

# Effect of physical training on pulmonary function tests in students of physical education institute

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## Abstract

**Background:** Regular physical exercise is known to have beneficial effects on health. When the body engages in exercise training several times a week or more frequently, each of these physiologic systems undergo specific adaptation that increases body efficiency and capacity. Exercise training increases cardio respiratory efficiency and tolerance to lactic acid along with muscle hypertrophy. **Aim and objectives:** Aim of our study is to find out the effects of physical training on pulmonary function tests in students of physical education institute. **Material and method:** This study was carried out on 60 students of Physical Education College, Miraj. Physical training were given for 6 months which includes morning and evening session of three hours per day. Recording of pulmonary function tests was done before and after 6 month of physical training. Analysis of data was done by paired t-test. **Observations and Results:** There was increase in FVC, FEV1 and PEFR values after physical training which was highly statistically significant. **Conclusion:** The present study showed that physical training improves pulmonary function test parameters. Regular physical exercise leads to increase in lung volumes and capacities. This can be due regular forceful inspiration and expiration for prolonged duration training leading to the strengthening of the muscles.

**Key Word:** Physical training, pulmonary function tests, PEFR.

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## INTRODUCTION

Physical training is the ability to endure, to bear up, to withstand stress, to carry in circumstances where an unfit person cannot continue and forms major basis for good and well-being.<sup>1</sup> In this study we have compared pulmonary functions of students of physical education before and after their training period in physical education institute students having age range between 20 to 25 years. When challenged with any physical task, the human body responds through a series of integrated changes in function that involve most

of all physiologic systems. Performing movement requires activation and control of the musculoskeletal system; the cardiovascular and respiratory systems provide the ability to sustain this movement over extended periods.<sup>2</sup> Nowadays physical inactivity is increased due to less participation in physical activity, sedentary lifestyle, and “passive” modes of transport and increased use of smart phones. Physical inactivity is directly associated with variety of non-communicable diseases (NCDs) and overall 1.9 million deaths.<sup>3,4</sup> Exercise is a form of physical activity that is planned, structured, repetitive and performed with the goal of improving health and fitness.<sup>5</sup> Exercises in the form of sports, aerobics or workouts, when performed regularly has benefits on the various systems of the body.<sup>6</sup> Exercise has a favourable influence on cardiovascular functions and also lung functions.<sup>7,8</sup> Buffalo health from their study concluded that pulmonary function test is a long term predictor of overall survival rates in the both genders and could be used as a tool in general health assessment.<sup>9,10</sup> Previous studies in this field have shown that sportspersons have higher values of lung volumes in comparison to their control counterparts who

are not engaged in any kind of regular physical exercise.<sup>11</sup> Many studies that have shown significant improvement in pulmonary functions as a result of the effect of exercise.<sup>8</sup> In present study main focus is on the effect of physical training on the pulmonary functions (like forced vital capacity, forced expiratory volume in 1 second, peak expiratory flow rate etc.). Present study conducted on the students of physical education who are doing regular physical training by participating in different exercise and games.

## MATERIAL AND METHOD

The present study was carried out on 60 BPED students consisting of 46 male and 14 female students, chosen from Physical Education College (B.P.Ed College), Miraj, District Sangli. Prior to study ethical committee permission was taken. Those willing to participate informed written consent of students was taken. Detail history and general examination of students were carried out to rule out any major health problems. The pulmonary function test of these subjects were assessed in two phases

– 1<sup>st</sup> phase at the start of their training and 2<sup>nd</sup> phase reading after 6 months of their training.

### Inclusion criteria

1. Age group 20 to 25 years.
2. Both male and female candidate
3. Willing to participate

### Exclusion

1. The subjects who are suffer from any cardiovascular, respiratory diseases as per physician examination
2. History of smoking, alcohol intake
3. History of any allergic disorder
4. History of previous regular exercise or any sports activity.

**Physical Training Programme:** All the students participated in physical training through the co-operation of the department of physical education. An instructor was assigned to supervise training. Students performed exercise for 3 hours per day, 6 days week. The exercise was carried out in two session in the morning (at 6a.m. to 7 a.m.) and at evening session (4p.m. to 6 p.m.) for six months. The course includes all types of sports that is athletic events as well as different types of games.

Session	Type/Modality of exercise	Duration min/hours	Frequency
Morning session (6A.M. to 7A.M.)	Warm up and cool down	10 min.	5-6days/week (for six months)
	Stretching exercise	20 min.	
	Jogging	30 min.	
Evening session (4P.M. to 6P.M.)	Different type of games:-	2 hours	
	Football, Hockey, Handball,		
	Kabbadi, Cricket, swimming, Athletics events etc.		

Students before starting of exercise warm up for 10 min. Warm up and cool down exercising at a low intensity for 5-10 min before and after the training session is a routine recommendation. Such activities help stretching and warming up of muscles and ligaments in preparation for the activity session. The cool down also prevents hypotension, which may occur with the sudden cessation of exercise.

**Pulmonary Function Tests:** For the present study pulmonary function tests (PFT) recording were done by using electronic computerized portable “Spiro Excel” PC based spirometer in sitting position (Medicaid system an ISO 9001:2000 company). All the subjects were made familiar with instrument and procedure demonstrated for performing the tests. Pulmonary function test were performed at the complete spirometric laboratory in T.B. Chest department of BVDU Medical College and Hospital, Sangli. Readings were taken in the morning session, during the post absorptive phase in order to keep uniformity in the condition of the readings and at the basal condition that is at complete rest. Three readings were taken and best of three reading were taken into account. The data of the subject like name, age (date of birth mentioned), height, weight, sex, date of performing the test, atmospheric temperature were fed to the computerized spirometer (BTPS).

**First phase readings:** The first phase recording of respiratory parameters were done before starting of physical training. Normal lung function values and ranges are conventionally calculated according to variable such as sex, age, height, weight and race which contribute to prediction of lung function.

**Second phase readings:** In second phase after six months of physical training pulmonary function test was recorded again as in the phase one. Statistical analysis is done by using student pair t-tests.

## Report showing Pulmonary function tests before and after physical training

Spirometry Results						
Parameter	Pred	Pre	%Pred	Pre	%Pred	%Chg
FVC (L)	5.14	4.97	97	5.56	108	12
FEV <sub>1</sub> (L)	---	3.23	---	3.39	---	5
FEV <sub>1</sub> (L)	4.37	4.61	105	4.69	107	2
PEFR (L/s)	9.91	11.96	121	13.35	135	12
PEFR (L/s)	---	12.83	---	10.89	---	-15
FEF <sub>25-75</sub> (L/s)	5.11	7.2	141	6.41	125	-11
FEF <sub>25%</sub> (L/s)	8.42	11.96	142	12.79	152	7
FEF <sub>50%</sub> (L/s)	5.57	7.72	139	7.29	131	-6
FEF <sub>75%</sub> (L/s)	2.63	4.25	162	3.09	117	-27
FEV <sub>1</sub> /FVC (%)	83.07	92.76	112	84.35	102	-9
FVC Time (Sec)	---	1.41	---	2.28	---	62
SVC (L)	5.38	3.67	68	1.13	21	-69
ERV (L)	---	1.44	---	0.08	---	-94
IRV (L)	---	0.87	---	0.06	---	-93
VE (L/min)	---	26.07	---	24.96	---	-4
Rf (l/min)	---	19.17	---	25.21	---	32
Ti (sec)	---	1.25	---	1	---	-20
Te (sec)	---	1.88	---	1.38	---	-27
Vt (L)	---	1.36	---	0.99	---	-27
Vv/Ti (L/s)	---	1.09	---	0.99	---	-9
Ti/Ttot (sec)	---	0.4	---	0.42	---	5
IC (L)	---	2.23	---	1.05	---	-53
ELA (Years)	22	22		22		

Pre Medication Report Indicates  
Normal Spirometry( %FEV<sub>1</sub>/FVC>80%Pred%FEV<sub>1</sub>  
/FVC and FVC>80%PredFVC )  
Pre Medication Report Indicates  
Normal Spirometry( %FEV<sub>1</sub>/FVC>80%Pred%FEV<sub>1</sub>  
/FVC and FVC>80%PredFVC )  
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### OBSERVATIONS

The following table shows the mean values and standard deviation of Forced Vital Capacity (litres), Forced Expiratory Volume in 1 second (litres) and PEFR(Litres/s) before and after six months of physical training.

Parameters	1 <sup>st</sup> phase (pre-training) n = 60 Mean±S.D.	2 <sup>nd</sup> phase (post training) n = 60 Mean±S.D.	P value
FVC (Litres)	3.73±0.76	4.45±0.74	0.000* Highly Significant
FEV <sub>1</sub> in 1 sec. (Litres)	3.38±0.70	3.99±0.66	0.000* Highly Significant
PEFR (Litres/s)	8.42±1.99	9.92±1.87	0.000* Highly Significant

P Value < 0.001 = highly significant

### DISCUSSION

In our study it has been observed that there is highly statistically significant increase in FVC, FEV<sub>1</sub> and PEFR (parameters of PFT) after six month physical training in students of physical education institute having age range between 20 to 25 years. Our findings are in agreement with several studies. Y.J. Cheng and *et al* 2003 in their study observed that swimmers were having higher lung function values than land based athletes and sedentary controls and increased physical activity, nonsmokers and cessation of smoking is leads to better cardio respiratory fitness.<sup>12</sup> In study on athletes, yogis and sedentary subjects done by Shivesh Prakash and *et al* observed that yogis and athletes were having significantly better lung functions as compared to sedentary workers. The Athletes showed higher FEV<sub>1</sub> as compare to sedentary workers.<sup>10</sup>

Similar results was observed by Richa Ghay Thaman *et al* (2010) In their study they found highly statistically significant increase in lung volume and flow rate in BSF trainee after their training period as compared to before training and with controls (medical students) having age group 18 to 23 years which can be due to regular forceful inspiration and expiration for prolonged duration training

leading to the strengthening of the muscles.<sup>3</sup> Also Suryawanshi and *et al* (2012) in their study observed significant increase of peak expiratory flow rate (PEFR), tidal volume (TV) and vital capacity (VC) after one year physical training in study group subjects.<sup>13</sup> However Sandip Hulke and *et al* 2011 in their study on effects of endurance training on lung function, and found there was no significant change in PFT parameters except PEFR which shows significant increase in males.<sup>14</sup> Results discussed above clearly indicate that there is significant difference in the static lung values as well as flow rates between the 1<sup>st</sup> Phase readings and 2<sup>nd</sup> phase readings. This confirms that regular exercise has a beneficial effect on the Pulmonary Functions. Maximum inflation and deflation during regular physical training is important stimulus for release of surfactant which can help improving lung function tests.<sup>15</sup> Training for long duration might leads to increase in the maximal shortening of the inspiratory muscles, which might improve the lung function parameters.<sup>3</sup> Physical training also improves strength of accessory muscles for inspiration and expiration along with the strength of skeletal limb muscles and cardiac muscles.<sup>16</sup> In our study there is improvement in FVC in

physically trained subjects as muscular exercise increases rate and depth of respiration which improves FVC.<sup>17</sup>The present study suggests that physical training help in improves lung volumes and respiratory functions. One of the limitations of this study is that it was carried out for six month duration and on subjects having age group 20 to 25 years. Studies should be carried out for long duration. The type of exercise is not specific, it should be classified. Also it did not assess the effect of physical training on other age group individuals.

## CONCLUSION

“All parts of the body if used in moderation and exercised in labours to which each is accustomed, become thereby healthy and well developed, and age slowly; but if unused and left idle, they become liable to disease, defective in growth, and age quickly”–Hippocrates The result of the present study showed that physical training and exercise improved pulmonary function test in Physical education College students after their six months training period. Regular physical activity or sport helps in achieving efficient lung functions, especially FEV1 and PEFr. Continued high physical activity is associated with lower mortality and improves the pulmonary functions and therefore should be encouraged.

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