

## EFFECT OF PRANAYAMA ON PULMONARY FUNCTION TESTS AND BREATH HOLDING TIME IN MALE MEDICAL STUDENTS

Dolly Rastogi\*, Jalaj Saxena\*\*, Anumeha Bhagat\*\*\*, Shashi Bhushan Mishra\*\*\*\*

Munish Rastogi\*\*\*\*\*, Sonali Saxena\*\*\*\*\*

Lecturer\*, Assistant Professor\*\*, Senior Resident (AIIMS, New Delhi)\*\*\*  
Professor (Era Medical College, Lko)\*\*\*\*, Lecturer (CSJM University, Kanpur)\*\*\*\*\*  
Consultant Cardiologist (Ishwardevi Medical & Cardiology Centre, Kanpur)\*\*\*\*\*

Department of Physiology, GSVM Medical College, Kanpur

### ABSTRACT:

**Study Objectives :** To ascertain effects of Pranayama training (Yogic Respiratory Exercises) on various pulmonary function tests and breath holding time in young healthy subjects.

**Setting :** 20 healthy male medical subjects divided in 2 groups of 10 students each (control group and training group). The training group was given yogic respiratory training of Pranayama for 6 days a week at a fixed time each day for a duration of 2 months.

**Methods :** Both groups were given exercise challenges both before and after training period. The study was divided into 2 phases. Phase I comprised of determination of pre and post exercise values before start of training. Phase II comprised of determination of same after completion of training period.

**Measurements :** PFTs, TV, FVC, FEV<sub>1</sub>, PEFR and Breath holding time were measured.  $p < 0.05$  was taken as significant.

**Results :** The pre and post exercise values in both phase showed that the control group did not have any significant changes. The training group showed significant fall in pre and post exercise respiratory rate after pranayama training as compared to pre-training levels ( $p < 0.001$ ). A significant increase in pre and post exercise values of TV ( $p < 0.001$ ), FEV<sub>1</sub> ( $p < 0.001$ ), FVC ( $p < 0.05$ ), PEFR ( $p < 0.001$ ) and Breath holding time ( $p < 0.001$ ) were observed.

**Conclusion :** Pranayama Training can alter PFTs increasing endurance time for better physical performance.

**Key words :** Pulmonary Function Tests (PFTs), Pranayama, Breath holding time, Exercise challenge.

**Abbreviation :** TV - Tidal Volume, FEV<sub>1</sub> - Forced Expiratory Volume in 1<sup>st</sup> second, FVC - Forced Vital Capacity, PEFR - Peak Expiratory Flow Rate, BHT - Breath holding time.

### Introduction :

Respiratory training can improve the ability of persons to sustain high levels of ventilation for long periods of time by improving the strength and endurance of the inspiratory muscles (1) Pranayama, a form of respiratory exercise has been shown to improve various respiratory parameters such as rate of respiration, forced vital capacity (FVC), forced expiratory volume in 1<sup>st</sup> second (FEV<sub>1</sub>), Peak

expiratory flow rate (PEFR) and breath holding time (2).

Pranayama has also proved to be beneficial in respiratory ailments such as pleural effusion (3) and bronchial asthma (4).

### Material & Method

The present study was conducted on 20 healthy male medical students. They were divided into two groups of 10 students each-

Group I or control and Group II which was given the Pranayama training for 6 days a week at a fixed time each day for a duration of 2 months. All the subjects were in the range of 20-25 years of age and had no previous involvement in any kind of Yogic or physical exercise. The study comprised of determination of following parameters: Respiratory rate, FVC, FEV<sub>1</sub>, PEFR and breath holding time. The work was conducted in 2 phases. During Phase I the baseline values were recorded and then the subjects were subjected to an exercise challenge comprising of acute exhaustive exercise, after which these parameters (excluding breath holding time) were again recorded.

Group II, then underwent two months of Pranayama training, at the completion of

which again the same parameters before and after the exercise challenge were recorded (Phase II).

The above group were compared as follows: (a) Pre & Post exercise values during Phase I study (b) Pre & Post exercise values during Phase II study (c) Pre exercise values during Phase I & II (d) Post exercise values during Phase I & II

**Statistical Analysis :**

By students 't' test and  $p < 0.05$  was considered as significant.

**Results :** The Pre & Post exercise values of Phase I & II of both the groups are given in table I & II.

**Table - I**  
**Pre & Post exercise values during Phase - I & II in Group - I**

Parameter	Phase - I		Phase - II	
	Pre-exercise (Mean ±SD)	Pre-exercise (Mean ±SD)	Pre-exercise (Mean ±SD)	Pre-exercise (Mean ±SD)
Tidal volume (ml)	355 ±49.72	505 ±49.72	345 ±59.86	490 ±39.44
Respiratory rate (per min)	18.20 ±2.93	31.30 ±3.05	18.60 ±1.89	31.60 ±3.23
FEV <sub>1</sub> (l)	2.96 ±0.42	3.01 ±0.42	2.87 ±0.36	3.02 ±0.42
FVC(l)	3.57 ±0.53	3.42 ±0.53	3.38 ±0.53	3.41 ±0.52
PEFR(l/min)	465.20 ±119.88	472.20 ±118.90	465.33 ±118.70	468.80 ±118.49
Breath holding time(sec)	36 ±2.06		35.80 ±3.70	

**Table - II**  
**Pre & Post exercise values during Phase - I & II study in Group - II**

Parameter	Phase - I		Phase - II	
	Pre-exercise (Mean ±SD)	Pre-exercise (Mean ±SD)	Pre-exercise (Mean ±SD)	Pre-exercise (Mean ±SD)
Tidal volume (ml)	410 ±56.76	1055 ±233.86	565 ±52.96	1625 ±203.10
Respiratory rate (per min)	18 ±1.88	36.60 ±4.2	13 ±1.88	24.50 ±4.32
FEV <sub>1</sub> (l)	3.48 ±0.26	3.62 ±0.23	3.95 ±0.078	4.08 ±0.22
FVC(l)	4.08 ±0.30	4.151 ±0.30	4.40 ±0.29	4.49 ±0.27
PEFR(l/min)	449.10 ±27.75	497.10 ±18.74	569.20 ±25.47	640.10 ±36.10
Breath holding time(sec)	52.60 ±10.96		88.30 ±11.59	

There was no significant change ( $p > 0.05$ ) in the pre and post exercise values of

Group I during Phase II as compared to Phase I. Group-II showed a highly significant increase in

pre & post exercise values of FEV<sub>1</sub> (p<0.001), FVC (p<0.05), PEFR (p<0.001) and breath holding time (p<0.001) during phase II as compared to pre & post exercise values of phase I respectively. However, there was a significant fall in pre & post exercise value of respiratory rate during phase II as compared to Phase I (p<0.001).

**Discussion :**

The training group showed a significant decrease in respiratory rate both before and after exercise (5), which may be in evidence of decreased autonomic arousal and also of psycho-physiological relaxation. The respiratory parameters such as tidal volume, FEV<sub>1</sub>, FVC & PEFR showed a significant rise in the training group (6,7,8). The lowered respiratory rate with high tidal volume keeps respiratory minute volume at par with untrained subjects at a lesser cost of muscular energy. The tidal volume and vital capacity was more in the trained subjects probably because of the training imparted to them by the controlled rhythmic Pranayamic breathings, associated with deep inhalations and exhalations, leading to increased development of respiratory musculature incidental to regular exercise. Vital capacity is a critical component of good health and its determination is important for normal subjects, smokers and patients with respiratory and cardiovascular problems. PEFR is an accurate and simple test for measuring airway resistance and strength of expiratory muscles.

Breath holding time was found to be significantly increased in our training group during Phase II study (5). It may be because of the reason that during Pranayamic breathing, subject while keeping his skeletal muscles relaxed & immobile, exercises a close, continuous voluntary control over his respiratory muscles. In these prolonged efforts

at controlling his respiratory muscles, the subject consciously and persistently overrides the usual stimuli for respiratory centres such as the impulses initiated by PCO<sub>2</sub> & PO<sub>2</sub>, as well as the impulses from higher centres.

**Conclusion :**

Pranayama Training can alter pulmonary function tests (PFTs) and Breath holding time increasing the endurance time for better physical performance.

**References :**

1. Larson JL, Covey MK, Wirtz SE, Berry JK, Alex CG, Langbein WE and Edwards L: Cycle ergometer and inspiratory muscle disease. *Am J Respir Crit Care Med*, 1999, 160 : 500-507.
2. Nayar HS, Mathur RM, Kumar RS: Effect of Yogic exercises on human physical efficiency *Ind Jour Med Res* 1975 Oct. 63, 10.
3. Prakasamma M, Bhaduri A : A study of Yoga as a nursing interaction in the care of patients with pleural effusion. *J Adv Nurs*. 1984, March: 9(2): 127-33.
4. Nagendra HR, Nagarathna R : An integrated approach of Yoga therapy for bronchial asthma: a 3-54 month prospective study. *J Asthma* 1986. 23(3): 123-37.
5. Telles S, Nagarathna R, Nagendra HR, Desiraju, T: Physiological changes in sports teachers following three months of training in yoga *Ind Jour Med Sci*. Oct. 1993, 47(10) : 235-8.
6. Gopal KS, Bhatnagar OP, Subramanian N and Nishith SD: Effect of yogasanas and Pranayamas on BP, PR and some respiratory functions. *Ind J Physiol Pharmacol*. 1973, July 17: 273-276.
7. Joshi LN, Joshi VD, Gokhale LV : Effect of short term Pranayama practice on breathing rate and ventilatory functions of lung *Ind J Physiol Pharmacol* 1992, 36: 105-108.
8. Yadav RK, Das S : Effect of yogic practice on pulmonary functions in young females. *Ind Jour Physiol Pharmacol* 2001, 45: 493-496.

