International Journal of Physiotherapy and Research,
Int J Physiother Res 2017, Vol 5(5):2420-23. ISSN 2321-1822
DOI: https://dx.doi.org/10.16965/ijpr.2017.221

Original Research Article

IMMEDIATE EFFECT OF DEEP BREATHING EXERCISE ON HEALTHY SUBJECTS

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ABSTRACT

Background: A behavioral task frequently used to assess distress tolerance is the breath holding task. The immediate effects of deep breathing exercises have different types of benefits like significant decrease of atelectatic area, increase in aerated lung area and a small increase in PaO_2 is well known. There exists an interrelationship in normal healthy persons between resting HR, RR & BP and breath bolding capacity. By adding the DBE in routine physiotherapy; we can improve the distress tolerance as well as lung capacity in healthy individuals.

Materials and Methods: 60 healthy subjects with the age of 20-25 years at Physiotherapy College, Ahmadabad was included for the study. Subjects on medication or not wililng to participate were excluded. Experimental study (pre and post) was conducted with purposive sampling**.** Height, weight, BMI, PR, RR, SpO_2, PEFR & breath holding time was recorded. Then subjects were instructed to perform DBE for 5 minutes (6 breaths/min). This was followed by recording of PR, RR, SpO_2, PEFR and lastly breath holding time. Data was analyzed by using SPSS 16 by keeping the level of significance at 5%. Wilcoxon test was used to see the statistical significance.

Results: PEFR, SpO_2 and breath holding time is found to be significantly increased (p=0.00) with significant decrease in PR, RR (p=0.00) in young adults of both genders.

Conclusion: The result indicates that the deep breathing exercise has an influence on parasympathetic nervous system. The increased PEFR can be due to decreased in small airway resistance.

KEY WORDS: Deep breathing exercises, Breath holding capacity, PEFR.

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Quick Response code	International Journal of Physiotherapy and Research ISSN 2321- 1822 www.ijmhr.org/ijpr.html	
DOI: 10.16965/ijpr.2017.221	Received: 19-07-2017 Peer Review: 20-07-2017 Revised: None	Accepted: 05-08-2017 Published (O): 11-10-2017 Published (P): 11-10-2017

INTRODUCTION

The deepest breath that the human beings take is the first cry after birth. First cry is the maximum inspiratory effort to expand the collapsed lung permanently at the time of birth, during which the intrapleural pressure becomes -70mm of Hg [1]. Benefits of practicing deep breathing have been found in Hindu Sanskrit texts from as early as the fifth century. However, the fact that it is such a vital component in Eastern meditation systems, such as Taoist qi gong, tai chi and pranayama yoga, suggests that the practice of deep breathing in the pursuit of health and enlightenment is probably much older [1].

Breath control, is a technique that involves slow and rhythmic breathing. It is known that the regular practice of deep breathing exercise increases parasympathetic tone, decreases sympathetic activity, improves cardiovascular and respiratory functions, decreases the effect of stress and strain on the body and improves physical and mental health [2,3]. Regular practice of rhythmic slow breathing has been shown to increase baroreflex sensitivity and reduce chemoreflex activation [4], and to reduce systolic, diastolic and mean blood pressures as well as heart rate variations in hypertensive patients [5]. Practice of slow breathing has also been advocated for the treatment of anxiety disorders as it attenuates cardiac autonomic responses in such patients.

From the point of view of oxygen gas exchange, human lungs are highly inefficient, as suggested by the 50–60 mmHg PO2 gap between atmosphere and arterial blood observed at sea level. Controlled breathing with low rate and high tidal volume, has been shown to improve the efficiency of ventilation by increasing alveolar and reducing dead space ventilation [6]. Slow deep breathing may also improve arterial oxygenation by increasing alveolar volume and gas exchange at the alveolar capillary membrane level.

A behavioral task frequently used to assess distress tolerance is the breath holding task [7]. During deep breathing exercise. Voluntary hyperventilation creates a considerable diffusion gradient for carbon dioxide runoff into the alveoli from venous blood that enters the pulmonary capillaries and this can increase the breath holding time after deep breathing.

Peak Expiratory Flow [PEF], which is generally measured by a peak flow meter and given in liters per minute. A decrease in PEFR indicates an increase in airway resistance and vice versa. It is a sensitive parameter and is useful for serial measurement because it will be affected before FEV, so can act as an early warning sign of small airway disease [8].

The aim of the present study is to find the immediate effect of deep breathing exercise on various cardiovascular variables in healthy young individuals.

MATERIALS AND METHODS

Study design and the participants:

Interventional study was conducted with purposive sampling on immediate effect of deep breathing exercise on healthy young adults. Study was conducted in Physiotherapy College, Ahmadabad. 60 subjects (n=60. Male=18, female=42) between the age of 20 – 25 years were included in the study. Subjects who were on medication and not willing to participate were excluded from the study.

Anthropometrical parameters [height in cms, weight in kg, BMI in kg/m^2]; Cardiorespiratory parameters like Respiratory rate [in breaths / min], Pulse rate[bpm], SpO_2[in %] by pulse oxymeter, PEFR [in Liters/min] by Peak flow meter & Breath holding time [in seconds] up to breaking point.

Then subject was directed to inhale slowly up to the maximum of 5 seconds and exhale slowly up to the maximum of 5 sec. [i.e. at the rate of 6 breaths /min] for 5 minutes.[9] Pulse rate, Respiratory rate, SpO_2, PEFR and breath holding time was measured again. Breath holding time was measured after measuring all parameters.

Response Rate: All the 60 students selected from the study population of 60 giving an overall response rate of 100%.

Outcome variable: Breath holding time, respiratory rate, pulse rate, SpO_2, PEFR.

Explanatory variables: Demographic and other factors - age, height, weight, BMI.

Statistical Analysis: Each parameter was computed for each subject before and after the intervention by using SPSS version 16. Willcoxon test was applied for analysis. P value < 0.05 is considered as significant.

RESULTS

Table 1: Represents anthropometrical parameters in young adults of both genders.

Variables	Male [mean ± SD]	Female [mean ± SD]	p value
Age (years)	21.78±0.943	21.24±0.98	0.261$^+$
Height (cms)	169.06±7.78	159.5±8.92	0.003*
Weight (kgs)	66.11±9.89	55.56±14.44	0.10$^+$
BMI (kg/m2)	23.11±3.03	21.68±3.27	0.112$^+$

* P<0.05, statistically significant $^+$p>0.05, statistically not significant

The mean age of our study population for male 21.78±0.94 yrs and female 21.24±0.98 years. Height and weight of males were comparatively more 169.06±7.78 cms and 66.11±9.89 kgs than females. Body mass index was almost same for both the groups – table 1.

Respiratory rate, pulse rate, SpO2 were decreased after deep breathing session of 5 minutes. This improvement was statistically significant.

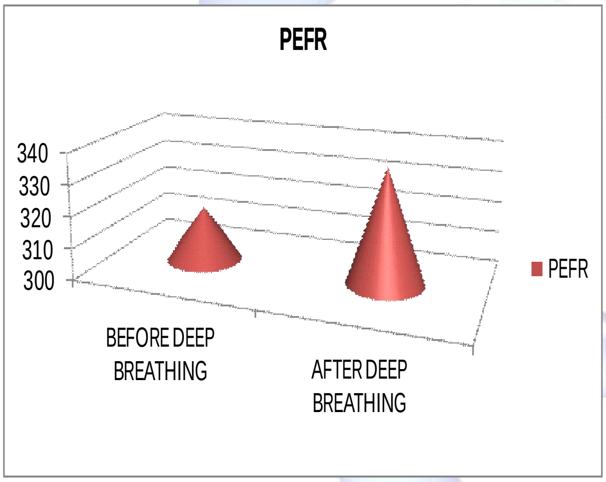
Table 2: Shows comparison of various physiological parameters before & after deep breathing (n=60).

Variable	Before deep breathing session [mean ± SD]	After deep breathing session [mean ± SD]	p value	Z value
Respiratory rate	23.17±3.49	19.72±2.57	0.00*	-6.52
Pulse rate	90.28±9.41	80.75±8.73	0.00*	-5.12
SpO2	96.92±1.36	97.73±1.10	0.00*	-5.33
PEFR	317.78±78.85	336.83±72.77	0.00*	-5.88
Breath holding time	30.53±14.68	40.70±16.35	0.00*	-6.47

* $P<0.05$, statistically significant
+$p>0.05$, statistically not significant

Figure 1 shows there is significant increase in PEFR after deep breathing exercise for 5 minutes at the rate of 6 breathes/ min.

Fig. 1: Effect of deep breathing on PEFR [Lit/min].



Breath holding time increased immediately after the deep breathing for 5 minutes at the rate of 6 breaths/min in both gender. This improvement is statistically significant.

DISCUSSION

A significant drop was observed in PR and RR after 5 min session of deep breathing exercise at the rate of 6 breaths/min. These results supports the study done by G.K.Pal [13]. Breath holding capacity was markedly increase after deep breathing exercise. Complex mechanisms delicately adjust breathing rate and depth to the body's metabolic needs. Deep breathing causes alveolar Pco2 decreases from its normal value of 40 mmHg to a low of 15 mm Hg. This creates a considerable diffusion gradient for carbon dioxide runoff into the alveoli from venous blood that enters the pulmonary capillaries. Consequently, a larger than normal quantity of carbon dioxide leaves the blood and arterial Pco2 decreases. Thais causes the drop down of RR and extends the breath holding duration until the arterial Pco2 and/or H^+ concentration rises to level that again stimulates to breath. The break point for breath holding corresponds to an increase in arterial Pco2 to approximately 50 mm Hg.

The another possible mechanism that contributed in significantly increased PERF and breath holding time can be stimulation of the pulmonary stretch receptors due to maximum inflation of the lung during deep breathing relaxes the smooth muscles of tracheo bronchial tree. The stretch receptors are thus trained to withstand more and more stretching this helps us to hold the breath for a long period [10]. Surfactant which is secreted by the type II pneumocytes is increased after deep breathing and this surfactant increases the compliance of the lung as shown in the increased compliance during the deflation phase of the pressure volume curve of a lung [1]. Similar results were found in the study done by the Bindu C.B [9].

Oxygen saturation increase significantly after the deep breathing exercise. SpO2 increase suggests that slow deep breathing improves the efficiency of ventilation. We are likely to have increased the used alveolar volume with slow deep breathing and, consequently, we have reduced dead space minute ventilation and the dead space to tidal volume ratio to a percentage, as previously reported for heart failure patients during slow deep breathing exercise [11]. Moreover, because slow deep breathing is associated to a reduction of sympathetic tone, the improvement of ventilation/perfusion matching may also originate by more respiratory sinus arrhythmia [12]. Finally, the reduction of sympathetic tone could lead to a reduction in metabolic rate, which, possibly combined with an increase of cardiac output, may lead to an increase of mixed venous PO2 and thus less admixture.

CONCLUSION

In summary, the present article shows the RR, PR decreases immediately after deep breathing. Same way SpO2 , PEFR and breath holding time increases.

Limitations & future scope of the study Sample size of the present study was less. Future research with more number of samples may want to investigate whether there is any other inter-relationship between the variables used in this study.

ACKNOWLEDGEMENTS

The authors are grateful to the Management, Principal, HOD & staff of SBB college of Physitherapy, Ahmedabad, Gujrat for their support and encouragement. We would like to thank the students who participated in the study.

Conflicts of interest: None

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How to cite this article:

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