

**Original Article****Effect of Specific Yogasanas on Volunteers Having Cardiovascular Hyper-Reactivity to Cold Pressor Test**

Authors

Jitendra Mahour¹, Sanjeev K. Shrivastava², Chanda Rajak³, Asha Shrivastava⁴^{1,2,4}Department of Physiology, GMC, Bhopal, M.P, India³Department of Physiology, SSMC, Rewa, M.P, India

Corresponding Author

Jitendra Mahour

Department of Physiology, GMC, Bhopal, M.P, India

Email: jitendre.mahour@gmail.com**ABSTRACT**

According to the World Health Organization, stress is a significant problem of our times and affects both physical as well as the mental health of people. Stress coping methods are the cognitive, behavioral and psychological efforts to deal with stress. The Yoga helps the person to control stress and hypertension. It offers gentle asanas, relaxation, pranayama and meditation which helps to calm your mind, teaching us to relax at will and giving a mental vacation. Numerous scientific studies have reported that yoga is beneficial both physiologically and psychologically. Stress reduction via Yoga has been shown to lower blood pressure levels and reduce cardiovascular risk in adults and adolescents. The aim of present study was to investigate whether practice of Yogasanas can reduce the prevalence of hyper-reactivity measured by cold-pressor test. The study group comprises 55 healthy medical students of 18-27 years age group. Initially there were 22 hyper-reactors to cold pressor test which reduce to 10 after practicing yogasanas for three months. The remaining subjects also reduce their reactivity to cold stress. Practice of "yogasanas" causes significant reduction in the cardiovascular hyper-reactivity. There was significant change in basal BP, BP after one minute of cold stress, rise in BP due to cold stress, heart rate and respiratory rate after performing yogasanas. The statistical analysis were carried out using student 't' test. We concluded that regular practice of Yogasanas for three months reduces 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.

Keywords: Stress; Cold pressor test; Hyper-reactive subjects; Blood Pressure; Heart rate; Respiratory rate.

INTRODUCTION

"Yoga" is practiced in India and all over world for over thousands of years. Increased awareness of

health and natural remedies, yogic techniques are gaining importance and receiving world wide acceptance. "Yoga" produces physiological

changes which has a sound scientific basis. Today man is subjected to far greater stress, strain and depression than before. It is well known that as a result of stress, various systems in the body are affected, giving rise to various psychosomatic disorders. There medial medicines used for these disorders are temporary. Therefore non-pharmacological approach is beneficial. "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^[1]. All over the world scientists have extensively studied yoga and claimed that it increases the longevity^[2] and has therapeutic and rehabilitative effects.^[3,4]

A growing body of evidence supports the belief that yoga benefits physical and mental health via down-regulation of the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic nervous system (SNS).^[5]

During exercise alpha waves are increased in the brain (increase calmness) and blood level of cortisol decreases which is a stress hormone.^[6]

Asanas have variety of effects including: relax muscles through holding them in gently stretched positions, action on pressure points, improvement of breathing, calming of nervous system, and promotion of homeostasis in cardiovascular, digestive, endocrine and other systems.^[7] Yoga practice causes increase in vagal tone and decrease in sympathetic tone^[8]

Hypertension is a common disorder of adult population all over the world. It is considered a major health problem leading to death and deformity. High blood pressure develops silently

and without warning and is sometime called silent killer. Hypertension is commonly defined using both systolic and diastolic blood pressure.^[9]

In the study of hypertension, cold pressor test, introduced by Hines and Brown^[10,11] was employed to measure the cardiovascular reactivity^[14]. The persons hyper-reactive to cold pressor test are susceptible for early onset of hypertension^[12,13].

MATERIALS AND METHODS

The present study was conducted in 55 healthy volunteers (35 males and 20 females) in the age group of 18-27 yrs of first year medical students. The study protocol was explained to the subjects and written consent obtained. Approval by ethical committee was 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 55 volunteers trained under the guidance of a certified "yoga" teacher for 15 days. They carried out "yogasanas" 30 minutes daily for three months, under supervision, in a prescribed manner in a quiet, well ventilated room or in open airspace sitting in a comfortable posture.

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

The schedule consisted of - Morning: - 15 minutes
Evening: - 15 minutes

Blood pressure was measured in supine posture by Sphygmomanometer¹⁴. 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 center 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 such that its mercury bulb was immersed in the mixture of ice and water ¹². Temperature inside the box was measured about 3⁰-4⁰C. 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.^[15]

OBSERVATIONS

Table No. 1 Distribution of Subjects according to Sex and Age

S. No.	Sex	Age	No. Of Subjects	Total Subjects	Percentage (%)
1.	Male	18-20	13	35	63.63%
		21-24	19		
		25-27	3		
2.	Female	18-20	18	20	36.36 %
		21-24	2		
		25-27	0		

Total Subjects = 55

Mean Age = 20.67 yrs

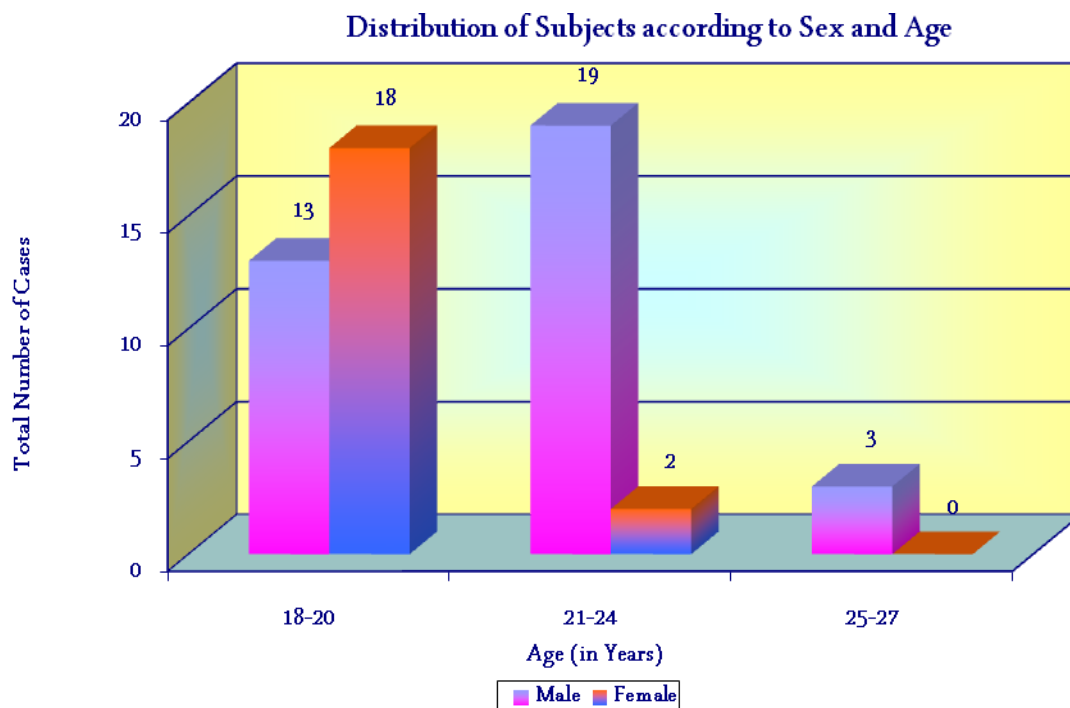


Table No. 2 Table showing changes in blood pressure in mm Hg during cold pressor test in hyper-reactors before and after three months of yogasanas.

S. No.	Parameters		Before of yogasanas		After 3 months of yogasanas		Difference between initial and final mean	P Value
			Mean Value	S. D.	Mean Value	S. D.	Mean Value	
1	Basal B. P.	Systolic	119.81	±7.56	115.81	±6.89	4.0	p<0.001
		Diastolic	77.09	±4.73	74.72	±5.03	2.37	p<0.005
2	B.P. after Hand dip in 4 ⁰ C water for 1 min.	Systolic	139.72	±9.66	133.27	±8.80	6.45	p<0.001
		Diastolic	88.81	±5.91	84.45	±6.89	4.36	p<0.005
3	Rise in Blood Pressure due to Cold Stress	Systolic	20.45	±7.29	18.36	±5.22	2.09	p<0.05
		Diastolic	11.72	±4.68	9.36	±4.24	2.36	p<0.05

Blood Pressure: The mean systolic blood pressure decreased from 119.81 ± 6.3 mm Hg to 115.81 ± 4.9 mm Hg after 3 months of yogic exercises. The diastolic blood pressure was found in the study to change from 77.09 ± 5.7 mm Hg to 74.72 ± 4.9 mm Hg.

Average rise in systolic blood pressure, due to cold-pressor test, initially was 20.45 ± 4.17 mm Hg, and this rise reduced to 18.36 ± 2.85 mm Hg. While the rise in diastolic blood pressure initially was 11.72 ± 2.85 mm Hg and this reduced to 9.36 ± 1.86 mm Hg.

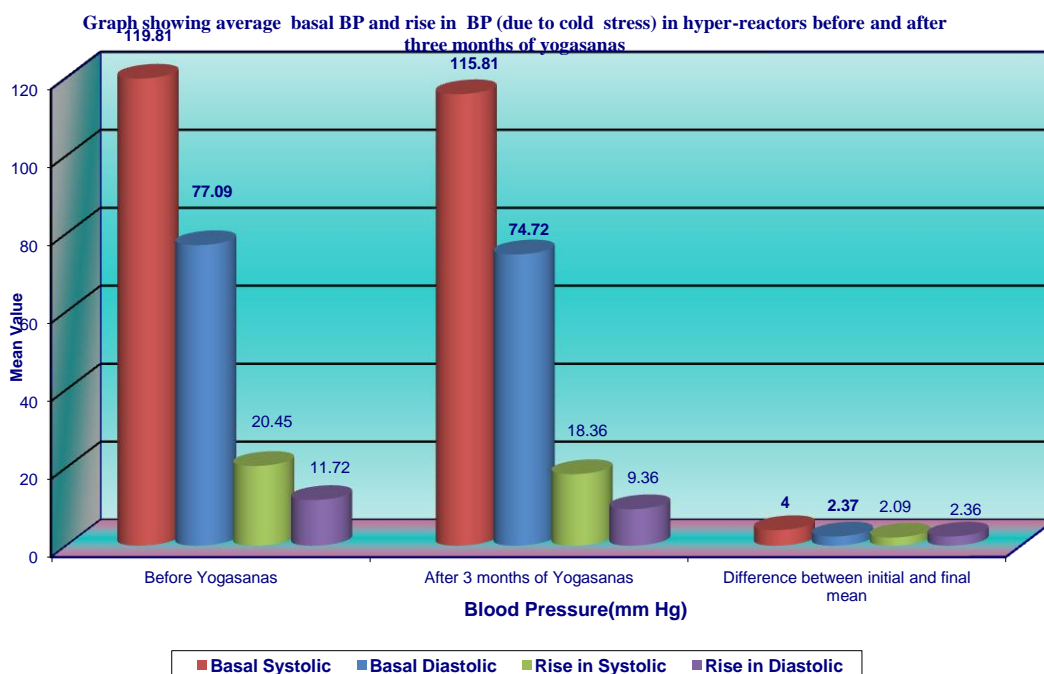


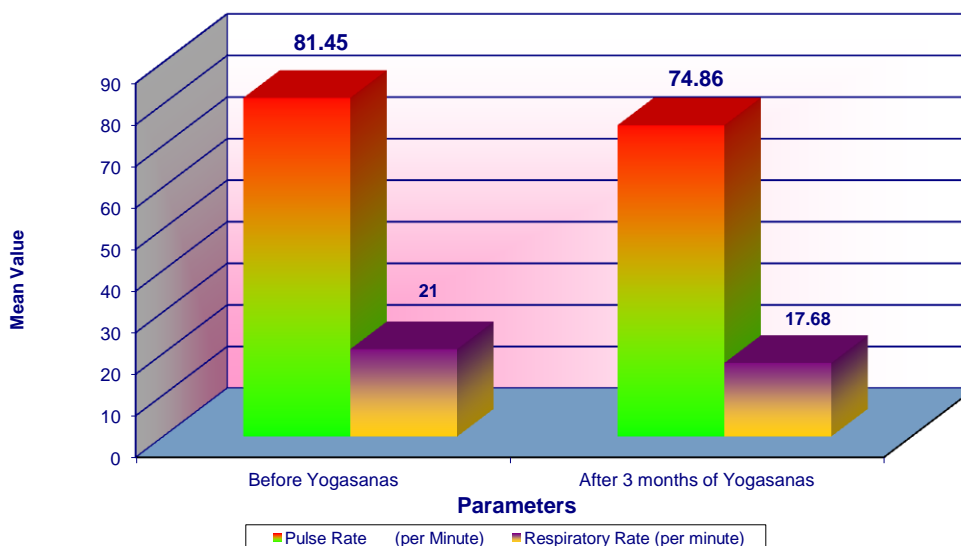
Table No. 3 Table showing comparison of Pulse Rate & Respiratory Rate in the hyper-reactor subjects before and after yogasanas

S. No.	Parameters	Before yogasanas		After 3 months of yogasanas		Difference between initial and final mean value	P Value
		Mean Value	S.D.	Mean Value	S.D.		
1.	Pulse Rate (per minute)	81.45	±3.17	74.86	±2.71	-6.59	p< 0.005
2.	Respiratory Rate (per minute)	21.0	±1.57	17.68	±1.52	-3.32	p<0.05

Pulse rate and Respiratory rate: Pulse rate decreases from mean value of 81.45 ± 5.14 to 74.86 ± 5.12 and respiratory rate decreases from

mean value 21.0 ± 2.17 per minute to 17.68 ± 1.56 per minute, which is significant.

Graph showing comparison of Pulse Rate & Respiratory Rate in the hyper-reactor subjects before and after yogasanas



RESULTS

Our results showed that “Yogasanas” causes significant reduction in the cardiovascular hyper-reactivity. A total of 55 volunteers including 35 males and 20females were included in the study (Table-1). Out of which 22 were hyper-reactor to cold pressor test. These hyper-reactors subjects practices yogasanas regularly for three months and after practicing yoga the number of hyper-

reactors reduces from 22 to ten. It means 12 subjects converted to hyporeactors. It was observed that the basal blood pressure, BP after one minute of cold stress, rise in BP due to cold stress (Table-2), pulse rate, respiratory rate were statistically more significantly altered. (Table-3)

DISCUSSION

In our study the cardiovascular autonomic function tests were carried out before and after three months of regular practice of “yogasanas”. The volunteers after practice of yogasanas showed autonomic equilibrium between sympathetic and parasympathetic nervous system.

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. It regulates the activity of smooth muscles, cardiac muscles and certain glands. It can be described as a specific motor output portion of the peripheral nervous system. 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.^[16]

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.^[17]

As a result of excessive stress, both the cerebral cortex and subcortical areas (the limbic system and the hypothalamic areas) become disturbed. These emotional disturbances ultimately lead to changes in functions of autonomic nervous system^[18]. We produced similar autonomic disturbance including cardiac sympathetic activation and parasympathetic withdrawal by application of cold pressor test^[19] and found that these disturbances were counterbalanced by doing regular practice of

yogasanas for three months. Yogasanas probably relaxes the cerebral cortex (supported by the presence of alpha waves) and by increasing parasympathetic predominance and/or inhibition of vasomotor centre (VMC) in medulla by cortico-hypothalamic descending pathway which was reflected by reduced hyper-reactivity to cold pressor test after performing yogasanas.

CONCLUSION

The present study shows that yogasanas has positive physiological benefits as evidenced by changes in cardiovascular parameters.

Young individuals are invariably exposed to professional, social and environmental stress. These stresses create conflict in the mind, leading to distress. We can say that the practice of yoga would benefit the young population as it would prepare them in overcoming stress by modulating and optimizing sympathetic activities in stressful situations thereby immediately restoring equilibrium, thereby avoiding intervention of inhibitory parasympathetic system.^[20]

So here we can conclude that Yoga is a great gift provided to us by great ancient Indian sages. If human being accepts yoga as a regular part of life, they can reduce the risks of many diseases especially those related to stress and thus the society becomes more disciplined and fit physically, mentally, spiritually and financially.

REFERENCES

1. Woolery A, Myers H, Sternlieb B, Zeltzer L. A yoga intervention for young adults

- with elevated symptoms of depression. *Altern Ther Health Med* 2004;10(2):60-63
2. Pathak JD, Mehrotra PP, Joshi SD. A plea for 'Pranayama' for elderly. *Indian J Physiol Pharmacol* 1978;22(4):77-80.
 3. Khanam AA, Sachdeva U, Guleria R, Deepak KK. Study of pulmonary and autonomic functions of Asthma patients after Yoga training. *Indian J Physiol Pharmacol* 1996;40(1):318-24.
 4. Labarthe D, Ayala C. Nondrug interventions in hypertension prevention and control. *Cardiol Clin* 2002;20:249-63.
 5. Ross A, Thomas S. The health benefits of yoga and exercise: A review of comparison studies. *The Journal of Alternative and Complementary Medicine* 2010;16(1):3-12.
 6. Kamei T, Toriumi Y, Kimura H, Ohno S, Kumano H, Kimura K. Decrease in serum Cortisol during Yoga exercise is correlated with alpha wave activation. *Percept Mot Skills* 2000;90:1027-32
 7. Monro R. Yoga therapy. *Journal of Bodywork and Movement Therapies* 1997
 8. Gharote ML. Effect of yogic training on physical fitness. *Yoga mimansa* 1973;15: 31-35
 9. WHO Expert Committee 1996.
 10. Hines EA Jr., Brown GE. A Standard Stimulus for Measuring Vasomotor Reactions: it's Application in the Study of Hypertension. *Mayo Clin Proc* 1932;7 :332-35
 11. Hines EA Jr., Brown GE. The cold pressor test for measuring the reactivity of the blood pressure. *Am Heart J* 1936;11:1-9.
 12. Verma V, Singh SK, Ghosh S. Identification of susceptibility to hypertension by the cold pressor test. *Indian J Physiol Pharmacol* 2005;49:119-20
 13. Flaa A, Eide IK, Kjeldsen SE, Rostrup M. Sympathoadrenal stress reactivity is a predictor of future blood pressure: An 18-year follow-up study. *Hypertension* 2008;52:336-41
 14. Perloff D, Grim C, Flack J, Frohlich ED, Hill M, McDonald M, et al. Human blood pressure determination by sphygmomanometry. *Circulation* 1993;88:2460-70
 15. Hines EA Jr. The significance of vascular hyper reaction as measured by the cold-pressor test. *Am Heart J* 1940; 19(4):408-16.
 16. Sharma RK, Deepak KK, Bijlani RL, Rao PS. Short-term physical training alters Cardiovascular autonomic response amplitude and latencies. *Indian J Physiol Pharmacol* 2004; 48(2):165-73
 17. Selvamurthy W, Director. Yoga in the Army. Delhi 1995.
 18. Udupa KN. Hypertension, Stress and its Management by Yoga. Delhi 1985(2nd ed.) 33
 19. Wirch JL, Wolfe LA, Weissgerber TL, Davies GA. Cold pressor test protocol to evaluate cardiac autonomic function. *Appl Physiol Nutr Metab* 2006;31:235-43

20. Sahoo JK, Vatve M, Sahoo KD, Patil VV.
Effect of specific “yogasanas” on
cardiovascular autonomic function
test.*Pravara Med Rev* 2010;5(1):10-15