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**Original Research Article**

# TO IDENTIFY WHICH EXERCISE HAS MAXIMUM EFFECT ON THE LUNG FUNCTION TEST

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**Abstract**

**Background & Methods:** The aim of the study is to identify which exercise has maximum effect on lung function tests. The idea behind choosing these physical activities was that in each group the types of movement performed were variable and body posture was also quite different. It was ensured that subjects chosen were regularly engaged in that particular activity. Pulmonary function tests were also carried out on age matched control groups. These cases were compared with healthy medical students, who acted as controls.

**Results:** Group A have, mean weight of 71.25 ±19.84 kg and mean calorie intake of 2913 ± 816.6 k cal. Group B have, mean weight of 67.96±6.28 kg and mean calorie intake of 2371 ± 557.1 k cal. Group C have, mean weight of 66.63±8.62 kg and mean calorie intake of 2219 ± 616.6 k cal. Group D have, mean weight of 58.73±8.73 kg and mean calorie intake of 2205 ± 467.6 k cal. We found all spirometry parameters are high in different exercise groups as compared to control.

**Conclusion:** Regular physical activity is one of the most emphasized remedies for prevention and management of non-communicable diseases. Physical activity has beneficial effect on almost every system of the body but information regarding the underlying mechanism causing physiological changes due to physical activity is less dispersed, therefore it is important to study the effect of various physical activities on physiological functions. Different type of physical activities have significant effect on respiratory parameters also.

**Keywords:** Exercise, Lung, PEFR-Peak expiratory flow rate & FVC-Forced vital capacity
**Study Design:** Cross-sectional study.

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## 1. Introduction

Primitive men (pre-10,000 B.C.) needed to be fit to be able to go through their journey to hunt for food and water[1]. Being nomads and hunters, the activities of these people required a lot of physical activity and fitness (their celebration events included trips of six to twenty miles to neighboring tribes to visit friends and family).

With the invention of the plow and other agricultural development (10,000-8,000 B.C.) came the beginning of a less active lifestyle. Neolithic men started using plow and animals to do the difficult tasks, thus decreasing the amount of physical activity[2].

In the ancient civilization (2500-250 B.C.), people started relating physical activity with physical well-being[3]. In China, through the philosophical teachings of Confucius, they associated certain diseases with physical inactivity. This lead through the development of Cong Fu gymnastics[4].

During the same period, Yoga was developed in India. Yoga is an exercise program that conforms to Hinduism and Buddhism beliefs and puts emphasis on spirituality. In 4000-250 B.C., there was a strong demand for fitness for military purposes. People during that era linked fitness with one’s performance in the military[5]. Activities like hunting, marching, riding and javelin throwing have been developed to meet the need for physically fit soldiers. The Persian Empire and Spartans are good examples of empires that make use of fitness for this purpose. Spartans required fitness for men to be good soldiers and for women to bear children who are fit to serve the state. Because of this, Sparta actually became one of the most physically fit societies in history[6].

Swimming is a worldwide and popular sport and it is one of the known recreational activities across the world. Swimming helps to increase thoracic and abdominal muscle strength and thereby enhancing the ability to inflate the lungs. Regular swimming practice gives a positive effect on the lungs by increasing pulmonary capacity and thus improves the lung functions.

## 2. Material and Methods

Present Study was conducted at Govt. Medical College, Ratlam, M.P after ethical approval for 01 Year on 80 cases (20 of each Group). Purposive sampling that is those subjects pursuing similar physical activity for a minimal period of two years in the age group of eighteen to twenty-five years. The idea behind choosing these physical activities was that in each group the types of movement performed were variable and body posture was also quite different. It was ensured that subjects chosen were regularly engaged in that particular activity. Pulmonary function tests were also carried out on age matched control groups. These cases were compared with healthy medical students, which acted as controls.

The present study was conducted on eighty males divided into four groups:

- Group A - young adults engaged in exercises in the akhada
- Group B – young adults engaged in exercises at the Gymnasium.
- Group C- young adults engaged in swimming.
- Group D- healthy young adults not routinely engaged in any specific exercise.

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## 3. Result

**Table No. 1: Comparison of Four Groups in Weight and Calorie Intake**

| | **Weight (In kg)** | | **Calorie Intake (In Kcal)** | |
|---|---|---|---|---|
| **Group** | **Mean** | **S.D** | **Mean** | **S.D** |
| A | 71.25 | 19.84 | 2913 | 816.6 |
| B | 67.96 | 6.28 | 2371 | 557.1 |
| C | 66.63 | 8.62 | 2219 | 661.6 |
| D | 58.73 | 8.73 | 2205 | 467.6 |

Group A have, mean weight of 71.25 ±19.84 kg and mean calorie intake of 2913 ± 816.6 k cal.
Group B have, mean weight of 67.96±6.28 kg and mean calorie intake of 2371 ± 557.1 k cal.
Group C have, mean weight of 66.63±8.62 kg and mean calorie intake of 2219 ± 616.6 k cal.
Group D have, mean weight of 58.73±8.73 kg and mean calorie intake of 2205 ± 467.6 k cal.

**Table No. 2: Comparison of Four Groups in Variables of Flow Volume**

| | **Forced vital capacity in liters** | | **Force Expiratory Volume in 0.5sec(liter)** | | **Force Expiratory Volume in1st sec (liter)** | | **FEV1\ Vcmax %** | |
|---|---|---|---|---|---|---|---|---|
| **Group** | **Mean** | **S.D** | **Mean** | **S.D** | **Mean** | **S.D** | **Mean** | **S.D** |
| A | 3.98 | 0.53 | 2.47 | 0.31 | 3.47 | 0.43 | 86.22 | 6.68 |
| B | 3.71 | 0.30 | 2.45 | 0.35 | 3.32 | 0.29 | 87.56 | 5.66 |
| C | 4.61 | 0.48 | 2.92 | 0.28 | 4.16 | 0.41 | 83.81 | 7.02 |
| D | 3.61 | 0.27 | 2.45 | 0.29 | 3.31 | 0.26 | 91.2 | 5.53 |

Group A has mean expiratory force vital capacity 3.98±0.53 liters, mean force expiratory volume in 0.5 sec is 2.47±0.31 liters, and mean force expiratory volume in 1 sec is 3.47±0.43 liters, FEV1/Vcmax 86.22±6.68%.
Group B has mean expiratory force vital capacity 3.71±0.30 litters, mean force expiratory volume in 0.5 sec is 2.45±0.35 liters, and mean force expiratory volume in 1 sec is 3.32±0.29 liters, FEV1/Vcmax 87.56±5.66%.
Group C has mean expiratory force vital capacity 4.61±0.48 liters, mean force expiratory volume in 0.5 sec is 2.92±0.28 liters, and mean force expiratory volume in 1 sec is 4.16±0.41 liters, FEV1/Vcmax 89.81±7.02%.
Group D has mean expiratory force vital capacity 3.61±0.27 liters, mean force expiratory volume in 0.5 sec is 2.45±0.29 liters, and mean force expiratory volume in 1 sec is 3.31±0.26 liters, FEV1/Vcmax 91.2±5.53%.
Our study showed that mean expiratory force vital capacity, mean force expiratory volume in

0.5 sec, mean force expiratory volume in 1sec and FEV1/Vcmax was more in exercise groups as compared to control. Swimmers showed maximum changes in all respiratory parameters.

**Table No. 3: Comparison of Four Groups in Variables of Expiratory Flow Rate**

| | **MEF25-75 liter/sec** | | **MEF25 Liter/sec** | | **MEF50 Liter/sec** | | **MEF75-85 Liter/sec** | | **PEF Liter/sec** | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Group** | **Mean** | **S.D** | **Mean** | **S.D** | **Mean** | **S.D** | **Mean** | **S. D** | **Mean** | **S.D** |
| A | 4.30 | 0.87 | 2.30 | 0.78 | 5.16 | 1.17 | 6.37 | 1.71 | 7.10 | 1.59 |
| B | 4.55 | 0.92 | 2.34 | 0.42 | 5.35 | 1.21 | 7.13 | 2.18 | 7.73 | 2.00 |
| C | 5.14 | 0.86 | 2.97 | 0.76 | 5.85 | 0.97 | 7.67 | 1.42 | 8.27 | 1.23 |
| D | 4.54 | 0.87 | 2.46 | 0.60 | 5.26 | 1.13 | 7.10 | 1.84 | 7.60 | 1.67 |

**Group A** have mean maximum expiratory flow rate between 25-75 % of vital capacity is 4.30±0.87 liter/sec, mean maximum expiratory flow rate at 25% of vital capacity is 2.30±0.78 liter/sec, mean maximum expiratory flow rate at 50% of vital capacity is 5.16±1.17 liter/sec mean maximum expiratory flow between 75-85% of vital capacity is 6.37±1.7 liters/sec, mean peak expiratory flow rate is 7.10±1.59 liters/sec.

**Group B** have mean maximum expiratory flow rate between 25-75 % of vital capacity is 4.55±0.92 liter/sec, mean maximum expiratory flow rate at 25% of vital capacity is 2.34±0.42 liter/sec, mean maximum expiratory flow rate at 50% of vital capacity is 5.35±1.21 liter/sec mean maximum expiratory flow between 75-85% of vital capacity is 7.13±2.18 liters/sec, mean peak expiratory flow rate is 7.73±2.00 liters/sec.

**Group C** have mean maximum expiratory flow rate between 25-75 % of vital capacity is 5.14±0.86 liter/sec, mean maximum expiratory flow rate at 25% of vital capacity is 2.97±0.76 liter/sec, mean maximum expiratory flow rate at 50% of vital capacity is 5.85±0.97 liter/sec mean maximum expiratory flow between 75-85% of vital capacity is 7.67±1.42 liters/sec, mean peak expiratory flow rate is 8.27±1.23 liters/sec.

**Group D** have mean maximum expiratory flow rate between 25-75 % of vital capacity is 4.54±0.87 liter/sec, mean maximum expiratory flow rate at 25% of vital capacity is 2.46±0.60 liter/sec, mean maximum expiratory flow rate at 50% of vital capacity is 5.26±1.13 liter/sec mean maximum expiratory flow between 75-85% of vital capacity is 7.1±1.84 liters/sec, mean peak expiratory flow rate is 7.60±1.67 liters/sec.

In our study we found that mean expiratory flow rate between 25-75%,at 25%,at 50% and between 75-85% of vital capacity litter/sec is higher in swimmers as compared to other groups.

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## 4. Discussion

Ventilation is the process of providing sufficient airflow through the respiratory passageways filling the gas exchange areas in an attempt to accommodate the cellular needs of oxygen delivery and carbon dioxide removal[7]. The resting voluntary responses typically ranged from a respiratory rate of ten to twelve breaths per minute, a tidal volume of approximately 0.5 L per breath and an airflow rate (i.e. minute ventilation) response of 5-6 L per minute. The exercise ventilation response vary, depending on the intensity of the exercise[8]. Changes in the ventilatory dynamics during exercise alter this variable, producing acute adaptations to the exercise for the respiratory systems that are profoundly remarkable. Respiratory rate can be increased five to six-fold during maximal exercise with respiratory rate of 50 to 60 breaths per minute. Accordingly, tidal volume is substantially altered from rest, with fivefold to sevenfold increases during maximal exercise and tidal volume of greater than 3L has been observed[9]. The net effect on minute ventilation is an astonishing 30 to 40-fold increase over resting airflow values with airflow rates approaching and exceeding 200 L per minute during maximal exercise in highly trained male athlete.

The ability of the individual to inflate and deflate their lungs depends upon the strength of the thoracic and abdominal muscles, posture of individual and the elasticity of lungs. Swimming increases this ability by number of factors. It involves keeping the head extended which is a constant exercise of the Erector Spinae muscles which increases the vertical and antero-posterior diameter of the lungs and supra-spinatus which increases the antero-posterior diameters of lungs. In swimming muscles such as the Sternocleidomastoid, Trapezius and the diaphragm are being constantly exercised[10].

Inspiratory Reserve Volume (IRV) reflects muscle strength, thoracic mobility and the balance between lung and chest elasticity. The muscles involved are the diaphragm and the accessory muscles of respiration. Some previous study found IRV was 25% higher in swimmers than non-swimmers. Similarly, we also found that swimmers have significantly higher IRV than non-swimmers. This can be explained by better functioning of the inspiratory muscles and improved thoracic mobility. Parameters defining inspiratory airflows were significantly higher in swimmers who trained regularly for 7-8 years. This finding appears to be due to the effect of training on inspiratory muscles.

## 5. Conclusion

Regular physical activity is one of the most emphasized remedies for prevention and management of non-communicable diseases. Physical activity has beneficial effect on almost every system of the body including respiratory system but the information regarding the underlying mechanism causing physiological changes due to physical activity is less dispersed, therefore it is important to study the effect of various physical activities on physiological functions. This study has demonstrated that exercise in the form of swimming, physical activity in gymnasium and akhada produces a significant improvement in PEFR and other respiratory parameters.

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