

## Effect of alternate nostril breathing exercise on cardiorespiratory functions

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### ABSTRACT

*Pranayama* (breathing exercise), one of the yogic techniques can produce different physiological responses in healthy individuals. The responses of Alternate Nostril Breathing (ANB) the *Nadisudhi Pranayama* on some cardio-respiratory functions were investigated in healthy young adults. The subjects performed ANB exercise (15 minutes everyday in the morning) for four weeks. Cardio-respiratory parameters were recorded before and after 4-weeks training period. A significant increment in Peak expiratory flow rate (PEFR L/min) and Pulse pressure (PP) was noted. Although Systolic blood pressure (SBP) was decreased insignificantly, the decrease in pulse rate (PR), respiratory rate (RR), diastolic blood pressure (DBP) were significant. Results indicate that regular practice of ANB (*Nadisudhi*) increases parasympathetic activity.

**Keywords:** ANB, *Pranayama*, Breathing exercise.

### INTRODUCTION

Yogic techniques are known to improve ones overall performance. *Pranayama* (breathing exercise) is known to be a part of yogic techniques. Patanjali in his Yoga Sutra describes- *Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana and Samadhi* as eight *angas* (parts) of yoga.<sup>1</sup> Amongst them, in the present materialistic world, the third and fourth part, *Pranayama* and *Asana* (Postures) are considered as very important part and prescribed by modern medicine too. Many physicians now recommend yoga to patients at risk for heart diseases, as well as those with back pain, arthritis, depression and other chronic diseases.<sup>2</sup> The beneficial effects of different *Pranayama* are well reported and has sound scientific basis.<sup>3-5</sup> Different types of *Pranayama* (breathing exercises) produces different physiological responses in normal young volunteers.<sup>4,6</sup> *Savitri Pranayama, Kapalbhati, Bhastrika Pranayama, Nadi suddhi Pranayama* (Alternate nostril breathing), are well known among them. These breathing exercises are reported to influence cardio-respiratory and autonomic functions.<sup>6-9</sup> and also help in reducing the scores of anxiety<sup>10</sup> and stress.<sup>5</sup> In the present study an attempt has been made to investigate the effect of ANB on different cardio-respiratory parameters on healthy young volunteers.

### SUBJECTS AND METHODS

Thirty six volunteers (32 males and 4 females) took part in the present study. Their age height, weight, age were recorded and BMI calculated. All the subjects were healthy and did not have any cardio-respiratory diseases and were not under any medications. All were non-smokers and were of same socioeconomic status. They all were sedentary. The aim and objective of the study were explained to each of them and verbal consent was

taken. A baseline record (which served as control) of respiratory rate (RR/min), Pulse rate (PR/min), SBP (mmHg), DBP (mmHg), PEFR (L/min) were recorded and pulse pressure (mmHg) was calculated on first day before starting Alternate Nostril Breathing (ANB) session. They carry out ANB practice for four weeks. By end of four weeks, all parameters were recorded again (following ANB session). RR/min was recorded by observing abdominal wall movement in supine position. PR/min and blood pressure (SBP and DBP in mmHg) was also measured in supine position. Pulse Pressure was calculated as SBP minus DBP. Each ANB session consist of 15 minutes in the morning in an empty stomach. They were directed to sit in an easy and steady posture (either in a lotus posture i.e. *Padmasana* or a comfortable sitting posture i.e. *Sukhasana*) with the head, neck and trunk erect and in a straight line and keep the body still during practice of ANB in a calm and quiet room. Practice of ANB was performed in following steps (Steps used by Raghuraj *et al* and Srivastav *et al* with some modification):<sup>4,7</sup>

1. The volunteer was asked to close one of his/her nostril (say right nostril) by his thumb and slowly breathe in upto maximum, through left nostril
2. He/she was asked to close his other nostril (left) by his/her ring finger and open the right nostril to exhale slowly upto maximum
3. Now, he/she was instructed to inhale through same right nostril (with left nostril closed) and then to open left nostril and exhale as stated above.

These three steps completed one cycles of *Nadisuddhi*. Subjects of the present study formed their own control, so separate control was not taken into account. Data were all entered in statistical software (SPSS version 10). Mean and standard deviation ( $\pm$  SD) of all parameters

**Table-1:** Physical characteristics of the subjects

Variables	Mean ± SD
Age (year)	24.67 ± 2.35
Height (cm)	167.05 ± 3.89
Weight (Kg)	61.14 ± 5.49
BMI	21.89±1.64

after four weeks were calculated and compared with values of control (mean ± SD) by applying student t-test.

**RESULTS**

The physical characteristics of the subjects are shown in table-1 and the comparison of different cardio respiratory variables before and after the four weeks of ANB exercises are presented in table-2. The mean respiratory rate dropped from 18.14 ± 1.57 per min to 16.03 ± 1.36 per min, pulse rate from 77.28 ± 4.18 per min to 74.31 ± 3.26 per min, systolic pressure from 116.78 ± 4.59 mm Hg to 115.28 ± 4.28 mm Hg and diastolic pressure from 79.44 ± 5.25 mm Hg to 74.28 ± 5.04 mm Hg, pulse pressure increased from 37.39 ± 2.32 mm Hg to 40.67 ± 3.55 mm Hg and PEFR from 495.28 ± 48.84 l/min to 507.50 ± 44.29 l/min.

**DISCUSSION**

Patanjali, first exponent of yoga, described *Pranayama* as the gradual unforced cessation of breathing.<sup>1</sup> The ancient science of yoga makes use of voluntary regulation of the breathing to make respiration rhythmic and to calm the mind to reach the ultimate goal.<sup>11</sup> This practice of *Pranayama* is an art of controlling the breath. A practitioner of *Pranayama* not only tries to breathe but at the same time tries to keep his attention on the act of breathing, leading to concentration. This act of

concentration removes his attention from worldly worries and “de-stress” him. This may decrease release adrenaline i.e. decrease sympathetic activity and hence decrease in heart rate, respiratory rate, blood pressure etc.<sup>5</sup> It is well known that both the nostril does not take part equally in breathing at a time. One nostril predominate the other and follows a definite cycle. In the yogic system of breathing, the right nostril dominance corresponds to activation of ‘*Pingala*’ subtle energy channel; related to sympathetic arousal and left nostril to ‘*Ida*’ subtle energy channel, corresponding to parasympathetic activation.<sup>8,12</sup> *Pranayama* effects the proper balance between ‘*Ida*’ and ‘*Pingala*’ i.e. Sympathetic and parasympathetic activity and gain spiritual upliftment.<sup>13-16</sup> Leaving the yoga-philosophy aside and being more confined to the modern medical physiology only, it can be said that various central and autonomic mechanism as well as mechanical (heart) and hemodynamic adjustments are triggered in response to variation of breathing patterns, thereby causing both tonic and phasic changes in cardiovascular functioning.<sup>4</sup> In the present study the fall in PR, RR, SBP, DBP and rise in PP and PEFR after four weeks of practice of ANB among our study subjects were noted. The decrease in PR, RR, DBP were significant (P<0.01) although the decrease in SBP was insignificant. Change in different parameters by exposure to ANB could be attributed to a balance between sympathetic and parasympathetic activation.

DBP depends upon peripheral resistance and lung inflation has been known to decrease systemic vascular resistance.<sup>17</sup> This response is initiated by pulmonary stretch receptors which bring about withdrawal of sympathetic tone in skeletal muscle blood vessels leading to wide spread vasodilation thus bringing up decrease in peripheral resistance<sup>18</sup> and thus decrease in DBP.

Increase in PEFR among our volunteers may be due to rise in thoracic-pulmonary compliances and bronchodilation by training in ANB. Stimulation of pulmonary stretch receptors by inflation of the lung reflexly relaxes smooth muscles of larynx and tracheobronchial tree; probably this modulates the airways caliber and reduces airway resistance.<sup>19</sup>

The work of Yadav and Das attributed the increase in PEFR by yogic exercise due to following changes in respiratory dynamics: increased respiratory muscle strength by the exercises of these muscles, cleansing of airways secretions and efficient use of diaphragmatic and abdominal muscles, thereby emptying and filling the respiratory apparatus more efficiently and completely.<sup>20</sup> Previous investigators also demonstrated the effect of *Pranayama* on enhancement of the

**Table-2:** Comparison of different cardio respiratory variables before and after the four weeks of ANB exercises

Variables	Before (mean ± SD)	After (mean ± SD)
Respiratory rate (RR/min)	18.14 ± 1.57	16.03 ± 1.36*
Pulse rate (PR/min)	77.28 ± 4.18	74.31 ± 3.26*
SBP (mmHg)	116.78 ± 4.59	115.28 ± 4.28
DBP (mmHg)	79.44 ± 5.25	74.28 ± 5.04*
Pulse Pressure (mmHg)	37.39 ± 2.32	40.67 ± 3.55*
PEFR (L/min)	495.28 ± 48.84	507.50 ± 44.29*

\*, Significant at p < 0.001

respiratory muscle efficiency and lung compliance by reducing elastic and viscous resistance of lung present during inspiration.<sup>7</sup> *Pranayama* acts as a physiological stimuli for release of lung surfactant and prostaglandins into alveolar spaces which increase the lung compliances.<sup>3</sup>

Considering the facts, it can be opined that regular practice of ANB type of *Pranayama* causes parasympathetic predominance as other slow breathing type *Pranayama* does (viz. *sabitri Pranayama*).<sup>6</sup> The major effects of ANB were fall in DBP and rise in PEFR. Therefore, this simple exercise can be prescribed to hypertensive patients (with proper monitoring) along with the medical therapy. The increase in PEFR by ANB practice obviously offers an increment in cardio-respiratory efficiency and it can be advocated to the patients of early bronchitis and as a preventive measure for COPD.

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