



Study of Pranayama on Heart Rate and Blood Pressure

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ABSTRACT

Asana, pranayama, and meditation are three main techniques of yoga practiced in India over thousands of years to attain functional harmony between the body and mind. The present study was conducted to practice of pranayama and improvements in cardiovascular functions in healthy individuals. sixty healthy subjects (30 males and 30 females) of 30–50 years age group.

There was significant reduction in resting heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial blood pressure after practicing pranayama for 30 days. This study showed beneficial effects of 30 days regular pranayama practice on cardiovascular functions irrespective of age, gender, and BMI in normal healthy individuals. The present study revealed highly significant improvement in HR, BP, PR after pranayama in study group as compared to control group. Pranayama has been found to be useful in inducing a state of psychological & physiological wellbeing.

KEYWORDS

Arterial blood pressure, Heart rate, pranayama

INTRODUCTION

The word yoga is derived from its Sanskrit origin "YUJ" which means "to bind", "to join" or "to apply". In the words of Maharshi Patanjali, "yoga is the restraint of the process of the mind". Yoga has been extensively studied for the beneficial effects on human health. Yoga is practiced all over the world. It produces consistent physiological changes and have sound scientific basis. The cardiovascular changes due to the process of ageing are being pre-poned ever since the past few decades. Psychosocial stresses of our modern life precipitates various cardiovascular and other disorders by distorting basic neuroendocrine mechanism. The psychosocial stresses activate limbic system and hypothalamus which controls the autonomic nervous system. When this system is stimulated, increase in output of both adrenaline and nor-adrenaline occur, both from sympathetic nerve fibres as well as from adrenal medulla causing increase in heart rate, systolic and diastolic blood pressures. Chronic exposure to psychosocial stimuli will result in the development of increase in blood pressure, coronary thrombosis and heart failure. In addition to the activation of sympatho-adreno-medullary system, exposure to psychosocial stresses also activates the hypothalamus centre governing pituitary-adrenal axis. An increased secretion of corticotrophin releasing hormone from hypothalamus. This hormone releases stimulates the release of adrenocorticotrophic hormone from anterior pituitary which in turn stimulates adrenal cortex. The psychosocial stressful situation activates hypothalamo-pituitary-adrenal gland axis, glucocorticoid and aldosterone levels increase in the plasma causing salt and fluid retention which increases blood volume and blood pressure imposing severe strain on the heart. The harmful effects of these stresses on bodily systems can be reduced effectively eliminated by enhancing the adaptive mechanisms of our body that can restore the equilibrium. By giving rest to the mind and body, yoga can shake off many disorders of psychosocial origin. Different types of pranayama produce different physiological cardiovascular responses in normal young individuals. During right nostril pranayama and alternate nostril pranayama, the heart rate increased, whereas during left nostril pranayama, there was a decrease or no change in heart rate. Four weeks of Nadisuddhi pranayama has shown significant decrease in pulse rate, diastolic blood pressure, systolic blood pressure along with significant increase in pulse pressure. During 'OM' meditation, there was a significant reduction in heart rate as compared to the control period in which non-targeted thinking was encouraged. All these studies reported the effects of

individual pranayama or meditation practice for minimum of 4 weeks to 6 months. This study was carried out to know the physiological effects of 30 days combined practice of pranayama and meditation in influencing cardiovascular status in healthy individuals of 30–50 years.

Materials and methods :

The present study was conducted in the Department of Physiology. Ethical clearance for the study protocol was obtained from the Institute ethical committee. sixty healthy subjects of age group 30–50 years were selected randomly participating pranayama who had not yet started practicing pranayama but were keen on learning. The same subjects were chosen as both study as well as control group in order to minimize the confounding factors and make the study more reproducible. Subjects who were trained in pranayama before, subjects with history of respiratory, cardiovascular and renal diseases, and diabetes were excluded from the study. Subjects who smoke and consume alcohol or any drugs were also excluded from the study. The subjects were selected after taking a detailed clinical history. An informed consent was obtained from all the members. Physical characteristics such as age, height, weight, and body mass index (BMI) were obtained. BMI was calculated as weight (kg) / height (m)². Heart rate (HR) and blood pressure (BP) were recorded before practice of pranayama and meditation. The subjects were asked to relax physically and mentally for 30 minutes in supine position in a silent room. In the same position, the Heart rate and the blood pressure were recorded. The blood pressure was recorded with the sphygmomanometer in supine position in the right upper limb by auscultatory method. Similarly, three readings were taken at an interval of 15 minutes each and average of the three values calculated. ECG was recorded by an ECG machine (108 T, BPL) using standard chest and limb leads. Heart rate was calculated from the tracings. Each ECG was reported by trained physician. The subjects were trained under the guidance of a certified yoga teacher. They carried out pranayama for 1 hour daily between 6 am and 7 am.

The pranayama practice schedule consisted of

1. Pranayama - 45 mins.
2. Meditation - 15 mins.

The different types of Pranayama practiced were – Vibhagiya Pranayama (sectional breathing)

- Adama (Kanista) Vibhagiya Pranayama (diaphragmatic/abdominal breathing)

- Madhyama Vibhagiya Pranayama (Thoracic/intercostal breathing)
- Aadya (Jesta) Vibhagiya Pranayama (upper lobar/clavicular breathing)
- Poorna mudra Pranayama (Full yogic breathing)

Nadishuddhi Pranayama (Alternate nostril breathing) Kapalabathi Kriya (cleansing breath)

Bahya Pranayama (the external breathing)

Cooling Pranayama

- Sitali Pranayama
- Sitkari Pranayama

The session was concluded by meditation.

After 30 days, once again the cardiovascular status was assessed clinically in terms of HR and BP, as done before the start of pranayama and meditation training. Results were presented as Mean SD. Student's *t* test was used to find the significance of study *P* value less than 0.05 was considered statistically significant.

Results

Comparison of parameters of before pranayama

	Study group	Control group	P value
HR [beats/min]	93.46±9.14	89.33±8.79	0.533
SBP [mmHg]	126.46±5.60	121.20±13.56	0.563
DBP [mmHg]	78.20±5.38	76.93±5.95	0.502
PP [mmHg]	51.26±7.26	44.26±12.24	0.392
MAP[mmHg]	94.28±4.20	91.86±7.12	0.886

Comparison of parameters after 30 days pranayama

	Study group	Control group	P value
HR [beats/min]	73.50±5.89	88.73±9.12	0.001**
SBP [mmHg]	113.13±5.43	122.20±11.13	0.125
DBP [mmHg]	70.40±5.56	78.67±6.07	0.055+
PP [mmHg]	40.73±7.95	48.53±7.77	0.783
MAP[mmHg]	83.97±4.06	95.48±7.25	0.045*

Discussion

The significant decrease in resting heart rate, systolic and diastolic blood pressure after the pranayama practice in the present study is in accordance with the findings of other studies on physiological effects of pranayama practice in healthy individuals.

In the present study a highly significant reduction in HR, SBP, and DBP can be attributed to modulation of autonomic activity with parasympathetic predominance and relatively reduced sympathetic tone. This autonomic modulation in pranayama is mediated through modification of breathing patterns which triggers various central and autonomic mechanisms as well as mechanical and hemodynamic adjustments causing both tonic and phasic changes in cardiovascular functioning. As a technique, pranayama can assume rather complex forms of breathing. But the essence of the practice is slow and deep breathing. Slow breathing induces a generalized decrease in the excitatory pathways regulating cardiovascular systems. During slow and deep breathing lung inflates to the maximum. This stimulates pulmonary stretch receptors which bring about withdrawal of sympathetic tone in skeletal muscle blood vessels leading to widespread vasodilatation and decrease in peripheral resistance and thus decrease diastolic blood pressure. While practicing pranayama one concentrates on the act of breathing which removes attention from worries and "de-stresses" him. This stress-free state of mind evokes

relaxed responses in which parasympathetic nerve activity overrides sympathetic activity.

Meditation by modifying the state of anxiety reduces stress-induced sympathetic over activity thereby decreasing arterial tone and peripheral resistance resulting in lowering of diastolic blood pressure and heart rate. Regular practice of pranayama has showed improvement in baroreflex sensitivity and decrease in the sympathetic tone thereby restoring blood pressure to normal level in patients of essential hypertension.

In the present study, the responses to 30 days of regular combined practice of pranayama and meditation were also assessed with respect to age and gender. It revealed that both males and females responded similarly to the pranayama practice.

When compared age wise, it revealed similar response to 30 days of pranayama and meditation practice in both age group ≤40 years and age group >40 years.

Although a significant decline in resting heart rate, SBP, DBP, and mean arterial BP after the pranayama practice in the present study is in accordance with the findings of other studies on physiological effects of pranayama practice in healthy individuals, the present study has some differences. The present study involved regular combined practice of pranayama and meditation for 30 days, whereas other studies reported the effects of individual pranayama or meditation practice for minimum of 4 weeks to 6 months.

Most of the studies conducted so far have generalized their results irrespective of age and gender of the subjects. Very few studies have been conducted on subjects above 40 years in which age group, cardiovascular diseases are more prevalent. In the present study, an attempt was made to fill up these lacunae.

Although the present study observed the clear short term (30 days) effects of pranayama and meditation practice, it remains to be assessed whether these changes persist after resuming normal respiration and whether long term practice will lead to stable modifications of cardiovascular control.

Thus in a nutshell, with this study, it is proved beyond doubt, that regular practice of pranayama and meditation for minimum of 30 days is beneficial in improving the cardiovascular functions even in healthy individuals irrespective of age, gender, and BMI.

Finally, these results and their explanations would justify the incorporation of pranayama as part of our lifestyle in promoting health and thereby preventing age related cardiovascular diseases.

Conclusion

Heart rate revealed significant decrease in study group compared to controls which is suggestive of psycho physiological relaxation. There is reduction in SBP and DBP and MAP indicates a trend of gradual shift of autonomic equilibrium towards relative parasympathetic dominance. We concluded that there is a decrease in sympathetic activity and increase in parasympathetic activity in study group as compared to controls.

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