International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

ISSN: 2347-6567

IJAMSCR |Volume 8 | Issue 3 | Jul - Sep - 2020
www.ijamscr.com

Research article *Medical research*

Effect of swimming as an exercise on peak expiratory flow rate in healthy adult females

Reena Sharma, Vishnu Ranade, Jaywant Nagulkar

Maharashtra University of health science, Nashik, India.

***Corresponding author: Reena Sharma**
Email: reenasharma10101996@gmail.com

ABSTRACT

Introduction
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. The purpose of this study is to evaluate the effect swimming on PEFR in swimmers and non swimmers.

Aim & Objectives
To calculate the PEFR in swimmers & non swimmers adult females & to compare effect of swimming on PEFR.

Materials and methodology
Ethics approval & participant consent was taken.60 subject were included in the aged between 18-35.Out of them 30 were swimmers & 30 were non swimmers. Individual with cardiac and pulmonary disorder were excluded. Correct instructions were given to the patients according to the guidelines of national institute of Health. PEFR was taken in sitting position immidiately after swimming.

Result
Data collected was analyzed using proper statistical test which shows that, there was a significant difference in mean of PEFR in swimmers than non swimmers with p-value < 0.005.

Conclusion
The study concluded that there is a significant effect of swimming on peak expiratory flow rate in adult swimmer females. This study has demonstrated that exercise in the form of swimming produces a significant improvement in PEFR.

Keywords: *PEFR-Peak expiratory flow rate, FVC-Forced vital capacity, VC-Vital capacity.*

INTRODUCTION

Swimming is a worldwide and popular sport and it is one of the known recreational activities across the world. Swimming is a well established whole body aerobic exercise and it differs from other exercise in several aspects like

- horizontal position of body
- performed in water
- respiratory muscles are taxed more
- different type of breathing patterns
- More conductance of heat in water as compare to air[1].

Swimming increase the ability by number of factors it involves keeping the head extended which is a constant exercise for erector spinae muscle which increases the vertical and antero posterior diameter of lung. Different muscles such as Sternocliedomastoid, trapezius and diaphragm are constantly exercised[1]

Swimming is considered to be best exercise for maintaining physical fitness and proper health and has a profound effect on lung functions. Swimming increases vital capacity due to development of broad chest long trunk and this increased vital capacity has helps swimmers to maintain their buoyancy. Swimming helps to increase thoracic and abdominal muscle strength and thereby enhancing the ability to inflate the lungs. Regular swimming thus produces a positive effect on the lung by increasing pulmonary capacity and thereby improving the functioning of lungs[9].

The benefits of swimming are also due to the horizontal position of the body, which provides a more adequate and constant breathing pattern compared with other forms of exercise, and to the high humidity present in pools. Other reasons are Ventilation is restricted in/under water and external pressure is increased. Heat conductance of water is higher than that of air. Diaphragm is exposed to greater pressure during swimming than running[9].

Restricted ventilation experienced during swimming leads the swimmer to face intermittent hypoxia and this may results in alveolar hyperplasia thus, increase FVC and VC[14].

Some physiological changes take place in the human body, when a person continuously swims which engages practically all muscle groups. Hence O2 utilization for the muscle is higher in swimmers[10]. The water pressure on the thorax makes the respiration difficult. Breathing is not as free during swimming, as in most other types of exercise.

The studies carried among men and women engaged in various sports to compare respiratory functions found that sports person have better level of pulmonary function than sedentary people[9]. Further evidence shows that aquatic exercise and swimming increase aerobic capacity, improve cardiovascular fitness and quality of life, and produce less airway resistance than the other types of vigorous physical activity, such as running and cycling.

Swimming is a demanding aerobic exercise that helps to keep heart and lungs healthy by improve coordination of breathing and movement of the body which also helps in expanding and strengthening of the lungs. Thus it helps to improve pulmonary function[14].

In the normal individual pulmonary function depend on many factors like expansibility of chest wall, pleura and alveoli, negative pressure of pleural cavity, elastic properties of lung parenchyma patency of the bronchopulmonary tree, respiratory muscle power and voluntary neuromuscular coordination and surfactant status[1]. It is well known that pulmonary functions may vary according to the physical characteristics including age, height, body weight and altitude[10]. As swimming has a positive effect on lung function & pulmonary capacity including respiratory muscle strength & elastic recoil, it also affects a person's Peak expiratory flow rate (PEFR).

Peak expiratory flow rate has been defined by European respiratory society as "The maximal flow which is achieved during the expiration which is delivered with maximum force, starting from the level of maximal lung inflation, following the maximal expiration which was expressed in Lit/min.

PEFR test measure how fast person can exhale. Peak expiratory flow rate refers to the maximum velocity of expiration[4]. PEFR is one of the convenient test and it measures the ease with which the lungs are ventilated[12]. It depends on the voluntary efforts and muscle strength of patient. This is suitable method for diagnosis of obstructive airway disorder. Peak expiratory flow rate is calculated by using device called peak flow meter. A peak flow meter is small hand held device that measure how fast the person blow air out of the lung when there is forceful exhalation after maximum inhalation. Peak flow meter has certain advantages like it gives visual feedback, cost effective, portable, diagnostic tool. The peak flow meter help to assess the airflow through the airway. PEFR can be therefore, be easy test for assessing effect of swimming on healthy adult females.

Need of Study

Regular swimming produces a positive effect on lung function & pulmonary capacity including elastic recoil. These factors help to improve pulmonary function. Swimming training has also shown to increase respiratory as well as abdominal muscle strength thus enhancing the ability to inflate the lungs. Increased respiratory muscle strength is associated with greater elastic recoil of the lungs while greater abdominal muscle strength is associated with improved expiratory capacity. Both these factors are required for higher expiratory flow rate & thus PEFR. On other hand PEFR is the only lung function test that can be measured by untrained individual with an inexpensive peak flow meter which is portable and cheap. It doesn't require electrical supply and laboratory setup which is expensive and time consuming. Also very few studies have been carried out on swimmers as compare to other sports & those that have been carried out are in male population. The literature is scarce on effect of swimming on PEFR in females. Review of previous literature indicated that swimming has been shown to be less asthamogenic than other forms of exercise and also previous studies have shown that effect of swimming is maximum as compared to any other sport on lungs. Thus the need of the study is to determine effect of swimming on peak expiratory flow rate in adult females.

Aim

To determine the effect of swimming on peak expiratory flow rate in healthy adult females

Objectives

- To calculate peak expiratory flow rate in swimmer females
- To calculate peak expiratory flow rate in non swimmer females
- To compare the effect of swimming on peak expiratory flow rate in healthy swimmer and non swimmers adult females

Selection Criteria

Inclusion Criteria

- Female subjects.
- Subject between 18-35 age group.
- Subject who performed swimming more than 3 months.

- Healthy individuals

Exclusion Criteria

- Subject with history of any cardiac or pulmonary disorder.
- Those who are unwilling to perform

Study Design

Research Design: Comparative Study
Sample population: Females between 18-35 age group
Type of sampling: conventional sampling

MATERIALS AND METHOD

The study was conducted at the Eklavya Kridasankul, Jalgaon. After obtaining the institutional ethical clearance. The present study included 60 healthy adult females, aged between18-35. Out of them 30 were swimmers and 30 were non swimmers.

PEFR was measured with a peak flow meter in immidiately after swimming. PEFR was measured in sitting position. The correct instruction s for PEFR technique was given according to guidelines of National Institute of Health, they were as follows:

Move indicator to the bottom of numbered scale.
Place the mouthpiece into your mouth and close your lips around it.
Place the nose clip on the nose.
Blow out as hard as fast as u can in single blow.
These steps are for repeated three times and the best one of 3 attempts were used for analysis.

RESULT

Table 1: Subgroups according to age

Variable	Groups	Swimmers		Non-swimmers	
		Frequency	Percentage	Frequency	percentage
Age	below 25	14	46.67	10	33.33
	26-30	9	30.00	7	23.33
	31-35	7	23.33	13	43.33

In swimmers, 46.6% were below 25, 30% were between 26 to 30 years, 23.3% were between 31 to 35 years.
In non swimmers 33.3% were below 25, 23.3% were between 26 to 30 years, and 43.3 % were between 31 to 35 y

Table 2: Subgroups according to BMI

Variable	Groups	Swimmers		Non-swimmers	
		Frequency	percentage	Frequency	percentage
BMI	Underweight	0	0.00	5	16.67
	Normal	13	43.33	17	56.67
	Over weight	15	50.00	7	23.33
	Obese	2	6.67	1	3.33

In swimmers, 0% was underweight, 43.3% were normal, 50% were overweight, and 6.6% were obese.
In non swimmers, 16.6% were underweight, 56.6% were normal, 23.3% were overweight and 3.3% were obese.

Table 3. Mean PEFR of swimmers and non swimmers

Variable	Swimmers		Non-swimmers	
	Mean	SD	Mean	SD
PEFR	450.00	60.70	281.67	49.97

450	Swimmers
281.67	Non-swimmers

Mean PEFR in swimmers is 450 l/min and mean PEFR in non swimmers is 281.6 l/min.

Table 4

PEFR	N	Mean	SD	t value	p value
Swimmers	30	450	60.7	11.72	0.000
Non-swimmers	30	281.7	50		

p value less than 0.05, shows the significant difference in the mean PEFR of swimmers and non swimmers

DISCUSSION

Present study was done to compare effect of the swimmers on PEFR in swimmer and non swimmer adult female's. The result showed that there is significant increase in PEFR in swimmers adult females as compared to non swimmer adult females.

Swimming is considered to be a very good exercise for maintaining proper health and also has a profound effect on lung function of an individual. Swimming as a form of exercise is unique in many aspects, it take place in water that presents completely different gravitational and resistive forces compared to air, It is performed in lying position, which alter gravitational effects on circulation.

In swimming there are different types of strokes like freestyle, butterfly, breaststroke, and backstroke. In breaststroke, inspiration is done through the mouth and nose above the water and expiration through the mouth inside the water. Thus, during swimming ventilation is restricted in every respiratory cycle, producing a condition of intermittent hypoxia .This intermittent hypoxia due to restricted ventilation leads to alveolar hyperplasia and also increased air entry, thus increasing the expiratory capacity like PEFR. Further the anaerobic process due to intermittent hypoxia leads to the stimulation of respiratory centre in the medulla thereby increasing the respiration.

During swimming, continuous circumductary movement of the arms take place along with inspiration & expiration, thus helping to increase thoracic mobility. Also swimming involves keeping the head extended which is constant exercise of erector spinae muscle which increases anteroposterior and vertical diameter of the lungs and supraspinatus increases A-P diameter of the lungs. Therefore configuration of thorax increases leads to increases air entry in the alveoli. Thus, swimming increases the ability to inflate and deflate the lungs due to above mentioned reasons.

All these factors leads to collectively increase in PEFR in swimmers which signifies increase in force of expiratory muscle group & decreased bronchial outflow resistance or both causing improvement in lung function.

CONCLUSION

The study concluded that there is a significant effect of swimming on peak expiratory flow rate in adult swimmer females. This study has demonstrated that exercise in the form of swimming produces a significant improvement in PEFR**.**

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How to cite this article: Reena Sharma, Vishnu Ranade, Jaywant Nagulkar. Effect of swimming as an exercise on peak expiratory flow rate in healthy adult females. Int J of Allied Med Sci and Clin Res 2020; 8(3): 698-701.

Source of Support: Nil. **Conflict of Interest:** None declared.