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Original Research Paper

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EFFECT OF PHYSICAL TRAINING ON PULMONARY FUNCTION TEST IN YOUNG ADULTS OF A PHYSICAL TRAINING ACADEMY

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ABSTRACT Physical inactivity and low cardio-respiratory fitness are recognized as important causes of morbidity and mortality. Pulmonary function tests help in monitoring the efficacy of physical training. It includes parameters like FEV1, FVC, MVV, PEFR, FEF 25-75. Cardio-pulmonary efficiency tests help to study aerobic conditioning, which includes lung ventilation. Lung ventilation, the most important parameter of physical fitness is controlled by skeletal muscle fitness. There are many studies carried out on defense personals, but very studies about young adults who aspire to take entry in the army, navy or police force. The present study was aimed to evaluate the importance of physical activity in improving strength and endurance of respiratory muscles. So we measured various spirometry parameters (PFT) to find out the cardio-respiratory response and blood pressure to study cardio-vascular response in the individuals who underwent rigorous physical training for 9 months. 30 healthy male subjects between age group of 18-23 years were selected randomly. Before and after training period of 9 months, spirometry and other parameters like height, weight, body surface area were recorded. We got statistically significant improvement in parameters like FEV1, FVC, MVV, PEFR and FEF 25-75. We observed statistically significant reduction in the mean systolic and diastolic resting blood pressure after training. From our results we conclude that physical training like regular aerobic exercise improves lung function parameters and cardiac efficiency. Regular aerobic exercise improves cardio-respiratory fitness.

KEYWORDS : Aerobic exercise, Physical training, FEV1, FVC, PEFR, MVV etc.

INTRODUCTION:

Regular physical activity is an essential component of a healthy lifestyle that helps to keep fit.[1] Physical fitness is the ability to carry out daily tasks with vigor and alertness without undue fatigue. Physical inactivity and low cardio-respiratory fitness are recognized as important causes of morbidity and mortality.[2] Aerobic exercise is physical exercise of relatively low intensity that primarily depending on the aerobic energy-generating process.[3]

Pulmonary function tests help in monitoring the efficacy of physical training. It includes parameters like FEV1, FVC, MVV, PEFR, FEF 25-75. Various cardio-pulmonary efficiency tests help us to study aerobic conditioning which includes lung ventilation. Lung ventilation, the most important parameter of physical fitness is controlled by skeletal muscle fitness. Lung function is an important predictive tool of morbidity and mortality in medical practice. Pulmonary function is a long term predictor of overall survival rates in both genders and can be used as a tool for general health assessment.[4]

There have been many studies carried out on defense personals, but very negligible studies about the young adults who aspire to take entry in the army, navy or police force.

The present study was aimed to evaluate the importance of physical activity in improving strength and endurance of respiratory muscles. So we measured various spirometry parameters (PFT) to find out the cardio-respiratory responses and blood pressure to study cardio-vascular responses in the individuals who underwent rigorous physical training for duration of nine months.

MATERIAL & METHODS:

This prospective study was done from January 2017 to January 2018 after approval from institutional ethics committee of the institute. The study was conducted in career training academy in Pune. The study participants were healthy young adults aspiring to gain entry in army, navy or police force.

The trainees included in the study were from different regions of Maharashtra.

The newly admitted candidates of the academy were screened for the inclusion and exclusion criteria. Those individuals who gave the history of smoking, respiratory illness like bronchial asthma, COPD, pneumonia, history of tuberculosis in past and any cardiovascular disease or history of congenital heart disease, chest or spinal deformity, obesity(BMI>32 kg/m^2) were excluded. 30 healthy male subjects between age group of 18-23 years were finally selected randomly. The individuals who voluntarily agreed to participate in the study were enrolled. The detailed information of project was given and procedure was explained.

After taking written informed consent, general examination and spirometry was done. The parameters recorded were height (stadiometer), weight (standard scale weighing machine), Body Surface Area (Dubois nomogram).[5]

Spirometry was done on computerized spirometry machine Helios 401. It was done in sitting position and in the post-absorptive phase i.e. 4 hours after lunch. The test was simple, non-invasive easy to perform. It was done in two maneuvers. In First maneuver, Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second (FEV_1), Peak Expiratory Flow Rate (PEFR), Forced mid Expiratory Flow Rate (FEF_{25-75}) were recorded. Second maneuver included recording of Maximum Voluntary Ventilation (MVV). Two trials were given to each participant. For each test the best one out of three test readings were taken.

The participants in the study underwent vigorous physical training for duration of 9 months. During the training period, they performed various forms of exercises for 3 hours in the morning and 2 hours in the evening. The exercises were in the form of running, resistance exercises and other moderate to severe exercises.

Again after a period of 9 months, Spirometry readings and all the other parameters were recorded in the same group of subjects under similar conditions.

Statistical analysis:

The results were given as Mean ± Standard Deviation. Comparisons were performed using paired student's t- test. A p-value of less than 0.05 was considered as statistically significant. Statistical software graph pad prism was used for the analysis of data. Microsoft word and Microsoft excel have been used to create text documents and tables etc.

RESULT:

Table no 1: comparison of pre-training and post training baseline characteristics of subjects.

Parameters	Pre-Training Mean ± SD	Post-Training Mean ± SD	P – Value
WEIGHT(Kg)	62.25 ± 10.13	58.21±9.811	<0.0001**
BSA (m2)	1.749 ± 0.1463	1.738±0.1425	0.3618ns
SBP(mm of Hg)	113.9± 11.90	112.6±11.35	0.0103*
DBP(mm of Hg)	68.50± 9.053	67.3±8.778	0.0107*
p values <0.05 : statistically significant*, p values <0.0001: statistically highly significant**, p values >0.05 : not significant SBP- systolic blood pressure, DBP- diastolic blood pressure, BSA- body surface area			

Table no 2: Comparison of pre-training and post training spirometry parameters.

Parameters	Pre-training Mean ± SD	Post-training Mean SD	p-value
FEV1	3.29± 0.44	3.62±0.31	0.0025*
FVC	3.43±0.57	3.88±0.57	0.0145*
PEFR	7.15± 1.89	8.35±1.21	0.0100*
PEF 25-75	5.60±1.42	6.27±1.25	0.0462*
MVV	146±12.75	151.5±9.04	0.0286*
p values <0.05 : statistically significant*, p values <0.0001: statistically highly significant**, p values >0.05 : not significant			

DISCUSSION:

The trainees in the career academy underwent vigorous physical training for duration of nine months. During training period, all the trainees were doing various forms of exercises mainly aerobic exercises like running, resistance exercises.

In the present study, improved respiratory performance was reflected in the spirometry parameters. The parameters like FEV1and FVC are the hallmarks of respiratory performances. We got statistically significant improvement in FEV1and FVC parameters after exercise training. This could be because of regular forceful inhalation and deflation of the lungs for prolonged period that leads to strengthening of respiratory muscles. As an effect of training, there must be an increase in the maximal shortening of the inspiratory muscles which has been shown to improve lung function parameters.[1]

We found statistically significant improvement in the mean values of PEFR and MVV before and after 9 months of physical training. The PEFR 25-75 also showed higher flow rates in post -training period. MVV which depends on strength of the voluntary muscles is an important parameter as it indicates physical work capacity.

The cardio-vascular changes were assessed by studying the blood pressure values before and after training period. We observed statistically significant reduction in the mean systolic and diastolic resting blood pressure after training the training period of nine months. The reduction of blood pressure indirectly indicates vasorelaxation, as regular exercise can restore the loss of endothelium-dependent vasodilation.[6] The mechanisms of physical training induced reduction in blood pressure are related to hemodynamic, humoral and neural factors like reduction in cardiac debt, a drop in total peripheral resistance due to increase in cross sectional area of vascular beds, particularly of skeletal muscles and vasodilatation caused by low levels of norepinephrine, plasma renin activity and a reduction in sympathetic activity.[7,8]

Training improves cardio-vascular, pulmonary and muscular adaptations to exercise by alterations in sympatho-adrenal acceleratory activity, vagally mediated deceleration. Training also leads to increased VO_2 max, increased muscle blood flow accompanied by elevated cardiac output, increased capillarization of muscle tissue and better substrate utilization.[9,10]

CONCLUSION:

From our results we conclude that physical training like regular aerobic exercise improves lung function parameters and cardiac efficiency. Practice of aerobic exercise would benefit those who aim to be in defense, as this would prepare them in overcoming stress by modulating and optimizing sympathetic activities in stressful situations. It can be considered an important lifestyle modification to improve overall lung health and for prevention high blood pressure in healthy adolescents. Regular aerobic exercise improves cardio-respiratory fitness.

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