

# Effectiveness of Aerobic Exercise Versus Resistance Training on Lung Function among Female Physiotherapy Undergraduate Students

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**Abstract:** Physical fitness specifically cardio respiratory fitness is important consideration for physiotherapy students. **Aims And Objectives:** To compare the effectiveness of aerobic exercise and resistance training in improving lung function. **Methodology:** The female students between the age group 18-22 were selected, who satisfies the inclusion and exclusion criteria were randomly divided into 2 groups, Resistance group and the Aerobics group. The training was given for a period of 8 weeks. Outcome measure was taken as PFT parameters such as Forced Vital Capacity, Forced Expiratory Volume in First Second, and Peak Expiratory Flow Rate. **Results and Discussion:** Students t test was used for the statistical analysis. Significance level kept  $p < 0.05$ . The results showed that, there is significant improvement in lung function parameters such as FVC, FEV1 and PEFr for both the Resistance and Aerobics Group when compared pre and post test data within groups. The results from the intergroup comparison showed that there are similar effects on lung function in Aerobics as well as Resistance group. **Conclusion:** The study revealed that Aerobic training as well as Resistance training are equally effective in improving lung function among female physiotherapy students.

**Keywords:** Aerobic exercise, Resistance training, Forced Vital Capacity, Forced Expiratory Volume in First Second, Peak Expiratory Flow Rate

## 1. Introduction

Regular physical activity is important for life long health and wellbeing. According to United States Department of Health and Human Services (USDHHS), regular physical activity is associated with increase health benefit and decrease risk of all-cause mortality<sup>[1]</sup>. Regular physical activity helps individuals to improve their cardio respiratory fitness, bone and muscular strength, prevent overweight or obesity, reduce symptoms of anxiety and depression, and reduce the risk of developing health conditions such as heart disease, cancer, type 2 diabetes, high blood pressure, osteoporosis and obesity<sup>[2]</sup>. Students who are physically active tend to have better grades, attendance and classroom behaviours. Physical activity is also associated with better cognitive performance. A sedentary lifestyle and low physical fitness are the most prevalent modifiable risk factor and predictor of both cardiovascular disease and all causes of morbidity and mortality. Physical fitness specifically cardiorespiratory fitness is important consideration for physiotherapy students as they are involved in multiple activities during their clinical postings in OPD, clinics and hospitals such as transferring, shifting, lifting during managing paraplegics and quadriplegics patients in hydrotherapy pools, mobilizing patients in ICU. A high level of Cardio-respiratory fitness permits continuous physical activity without a decline in performance and allows for rapid recovery following fatiguing physical activity<sup>[6]</sup>.

Aerobic capacity is defined by the ACSM as the product of the capacity of the cardiorespiratory system to supply oxygen and the capacity of the skeletal muscles to utilize

oxygen<sup>[7]</sup>. It is a type of exercise that overloads the heart and lungs, and causes them to work harder than at rest. To become physically fit, individuals must participate regularly in some form of physical activity that uses large muscle groups and challenges the cardiorespiratory system<sup>[8]</sup>. Aerobic exercise training, or conditioning, is augmentation of the energy utilization of the muscle by means of an exercise program. Aerobic training depends on exercise of sufficient frequency, intensity, and time. This kind of training produces cardiovascular and muscular adaptations and is reflected in an individual's endurance<sup>[10]</sup>. Resistance exercise is any form of active exercise in which dynamic or static muscle contraction is resisted by an outside force applied manually or mechanically. Resistance training refers to a specialized method of physical conditioning that involves the progressive use of a wide range of resistive loads and a variety of training modalities designed to enhance muscular fitness. In addition to enhancing all components of muscular fitness like muscular strength, endurance and power, regular participation in a resistance training programme is associated with significantly better cardio metabolic risk profiles, lower risk of all-cause mortality and fewer cardio vascular disease events<sup>[10]</sup>. The aim of this study is to compare the Effectiveness of Aerobic exercise and Resistance Training in improving the Lung Function among Female Physiotherapy Students.

## 2. Methodology

The study was designed to determine the effectiveness of Aerobic exercise and Resistance exercise in improving lung function and to compare the effectiveness between the two groups. Ethical approval was obtained from the Ethical

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committee of Medical Trust Hospital, Cochin. Two group pre-test and post- test design was used with convenient sampling. The independent variables were aerobic exercise and resistance exercise whereas the dependent variables were Forced Vital Capacity (FVC), Forced Expiratory Volume in First Second (FEV1) and Peak Expiratory Flow Rate (PEFR).

**Study Design:** Pre and post experimental study design without control group

**Sampling Technique:** Convenient sampling.

**Sample Size:** 30

**Study Duration:** Two months

**Study Setting:** Medical Trust Institute of Medical Science.

**Inclusion Criteria:**

- Female students having age group between 18 and 22.
- Students having BMI 18.5 to 24.5.
- Students willing to participate in the study.
- Students not involved in any other physical fitness training programs.
- Healthy subjects without any pathologic or orthopaedic limitation.

**Exclusion Criteria:**

- Any known musculoskeletal, cardiopulmonary, neurological or endocrine problems.
- Students who underwent any major surgeries.
- Subjects on any medications for long duration.
- Menstrual irregularities.

**Sampling Procedure:**

30 Subjects will be recruited from the Medical trust college of Physiotherapy according to inclusion & exclusion criteria and divided into 2 groups(Group A and Group B). In Group A, 15 subjects will receive conventional training and Resistance training as per DeLorme regimen, 3 days/week for 8 weeks. In Group B, 15 subjects will receive conventional training and Aerobic training 40 mins a day, 3 days/week for 8 weeks. Both groups will receive a warm-up and cool down session for 10 minutes. Pre-test and post-test spirometry will be done before and after the treatment. Conventional training includes Deep breathing exercises for a period of 10 minutes for both Resistance and Aerobics exercise.

**Resistance Training Protocol (Group A)**

Eight weeks of training program included 5 minutes of initial warm up exercises which includes general body active exercises, upper and lower body stretching exercises. Resistance training were performed for about 30 minutes using weight cuffs after assessing their 10-repetition maximum (10 RM), which was considered as the maximum weight that could be lifted through the full range of motion ten times. Resistance exercises were given for upper limb muscles which include Biceps, Triceps and Deltoid and lower limb muscles which include Iliopsoas, Gluteus maximus, Hamstrings and Quadriceps. At the beginning, 10

lifts with 50% of 10 RM and then progressively increased to 75% of 10 RM and progressed to 100% of 10 RM during the last week of training. Each exercise was performed as 4 sets of 10 repetitions each. Training workload increased when more than 10 repetitions per set could be performed. One-minute rest period was given between each set and 30 seconds between each exercise. At the end of each session, cool down exercises were given for 5 mins, which included stretching exercises. The resistance training was performed forty minutes, thrice weekly for 2 months.

**Exercises for upper limb:**

- 1) Biceps curl.
- 2) Triceps kickback.
- 3) Dumbbell seated shoulder press

**Exercises for lower limb:**

- 1) Squatting with weight
- 2) Heel rises with weight
- 3) Standing leg curl.
- 4) Hip flexion.
- 5) Hip extension.
- 6) Knee extension.

Frequency: 40 mins/day, 3days /week including warm up and cool down period. Duration: 8 weeks

**Aerobic Training Protocol (Group B)**

Eight weeks of aerobic training program included 5 minutes of initial warm up exercises which includes general body active exercises, upper and lower body stretching exercises. Aerobic exercises last for about 30 mins which included walking, jogging, and aerobic dance with music at 50-75% of maximum heart rate. Maximum heart rate was calculated by using the formula:  $HR_{max} = 220 - \text{Age}$ . The cool-down phase includes 5 mins of stretching exercises. The exercises were performed for forty minutes, thrice weekly for 2 months.

**Aerobic Training**

Mode: 20 mins of aerobic walking and jogging and 10 mins of aerobic dancing. Intensity: Moderate intensity 50-75% of maximum heart rate.Frequency:40 mins/ day, 3 days / week including warm up and cool down period.

**3. Results**

**Paired 'T' test (Comparison Within Group)**

Analysis of pre and post-test FVC values of Group B using paired 't' test shows t value 4.68 and p value less than 0.001. Hence there is a significant improvement in FVC values after Aerobics training. Analysis of pre and post-test FVC values of Group A using paired 't' test shows t value 4.629 and p value less than 0.001. Hence there is a significant improvement in FVC values after Resistance training. Analysis of pre and post-test FEV1 values of Group A using paired 't' test shows t value 4.45 and p value less than 0.001. Hence there is a significant improvement in FEV1 values after Resistance training. Analysis of pre and post-test FEV1 values of Group B using paired 't' test shows t value 3.463 and p value less than 0.05. Hence there is a significant improvement in FEV1 values after Aerobics training. Since the significance (p-value) is less than 0.05,

we can conclude that the average improvement in forced Expiratory Volume in First Second, 0.21 is significant. So, there is a significant effect of Aerobic exercises to improve forced Expiratory Volume in First Second in group B. Analysis of pre and post- test PEFR values of Group A using paired 't' test shows t value 5.106 and p value less than 0.001. Hence there is a significant improvement in PEFR values after Resistance training. Analysis of pre and post-test PEFR values of Group B using paired 't' test shows t value 4.879 and p value less than 0.001. Hence there is a significant improvement in PEFR values after Aerobics training. Since the significance (p-value) is less than 0.05, we can conclude that the average improvement in PEFR, 1.05 is significant. So, there is a significant effect of Aerobic exercises in improving Peak Expiratory Flow Rate

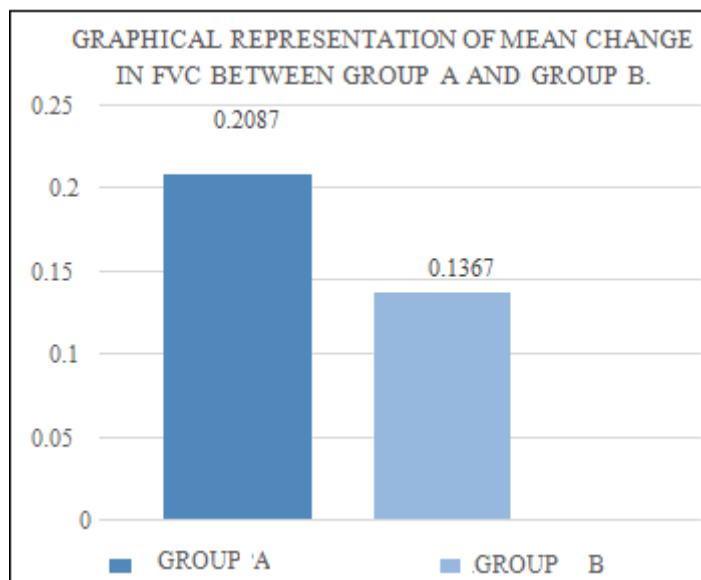
in group B. Analysis between Group A and Group B using Independent 't' test for FVC shows that 't' value 1.341 and p value greater than 0.05. Hence there is no statistical significance for FVC scores between Group A and Group B.

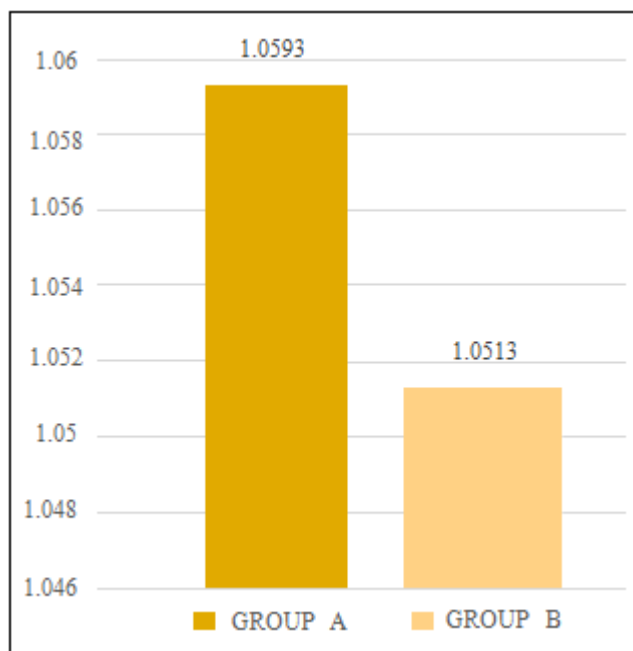
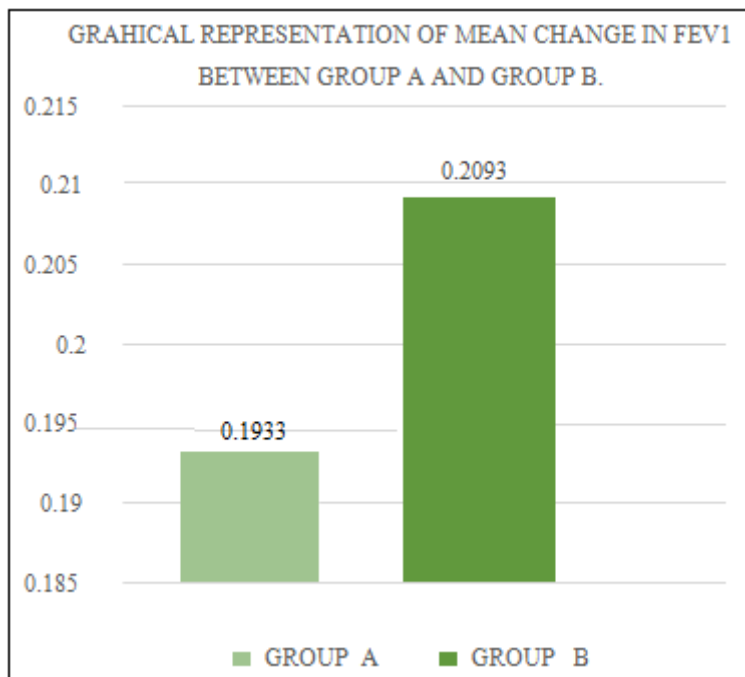
**Independent T Test Results**

Analysis between Group A and Group B using Independent 't' test for FEV1 shows that 't' value 0.215 and p value greater than 0.05. Hence there is no statistical significance for FEV1 scores between Group A and Group B. Analysis between Group A and Group B using Independent 't' test for PEFR shows that 't' value 0.027 and p value greater than 0.05. Hence there is no statistical significance for PEFR scores between Group A and Group B.

PAIRED 'T' TEST		GROUP A			GROUP B		
OUTCOMES		FVC	FEV1	PEFR	FVC	FEV1	PEFR
MEAN	Pretest	2.68	2.3767	4.8460	2.6420	2.2587	5.0753
	Post test	2.89	2.5700	5.9053	2.7787	2.4680	6.1267
S.D	Pretest	.53125	.34702	1.01547	.37106	.32439	1.02527
	Post test	.65193	.45313	.81562	.33728	.32901	.88743
Table 'T' value							
Calculated 'T' value		4.629	4.629	5.106	4.68	3.46	4.879
p value		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

Independent 'T' Test		FVC	FEV1	PEFR
MEAN	GROUP A	.2087	.1933	1.0593
	GROUP B	.1367	.2093	1.0513
S.D	GROUP A	.17460	.16808	.80356
	GROUP B	.11293	.23414	.83457
Table 't' value				
Calculated 't' value		1.341	.215	.027
P value		0.191	0.831	0.979





#### 4. Discussion

Physical inactivity in college students results in reduced fitness level in the sedentary people. Sonia Pawaria et al, 2017, conducted a cross sectional study on Cardio respiratory fitness of Physiotherapy students and concluded that lower level of aerobic capacity among physiotherapy graduate students and physical activity should be encouraged in colleges to promote the

Overall physical, mental and social wellbeing of the students.

The female students between the age group 18-22, who satisfied the inclusion and exclusion criteria from Medical Trust Institute of Medical sciences were randomly divided

into two groups, group A- the resistance group and group B- the aerobics group. Pulmonary function test was performed for all the 30 subjects before and after the intervention.

Within group, comparison of pre and post test data for FVC among Group A, (resistance group) showed significant difference in the paired t test with a mean difference of 0.21 at level of significance less than 0.05. For FEV1, comparison of pre and post test data also showed significant difference in the paired t test with a mean difference of 0.19 at level of significance less than 0.05. For PEFR, comparison of pre and post test data showed significant difference in the paired t test with a mean difference of 1.05 at level of significance less than 0.05.

Group B also showed significant improvement in their mean values of FVC, FEV1 and PEFR in the paired t test within group comparison of pre and post data. For FVC, comparison of pre and post test data showed significant difference in the paired t test with a mean difference of 0.13 at level of significance less than 0.05. For FEV1, comparison of pre and post test data showed significant difference in the paired t test with a mean difference of 0.21 at level of significance less than 0.05. For PEFR, comparison of pre and post test data showed significant difference in the paired t test with a mean difference of 1.05 at level of significance less than 0.05. The improvement in pulmonary function could be due to increased strength of respiratory muscles, increased thoracic mobility and balance between lung and chest elasticity gained from regular exercise. During exercise, ventilation might increase from resting values of around 5-6 litre/min to >100 litre/min. Ventilation increases in work rate at submaximal exercise intensities. Oxygen consumption also increases linearly with increasing work rate at submaximal intensities.

## 5. Future Scope

- 1) The duration of study should be increased. It may lead to better and valuable result.
- 2) More number of participants can be included in the study.
- 3) A follow up study could ensure the long-term effect of the training programme.

## 6. Conclusion

The present study suggests that there is an improvement in lung function after 8 weeks of Aerobics training and Resistance training. The study reveals that both aerobics training as well as resistance training are equally beneficial on lung function.

Based on the present study, it is suggested that actions promoting the factors of physical activities, programmes and courses focused on importance of physical fitness and health of professionals should be taken into account during college time.

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