

NADI SHODHANA PRANAYAMA AND ITS IMPACT ON PARAMETERS OF CARDIOVASCULAR, PULMONARY, AND BRAIN FUNCTIONS

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Abstract

Background: Practice of pranayama has been recognized to control cardiac autonomic status with an improvement in cardio-respiratory functions.

Objective: To determine impact of Nadi-shodhana pranayama practice for 20 minutes on heart rate, systolic and diastolic blood pressure, peak expiratory flow rate.

Methods: Ninety normal healthy subjects aged between 17-20 years of first year MBBS course volunteered for this study out of total 150. Among them 40 were females and 50 were males. They did not have any previous training in Pranayama. All the selected physiological parameters were measured before and after performing 'Nadi-shodhana Pranayama'. Epi-info 7 was used for analysis.

Results: Following nadi-shodhana pranayama a significant decline in basal heart rate and systolic blood pressure was observed. Peak expiratory flow rate was significantly improved ($P < 0.01$). No significant changes in respiratory and other cardiovascular parameters were seen.

Conclusion: Nadi-shodhana Pranayama swiftly alters cardiopulmonary response. Further studies on a larger sample size need to illustrate the underlying mechanisms involved in this alteration.

Keywords: Nadi-shodhana pranayama, heart rate, blood pressure, peak expiratory flow rate.

INTRODUCTION

These days yogic techniques including pranayama are gaining importance and fetching increasingly satisfactory to the scientific community. Pranayama means control of prana. Prana, in Indian philosophy, denotes to all forms of energy in the world. And because this energy pranayama is generally considered to mean regulated breathing.¹ As a technique, pranayama can accept rather complex forms of breathing, but the core of the practice is slow and deep breathing. Such breathing is economical because it reduces dead space ventilation. It also refreshes air throughout the lungs.² Pranayama breathing has been shown to alter autonomic activity. Pranayama training harvests a decrease in basal sympathetic tone. Slow and deep breathing itself has a calming effect on the mind and helps an individual to de-stress and may also exert profound physiological effects on pulmonary,

cardiovascular, and mental functions of the brain.³ So, the rationale behind the study was to investigate the immediate effect of 'Nadi-shodhana' on resting heart rate, blood pressure, peak expiratory flow rate in young healthy subjects.

Materials and Methods

Study Design- Case- Control study

Study Duration- January 2018 to March 2018 (3 months)

Study Settings- Department of Physiology, RIMS, Raipur (CG)

Study Population- Ninety healthy volunteers aged between 17-20 years were recruited and separated into study and control groups. All were MBBS 1st year students.

Sampling Technique- Purposive sampling technique.

Sample size- 90 healthy MBBS students out of total 150.

Inclusion Criteria- Those who are willing to participate and free from any medical condition.

Exclusion Criteria- Those who have not given consent and students who were having even a single medical condition were excluded from the study.

Consent Type- Written Informed Consent

Ethical Consideration- The study was approved by Institutional Ethics Committee.

Methodology

The Faculty involved in this study addressed the class of 100 students on the purpose of this study, the procedure to be followed, and willingness of the subjects to participate in this investigation. After the address, the faculty demonstrated the mode of Nadi-shodhana pranayama to the subjects. Among these 100 students, 90 students met the criteria. And were randomly divided into two group A and B. The students were matched for sex, age, and body mass index. 40 subjects were studied separately and twice (for before and after Pranayam) at the same time. Rest were divided in control group A, the recording was done before starting to relax in a couch and immediately after (within 5 minutes) 20 minutes resting period. In control group B, the recording was done before performing quiet breathing in any comfortable sitting posture and immediately after 20 minutes quiet breathing with closed eyes. Each month 15 students were studied to avoid any interference in studies.

After initial training the subjects were demonstrated to do Nadi-shodhana pranayama in the following steps⁴:

1. Open the right hand and bend index and middle fingers against the palm. The thumb was used for closing the right nostril while the fourth and fifth fingers were used for the left nostril.
2. Place the right thumb against the ala at the end of the nostril to close it and similarly press the fourth and fifth fingertips against the left nostril.
3. Start the exercise in the 'Sukhasana posture', with relaxed attitude and concentration as below.
- 3.1 Exhale slowly and deeply without closing the nostrils but being ready to do so.

3.2 Inhale slowly and quietly through the left nostril while closing the right.

3.3 At the end of the inhalation, close both nostrils and hold the breath for a while (not more than 1-2 seconds).

3.4 Keep the left nostril closed and exhale through the right as quietly as possible.

3.5 After exhaling completely, inhale slowly and quietly through the right nostril.

3.6 Close both nostril and wait for a while, then open the left nostril and exhale slowly and silently.

3.7 Inhale through the same nostril and continue these exercises were done for 20 minutes.

Heart rate, Systolic and Diastolic blood pressure, Peak Expiratory flow rate with mental efficiency in the form of problem-solving ability which was checked by allotting arithmetic problems to students both before and after pranayama in cases and controls and were calculated. The subject was asked to take a deep breath and then to blow hard into the mouthpiece of the flow meter with a sharp blast.

Statistical Analysis

The Data were first collected in Excel sheet then further exported to Epi-info 7 software for analysis. Recorded observations were expressed as mean±SD. Paired t-test was used as test for statistical significance. Epi-info 7 was used for analysis. P<0.05 is statistically significant.

Results

Table 1: Immediate effect of Nadi-shodhana Pranayama on Parameters in Case group

Parameters	Before pranayama	After pranayama	p-value
Basal heart rate	84.6±4.2	74.2±3.8	0.001*
Systolic BP	120.4±4.2	118±4.2	0.01*
Diastolic BP	78±2.4	78.4±2.2	0.07
PEFR	420±68.4	468±74.2	0.02*
Mental efficiency	88.2±23.1	70.2±21.2	0.11*

*p<0.05 is statistically significant

As per table 1 among the cardiovascular parameters studied, a significant decline in heart rate (P=0.001) and systolic blood pressure (P=0.01) was observed only in the study group. Diastolic blood pressure did not change significantly in study group. The peak expiratory flow rate improved significantly (P<0.05) following pranayama practice. The time taken to

solve the arithmetic problems decreased significantly only after practice of Nadi-shodhana pranayama, but it was not found to be significant. ($p>0.05$).

Table 2: Immediate effect of Nadi-shodhana Pranayama on Parameters in Control groups (A and B) in average values

Parameters	Before pranayama	After pranayama	p-value
Basal heart rate	83.6±4.2	82.8±2.8	0.11
Systolic BP	120.6±4.1	118.2±3.2	0.45
Diastolic BP	78.6±2.4	80.0±2.2	0.35
PEFR	421.4±40.6	422.4±52.4	0.41
Mental efficiency	90±20.2	88.2±22.2	0.07

*** $p<0.05$ is statistically significant**

As per table 2 Average in both control groups displayed no significant change in heart rate and systolic blood pressure following 20 minutes rest and quiet breathing. Diastolic blood pressure and PEFR did not change significantly in control groups. Twenty minutes rest and quiet breathing had no significant effect on the time taken to solve the problems.

Discussion

In general, yogic practices have been proposed to reduce heart rate and blood pressure.⁴ However, no study indicates a decline in blood pressure.² Yogic asanas and pranayama have been shown to reduce the resting respiratory rate and increase vital capacity, timed vital capacity, maximum voluntary ventilation, breath holding time and maximal inspiratory and expiratory pressure.^{5,6} Shirley Telles and her colleagues at Swami Vivekananda Yoga Research Foundation reported that, during meditation, there was a significant reduction in heart rate but an increase in cutaneous peripheral vascular resistance, indicating a physiologically relaxed state but increased mental alertness.⁷ Although a significant decline in basal heart rate observed in the present study is in accordance with the findings of Udupa et al.² it has some differences. In his study, in addition to nadi-shodhana pranayama, other types of pranayama were also included, and the training period was of three months. A significant decline in systolic blood pressure in the present study is in accordance with the findings of Bhargava et al.⁴ who evaluated the nadi-shodana pranayama effect after 4 weeks of regular practice. Pranayama is an art of control of breathing. A practitioner of pranayama not only tries to breathe, but at the same time, also tries to keep his/her attention on the act of breathing,

leading to concentration. These acts of concentration remove his attention from worldly worries and de-stress him/her. This stress-free state of mind evokes relaxed responses.³ In this relaxed state, parasympathetic nerve activity overrides sympathetic nerve activity.² Therefore, the significant decline in basal heart rate and systolic blood pressure in the pranayama practice could be largely due to better parasympathetic control over the heart. The results of the present study not only demonstrated the beneficial effect of Nadi-shodhana pranayama on cardiopulmonary function but also demonstrated its positive impact on higher functions of the brain. To best of our knowledge, there are no studies in the past studying the effect of pranayama practice on simple arithmetic problem-solving ability. Problem solving is considered as a mental stress causing sympathetic arousal.⁸ Yogic practices have been shown to reduce baseline average glucocorticoid levels. However, the glucocorticoid response to an acute challenge is enhanced. These findings indicate a lower level of stress and enhanced capacity to cope up with a challenge.⁹

Conclusion

In the present study the positive results might apply to workplaces to progress work efficiency and to educational institutes to improve learning ability. Daily few minutes of practice may help in setting the mind healthier on works and studies it also leads to physical fitness and lifestyle modification programs in maintaining better physical and mental health. Long term effects needed to be studied along with novel approaches. Studies are required with large sample size to establish the beneficial effects of pranayama practice.

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