



STUDY THE EFFECT OF YOGA ON PLASMA ADRENALINE, AND CARDIOVASCULAR PARAMETERS IN HYPER-REACTORS TO COLD PRESSOR TEST IN YOUNG HEALTHY MEDICAL STUDENTS

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ABSTRACTS

Background: Stress may be defined as psychophysiological process usually experienced as a negative emotional state. It is a common condition, a response to a physical threat or psychological distress that generates a host of chemical and hormonal reactions in the body. The health effects of stress involve mainly autonomic, cardiovascular, and immune systems. **Objective:** The aim of present study was to investigate whether regular practice of Yoga for three months can reduce cardiovascular and respiratory reactivity induced by cold pressor test. **Material and method:** The present study included 60 male medical students of first M.B.B.S. of 18 to 25 years of age. After

recording the basal blood pressure and pulse rate, and the cardiovascular reactivity of all the 60 students was measured by application of cold pressor test devised by Hines & Brown (1936). 35 were found to be hyper reactor to this test. These hyper reactors underwent Yogasana, Nadishodhana, Bhramari Pranayama, Omkar Chanting and meditation for the duration of 12 weeks. Before and After the yogic training period the plasma Adrenaline level, mean blood pressure and mean pulse rate/ min was measured which was found to be significantly reduced. Statistically by using student, "t" test. **Result:** Regular practice of yoga for 3 months significantly reduced the cardiovascular reactivity to cold pressor test, plasma Adrenaline level basal blood pressure and pulse rate. **Conclusion:** We concluded that regular practice of yoga for three months reduced the plasma Adrenaline level and cardiovascular parameters and. Possibly by inducing parasympathetic predominance and cortico-hypothalamo-medullary inhibition.

KEYWORDS: Stress, Yoga, Cold pressor test. Plasma Adrenaline.

INTRODUCTION

The present age of speed and competition has increased the stresses. The present age of speed and competition has increased the stresses and strains. It is resulting in life style related health problems such as Obesity, Diabetes Mellitus, Hypertension and Coronary Artery Disease^[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, HIV-infection & affects multiple systems of body.^[4]

On entering into the professional college the student is in a new challenging and stressful environment. Factors contributing to high levels of stresses in professional colleges could be highly competitive curriculum, intense academic competition, and excessive demands on coping abilities in physical, emotional, intellectual, financial and social terms. Possibly these and many more factors contribute to high levels of stress in medical students. With the above facts in mind the relevance of yoga in medical education was evaluated.^[6]

Academic examination stresses.^[7], associated with changes in the mental and physical health such as increasing anxiety, increasing negative mood and changes in the immune functioning.^[8]

Adrenaline is an important part of your body's ability to survive, but sometimes the body will release the hormone when it is under stress but not facing real danger.. Excessively high levels of the hormone due to stress without real danger can cause heart damage, insomnia, and a jittery, nervous feeling. leading to anxiety, weight loss, palpitations, rapid heartbeat, and high blood pressure. Too little adrenaline rarely occurs, but if it did it would limit the body's ability to respond properly in stressful situations.^[14]

Walter Cannon et al., (1911)^[15] was the first person to propose that emotional stress causes excess of adrenaline secretion from adrenal medulla leading to tachycardia, high blood pressure etc. Later it was found that all these manifestations occur not only from adrenaline secretion but also from over activity of the sympathetic nervous system which liberates nor-adrenaline at its nerve endings. 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 stimulate autonomic nervous system, increase in output of both adrenaline and nor-adrenaline, both from sympathetic nerve fibers as well as from adrenal medulla causing increase in heart rate, systolic and diastolic blood pressures and an increased secretion of glucocorticoid & aldosterone from adrenal cortex causing salt and fluid retention which increases blood volume and blood pressure imposing severe strain on the heart.^[16]

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 health well-being and peace of mind. In the study of hypertension, cold pressor test, introduced by Hines and Brown, was employed to measure the cardiovascular reactivity.^[17]

In the ancient system of education various yogic practices like Suryanamaskar, Pranayama, meditation as well as good value systems were introduced with the formal education to enable the development of good physique, strong ethical values and good stress tolerance.^[9] A state of mental tranquillity is achieved by the practice of yoga as revealed by increase in alpha index of electroencephalogram after short term yoga.^[12,13]

Yoga can protect the individual by bringing harmony between mind and body, modulating stress responses and one's attitude to stress as also improving mental faculties such as attention, memory, learning efficiency and positive attitude to life.^[14,15,16]

Yoga is the best lifestyle modification, which aims to attain the unity of mind, body and spirit through asanas (exercise), pranayama (breathing), and meditation.^[17,18] At intellectual level, yoga can sharpen memory, concentration, decrease anxiety levels.^[19, 20]

MATERIAL AND METHODS

The present study will be done in the Department of Biochemistry, R.D GARDI Medical College, Ujjain (M.P.) and Central Investigation Laboratory. The study will be carried after the approval of Institutional Ethics Committee to use human subjects in the research study. Informed consent will be taken from healthy medical students.

Study group comprised 60 male healthy subjects of 18-25 years. They were subjected to cold pressor test according to Hines & Brown^[18] Out of 60 volunteers, 35 turned out to be hyper-reactive to this provocative test. The hyper-reactivity of 30 volunteers converted to hypo-reactivity after the yoga therapy of three months (85.71%). The parameters like plasma Adrenaline level, basal blood pressure, rise in blood pressure, pulse rate were also significantly reduced statistically by using student test.

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. They were not practicing any known stress relieving or relaxation technique previously.

All the 35 volunteers of study group were trained under the guidance of a certified “yoga” teacher for 15 days in the Deptt. Of Physiology. They carried out “Yogasanas, Pranayama and Meditation” 60 minutes, twice a day for three months, under supervision, in a prescribed manner.

The schedule consisted of

□ Yogasanas- -10 minutes □ Pranayama- -10 minutes □ Chanting of Om -10 minutes □ Meditation- -30 minutes

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

The Pranayama performed was: Nadi sodhan and Bhramri

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

CHANTING OF OM Chanting of "OM" practiced, in sitting /comfortable position with eyes closed. The Om word were repeated several time with prolong breath holding and continued for 10 minutes.

The Meditation performed was the same, as was told by Lord Krishna to Arjun in Kuruchhetra, (Method is available in Bhagvat Geeta^[21] 9th to 16 slokes of Dhana Yoga chapter).

Plasma Adrenaline- Plasma adrenaline will be estimated by high performance liquid chromatography with electrochemical detection method of Boomsma F, et al 1993.

Collection of blood Samples: Under all aseptic precautions, 5 ml venous blood sample was collected from antecubital vein at 8 a.m. in hyper-reactors to cold pressor test by disposable syringe. This sample was used for separation of serum and plasma.

Separation of Plasma

Blood samples of the selected subjects will be collected in a heparin vacutainer without any preservatives/antioxidants and transported at 4o C for estimation of adrenaline (Ad). Plasma will be separated immediately by centrifugation, at 2000 rpm for five minutes and stored at -30o C. Plasma Ad, will be estimated within 60 days of storing at -30o C.

BP was measured in supine posture by Sphygmomanometer^[22] Two reading were taken five minutes apart and the mean of two was taken as the BP. 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 such that its mercury bulb was immersed in the mixture of ice and water.^[7] 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.^[8] The data was analyzed statistically by using statistical software Graph Pad in Stat vs. 3.10 and MS Excel (2003). Statistical analysis of BP, and pulse rate and rate of respiration were done using student,,t test and $p < 0.01$ was considered as significant.

RESULTS

Our results showed that “Yoga” causes significant reduction in cardiorespiratory hyperreactivity. A total of 60 male volunteers were included in the study. Out of which 35 were hyper-reactor to cold pressor test. These hyper-reactors practiced yoga regularly for three months and after this period 30 volunteers become hypo-reactors. 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, and pulse rate were statistically more significantly altered. (Table-1).

Mean cardio-vascular parameters

1. The mean basal systolic blood pressure was 123.7 ± 2.91 mm Hg, mean diastolic blood pressure 81.94 ± 3.305 mm Hg, mean basal Pulse rate 77.89 ± 5.46 / min.

2. **The mean basal Plasma Adrenaline** level 9.76 ± 0.66 ng/L

The effect of cold pressor test before yoga

The mean rise in systolic blood pressure, was 145.1 ± 2.803 mm Hg ($p < 0.000$). While the rise in diastolic blood pressure was 94.97 ± 17.03 mm Hg ($p < 0.000$). and rise in Pulse rate 86.11 ± 5.465 / min ($p < 0.000$).

The effect of 03 months of yoga only in study group

1. The mean systolic blood pressure decreased from 123.7 ± 2.91 mm Hg to 119.4 ± 1.864 mm Hg ($p < 0.000$), mean diastolic Blood pressure was decreased from 81.94 ± 3.305 to 77.71 ± 4.177 mm Hg. ($p < 0.001$), mean Pulse rate was decreased from 77.89 ± 5.46 / min to 75.31 ± 5.57 / min ($p < 0.000$), after 3 months of yogic exercises, pranayama and meditation & were statistically highly significant. (Table-1).

2. **The mean basal Plasma Adrenaline** level decreased from 9.76 ± 0.66 ng/L to 8.71 ± 0.88 ng/L ($p < 0.000$), due to effect of yoga & were statistically highly significant.

The effect of cold pressor test before and after 03 months of yoga only in study group -

1. The mean systolic blood pressure decreased from 145.1 ± 2.803 mm Hg to 132.7 ± 3.724 mm Hg ($p < 0.000$), mean diastolic Blood pressure was decreased from 94.97 ± 17.03 to 82 ± 14.94 mm Hg. ($p < 0.000$), mean Pulse rate was decreased from, 86.11 ± 5.465 / min to 78.51 ± 4.83 ($p < 0.000$), after 3 months of yogic exercises, pranayama and meditation & were statistically highly significant. This shows that the decreased effect of cold pressor test after yoga indicate decreased effectiveness of cold pressor test due to effect of yoga (Table-2).

2. The mean basal Plasma Adrenaline decreased from 375.2 ± 45.33 ng/L to 116.6 ± 24.55 ng/L ($p < 0.000$), due to effect of yoga & were statistically highly significant. This shows that the decreased effect of cold pressor test after yoga indicate decreased effectiveness of cold pressor test due to effect of yoga (Table-2).

OBSERVATION TABLE**Table (1): Showing changes in basal Systolic B.P., basal Diastolic B.P., basal Pulse Rat/min and mean basal Plasma Adrenaline level before and after three months of yoga in hyper-reactors to cold pressor test.**

S. No.	Parameters	Before yoga.	After three months of yoga.	P Value
		Mean Value S. D.	Mean Value S. D.	
1	Basal Systolic B.P. (mm Hg)	123.7 ± 2.916	119.4 ± 1.864	p<0.000
2	Diastolic B.P.(mm Hg)	81.94 ± 3.305	77.71 ± 4.177	p<0.000
3	Pulse Rate/min	77.89 ± 5.465	75.31 ± 5.57	p<0.000
4	Plasma Adrenaline ng/L	9.76 ± 0.66	8.71 ± 0.88	p<0.000

Table No: (2) Show effects of cold pressor test before & after 3 month of Yoga practices on basal Systolic B. P, basal Diastolic B. P., basal Pulse rate/ min and mean basal Plasma Adrenaline level in hyper-reactors to cold pressor test.

S. No.	Parameters	Cold Pressor test, Before yoga.	Cold Pressor test, After three months of yoga.	P Value
		Mean Value S. D.	Mean Value S. D.	
1	Basal Systolic B.P. (mm Hg)	145.3 ± 2.69	132.7 ± 3.724	p<0.000
2	Diastolic B.P.(mm Hg)	94.97 ± 17.03	82 ± 14.94	p<0.001
3	Pulse Rate/min	86.11 ± 5.465	78.51 ± 4.83	p<0.000
4	Plasma Adrenaline ng/L	375.2 ± 45.33	116.6 ± 24.55	p<0.000

DISCUSSION

On analyzing the effect of yoga on hyper reactor subjects of first-year MBBS student age group 18-25 years, in our study, the plasma Adrenaline level, basal cardiovascular parameters systolic blood pressure, diastolic blood pressure, pulse rate and plasma Adrenaline were studied in study group before yoga and after three months of Yogasana, Nadishodhana, Bhramari Pranayama, Omkar Chanting and meditation (Yoga) & also were studied the effect of cold pressor test before yoga and after three months of “yoga.”

The study group volunteers showed the effect of cold pressor test on mean systolic blood pressure, mean diastolic blood pressure, mean pulse rate and mean Plasma Adrenaline level were increased (p<0.000) due to increase sympathetic activity of nervous system and statistically highly significant before yoga. After three month of yoga the values of all cardiovascular parameters and mean Plasma Adrenaline level were decreased (p<0.000) and statistically highly significant after yoga and the reactivity to cold pressor test after yoga were

decreased ($p < 0.000$) due to decrease sympathetic activity & increase parasympathetic activity of nervous system & were statistically highly significant after yoga.

In the present study we observed that due to regular practices of yoga, the mean systolic blood pressure, mean diastolic blood pressure, mean pulse rate and mean Plasma Adrenaline level were decreased ($p < 0.000$) & due to autonomic equilibrium between sympathetic and parasympathetic nervous system & due to increase in vagal tone.^[21, 22, 23, 24] were statistically highly significant. DBP depends upon peripheral resistance and lung inflation has been known to decrease systemic vascular resistance and decrease in DBP.^[25] Yoga leads to an inhibition of the posterior or sympathetic area of the hypothalamus. This inhibition optimizes the body's sympathetic responses to stressful stimuli and restores autonomic regulatory reflex mechanisms associated with stress. This inhibition results in lower anxiety, heart rate, respiratory rate, blood pressure, and cardiac output in students practicing yoga and meditation.^[26,27,28,29,30]

Practice of Pranayama is an art of controlling the breath and keep his attention on the act of breathing, and removes his attention from worldly worries and “de-stress” him. This may decrease release adrenaline i.e. decrease sympathetic activity and hence decrease in heart rate, respiratory rate, blood pressure etc.^[31] the right nostril dominance corresponds to activation of “Pingala” subtle energy channel; related to sympathetic arousal and left nostril to “Ida” subtle energy channel, corresponding to parasympathetic activation.^[32,33] Pranayama effects the proper balance between “Ida” and “Pingala” i.e. Sympathetic and parasympathetic activity and gain spiritual upliftment.^[34,35,36] Bhramari Pranayama. 2decrease systolic blood pressure due to increased parasympathetic activity.^[37,38] Significant decrease in heart rate during mental chanting of -"OM", which is suggestive of psychophysiological relaxation^[39,40]

Regular practice of Hatha yoga and Omkar meditation causes alterations in autonomic balance, respiratory performance and wellbeing. Significant reduction in systolic, diastolic, and mean arterial pressure indicates a trend of gradual shift of autonomic equilibrium toward relative parasympatho-dominance because of the reduction of sympathetic activity, also facilitates secretion of melatonin from the pineal gland, which may be acting as a psychosensitive hormone which, in turn, might be responsible for improved sense of wellbeing.^[41] Collective impact of Nadidhodhana, Bhramari Pranayama and Omkar chanting modulate the sympathetic and parasympathetic activity thereby resulting in relaxation.^[42]

Chanting of Om mantra resulting in stabilization of brain, removal of worldly thoughts and increase of energy.

On Transcendental Meditation, the cortisol levels was a significant drop in the meditation group^[43,44] mainly due to decrease release of stress hormone “ cortisol ” from adrenal cortex & the adrenaline levels from adrenal medulla^[45,46,47] due to decrease sympathetic discharge from Adrenal gland.

This modulation of autonomic nervous system activity might have been brought about through the conditioning effect of yoga on autonomic functions and mediated through the limbic system and higher areas of central nervous system^[48] and mechanical and hemodynamic adjustments causing both tonic and phasic changes in cardiovascular functioning^[49] and increases the baroreflex sensitivity and decreases the sympathetic tone, thereby restoring blood pressure in patients of essential hypertension.^[50]

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. Restoring equilibrium, thereby avoiding intervention of inhibitory parasympathetic system.^[51] Combined practice of physical posture, breathing exercises, and meditation, needs of society, thus yoga to stop the stress response.^[52]

Yoga with physical, emotional, mental, personality development and holistic understanding offers to cope with stressful states. To meet the modern lifestyle full of challenges, stress and tensions an all-round personality development has become mandatory for the student. The aspect of relaxation and detachment is lacking in our education process and it is this new dimension that needs to be added to the curriculum. Thus yoga can be beneficial in achieving a tranquil state of mind during routine activities and yet providing then concentration and arousal essential in demanding or stressful situations like examinations.^[53]

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. 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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