in school boys. Ind J Physiol Allied Sci 1989;43: 88-92.
17. Kamat SR, Sarma SB, Raju VRK. Indian norms for pulmonary functional observed values, predictive equations and inter correlations. J Assoc Physicians Ind 1977; 25:531-40.
18. Miller GJ, Saunders MJ, Gilson RJC, Ashcroft MT. Lung function of healthy boys and girls in Jamaica in relation to ethnic composition, test exercise performance and habitual Physical activity. Thorax 1977; 32:486-96.
19. Pherwani Asha V., Desai A.G. and Solepure A.B. A study of Pulmonary Function of Competitive Swimmers. Indian Journal of Physiology and Pharmacology 1989; 33 (4):228-232.
20. Newman F, Smalley BF, Thomson ML. A comparison between body size and lung function of swimmers and normal school children. J Applied Physiol. 1961; 156: 9–10.
21. De A.K., 1992; Peak expiratory flow rate in adolescent male swimmers of all India rural swimming meet. Indian J Physiol Pharmacol. 1989; 33(4):228-32.
22. Doherty M, Dimitriou L. Comparison of lung volume in Greek swimmers, land based athletes, and sedentary controls using allometric scaling. Br J Sports Med. 1997; 31:337-341.
23. Mehrotra PK, Verma N, Yadav R, Lewari S, Shukla no study of pulmonary function in swimmers of Lucknow city. Ind,J,Physiol,Pharmacol 1997;47:83-86.
24. Lakhera S C et al, lung function in middle distance adolescent runners.Indian Journal of pysol Pharmacol. 1994, Apr; 38(2):117-20.
25. Shephard, R. J., 1978 "Human physiological work capacity". Cambridge University Press, Cambridge.