

Full Length Research Paper

Effects of a 6-week nadi-shodhana pranayama training on cardio-pulmonary parameters

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The aim of the study is to assess the effects of a 6-week nadi-shodhana pranayama training on cardio-pulmonary parameters. A group of 30 male healthy subjects were selected from department of physical education (T), Guru Nanak Dev University, Amritsar (Punjab, India), aged 18 – 24 years, volunteered to participate in the study. Subjects were assigned into two groups: A (experimental: N-15) and B (control: N-15). The subjects from Group A (experimental: N-15) were subjected to a 6-week nadi-shodhana pranayama training programme. This lasted 6 weeks and consisted of daily sessions, lasting 30 min. Heart rate was measured by counting radial pulse for a minute. Vital capacity was measured by spirometer. Both systolic and diastolic blood pressures were measured with the auscultatory method by using sphygmomanometer and stethoscope. Results showed that the vital capacity significantly improved ($P<0.01$) in experimental group compared with the control one. A significant decline in basal heart rate ($P<0.01$) and systolic blood pressure ($P<0.05$) was observed. In contrast, control subjects did not show any significant change in these parameters. 'Nadi-shodhana Pranayama training programme may be recommended to improve vital capacity and control heart rate and blood pressure and may contribute to enhance health status and wellness.

Key words: Nadi-shodhana pranayama, heart rate, vital capacity, systolic, diastolic, blood pressure.

INTRODUCTION

Yogic techniques produce consistent physiological changes and have sound scientific basis (Chhina, 1974; Udupa and Singh, 1972). There are few reports on the effects of various *pranayams* i.e. yoga breathing on body functions (Pathale et al., 1978; Gopal et al., 1973). In philosophical terms, yoga refers to the union of the individual self with the universal self (Hadi, 2007). Asana and pranayama have been incorporated alongside Ayurvedic medicine as the basis of a system of medical therapy. Training to yoga respiration selectively increases the respiratory sensation, perhaps through its persistent conditioning of the breathing pattern (Florence et al., 2005). Yoga has been practiced for thousands of years. It is based on ancient theories, observations and principles of the mind-body connections. Substantial research has been conducted to look at the health benefits of yoga – yoga postures (*asanas*), yoga breathing (*pranayama*) and

meditation. These yoga practices might be interacting with various somatic and neuro-endocrine mechanisms bringing about therapeutic effects (Malhotra and Singh, 2002). The overall performance is known to be improved by practicing yoga techniques (Upadhyay et al., 2008) and their effects on physical functions were reported (Hadi, 2007). A study by Udupa et al. (1975) indicates that pranayama training produces a decrease in basal sympathetic tone. Yoga practices can also be used as psycho-physiological stimuli to increase the secretion of melatonin which, in turn, might be responsible for perceived well-being (Harinath et al., 2004). Yoga breathing, or pranayama, is the science of breath control. Pranayama (breathing exercise), one of the yogic techniques can produce different physiological responses in healthy individuals (Upadhyay et al., 2008). Raghuraj et al. (1998) have reported that Nadi-shodhana pranayama increases parasympathetic activity. Slow and deep breathing itself has a calming effect on the mind and helps an individual to de-stress (Sandeep et al., 2002). The physiological and psychological benefits of yoga have been demonstrated in several studies

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(Selvamurthy et al., 1983; Bal and Singh, 2010; Bal, 2010). These studies have shown that regular practice of yoga leads to improvement in physiological functions and human performance. Yoga and paranyama may be as effective as or better than exercise at improving a variety of health-related outcome measures (Ross and Thomas, 2010) and as a result this study was undertaken to find out the effects of a 6-week nadi-shodhana pranayama training on cardio-pulmonary parameters.

MATERIAL AND METHODS

Subjects

Thirty randomly selected male students of department of physical education (T) Guru Nanak Dev University, Amritsar (Punjab, India) aged 18 – 24 years, volunteered to participate in the study. A written consent was obtained from the subjects. They were randomly assigned into two groups: A (experimental N=15) and B (control N=15). The subjects from Group A were subjected to a 6-week nadi-shodhana pranayama training programme. This lasted for 6 weeks with consistent daily 30 min session, was conducted for continuous six days in a week with Sunday as a relaxing day. Studies parameters included heart rate, vital capacity, systolic and diastolic blood pressure.

Selection of variables and tests

The Subjects were tested on the following physiological test variables:

1. Physiological Variables Test / Equipments.
2. Heart Rate – Stethoscope and Digital Stop Watch.
3. Vital Capacity -Spiro meter.
4. Blood Pressure (Both systolic and diastolic) – sphygmomanometer and stethoscope.

Study protocol

The trainer involved in this study addressed the group of 15 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 trainer demonstrated the mode of Nadi-shodhana pranayama to the subjects. Each subject was studied separately and twice at the same time (6.15 A.M. to 7.00 A.M).

After an initial warm-up, all subjects were put through Nadi-shodhana pranayama for 30 min. They were asked to assume 'Sukhasana' (the comfortable posture) and regulate the alteration of breathing as follows:

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 follows:
 - i. Exhale slowly and deeply without closing the nostrils but being ready to do so.
 - ii. Inhale slowly and quietly through the left nostril while closing the right.
 - iii. At the end of the inhalation, close both nostrils and hold the

breath for a while (not more than 1-2 seconds).

- iv. Keep the left nostril closed and exhale through the right as quietly as possible.
- v. After exhaling completely, inhale slowly and quietly through the right nostril.
- vi. Close both nostril and wait for a while, then open the left nostril and exhale slowly and silently.
- vii. Inhale through the same nostril and continue.

Physiological parameter measurements

Heart rate was measured by counting radial pulse for a minute. Three readings were taken and their average was recorded. Vital capacity was measured by spirometer. The subject was asked to take a deep breath and then to blow hard into the mouthpiece of the Spiro meter with a sharp blast. Three recordings were taken at one-minute intervals and the average of the three highest readings was noted. Subjects asked to following a maximum inspiration, all the air possible was forcibly exhaled through the mouthpiece. Both systolic and diastolic blood pressures were measured with the auscultatory method by using sphygmomanometer and stethoscope. Three readings were taken and their average was recorded.

Data analysis

Values are presented as mean values and SD. The Student t' test was used to compare parameters within groups. Data was analyzed using SPSS Version 16.0 (Statistical Package for the Social Sciences, version 16.0, SPSS Inc, Chicago, IL, USA).

RESULTS

The mean, standard deviation and t-test values of cardio pulmonary parameters of experimental group and control group during Pre Test and Post Test are presented in Tables 1, 2, 3 and 4. A significant decline in basal heart rate ($P<0.01$) and systolic blood pressure ($P<0.05$) was observed. The vital capacity significantly improved ($P<0.01$) in experimental group. No significant differences were observed for diastolic blood pressure. No significant changes were noted in the control group..

DISCUSSION

Pranayama practices are known to significantly improve health status, reduce stress and anxiety. In his study, in addition to nadi-shodhana pranayama, other types of pranayama were also included and the training period was of three months. Our study showed reduction in heart rate which is similar to the finding of (Telles and Desiraju, 1993). Further it showed significant improvement in the vital capacity which helps in the well being of the subjects, which is in accordance with Bal. (2008). From the results it is evident that the 6-week of pranayama training programme showed significant improvement in vital capacity. The findings are supported by the study conducted by Upadhyay et al. (2008), showed a significant increment in pulmonary parameter such as Peak expiratory flow rate (PEFR L/min) and

Table 1. Mean, SD and t –test values of heart rate (beats/minute) of experimental group and control group during pre test and post test.

Group	Test	N	Mean	SD	t-value
Experimental	Pre –test	15	78.33	1.82	6.39**
	Post-test	15	68.2	7.07	
Control	Pre –Test	15	78.33	2.87	1.62
	Post-test	15	79.33	3.06	

**Significant at $p < 0.01$ level.

Table 2. Mean, SD and t –test values of vital capacity (liters) of experimental group and control group during pre test and post test.

Group	Test	N	Mean	SD	t-value
Experimental	Pre –test	15	4.21	0.3	6.35**
	Post-test	15	4.37	0.27	
Control	Pre –test	15	3.92	0.2	0.16
	Post-test	15	3.91	0.26	

**Significant at $p < 0.01$ level.

Table 3. Mean, SD and t –test values of systolic blood pressure (mmHg) of experimental group and control group during pre test and post test.

Group	Test	N	Mean	SD	t-value
Experimental	Pre –test	15	126.2	9.79	2.24*
	Post-test	15	121.26	1.62	
Control	Pre –Test	15	124.4	7.68	0.09
	Post-test	15	124.33	7.12	

*Significant at $p > 0.05$ level.

Table 4. Mean, SD and t–test values of diastolic blood pressure (mmHg) of experimental group and control group during pre test and post test.

Group	Test	N	Mean	SD	t-value
Experimental	Pre –test	15	76.26	4.16	1.53NS
	Post-test	15	74.86	3.39	
Control	Pre –test	15	77.26	4.25	0.91NS
	Post-test	15	75.86	5.2	

*Significant at $p < 0.05$ level.

Pulse pressure (PP). The findings are also supported by the study conducted by Bal. (2008) the study showed significant improvement in vital capacity and maximal ventilatory volume with the training programme of bhastrika and anulom vilom pranayama. Although a significant decline in systolic blood pressure in the present study is in accordance with the findings of Bhargava et al. (1988) who evaluated the Nadi-Shodana Pranayama effect after 4 weeks of regular practice.

Diastolic blood pressure mainly varies with the degree of peripheral resistance (Guyton, 1996) and heart rate. The non-significant change in diastolic blood pressure observed in the present study suggests that 'Nadi-shodhana Pranayama' might have no any long term effect on peripheral vascular resistance or it has some roles, but is obscured by a slow heart rate. Since yoga aims at perfection of the body and mind, it is natural to ask whether the progress towards perfection is reflected

in objective reproducible changes in physiological variables. Results of this study also supported by (Nayar et al., 1975; Joshi et al., 1992) who suggest that Yogic asanas and pranayama have been shown to reduce the physiological parameters such as resting respiratory rate and increase vital capacity, timed vital capacity, maximum voluntary ventilation, breath holding time and maximal inspiratory and expiratory pressures. The results of the present study demonstrated the beneficial effect of Nadi shodhana pranayama on cardio-pulmonary function.

Conclusion

Summing up, the 6-week pranayama training programme had significant effect on heart rate, vital capacity and blood pressure. Thus, such training may be recommended to improve physical and physiological fitness-based performance. The positive results found in the present study might apply to sports persons to improve physiological efficiency. A few minutes practice daily may help in maintain healthy life. The daily practice could also be parts of physical fitness and life style modification programs in maintaining better physical and mental health.

Practical applications

The present data will serve as a reference to provide more evidence to support the beneficial effect of pranayama training on physiological variables. Although the present study suggests some applications, further studies with larger number of subjects from different lifestyles need to establish the beneficial effects of pranayama practice.

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