

Original article:

Effect of forty days of Pranayama Training on Cardiorespiratory Parameters

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ABSTRACT:

Introduction: Rapid industrialization, environmental pollution, overcrowding, sedentary lifestyle and various stress factors are responsible for the deterioration of the physical health of a person. Also, prevalence of obesity in developing countries is believed to be on the rise. This requires special and specific techniques to transcend the limits of our physical and mental abilities experienced in everyday life. Hence, in the present study beneficial effect of Pranayama on cardio-respiratory function was studied.

Materials and method: Study was conducted in Santosh Medical College and Hospital in Ghaziabad after the institutional ethical clearance and written consent from each participant. A total of 50 normal subjects were recruited in the study, were divided into study and control groups, each group containing 25 subjects. The study group was asked to perform Kapalbhathi Nadishuddhi and Bhramari pranayama for duration of 40 days. Cardio-respiratory parameters were assessed before and after 40 days in both the groups.

Statistical analysis: Paired t- test was applied for statistical analysis and p value <0.05 was considered the level of significance.

Results and conclusion: In study group, heart rate, respiratory rate, systolic blood pressure were decreased whereas peak expiratory flow rate was increased significantly as compared to that of control group. This shows that Bhramari, Nadishuddhi and Kapalbhathi pranayama have improving impact on these cardiorespiratory parameters.

Key words: Pranayama, HR,BP,RR and PEFr

Introduction

“Yoga” is Sanskrit word derived from the root “yuj” which means union. Yoga is a psycho-somatic-spiritual discipline for achieving union & harmony between our mind, body and soul and the ultimate union of our individual consciousness with the Universal consciousness.¹Pranayama, the fourth limb in the Ashtanga Yoga, is made up of

two words, *Prana* and *Ayama*. *Prana* stands for the capacity to keep body alive by air, i.e breathe and *Ayama* means expansion, stretching or extension and control of breathe. Thus, Pranayama means the art of controlling prana. *Pranayama* is basically undertaken for somatic and psychic purification, regulation of *prana* to each body organ and to

optimize the cardio-pulmonary and autonomic functions.²

Pranayama is the first step towards re-orienting and improving the functioning of mind and body by learning to utilize the air we breathe. Pranayama implies correct breathing and control over prana. The cranial and spinal nerves spread throughout the body. These nerves send out and send in to the brain pain and motor impulses. Prana flows throughout these pathways. It also flows through all the nadis, or energetic pathways, which have been studied by ancient Yogis. *Nadis* means channels or vehicles. Some texts describe 72,000 nadis in the body, but fourteen are considered important, and only six of them are the most important of all. They are called the *ida*, *pingala*, *sushumna*, *brahmani*, *chitrana*, and the *vijnana*. Among these six, three are even more important than any others. The techniques of Pranayama are designed to bring the central nadi, the sushumna, into primary function, rather than the *ida* or *pingala* dominating the functions of prana flow. With activation of the sushumna as the primary flow for prana, the Yogi experiences freedom from the human condition, and joy. Pranayama involves systemic and disciplined inspiration and expiration with retention or holding of breathe in specific proportion or specific manner. It also aims at conditioning the speed of breathing. When we breathe very fast the storehouse of power that sustains life dries up speedily and thus a long life span is not possible. The more the breathing is slow the more our life span attains longevity.³ This study attempts to assess the effect of 40 days of Pranayama training on cardiovascular and respiratory system in normal young healthy individuals.

Material & method:

Ethical clearance for the study protocol was obtained from institute ethical committee. Fifty

healthy subjects of age group 18-30 years, who were interested to take part in the study, were selected and informed consent was taken. Subjects who were trained in yoga before, subjects with history of previous surgery, recent cardio-respiratory diseases, diabetes, asthma, atopic skin diseases and with any chronic illness were excluded from the study. The health status of the subject was assessed by history taking and thorough general and systemic examination. The subjects were explained about the procedure and importance of the study. The selected cardiorespiratory parameters were recorded in the subjects before and after 40 days of Pranayama training and the findings were compared. The various parameters compared are:

- HR (heart rate) was measured by counting the Radial pulse
- BP (Blood Pressure) was measured by standard mercury Sphygmomanometer (Prolix, Primepack Meditech Industries, New Delhi, India)
- RR (respiratory rate) by inspection / palpation of chest movement
- PEFr (Peak expiratory flow rate) was measured in Lit/min by Wrights Peak Flow Meter (Lifeline Surgicals, New Delhi, India).

In this study the subjects were trained Pranayama for two weeks. Then, they practiced forty minutes daily the same under our direct supervision for 40 days. Pranayama was practiced in Padmasana or Sukhasana position. The Yoga practice consisted of:

- Warm up (5 min)
- Pranayama (25 min), Pranayamas adapted for study purpose were:
 - Nadishuddhi,
 - Kapalbhathi and
 - Bhramari
- Meditation (10 min).

The first phase of the recording of the parameters was done at the beginning of their course. The second phase of the recording was done after 40 days of the regular pranayama practice.

For statistical analysis of data, paired 't' test was employed using SPSS for Windows. The level of significance was set at 0.05 and 'p' value less than 0.05 was considered statistically significant.

Findings and results :

There is statistically significant decrease in heart rate, respiratory rate and systolic blood pressure and a significant increase in peak expiratory flow rate of Yoga Group after 40 days of Pranayama training.

Effect on Heart Rate:

The decrease in mean \pm SD of heart rate before Pranayama training in Yoga Group was 78.88 ± 2.83 beats per minute as compared to 73.56 ± 1.41 beats per minute after 40 days of Pranayama training is statistically significant, $p < 0.05$ as seen in Fig 1.

Effect on Blood pressure (Systolic & Diastolic):

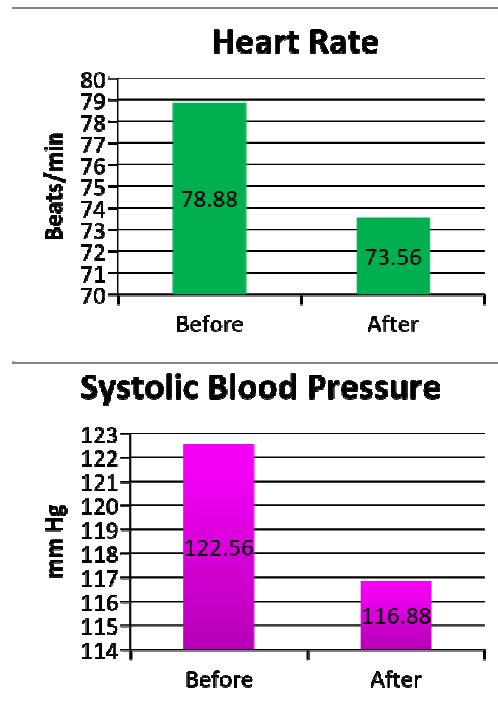
The decrease in mean \pm SD systolic blood pressure before Pranayama Training in Yoga Group 122.56 ± 4.49 mm of Hg to 116.88 ± 4.20 after Pranayama is statistically significant, $p < 0.05$. Diastolic blood pressure mean \pm SD decreased in Yoga Group from 76.24 ± 4.29 mm of Hg before Pranayama to 74.56 ± 2.61 mm of Hg after 40 days of Pranayama, which is statistically insignificant, as seen in Fig 2 &3.

Effect on Respiratory Rate:

The decrease in mean \pm SD of respiratory rate before yoga was 16.64 ± 0.81 per minute as compared to decrease in respiratory rate to 15.08 ± 0.70 per minute after 40 days of Pranayama training which is statistically significant, $p < 0.05$ as seen in Fig 4.

Effect on PEFr:

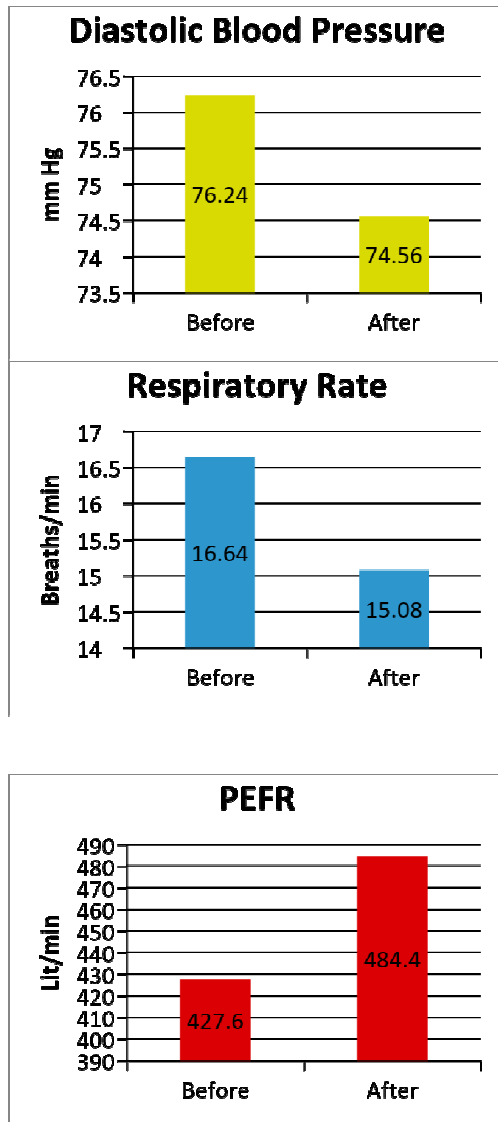
The increase in mean \pm SD of peak expiratory flow rate before Pranayama in Yoga Group was 427.6 ± 60.01 as compared to 484.4 ± 41.03 after 40 days of Pranayama training is statistically significant, $p < 0.05$ as seen in Fig 5.



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Discussion

Cardiac Parameters:

In the present investigation two parameters like heart rate (HR) and blood pressure considered as cardiac parameters. Both parameters regulated by the cardiac-vagal centre (CVC) and vaso-motor centre (VMC) through the autonomic nerve connection. Results showed that heart rate of group A significantly reduces after 40 days Pranayama training. It states that yoga may be activate the regulatory centre and increases the parasympathetic activity and decreases the sympathetic activation. That condition may be improving the physical as

well as physiological capacity to do perform any type of work. A group of scientist also reported that statistically significant reduction in pulse rate after regular practice of yoga and it is attributed to increased vagal tone and decrease in sympathetic activity^{4,12}.

Systolic blood pressure (SBP) depends on cardiac output and diastolic blood pressure (DBP) depends on total peripheral resistance. Again cardiac output depends on heart rate and stroke volume. So when heart rate reduces the systolic blood pressure also reduces. In this investigation SBP also significantly reduces after 40 days of yoga practice, it may be due to improving the vagal tone. Diastolic blood pressure also reduces in this study but it is non-significant^{9,13,14}. It indicated that Nadi-shodhana Pranayama might have no any long term effect on peripheral vascular resistance or it has some roles, but it may need practice for longer periods.¹⁴

There might be a few possible reasons for the significant improvement in cardiac functions. Blood pressure and pulse rate related with cardiovascular system is controlled by autonomic nervous system. Pranayama increases cardiac output, decreases hepatic renal blood flow and increases peripheral vessels blood flow¹⁴. Nadi-shuddhi brings a balance in autonomic nervous system.⁴ Yoga practitioner not only tries to breathe, but at the same time, also tries to keep his attention on act of breathing, leading to concentration. These acts of concentration remove his attention from worldly worries and de-stress him. In this relaxed sate, parasympathetic activity overrides sympathetic activity.⁶ Lung inflation has been known to decrease systemic vascular resistance. This response is initiated by pulmonary stretch receptors which bring about withdrawal of sympathetic tone in skeletal muscle blood vessels

leading to wide spread vasodilatation thus bringing up decrease in peripheral resistance.^{14,15}

Respiratory Parameters:

Respiratory rate (RR) and peak expiratory flow rate (PEFR) are considered as respiratory parameters in this investigation. Results showed that both parameters changes significantly in Yoga group A. Practice of Yoga brings decline in respiratory rate by decreasing sympathetic activity¹⁶⁻²⁰ and PEFR increases due to improving the respiratory muscles activity²¹⁻²⁴.

The effects can be explained on the following basis that increased power of respiratory muscles that is due to work hypertrophy of the muscles during pranayama and other exercises²² due to which the chest and lungs inflate and deflate to the fullest possible extent. The maximum inflation and deflation near to total lung capacity is an important physiological stimulus for the release of lung surfactant and prostaglandins increasing the alveolar spaces thereby increasing lung compliance and decreasing bronchial smooth muscle tone activity respectively.²⁵ Stimulation of pulmonary stretch receptors by inflation of the lung reflexly relaxes smooth muscles of larynx and tracheobronchial tree; probably this modulates the airways calibre and reduces airway resistance via bronchodilation.⁴ Slow and deep inhalation and prolonged exhalation as in Anulom-vilom causes efficient use of intercostals and diaphragmatic muscle. This trains the respiratory apparatus to get emptied and filled more completely. Yogic breathing raises and descends the diaphragm a lot more, increasing vertical diameter of thoracic cavity.²⁶ This allows in inhaling more, thus pulling more oxygen lower into the lungs, resulting in more perfusion of lungs thus increasing the efficiency of oxygen infusion into the blood stream because the oxygen is exposed to more of the

blood. In breathing exercises like kapalbhati powerful strokes of exhalation in quick succession with contraction of abdominal and diaphragmatic muscle trains the subject to make full use of diaphragm and abdominal muscles in breathing.²⁶ Procedures like Kapalbhati and Nadishuddhi help in removal of infective nasal secretions, clearing up respiratory passages and alveoli. Yoga with its calming effect on the mind can reduce and release emotional stresses thereby withdrawing the bronchoconstrictor effect.²²

Conclusion:

India has a rich tradition of Yogic practices. Lifestyle modifications like yoga, the ancient practice of postures, breathing and meditation, are gaining importance by healthcare professionals. Considering the findings, the present study suggested that regular practice of Yoga improved cardio-ventilator functions as shown by increase in PEFR and fall in RR, PR and SBP.

It revealed that Yogic practices decrease the risk of disease directly or indirectly by promoting health and fitness. Pranayama breathing techniques can be used effectively for fitness, prevention and therapeutic purposes, either alone or as an adjunct therapy. It may obviate the need of drug therapy or may decrease the dosage or reduce the number of drugs needed. It may be assumed that Yoga adjunctively with conventional therapy may lead to quicker control as well decreasing therapy dosage and duration. Making Yoga a part and parcel of our day to day routine may condition the cardiac and respiratory system leading to prevention and onset of diseases like Asthma, COPD and Hypertension more importantly in the latter stages of life. In light of these facts, it can be said that Yogic practices can be adopted as a potent way of maintaining health and fitness.

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