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Effects of sedentary life style on respiratory rates and peak expiratory flow rate among medical students

Sukanya Badami[1,*], Mahesh Baragundi[2]

[1]Assistant Professor, Dept. of Physiology, [2]Professor & HOD, Dept. of Microbiology, Gadag Institute of Medical Sciences, Gadag, Karnataka

***Corresponding Author:**
Email: sukanya_mahesh@rediffmail.com

Abstract

Introduction: Physical fitness is required not only by athletes for better performance but also by non-athletes for maintenance of physical and mental health. Heavy academic workloads in medical schools make it difficult for medical students to maintain a regular exercise program. Physical Education class provides a great variety of activities and high intensity exercises for students.

Objectives: The current study was undertaken to compare Resting, peak exercise, 5 min after exercise respiratory rates and respiratory rate recovery following Astrand-Ryhming step test and Peak expiratory flow rates (PEFR) between students of Medical Education (ME) and Physical Education (PE).

Methods: Study was conducted on 50 healthy male medical students and 50 healthy age matched male physical education students after completion of 9 months of course in the college. Respiratory rate in cycles/ min was recorded for three times. First before the step test, second immediately from 15 seconds to 30 seconds after the test and third time at 5 min after the test without the knowledge of the subject. Respiratory rates were recorded as RRR, RRE and RR5 respectively. Peak Expiratory Flow Rate (PEFR) in lit/min was recorded using mini Wright's Peak Flow meter.

Results: All the respiratory rates were lower in PE students than ME students and all the differences were statistically highly significant. The increase in respiratory rate at the end of ARST over pretest was significantly lower in PE students (10.7±3.8 cycles/min) than ME students (16.6±5.8 cycles/min). The rise in respiratory rate after exercise was less in PE students than ME students. Percent recovery respiratory rate 5 min after ARST was significantly higher in PE students (75.70%) than ME students (40.96%). The mean PEFR±1SD was more in PE students (569.1±30.8) than ME students (479.8±67.6) and the difference was statistically highly significant.

Conclusion: The present study revealed that the important parameters of pulmonary fitness were significantly better in PE students than ME students. These health beneficial effects can be attributed to the regular physical training schedules of PE.

Keywords: Respiratory Rate, PEFR, Medical Education.

Introduction

Physical fitness is required not only by athletes for better performance but also by non-athletes for maintenance of physical and mental health. Heavy academic workloads in medical schools make it difficult for medical students to maintain a regular exercise program. Physical Education class provides a great variety of activities and high intensity exercises for students. Research findings in the last three decades, have shown that physical inactivity and a negative life style has seriously threatened health and hastened the deterioration rate of human body.(1) Inadequate physical activity and low levels of fitness in adults contribute to the development of obesity, type-2 diabetes mellitus, hypertension, the metabolic syndrome, hypercholesterolemia, myocardial infarction, osteoporotic fractures, depression and some cancers.(2) A sedentary life style is the most prevalent modifiable risk factor for cardiovascular diseases and this is particularly important in view of mounting evidence that physical activity and regular exercise may reduce the risk for the chronic diseases and death especially from coronary heart disease.(1) Aerobic training is responsible for metabolic adaptations that allow more efficient adjustment of energy expenditure during exercise recovery.(3) Sedentary life styles could be associated with less efficient pulmonary functions. Hence, the current study was undertaken to compare important pulmonary fitness parameters between students of Medical Education (ME) and Physical Education (PE).

Materials and Methods

Study was conducted on 50 healthy male medical students and 50 healthy age matched male physical education students after completion of 9 months of course in the college. Permission to conduct the study was obtained from the institutional ethical committee and principals of both colleges.

Inclusion Criteria:

- Healthy male students of medical and physical education.
- Aged between 18-25 years after completion of 9 months study course.

Exclusion Criteria:

Subjects with:

- Cardiovascular diseases
- Respiratory diseases
- Musculoskeletal, Neuromuscular, Endocrine disorders.
- Allergic disorders.

- Alcoholism/smoking habit.
- Chronic infection /disease.
- Acute illness at the time of study.

Details of study were explained and a written consent was taken from subjects.

All the study parameters in both the groups were recorded during morning hours between 9 am to 11 am at room temperature to avoid any possible diurnal variation effect. Subjects were told to report an hour before experiment. They were asked to refrain from heavy meal or drinking coffee/tea, at least for an hour and allowed to take rest for half an hour before the experiment.

Astrand-Rhyming Step test (ARST)[4]: ARST for men requires subjects to step up and down on a 40 cm (16 inch) bench for 5 min at rate of 90 steps/min (22.5 cycles of stepping) or until exhaustion. The procedure of exercise test was explained to the subjects and demonstrated beforehand and subjects were made to take a pretest to allay apprehension.[5]

Respiratory rate in cycles/ min: Respiratory rate in cycles/ min was recorded for three times. First before the step test, second immediately from 15 seconds to 30 seconds after the test and third time at 5 min after the test without the knowledge of the subject. Respiratory rates were recorded as RRR, RRE and RR5 respectively. Percent recovery respiratory rate at the end of 5 min recovery was calculated by using formula,[6]

$$\text{Percent recovery respiratory rate} = \frac{(\text{RRE-RR5})\times 100}{\text{RRE-RRR}}$$

Peak Expiratory Flow Rate (PEFR) in lit/min: Under aseptic precautions, the subject was asked to blow forcefully after deep inspiration into the mini Wright's Peak Flow meter (PEAK FLOW MASTER CIPLA-MUMBAI-INDIA). The calibrations are from 60-800 liters per minute. Three readings were taken in standing position and the best was considered.

Statistical Analysis

Data was analyzed by following statistical methods.

1. Unpaired 't' test.
2. Chi-square test.

All the statistical operations were done through SPSS for Windows (Version 16. Chicago). P>0.05 was considered statistically not significant (NS) and P<0.05 was considered statistically significant (S). P<0.001 was considered statistically highly significant.

Results

Respiratory rate: Table 1, shows the comparison of mean resting, peak exercise, and 5 min after ARST respiratory rates between ME and PE students. All the respiratory rates were lower in PE students than ME students and all the differences were statistically highly significant.

Table 1: Comparison of respiratory rates in cycles/min between students of medical and physical education

Parameter	Medical Education Mean ± SD	Physical Education Mean ± SD	t value	p value	Remarks
RRR	19.3±1.7	17.3±2.3	4.95	<0.001	HS
RRE	35.9±5.3	28.0±5.2	7.48	<0.001	HS
RR5	29.1±3.7	19.9±2.8	13.84	<0.001	HS

HS-Highly significant, RRR-Resting respiratory rate, RRE- Peak exercise respiratory rate, RR5-5 min after ARST respiratory rate.

Table 2, shows that the increase in respiratory rate at the end of ARST over pretest was significantly lower in PE students (10.7±3.8 cycles/min) than ME students (16.6±5.8 cycles/min). The rise in respiratory rate after exercise was less in PE students than ME students. Percent recovery respiratory rate 5 min after ARST was significantly higher in PE students (75.70%) than ME students (40.96%). The recovery of respiratory rate was faster in PE students than ME students.

Table 2: Comparison of increase in respiratory rate at the end of Astrand-Rhyming Step test (ARST) and Percent recovery respiratory rate (Percent RRR) at the end of 5 min recovery after ARST over pre -test between students of medical and physical education

Increase in respiratory rate at end of ARST over pre -test					Percent recovery respiratory rate at the end of 5 min recovery after ARST over pre -test				
Medical Education (RRE-RRR)	Physical Education (RRE-RRR)	t	p	Remark	Medical Education (Percent RRR)	Physical Education (Percent RRR)	t	p	Remark
16.6±5.8	10.7±3.8	6.07	<0.001	HS	40.96%	75.70%	11.54	<0.001	HS

HS-Highly significant, RRR-Resting respiratory rate, RRE- Peak exercise respiratory rate.

Peak expiratory flow rate: Table 3, shows the comparison of PEFR in lit/min between students of ME and PE. The mean PEFR±1SD was more in PE students (569.1±30.8) than ME students (479.8±67.6) and the difference was statistically highly significant.

Table 3: Comparison of PEAK expiratory flow rate between students of medical and physical education

Parameter	Medical Education Mean ± SD	Physical Education Mean ± SD	t value	p value	Remarks
PEFR Liters/min	479.8±67.6	569.1±30.8	8.50	<0.001	HS

HS-Highly significant, PEFR- PEAK expiratory flow rate

Discussion

Most of medical students lead a physically inactive life, probably because heavy academic demands of medical school may cause medical students exhausted or may leave no time to exercise. It is also possible that the advances in modern technology have almost completely eliminated the necessity for physical exertion in daily life. On the other hand physical education students lead a physically active life as their academic curriculum itself includes daily physical exercise and outdoor games. An impressive accumulation of research data over the past three decades has documented that regular exercise is important for health and wellbeing and physical inactivity is a major health problem. Compelling evidence suggests that physical inactivity is contributing factor in several chronic diseases and conditions.(1) In this context, the present study was conducted to assess and compare important pulmonary fitness parameters between students of medical and physical education.

In the present study, none of the ME students gave history of regular physical exercise in the past 9 months whereas all the PE students gave history of regular exercise in the past 9 months of about 4 hours/day for six days a week.

Respiratory rates increased following ARST in both groups. Similar increases in respiratory rate following exercise are reported in other studies also.(7,8) This is due to a rapid neurogenic component and a slower humoral component according to the neurohumoral theory of exercise hyperpnoea. As person begins to exercise the respiration increases in depth and rate in proportion to concentration of CO_2 in blood.(8)

In the present study mean resting, peak exercise and 5 min post exercise respiratory rates were lower in PE students than ME students . Increase in respiratory rate following ARST was also lower in PE students. Percent recovery respiratory rate was higher in PE students (75.70%) than ME students (40.96%) at the end of 5 min recovery after the ARST.

Similar to the findings of the present study, Izedebska E et al(9) and Khodnapur IP et al(10) also have demonstrated a significantly lower resting respiratory rates in trained young normotensive and trained residential school children respectively. Studies done by Alpert JS et al,(11) and Pierce AK et al,(12) have also reported diminished resting respiratory rate after training in patients with chronic obstructive pulmonary disease.

The time for recovery of resting respiratory rate after ARST was significantly less (6.8±1.98 min) in PE education students than ME students (11.9±2.97 min) in a study by De AK et al.(13) These finding correlate well with the findings of the present study. The recovery respiratory rates as well as the recovery time have direct correlation with the degree of exercise and fitness of the individual.(13)

Regular aerobic training is associated with several cardiovascular, pulmonary and muscular adaptations leading to improvement in metabolic regulation.(3) These changes lead to lesser increase in respiratory rate and faster recovery of respiratory rate in trained individuals following exercise.

Mean PEFR in PE students (569.1±30.8 lit/min) was significantly higher when compared to PEFR of ME students (479.8±67.6 lit/min).

Previous studies by various authors have also reported a significantly high PEFR in trained subjects when compared to untrained subjects.(14-17)

No significant improvement in PEFR was observed after endurance training in a study by Hulke SM et al.(18)

PEFR is effort dependent and also reflects the status of larger airways.(19) It is a measurement which is dependent upon several variables including airway resistance, maximal voluntary muscular effort and possible compressive effect of the maneuver on thoracic airways.(20) Aerobic training causes regular forceful inhalation and deflation of the lungs for prolonged periods. This in turn leads to strengthening of respiratory muscles and structural charges in the airways which increase PEFR values in trained subjects.(15) No improvement of PEFR in trained subjects in the study by Hulke SM et al,(18) could be due to lesser duration and moderate degree of exercise not involving respiratory system performed by the subjects in their study.

The present study revealed that the important parameters of pulmonary fitness like Respiratory rates and PEFR were significantly better in PE students than ME students. These health beneficial effects can be attributed to the regular physical training schedules of PE. Beneficial effects of exercise are well known since the ancient Vedas. The present attractive education system has helped to improve the education standards, but the non-active sedentary stressful life has made the youth physically unfit. Regular physical activity is an essential part of the healthy life style and should be encouraged among medical students.

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