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Original Research Article

Transient Effect of Slow and Deep Breathing Exercise on Cardiopulmonary Functions

Rajan Pandit[1*], Paresh Roychowdhury[2]

[1*]M.Sc (Medical) Physiology, [2]MD, PhD, Professor and HOD,
Department of Physiology, Nepal Medical College, Jorpati, Kathmandu, Nepal.

ABSTRACT

Introduction: In recent years, there has been considerable interest in scientific research on yoga which is being practice to decreases the effect of stress and strain on body and mind. Concentrating more towards the modern physiology, rather than yogic philosophy, the present study has been carried out to find the transient effect of simple slow and deep voluntary breathing exercise on cardiopulmonary function.

Methods: Healthy, non-smoker sedentary volunteers (n=30, age=18-21) participated in the study. Following 5 minutes rest, peak expiratory flow rate; heart rate, and blood pressure were recorded. Then the participants were asked to perform slow and deep breathing exercise paced by metronome- approximately 6cycles/min for 5 minutes. Immediately after the maneuver the aforesaid parameters were measured.

Result: Immediately after 5 minutes of breathing exercise, we found significant decrease in heart rate, systolic blood pressure, diastolic blood pressure and significant increase in peak expiratory flow rate ($P<0.05$). Furthermore, the participants also reported sense of calmness and sleepiness.

Conclusion: Results of previous and present study indicated simple slow and deep breathing exercise for 5 minutes at the rate of approximately 6cycles/min might be used as alternative breathing technique instead of other *pranayamic* breathing exercises, which required complex procedures and stringent rules, for a stress free life.

Key words: Cardiopulmonary, Simple vs Stringent Breathing Rules, Slow-Deep Breathing Exercise.

***Correspondence to:**

Rajan Pandit,
Lecturer, Department of Physiology,
Nepal Medical College, Jorpati, Kathmandu, Nepal.

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INTRODUCTION

Stress is a condition that disrupts or destabilizes homeostasis, e.g. homeostasis of central nervous system, blood pressure, heart rate, skeletal muscle efficiency, and so on. The causes of stress-related diseases are increasing day by day throughout the world. The Global Burden of Disease Survey by World Health Organization estimates that mental disease, including stress-related disorder, will be second leading cause of disability by the year 2020.[1]

The famous yoga guru, baba Ramdev (*Patanjali)*, in his *Yoga Sutra* describes—*Yama, Niyama, Asana, Pranayama, Pratyahara, Dharma, Dhyana,* and *Samadhi* as eight angas (parts) of yoga.[2]

In recent years, there has been considerable interest in scientific research on yoga. The focus on the scientific studies is mainly on *Asanas* (posture of resting body) and *Pranayama* (voluntary breathing exercise).The effect of different *Pranayamas* on healthy[3] and disease person[4-6] has been well studied and showed beneficial effect on cardiopulmonary and autonomic functions.

Many previous studies revealed that the regular practice of breathing exercise *Pranayama* not only increase parasympathetic tone but also decrease sympathetic tones simultaneously and thereby decreases the effect of stress and strain on body and mind.[7-9]

Concentrating more towards the modern physiology, rather than yogic philosophy, the present study has been carried out to find the transient effect of simple slow and deep voluntary breathing exercise (slow- deep inspiration followed by slow- deep expiration; approximately 6 cycles/min for 5 minutes) on cardiopulmonary functions.

MATERIALS AND METHODS

The study was done in January-June 2013 in the Department of Physiology, Nepal Medical College. Healthy, non-smoker sedentary participants (n=30, age=18-21) took part in the study. During orientation program, the experiment protocol, aims and objectives of the study were fully explained to them. The participants were requested to abstain from beverages like coffee for preferably 12 hours, strenuous physical activity and alcohol for at least a day prior to breathing exercise. The room temperature was maintained at 22-26°C.The participants had no history of any major disease.

Following 5 minutes rest, peak expiratory flow rate, heart rate, and blood pressure were recorded by palpating radial artery, and using stethoscope and sphygmomanometer respectively.

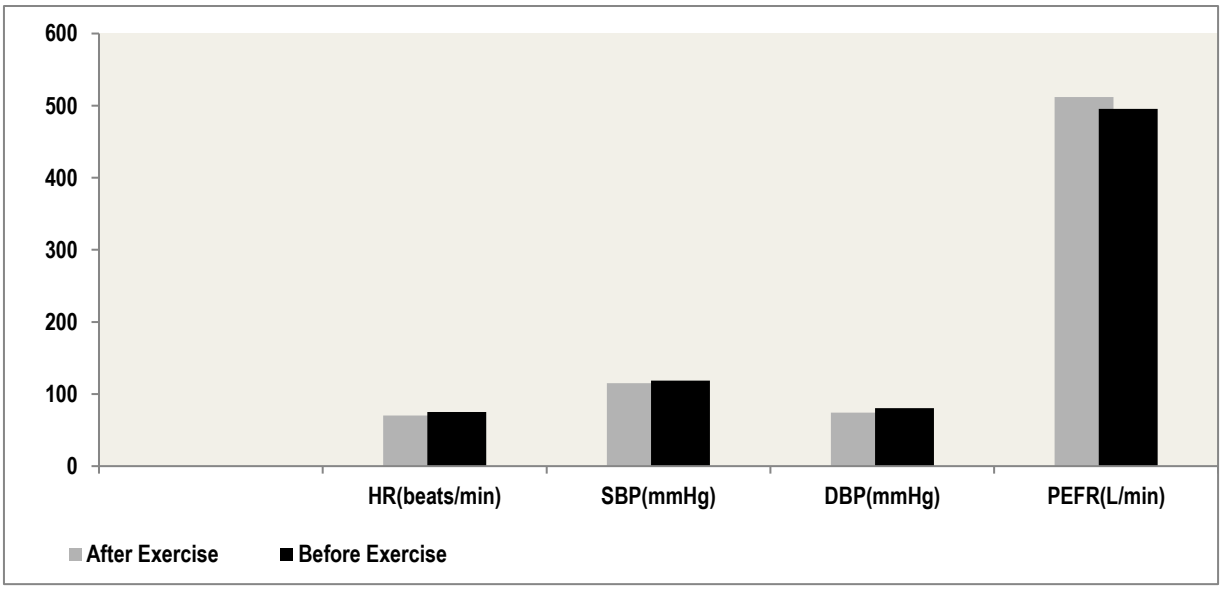
The breathing techniques were demonstrated to each of them. Then they were directed to sit in easy and steady posture with head, neck and trunk erect in straight line keeping the body still while practicing slow deep inspiration followed by slow deep expiration for 5 minutes paced by a metronome —approximately 6 cycles/min. The breathing must not be abdominal. Immediately after 5 minutes of this breathing practice, their heart rate and blood pressure was recorded, and then followed by recording of peak expiratory flow rate in the aforesaid manner using the same instruments. Data were compiled using MS Excel and statistically analyzed using student t-test.

Table 1: Comparison of cardiopulmonary parameters before and after simple breathing exercise (n=30)

Parameters	Before Exercise (Mean±SD)	After Exercise (Mean±SD)	P- value	Remarks
HR (beats/min)	75.8±3.23	70.2±2.16	<0.05	Significant
SBP (mmHg)	118.78±3.29	114.92±5.25	<0.05	Significant
DBP (mmHg)	80.39±2.25	74.28±5.02	<0.05	Significant
PEFR (L/min)	495.39±30.3	512.0±20.1	<0.05	Significant

HR=Heart Rate; SBP=Systolic Blood Pressure; DBP=Diastolic Blood Pressure; PEFR=Peak Expiratory Flow Rate

Figure 1: Comparison of cardiopulmonary parameters before and after simple breathing exercise (n=30)



RESULTS

From the **Table-1/Figure-1,** it is evident that immediately after 5 minutes of this breathing practice, there was significant decrease in mean heart rate (75.8 beats/min Vs 70.2 beats/min), mean systolic blood pressure (118.78 mmHg Vs 114.92 mmHg) and mean diastolic blood pressure (80.39 mmHg Vs 74.28 mmHg) and significant increase in peak expiratory flow rate (495.39 L/min Vs 512.00 L/min), (P<0.05).

Furthermore, when the volunteers were asked about their feeling after the breathing exercise, they reported feeling of calmness and sleepiness.

DISCUSSION AND CONCLUSION

Respiratory and cardiovascular control systems are coupled reciprocally. While each system affects the other, respiration, the slower oscillation, has a stronger influence on the cardiovascular system than arterial blood pressure has on the breathing pattern.[10] An individual practicing slow-deep breathing exercise not only tries to breath but simultaneously tries to keep his/her attention to the act of breathing, leading to concentration, thereby removes his/her attention from worldly worries and de-stresses himself/herself. This may decrease the release of stress hormones- epinephrine, nor-epinephrine and hence modulates heart rate, blood pressure.

At the same time, adrenaline mediated activation of ascending reticular system, driving systems of the brain, is also inhibited.[11] This might resulted the feeling of calmness and sleepiness in our participants.

The heart rate is determined, in normal resting person, mainly by background vagal activity. The basal heart rate is, therefore, the function of parasympathetic system.[12] In our study, there was significant decrease in heart rate and systolic blood pressure following 5 minutes of breathing exercise. This indicates that the practice of slow and deep breathing exercise improves vagal activity.

Diastolic blood pressure depends mainly on total peripheral resistance. Lung inflation has been known to decrease systemic vascular resistance.[13] This reflex is brought about by pulmonary receptors which cause withdrawal of sympathetic tone in skeletal muscle blood vessels leading to decrease peripheral resistance and diastolic blood pressure in our study.

Breathing exercise releases lung surfactant and prostaglandins into alveolar spaces thereby increases lung compliances.[14]

Furthermore, stimulation of pulmonary stretch receptors by inflation of lung by slow deep breaching reflexly relaxes smooth muscles of larynx and tracheobrochial tree-probably reducing air way resistances from larynx to bronchi[15] and also supported by significant increase in peak expiratory flow rate in our study.

Our findings corroborate with the previous observations[2-4,16] that *pranayamic* breathing decreases heart rate and blood pressure by improving vagal tone and by decreasing sympathetic discharge.

Results of previous and present study indicated – simple slow and deep breathing exercise for 5 minutes at the rate of 6cycles/min might be used as alternative breathing technique instead of other *pranayamic* breathing exercises, which required complex procedures and stringent rules, for a stress free life.

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