

A Study of Combined Effect of Yoga (Yogic Exercises, Pranayama & Meditation) on Hyper-reactivity to Cold Pressor Test in Healthy Individuals

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ABSTRACT

Background: Now a day, stress is dangerous & significant problems of World & affects physical, mental, behavioral, & emotional health. Yoga has been reported to control stress, to be beneficial in treating stress related disorders, improving autonomic functions, lower blood pressure, increase strength & flexibility of muscles, improve the sense of well being, slow ageing process, control breathing, reducing signs of oxidative stress & improving spiritual growth.

Aims & Objective: The aim of present study was to investigate whether regular practice of Yoga for six months can reduce the cardiovascular hyper-reactivity induced by cold pressor test.

Materials and methods: The study group comprised 75 healthy subjects of 25-45 years age group. Initially there were 27 hyper-reactors to cold pressor test. The hyper-reactivity of 22 volunteers converted to hypo-reactivity after the yoga therapy of six months (81.48%). Other parameters like basal blood pressure, rise in blood pressure, pulse rate and rate of respiration were also statistically significantly reduced (by using student 't' test)

Results: Regular practice of yoga significantly reduces the cardiovascular hyper-reactivity in basal blood pressure, rise in blood pressure after one minute of cold stress, pulse rate, & rate of respiration, after six month of yoga practice.

Conclusion: Regular practice of yoga for six months reduced the Cardiovascular hyper-reactivity to cold pressor test in subjects, who were hyper reactive to cold stress, possibly by inducing parasympathetic predominance and cortico-hypothalamo-medullary inhibition.

KEY WORDS: Yoga; Pranayama; Meditation; Cold Pressor Test

INTRODUCTION

Stress is described as a state of anxiety, strain, nervousness, tension, constant worry or pressure. It is an accepted fact that psychosocial factors operate through mental processes, consciously or unconsciously, to produce hypertension and other cardiovascular disorders.^[1]

Cardiovascular disease has become a major cause of mortality in developing nations in the age group of 30 – 69 years. The cardiovascular mortality due to hypertension is seen more in developing nations.^[2,3] Stress, anxiety and depression are known to be significant factors in the onset and progression of a wide spectrum of illness ranging from cardiovascular diseases, asthma, cancer, to HIV-infection. Yoga practices are time-honored stress management/health promotion techniques whose health benefits are being validated by modern medical science. Independent research has shown that significantly reduced levels of cortisol reduce the level of stress, relieve anxiety, depression, increase anti – oxidant production, enhance brain function, enhance the sense of well – being and peace of mind.^[4]

The health benefits are scientifically proven with researchers reporting that pranayama is beneficial in treating a range of stress related disorders.^[5] Improving autonomic functions^[6], and reducing sign of oxidative stress.^[7] The alternative etymology for compound pranayama is –“Expansion of Individual energy to cosmic energy is called pranayama”.^[8] Meditation, yoga, progressive muscular relaxation or cognitive therapy may reduce the BP to a variable degree, and combination of these treatments may even be more successful. Stress reduction via Transcendental Meditation has been shown to lower BP levels and reduce CVD risk in adults and adolescents.^[9] Regular practice of breathing exercise (pranayama) increases parasympathetic tone, decreases sympathetic activity, improves cardiovascular and respiratory functions, decreases the effect of stress and strain on the body and improves physical and mental health.^[10-12]

“Yogic” postures are now, one of the non-pharmacological therapies against stress and strain. “Yoga” Practice has been shown to be effective in improving mood and decreasing stress and depression.^[13] During exercise alpha waves are increased in the brain (increase calmness) and blood level of cortisol decreases which is a stress hormone.^[14] Vagal tone increases and sympathetic tone decreases after “yoga” practice.^[15] Yogic practices can be used as psycho-physiologic stimuli to release endogenous secretion of melatonin, which, in turn, might be responsible for improved sense of well-being.^[16]

In the present study, cold pressor test, introduced by Hines and Brown^[17,18], was employed to measure the cardiovascular reactivity. The persons hyper-reactive to cold pressor test are susceptible for early onset of hypertension.^[19-22] We tested whether regular practice of Yoga for 6 months can reduce the cardiovascular hyper-reactivity, thereby reducing the morbidity and mortality from cardiovascular disorders.

The aim of present study was to investigate whether regular practice of Yoga for 6 month can reduce the cardiovascular hyper-reactivity induced by cold pressor test.

MATERIALS AND METHODS

Study group comprised 75 male healthy subjects of 25-45 years. They were subjected to cold pressor test introduced by Hines & Brown.^[18] Out of 75 volunteers, 27 turned out to be hyper-reactive to this provocative test. After the yoga therapy of six months the hyper-reactivity of 22 volunteers converted to hypo-reactivity (81.48%). Other parameters like basal blood pressure, rise in blood pressure, pulse rate and rate of respiration were also significantly reduced statistically by using student ‘t’ test.

The study protocol was explained to the subjects and written consent was obtained. Approval by ethical committee of S.S. Medical College, Rewa, M. P., was also obtained. All the volunteers were clinically examined to rule out any systemic

diseases. All subjects were non-alcoholic and non-smokers. They were not taking any drugs, and they had similar dietary habits as well as physical and mental activities at work and home.

All the 27 hyper-reactive volunteers were first trained under the guidance of a certified “yoga” teacher for 15 days. They then carried out “Yogasanas, Pranayama and Meditation” 80 minutes, twice a day for six months, under supervision, in a prescribed manner, at R. B. mission, Shahdol M. P. The schedule consisted of-

Yogasanas: 10 minutes

Pranayama: 10 minutes

Meditation: 60 minutes

The Asanas practiced were: Ardachakrasana, Tadasana, Paschimottasana, Utthita Trikonasana, Vajrasana, Salamba Sarvangasana, and Halasana.

The Pranayama performed was: Anulom-vilom.

The volunteers practiced yoga early in the morning and again in the evening, in a quiet, well ventilated room or in open air space sitting in a comfortable posture.

BP was measured in supine posture by Sphygmomanometer.^[23] Two readings were taken 5 minutes apart and the mean of two was taken as the basal blood pressure.

For cold pressor test, a thick walled thermocol box measuring 38 cm × 26 cm × 18 cm, closed from all sides, was used. A hole was made in the centre of the top of the box to allow entry to one hand of the subject. Another small hole was made at the corner of the top of the box for laboratory thermometer. Before starting the experiment the box was filled a mixture of ice and water and the laboratory thermometer was placed in such a way that its mercury bulb was immersed in the mixture of ice and water.^[17] Temperature inside the box was maintained around 30-40°C. The hand was immersed in cold water up to the wrist for one minute (cold stress). An elevation above the basal level of more than 20 mm of Hg in systolic or of more than 15 mm in diastolic was considered as hyper-reactive response.^[18]

The hyper-reactivity of 22 volunteers converted to hypo-reactivity after the yoga therapy of six months (81.48%). Other parameters like basal blood pressure, rise in blood pressure, pulse rate and rate of respiration were also significantly reduced statistically by using student ‘t’ test.

Statistics:

The data was analyzed statistically by using statistical software Graph Pad in Stat vs. 3.10 and MS Excel (2003). Statistical analysis of BP, pulse rate and respiratory rate were done using student’s ‘t’ test and $p < 0.05$ was considered as significant.

RESULTS

Our results showed that “Yoga” causes significant reduction in the cardiovascular hyper-reactivity. A total of 75 male volunteers were included in the study. Out of which 27 were hyper-reactor to cold pressor test. These hyper-reactors practiced yoga regularly for six months and after this period the 22 volunteers became hypo-reactors, whereas no change in the hyper-reactivity was observed in five volunteers. The statistical analysis was carried out using student ‘t’ test. It was observed that the basal blood pressure, rise in BP due to cold stress, pulse rate, respiratory rate were statistically more significantly altered.

Blood Pressure: The mean systolic blood pressure decreased from 125 ± 3.81 mm Hg to 121 ± 5.56 mm Hg after 6 months of yogic exercises, pranayama and meditation. The diastolic Blood pressure was found in the study to change from 83 ± 4.12 mm Hg to 79 ± 6.0 mm Hg.

Average rise in systolic blood pressure, due to cold pressor test, initially was 20.45 ± 3.18 mm Hg, and this rise reduced to 16 ± 3.64 mm Hg ($p < 0.0382$). While the rise in diastolic blood pressure initially was 15 ± 6.63 mm Hg and this reduced to 13 ± 3.14 mm Hg ($p < 0.0385$). (Table-1)

Pulse Rate and Respiratory Rate: Pulse rate decreased from mean value of 81.45 ± 5.14 to 74.86 ± 5.12 ($p < 0.01$) and respiratory rate

decreased from mean value 21.0 ± 2.17 per minute to 17.68 ± 1.56 per minute, which is significant. ($p < 0.01$) (Table-2)

Table-1: Changes in Blood Pressure in mm Hg During Cold Pressor Test in Hyper-reactors Before and After Six Months of Yogic Exercises, Pranayama and Meditation

Sr. No.	Parameters		Before of Yogic Exercises, Pranayama & Meditation		After 6 Months of Yogic Exercises, Pranayama & Meditation		Difference Between Initial and Final Mean	P Value
			Mean Value	S. D.	Mean Value	S. D.		
1	Basal B. P.	Systolic	125.0	± 3.81	121.0	± 5.56	4.0	$p < 0.0001$
		Diastolic	83.0	± 4.12	79.0	± 6.0	4.0	$p < 0.0002$
2	B.P. after Hand dip in 4 ⁰ C water for 1 min.	Systolic	145.0	± 6.63	129.0	± 6.74	16.0	$p < 0.0002$
		Diastolic	95.0	± 6.23	85.0	± 4.74	10.0	$p < 0.0004$
3	Rise in Blood Pressure	Systolic	20.0	± 3.18	16.0	± 3.64	4.0	$p < 0.0382$
		Diastolic	15.0	± 6.63	13.0	± 3.14	2.0	$p < 0.0385$

Table-2: Comparison of Pulse Rate & Respiratory Rate in the Hyper-reactor Subjects Before and After Yoga

Sr. No.	Parameters		Before of Yogic Exercises, Pranayama & Meditation		After 6 Months of Yogic Exercises, Pranayama & Meditation		Difference Between Initial and Final Mean	P Value
			Mean Value	S. D.	Mean Value	S. D.		
1	Pulse Rate (per Minute)		76	± 5.74	72	± 4.67	4.0	$p < 0.0003$
2	Respiratory Rate (per minute)		18	± 1.59	16	± 1.33	2.0	$p < 0.023$

Figure-1: Changes in Blood Pressure in mm Hg During Cold Pressor Test in Hyper-reactors Before and After Six Months of Yogic Exercises, Pranayama and Meditation

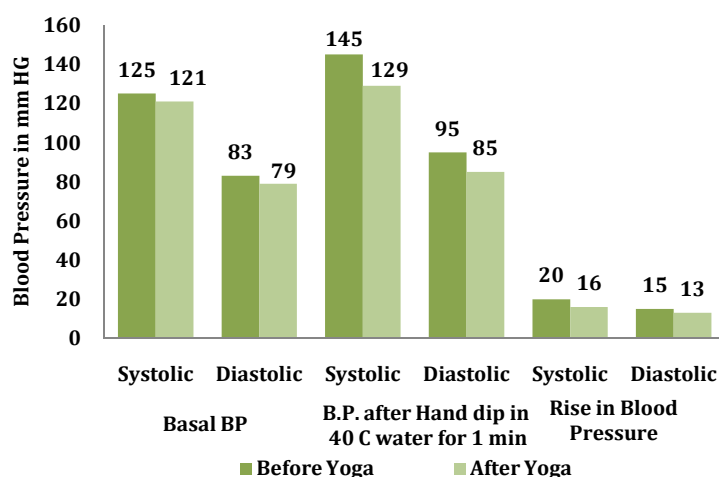
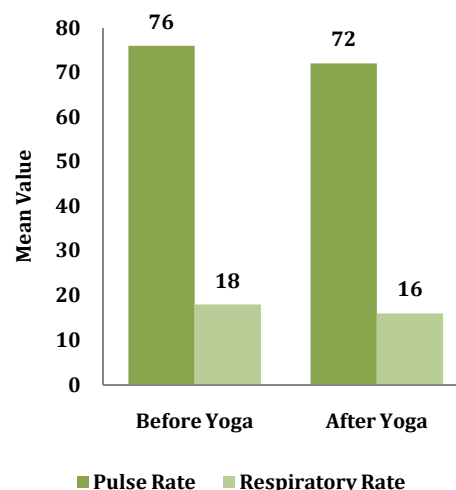


Figure-2: Comparison of Pulse Rate & Respiratory Rate in the Hyper-reactor Subjects Before and After Yoga



DISCUSSION

On analyzing the effect of yoga in normal subjects of age group 25-45 years, in our study, the cardiovascular autonomic function tests were studied before and after six months, of "yoga". The volunteers after "yoga" practice showed autonomic equilibrium between sympathetic and parasympathetic nervous system.

In the present study we observed that there was significant difference in blood pressure, pulse rate, respiratory rate and reactivity to cold pressor tests after practicing "yoga" which indicates decrease in sympathetic activity and increase in parasympathetic activities which is mainly due to increase in vagal tone. [24-27,31]

The autonomic nervous system plays a major role in bringing about adaptation of human body to environmental changes, thereby modulating the sensory, visceral, motor and neuro-endocrine functions, regulates the activity of all muscles, and certain glands. Autonomic nervous system is one of the most important mediators of this response and these changes may be responsible for the present observation in cold pressor test.^[13]

The practice of “asanas” relaxes the muscles and joints which influences the hemodynamic mechanism, thereby improving blood circulation to vital organs. This may also activate the neuro-endocrine axis which is important in facing physical and mental stress.^[13]

Everybody is invariably exposed to professional, social and environmental stress. Stress is known to increase the risk of coronary events. Yogasana, pranayama, and meditation are often recommended as a way to relieve stress and improves the ability of cardiovascular system and mental status of the subjects, by modulating and optimizing sympathetic activities.^[24-30]

The practice of yoga prepares the person in overcoming stress by modulating and optimizing sympathetic activities in stressful situations thereby immediately restoring equilibrium, thereby avoiding intervention of inhibitory parasympathetic system.^[13]

Combined practice of physical postures, breathing exercises, and meditation in a sequence is the best way to meet the present day anti-stress, non-pharmacological therapy.^[32]

CONCLUSION

Non pharmacological methods like yogic asanas, pranayama, and meditation should be encouraged to control the modifiable risk factors by increasing parasympathetic activity and decreasing sympathetic activity and provides significant improvements in cardiovascular parameters and respiratory functions. It can thus be concluded that these results would justify the

incorporation of yoga as part of our life style in prevention of hyper-reactivity to stress related disorders and age-related cardiovascular complications.

“In a tension-filled society, yoga, pranayama, and meditation alone will bring solace from problems and hence they are essence of the life.”

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