ORIGINAL RESEARCH

Analysis of slow deep breathing effect on heart rate and the blood pressure

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ABSTRACT
Background: Slow deep breathing practices, such as diaphragmatic breathing or paced breathing, have been shown to have beneficial effects on blood pressure and heart rate through various physiological mechanisms. The present study was analysis of slow deep breathing effect on heart rate and the blood pressure. **Materials & Methods:**110 healthy subjects of both genders were subjected to three months slow deep breathing exercise. Assessment of blood pressure, pulse and respiratory rates was done. **Results:** The mean pulse rate before deep breathing was 78.4 beats/min in group I and 76.2 beats/min in group II. Respiratory rate was 17.2 cycles/min in group I and 16.8 cycles/min in group II. The mean SBP was 120.5 mm Hg in group I and 118.6 mm Hg in group II, DBP was 78.2 mm Hg in group I and 74.2 mm Hg in group II. The difference was significant (P< 0.05). The mean SBP after deep breathing was 114.5 mm Hg in group I and 112.6 mm Hg in group II, DBP was 78.2 mm Hg in group I and 73.2 mm Hg in group II, pulse rate was 70.4 beats/min in group I and 71.2 beats/min in group II. Respiratory rate was 14.2 cycles/min in group I and 15.1 cycles/min in group II. The difference was significant (P< 0.05). **Conclusion:** Deep, slow breathing lowers heart rate and blood pressure while enhancing autonomic processes.
Key words:breathing, Autonomic function, systolic blood pressure

INTRODUCTION

Slow deep breathing practices, such as diaphragmatic breathing or paced breathing, have been shown to have beneficial effects on blood pressure and heart rate through various physiological mechanisms.Slow deep breathing stimulates the parasympathetic nervous system, which is responsible for promoting relaxation and reducing stress. This activation leads to a decrease in sympathetic nervous system activity, which is associated with lower heart rate and blood pressure.[1]

The baroreflex is a physiological mechanism that helps regulate blood pressure by sensing changes in blood pressure and adjusting heart rate and vascular tone accordingly. Slow deep breathing can enhance baroreflex sensitivity, leading to more effective regulation of blood pressure and heart rate.[2]Slow deep breathing increases vagal tone, which refers to the activity of the vagus nerve, a major component of the parasympathetic nervous system. Higher vagal tone is associated with lower heart rate and improved cardiovascular function.Slow deep breathing practices have been shown to reduce levels of stress hormones such as cortisol and adrenaline, which can contribute to hypertension and elevated heart rate. By promoting relaxation and reducing stress, slow deep breathing can help lower blood pressure and heart rate.[3]

The normal breathing pattern is automatic and rhythmic, with cyclical inspiration and expiration. During the inspiration phase, the diaphragm and ribs contract along with the intercostal muscles, expanding the chest's capacity. This lowers the pressure inside the chest, allowing air to enter the lungs. During an exhale, the diaphragm and intercostal muscles relax, and the pull of the ribcage lowers the thoracic volume, increases the pressure inside the thorax, and allows air to escape.[4] Studies show that regular breathing exercises improve autonomic functions by raising vagal tone and decreasing sympathetic activity. Moreover, deliberate deep, slow breathing improves minute ventilation, raises the amount of wasted dead space, andperipheral chemoreceptors is consequently reduced. Numerous studies have also demonstrated that breathing affects the SBP and DBP values in various ways.[5,6]The present study was analysis of slow deep breathing effect on heart rate and the blood pressure.

MATERIALS & METHODS

The present study was conducted on 110 healthy subjects of both genders. All subjects agreed with their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Two groups were made. Group I comprised of 55 males and group II had 55 females. The individual was instructed to deep breathe at a rate of six breaths per minute throughout two sessions, each lasting five minutes. Before the second session, which lasted five minutes and involved deep breathing at a pace of six breaths per minute, there was a five-minute pause. For three months, the subject groups had to perform the same drills under the investigator's supervision each day. Subjects are instructed to sit up straight and concentrate on their breathing while performing this activity. Assessment of blood pressure was done. A typical pulse oximeter was put on the index finger to measure the pulse and respiratory rates. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Comparison of parameters before deep breathing

Parameters	Group I	Group II	P value
Pulse rate (beats/min)	78.4	76.2	0.42
RR (cycles/min)	17.2	16.8	0.57
SBP (mm Hg)	120.5	118.6	0.12
DBP (mm Hg)	78.2	74.2	0.05

Table I, graph I shows that mean pulse rate before deep breathingwas 78.4 beats/min in group I and 76.2 beats/min in group II. Respiratory rate was 17.2 cycles/min in group I and 16.8 cycles/min in group II. The mean SBP was 120.5 mm Hg in group I and 118.6 mm Hg in group II, DBP was 78.2 mm Hg in group I and 74.2 mm Hg in group II. The difference was significant (P< 0.05).

Graph I Comparison of parameters before deep breathing

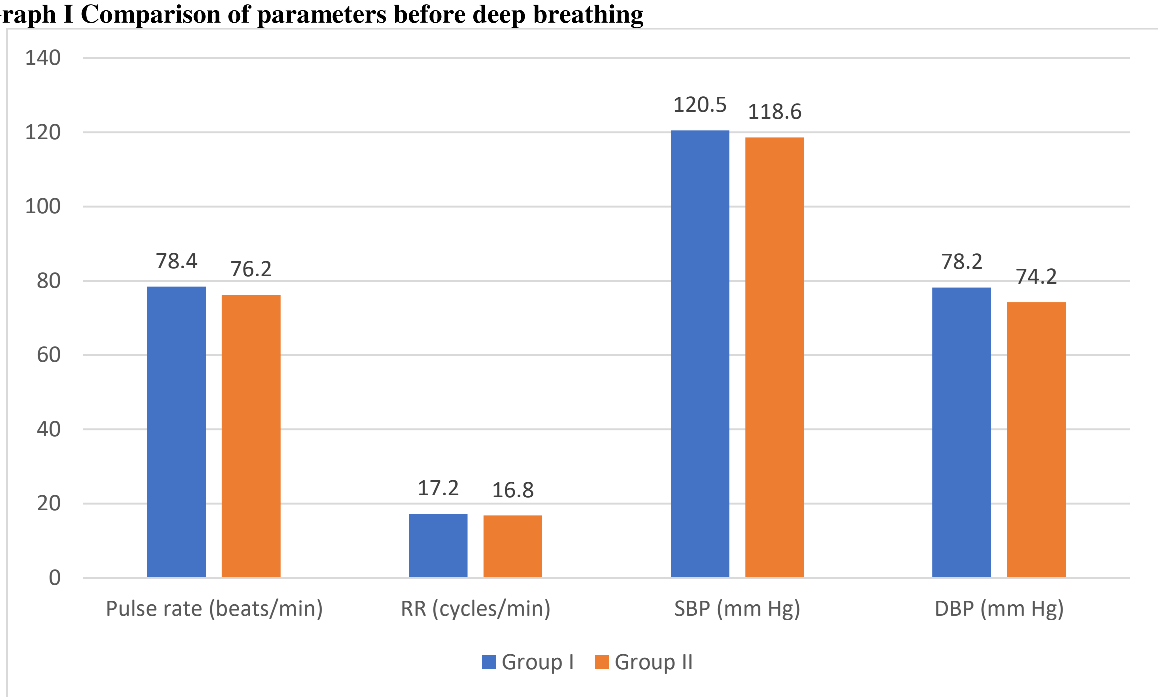
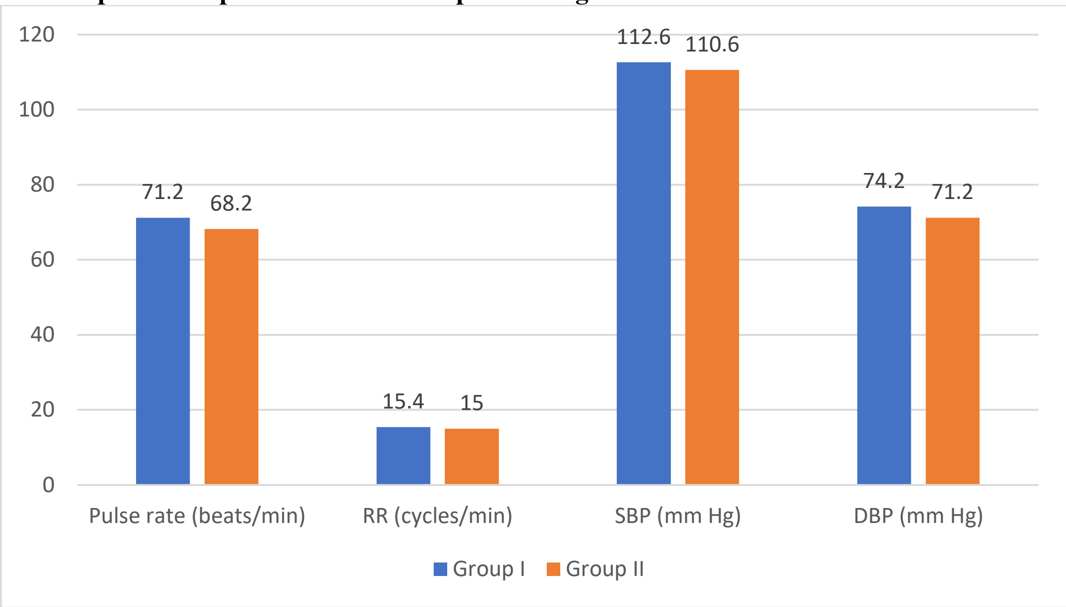


Table II Comparison of parameters after deep breathing

Parameters	Group I	Group II	P value
Pulse rate (beats/min)	71.2	68.2	0.01
RR (cycles/min)	15.4	15.0	0.92
SBP (mm Hg)	112.6	110.6	0.05
DBP (mm Hg)	74.2	71.2	0.01

Table II, graph II shows that mean SBP after deep breathingwas 114.5 mm Hg in group I and 112.6 mm Hg in group II, DBP was 78.2 mm Hg in group I and 73.2 mm Hg in group II, pulse rate was 70.4 beats/min in group I and 71.2 beats/min in group II. Respiratory rate was 14.2 cycles/min in group I and 15.1 cycles/min in group II. The difference was significant (P< 0.05).

Graph II Comparison of parameters after deep breathing



DISCUSSION

It is commonly known that breathing is one of the major physiological activities that influences blood pressure. Numerous methods of relaxation, such as yoga, concentrate on controlling breathing.[7,8] The body experiences a peaceful, relaxed, and concentrated state as a result of the active relaxation response. Deep breathing is therefore among the most efficient, straightforward, and age-old techniques for reducing stress that can be applied almost anywhere.[9,10] To further condition the person, a bio-feedback mechanism is employed.It has been demonstrated that regular rhythmic slow breathing exercises improve baroreflex sensitivity, decrease chemoreflex activation, and lower mean, diastolic, and systolic blood pressure in hypertension individuals.8 Since slow breathing reduces cardiac autonomic reactions in anxious patients, it has also been recommended as a treatment for anxiety disorders.[11]The present study was analysis of slow deep breathing effect on heart rate and the blood pressure.

We found that the mean pulse rate before deep breathing was 78.4 beats/min in group I and 76.2 beats/min in group II. Respiratory rate was 17.2 cycles/min in group I and 16.8 cycles/min in group II. The mean SBP was 120.5 mm Hg in group I and 118.6 mm Hg in group II, DBP was 78.2 mm Hg in group I and 74.2 mm Hg in group II. Radaelli et al[12] in 24 resting, supine healthy male volunteers, blood pressure, R-R interval (electrocardiogram) and ventilation (impedance) were recorded continuously. Both assessments were performed during spontaneous breathing and during 6 cycles/minutes controlled ventilation in random order.The depressor and bradycardic responses to neck suction were significantly larger during slow breathing than in spontaneous breathing (+32 and +85%, respectively; both P < 0.01). The alpha index was also significantly larger during slow breathing (+62%; P < 0.01). Even after the volunteers were divided into older (> 50 years, n = 9) and younger (< 30 years, n = 9) groups, the baroreflex potentiation related to slow breathing was clearcut and significant for both the depressor (+46 and +24% older and younger volunteers; both P < 0.01) and the bradycardic (+130 and +73% older and younger volunteers; both P < 0.01) responses. When the assessment was made by computing the cross-spectral alpha index, a marked potentiation related to slow breathing was observed in younger volunteers (+99%; P < 0.01), whereas in older volunteers only a trend to an enhancement (by 32%; P < 0.055) was observed.

We found that the mean SBP after deep breathing was 114.5 mm Hg in group I and 112.6 mm Hg in group II, DBP was 78.2 mm Hg in group I and 73.2 mm Hg in group II, pulse rate was 70.4 beats/min in group I and 71.2 beats/min in group II. Respiratory rate was 14.2 cycles/min in group I and 15.1 cycles/min in group II.Laude et al[13] conducted a study to determine the relationships between respiratory sinus arrhythmia and changes in SBP during voluntary control of tidal volume in healthy participants. They found that the severity of the respiratory arrhythmia increased as tidal volume and breathing frequency decreased. The SBP decreased during inspiration, and as the tidal volume increased, so did the rate of fall. They concluded that a simple shift in HR is not as complex as the respiratory changes associated with SBP.

Anderson et al[14]investigated the effects of daily practice of DGB on (a) 24-h BP and breathing patterns in the natural environment, as well as (b) BP and breathing pattern during clinic rest. Altogether, 40 participants with pre-hypertension or stage 1 hypertension were trained to decrease breathing rate through DGB or to passively attend to breathing

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(control, CTL) during daily 15-min sessions. The participants practiced their breathing exercise at home for 4 weeks. The DGB (but not the CTL) intervention decreased clinic resting BP, mid-day ambulatory systolic BP (in women only) and resting breathing rate, and increased resting tidal volume. However, 24-h BP level was not changed by DGB or CTL interventions, nor was overnight breathing pattern. These findings are consistent with the conclusion that a short-term, autonomic mechanism mediated the observed changes in resting BP, but provided no evidence that regular DGB affected factors involved in long-term BP regulation.
The shortcoming of the study is small sample size.

CONCLUSION

Authors found that deep, slow breathing lowers heart rate and blood pressure while enhancing autonomic processes.

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