

## EFFECT OF ONE MONTH DIAPHRAGMATIC BREATHING ON PEAK EXPIRATORY FLOW RATE AND BREATH HOLDING TIME

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### Abstract

Practice of yoga based relaxation techniques has been associated with various physiological changes in our body. The long term practice of these techniques has been reported to improve the pulmonary functions. However, the study on effects of short term diaphragmatic breathing on lung functions is yet lacking. Therefore, the present analytical study was conducted to find the changes in pulmonary functions after practising diaphragmatic breathing for one month among (n=40; 20 males and 20 females) 1<sup>st</sup> year MBBS students aged between 18-20 years. Peak expiratory flow rate (PEFR) and breathe holding time (BHT) was recorded in these subjects before and after one month of practising diaphragmatic breathing. There was a significant increase in both PEFR and BHT after 1 month of diaphragmatic breathing manoeuvre depicting the beneficial of diaphragmatic breathing on pulmonary functions.

**Key words:** Yoga; Pulmonary functions; Peak Expiratory Flow Rate; Breath Holding Time

### Introduction

Sedentary lifestyles could be associated with less efficient pulmonary functions. Involvement in. Certain physical activities, sports or yoga could Yoga have been demonstrated in several studies<sup>2-4</sup>. Various studies have reported benefits in both Peripheral nerve function as well as central neuronal processing.<sup>5,6</sup> Diaphragmatic breathing has been the primary mode of training used for patients suffering from chronic obstructive lung diseases.<sup>7</sup> Moreover, diaphragmatic breathing is an extremely important component of yoga training and yogic exercises have been found to Produce remarkable physiological changes and have scientific basis.<sup>2</sup>

<sup>3</sup> There are a number of reports on the effects of long term yoga based relaxation techniques to improve lung functions.<sup>8-10</sup> However, to the best of our knowledge, the acute effects of diaphragmatic breathing on pulmonary functions in healthy young adults have not been much studied. Moreover, literature is deficient on the effect of yoga training on peak Expiratory Flow Rate (PEFR) and Breath Holding Time (BHT) and therefore the present study was undertaken. Help in respiratory muscle strengthening and improvement in pulmonary functions.<sup>1, 2</sup> Physiological and psychological benefits of Department of Physiology, Government Medical College, and Haldwani among 1<sup>st</sup> year MBBS Students in the group of 18-22 years. Forty students (20 males and 20 females) participated in the study. Questionnaire was used to collect information about familial history of diabetes mellitus, hypertension, and personal

history of smoking, tobacco intake or alcohol consumption. Dietary history was also taken. Further, the anthropometric parameters like age, weight, height, body surface area were recorded of all the subjects. Earlier studies have revealed that PEFR is correlated with age, height and weight.<sup>11,12</sup> In both men and women age showed significant negative correlation whereas height showed positive correlation with pulmonary functions.<sup>13</sup> Taking these studies into consideration the anthropometric parameters were recorded.

### Material & Method:

The present study was performed after obtaining The approval of the Ethical committee of the College.

This study was conducted in the A Subject who was physical and mentally fit, was a non-smoker, was free from any respiratory or cardiac disease or any other systemic disease, was co-operative and capable of understanding the procedure and did not perform any other form of physical or yogic exercise during the study period was included in the study. Informed consent of each subject was taken.

### Procedure of diaphragmatic exercise:

1. Subject was asked to sit erectly and comfortably. 2. He/she was asked to put one hand on his/her chest and the other on abdomen. 3. Then subject was further asked to feel the abdomen which expanded with hands during inhalation. The

parameters recorded were peak expiratory flow rate (PEFR) and breathe holding time (BHT).

#### Peak Expiratory Flow Rate (PEFR) Recording:

PEFR was recorded directly by using Wright's Peak Flow Meter having a range of 60-800 L/min. The subject was asked to take a deep inspiration with maximum effort and then he/she was instructed to blow out forcefully through the mouth piece into the instrument.

#### Results:

**Effect on PEFR** The basal value of PEFR in males was  $406.8 \pm 5.1$  L/min and in females was  $293.5 \pm$  L/min ( Fig 1 ). After practising diaphragmatic breathing for 1 month, there was a significant improvement in the test was performed in

standing position with nose clip applied. After a few practice trials, the highest of the three test reading was taken as the final reading. Test was performed between 9-11 an to avoid the effects of diurnal variation.<sup>14</sup>

**Breath Holding Time (BHT) recording:** BHT was recorded by asking the subject to count the number 1,2, 3,....., till he could hold his breath. The test was performed in sitting position with nose clip applied. The time was recorded in seconds using a stopwatch.

**Statistical Analysis** The pooled data obtained from the study were subjected to SPSSV16 (SPSS windows version 16 software). Paired t-test was applied. A p value < 0.05 was considered significant. PEFR in both males and females (Fig 1).

Peak Expiratory Flow Rate (Litres/min)

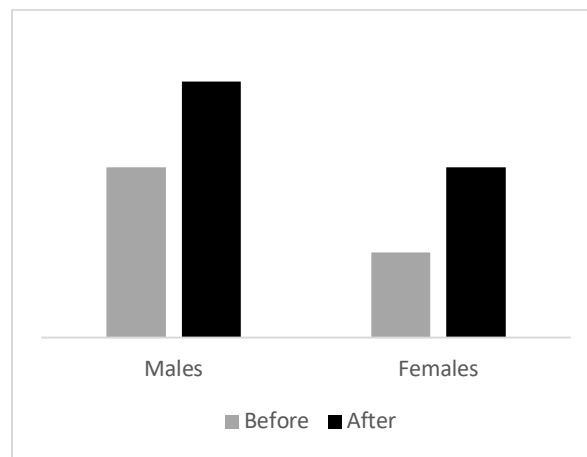


Fig 1. PEFR in males and females before and after 1 month of practising diaphragmatic breathing is shown. An asterisk mark denotes significant improvement in PEFR after diaphragmatic breathing in both males and females (\* p = 0.0018 in males and p = 0.000008 in females, as compared to before values (student's T-test for paired observations).Effect on BHT

The initial BHT was  $19.6 \pm .042$  sec and  $17.1 \pm 0.45$  sec in males and females respectively (Fig 2).

There was a significant increase in BHT in both Male and female after practising diaphragmatic breathing for 1 month (Fig2).

Breath Holding Time (Seconds)

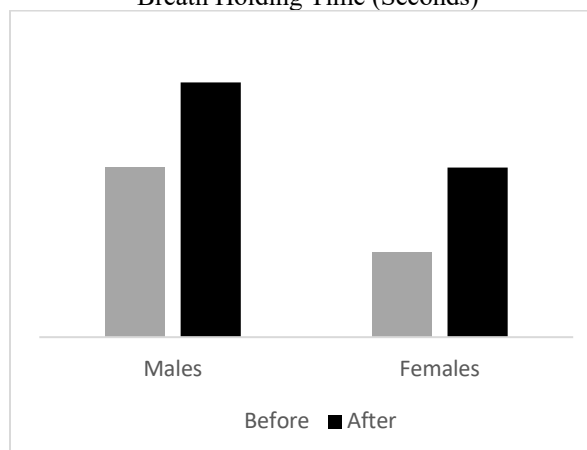


Fig 2. BHT in males and females before and after 1 month of practising diaphragmatic breathing is shown. An asterisk mark denotes significant improvement in BHT after diaphragmatic breathing in both males and females (\*  $p = 0.0000025$  in males and  $p = 0.0000019$  in females, as compared to before values (Student's T-test for paired observations)).

### Discussion

The results of the present study showed that the subject who have performed diaphragmatic breathing for one month showed marked improvement in PEFR and BHR. The results of our study can be compared with the results of the study performed earlier by Prakash et al which showed that pranayama (a yogic practice) has beneficial effect on respiratory efficiency.

Pranayama includes various exercises like Bhastrika, Kapalbharti, etc which involve forceful inspiration followed by forceful expiration.<sup>1,15</sup> On the contrary, the subjects in the present study were asked to slowly at the rate of 6-8 breaths/min. Diaphragmatic dysfunction and alteration of thoraco-abdominal movements are Common in patients with COPD. Breathing strategies have been considered an important component of pulmonary rehabilitation and refer to a range of techniques which includes diaphragmatic breathing. In clinical trials, where diaphragmatic breathing was conducted for 4 weeks relieved the respiratory symptoms and improved the exercise tolerance.<sup>16</sup> Further, it is reported elsewhere that practice of deep diaphragmatic breathing in COPD patients is associated with improvement in blood gases and also induces significant increase in tidal volume.<sup>17</sup>

During yoga practice, one control the stimuli to the respiratory centres. Control over the respiratory centres improves cardio-respiratory endurance which might be responsible for increase in PEFR and prolongation of BHT in subjects practising diaphragmatic breathing.<sup>18</sup> Yogis who are engaged in various breathing exercises have significantly higher PEFR presumably due to respiratory muscle conditioning. Therefore, diaphragmatic breathing can be of great use for the sedentary workers or professional workers who have on time to do physical or yogic exercises. Such persons can practice diaphragmatic breathing as it can be performed while sitting even at workplace. By adopting this practice one can overcome stress and can develop better pulmonary function performance.

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### References

1. Prakash S, Meshram S, Ramtekkar U. Athletes, yogis and individuals with Sedentary lifestyles; Do their lung Function differ? *Indian J Physiol Pharmacol.* 2007;51(1):76-80.
2. Madanmohan RUC, Thombre DP, Balakumar B, Nambinarayanan TK, Thakur S, Krishnamurthy N et al. Effect of yoga training on reaction time, respiratory endurance and muscle strength. *Indian J Physiol Pharmacol.* 1992 ; 36 : 229 - 33.
3. Selvamurthy W, Nayar HS, Joseph NT, Joseph LS, Physiological effects of Yogic practice. *NIMHANS Journal.* 1983 ;1 : 71 – 80.
4. Dostalek C. Yoga: A returning Constituent of medical sciences. *Yoga Mimamsa.* 1985 : 24 : 21 -34.
5. Malhotra V, Singh S, Tandon OP, Madhu SV, Prasad A, Sharma SB, Effect of yoga asanas on nerve conduction in type 2 diabetes. *Indian J Physiol Pharmacol.* 2002 ; 46 : 298 -306.
6. Bhavanani AB, Madanmohan, Udupa K. Acute effect of Mukh Bhastrika (a Yogic bellows type breathing) on Reaction time. *India J Physiol Pharmacol.* 2003 ; 47(3) : 297 – 300.
7. Shaw I, Shaw BC, Brown GA. Role of Diaphragmatic breathing and aerobic exercise in improving pulmonary function and maximum oxygen consumption in asthmatics. *Science and sports.* 2010 ; 25(3) : 139 – 45.
8. Bhole MV, Karambelkar PV, Gharote ML. Effect of yoga practice on vital Capacity. *Indian J Chest Dis.* 1970; 12:32-5.
9. Gopal KS, Bhatnagar OP, Subramanian N, Nishith SD, Effect of yagasanas and Pranayamas on blood pressure, pulse Rate and some respiratory function, *Indian J Physiol pharmacol.* 1973; 17: 273-6.
10. Makwana K, Khirwadkar N, Gupta HC. Effect of short term yoga practice on ventilatory function tests. *Indian J Physiol Pharmacol.* 1988; 32:202-8.
11. Dikshit MB, Prasad BAK, Jog NV. Peak Expiratory Flow Rates in elderly Indians. *Indian J Physiol Pharmacol.* 1991; 35(1): 39-43.
12. Mahajan KK, Maini BK, Mahajan SK, Srivastava SC, Chander S. Pulmonary functions and their correlation with anthropomorphic parameters in young adults of Haryana (India). *Indian J Physiol Pharmacol.* 1978; 22: 87-82.
13. Viran N, Shah B, Celly A. Pulmonary Function studies in healthy non-smoking Adults in Sri Aurbindo Ashram. *Indian J Med Res.* 2001; 114: 177-184.
14. Mahajan KK, Mahajan SK, Maini BK. Diurnal, day to day and seasonal Variations in ventilatory functions in Healthy adults. *Ind Med Gaz;* xix: 76-8.
15. Fanta CH, Leith DE, Brown R. Maximal shortening of inspiratory muscles: effect of training. *J Appl Physiol.* 1983; 54: 1618-23.
16. Yamaguti WP, Claudino RC, Neto AP, Chammas MC, Gomes AC, Salge JM et Al. Diaphragmatic breathing training Program improves abdominal motion during natural breathing in patients with chronic obstructive pulmonary disease: a randomized

- controlled trial. Arch Phys Med Rehabil. 2012;93(4): 571-7.
17. Vitacca M, Clini E, Bianchi L, Ambrosino N. Acute effects of deep Diaphragmatic breathing in COPD Patients with chronic respiratory Insufficiency. Eur Respir J. 1998; 11: 408-415
18. Madanmohan, Rai UC, Balavittal V, Thombre Dp, Swami Gitananda. Cardiorespiratory changes during savitri Pranayama and shavasan. The Yoga Review. 1983; 3: 25-34.