Volume : 5 | Issue : 4 | April 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Research Paper

Effect of yoga practices on serum cortisol level & cardiovascular parameters in hyper-reactors to cold pressor test in young healthy medical students"

Medical Science

KEYWORDS : Yoga, cold pressor test, stress hormones

Dr. Gajanan Govind Potey	Professor, Department of Medical Biocchemistry, R.D.Gardi Medicical College Ujjain, M.P. INDIA
Mr. Rahul Verma	P.G. student in Medical Biochemistry, R.D.Gardi Medicical College Ujjain, M.P. INDIA
Dr. Chanda Rajak	Professor, Department of Physiology, Govt. S.S. Medical College, Rewa M.P. INDIA
Dr S.P. Mahapatra	Ass. Professor, , Department of Pharmacology, Govt. S.S. Medical College, Rewa M.P. INDIA

ABSTRACT

Background: 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. 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.[1]

Aims & objectives: The aim of present study was to study the "Effect of Yoga (yogic exercises, pranayama and meditation) on serum cortisol and hyper-reactivity to cold pressor test in young healthy medical students"

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 serum cortisol level, blood pressure and pulse rate, the cardiovascular reactivity of all the 60 students was measured by application of cold pressor test devised by Hines & Brown(1934).30 were found to be hyper reactor to this test. These hyper reactors under went yogic exercises, pranayam and meditation for the duration of 12 weeks. After the yogic training period the serum cortisol, level, blood pressure and pulse rate was again measured which was found to be significantly reduced.

Result: Regular practice of yoga is effective in reducing the stress level as indicated by reduction in the serum cortisol level and cardiovascular hyper reactivity.

Conclusion: Modern man is the victim of stress and stress related disorders which threaten to disrupt his life totally. Being holistic in its approach, yoga offers the best way out of this 'whirlpool of stresses. Yogic lifestyle, yogic diet, yogic attitudes and various yogic practices help man to strengthen his body and mind and develop positive health, enabling him to withstand stress by normalizing the perception of stress, optimizing the reaction to it and by effectively releasing the pent-up stress through various yogic practices. [2]

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 [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 & affect multiple systems of body. 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.[1]

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 fibres as well as from adrenal medulla causing increase in heart rate, systolic and diastolic blood pressures. & 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. [4]

The stress hormone, cortisol, is public health enemy number one. Scientists have known for years that elevated cortisol levels: interfere with learning and memory, lower immune function and bone density, increase weight gain, blood pressure, cholesterol, Heart diseases & elevated cortisol levels act as a potential trigger for mental illness and decreased resilience—especially in adolescence [5].

Factors contributing to high levels of stresses in professional colleges could be highly competitive curriculum, intense academic competition, 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. [6]

In the study of hypertension, cold pressor test, introduced by Hines and Brown,[7] was employed to measure the cardiovascular reactivity.[8] The persons hyper-reactive to cold pressor test are susceptible for early onset of hypertension.[9, 10, 11, 12] We tested whether regular practice of Yoga for 3 months can reduce the serum cortisol level & cardiovascular hyper-reactivity, for reducing the morbidity and mortality from cardiovascular disorders.

"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]

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

Volume : 5 | Issue : 4 | April 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

good stress tolerance [14]. A state of mental tranquility is achieved by the practice of yoga as revealed by increase in alpha index of electroencephalogram after short term yoga [14, 15].

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 [12, 13, 14]. Total growth of personality at physical, mental, intellectual and social level can result with the regular practice of yoga [15]. At physical level regular practice of asanas, pranayama bestows a proportionate, flexible, normally relaxed body with an ability to withstand stress efficiently [16]. Yoga is the best lifestyle modification, which aims to attain the unity of mind, body and spirit through asanas, pranayama, and meditation [17]. At critical times necessary energy gets evoked to deal with the stressful state [7]. At intellectual level, yoga can sharpen memory, concentration, decrease anxiety levels [15, 16]. At spiritual level yoga creates an awareness to look for happiness from within oneself and to be at peace with oneself.

The present study has been undertaken with the aim of de-stressing the hyper-reactors by practicing yogic exercises, Pranayama, and Meditation, because hyper-reactors are likely to develop hypertension and other stress related diseases in future life. Ours is a humble attempt towards restoring the peace and normalcy of life and this gives a message to human beings that the regular and proper practice of yoga produces an inner balance of mind that remains stable and this is the best way to maintain the health and longevity without financial burden.

Material & Methods:
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, 30 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(100%). The parameters like rise in serum cortisol level, basal blood pressure, rise in blood pressure, pulse rate were also significantly reduced statistically by using student't' test.

The study protocol was explained to the subjects and written consent obtained. Approval by ethical committee of S.S. Medical College, Rewa, M. P., 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. They were not practicing any known stress relieving or relaxation technique previosly

- All the 30 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
- Meditation- -40 minutes
- ***The asanas practiced were*:** Ardhachakrasana, Tadasana, Paschimottasana, Utthita Trikonasana, Vajrasana, Salamba Sarvangasana, and Halasana.
- ***The Pranayama performed was**: Ujjayi*
- 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.
- ***The Meditation performed was**: the same, as was told by Lord Krishna to Arjun in Kuruchhetra (Method is available in Bhagvat Geeta. 9th to 16 slokes of Dhana Yoga chapter)*
- BP was measured in supine posture by Sphygmomanometer.[23] 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 was used and 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 3^0-4^0C. 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]

Collection of blood sample for Serum cortisol levels
All of the **subjects of study group** were asked to report at 9 am. Taking all aseptic precautions, 5 ml venous blood sample was drawn from the antecubital vein of each subject. Second **blood sample was taken in study group after 3 month of yoga practice from the start of study.**

The serum separated after centrifugation was divided into aliquots and batch analyzed by Enzyme-Linked Immunosorbent Assay (ELISA), using a commercial ELISA kit (IBL-Hamburg GmbH).after every collection.

STATISTICS:
The data was analyzed by using statistical software Graph Pad in Stat vs. 3.10 and MS Excell (2003). analysis of serum cortisol level, BP, and pulse rate were done using student't' test and $p < 0.05$ was considered as significant.

Results:
Our results showed that "Yoga" causes significant reduction in serum cortisol level & the cardiovascular hyper-reactivity. A total of 60 male volunteers were included in the study. Out of which 30 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 serum cortisol level, basal blood pressure, rise in BP due to cold stress & pulse rate were statistically more significantly altered. (Table-1)

Blood Pressure: The mean basal systolic blood pressure was 123.9±**2.96** mm Hg **, mean** diastolic blood pressure 81.8 ± 3.49 mm Hg **,** mean basal Pulse rate 77..0 ± 5.19/ min & basal Serum cortisol level 10.06 ± 0.582 microgram / dl

Due to cold pressor test, 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 98.27 ± 3.74 mm Hg, (p<0.000). Rise in Pulse rate 85.33 ±5.10 / min (p<0.000). & rise in Serum cortisol level 12.72 ± 0.533 microgram / dl (p<0.000)..

The effect of 03 months of yoga only in study group:
The mean systolic blood pressure decreased from 123 ± 2.96 mm Hg to 119.7 ± 1.96 mm Hg (p<0.000), mean diastolic Blood pressure was decreased from 81.8 ± 3.49 to77.9 ± 4.20 mm Hg. (p<0.000), **,** mean Pulse rate was decreased from77..0 ± 5.19/ min to 74.53 ± 4.85/ min (p<0.000), & mean Serum cortisol level was decreased from 10.06 ± 0.582 microgram / dl to 9..07 ± 0.95 microgram / dl (p<0.000), **after 3 months of yogic exercises, pranayama and meditation & were statistically highly significant.** (Table-2)

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 level of serum cortisol & cardiovascular autonomic function tests were studied in study group before yoga , and after three months of "yoga" (Asana, Pranayama & Meditation). the study group

volunteers showed the effect of cold pressor test on mean serum cortisol, mean systolic blood pressure, mean diastolic blood pressure & mean pulse rate were increased (p<0.000) due to increase sympathetic activity of nervous system & were statistically highly significant.

Due to regular practices of yoga, mean serum cortisol, mean systolic blood pressure, mean diastolic blood pressure & mean pulse rate were decreased (p<0.000) & due to autonomic equilibrium between sympathetic and parasympathetic nervous system & were statistically highly significant. In the present study we observed that there was statistically more significant decrease in serum cortisol, blood pressure & pulse rate, after practicing "yoga" which indicates decrease in sympathetic activity and increase in parasympathetic activities which is mainly due to increase in vagal tone. [18, 19.20, 21] " On Transcendental Meditation, the cortisol levels was a significant drop in the meditation group [22, 23.24, 25] mainly due to decrease release of stress harmone " cortisol " from adrenal cortex ,

The significant decrease in resting pulse rate, systolic and diastolic blood pressure after the yoga practice in the present study is in accordance with the findings of other studies on physiological effects of yoga practice in healthy individuals. [26] Similar reduction in resting PR and blood pressure after yoga practice were also reported in hypertensive patients, ,[27,28] in asthmatic patients [29] and in diabetic patients. [30] can be attributed to modulation of autonomic activity with parasympathetic predominance and relatively reduced sympathetic tone. This autonomic modulation in yoga 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. [31] The mean values of pulse rate, systolic blood pressure and diastolic blood pressure are highly significant reduction after 6 months of yoga practice. Reduction in heart rate and blood pressure indicate a shift in the balancing components of autonomic nervous system towards the parasympathetic activity which was reportedbySanthaJosephetal[32,33] 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 was reported[34] . Regular practice of yoga increases the baroreflex sensitivity and decreases the sympathetic tone, thereby restoring blood pressure to normal level in patients of essential hypertension was reported [35] . Meditation by modifying the state of anxiety reduces stress – induced sympathetic over activity thereby "In a tension-filled society, yoga, pranayama and meditation alone will bring solace from all problems and hence they are the essence of life".

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.[36] Combined practice of physical posture, breathing exercises, and meditation, needs of society, thus yoga to stop the stress response.[37]

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. .[38]

CONCLUSION:

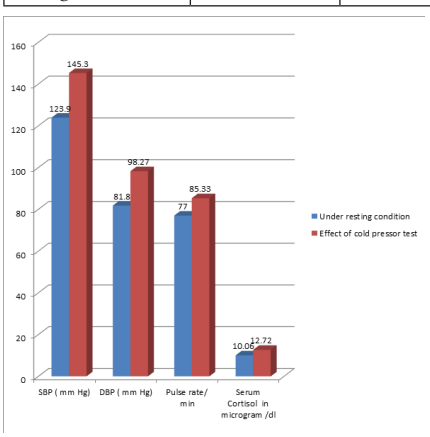
Non pharmacological methods like yogic asanas, pranayama, and meditation should be encouraged to control the modifiable risk factors by increasing parasympathetic activity and decreasing sympathetic activity and provides significant improvements in cardiovascular parameters and respiratory functions. 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".

Table No. 1

Show effects of cold pressor test on basal Systolic Blood Pressure(mm Hg), Diastolic Blood Pressure(mm Hg), Pulse rate/ min & Serum Cortisol in study group

Parameters	Under **resting** condition Mean value & Standard deviation	Effect of cold pressor test Mean value & Standard deviation	P value
Systolic Blood Pressure(mm Hg)	123.9 ± 2.968	145.3 ± 2. 803	(p<0.000).
Diastolic Blood Pressure(mm Hg)	81.8 ± 3.49	98.27 ± 3.74	(p<0.000).
Pulse rate/ min	77..0 ± 5.19	85.33 ±–.5.10	(p<0.000)
Serum Cortisol in microgram /dl	10.06 ± 0.582	12.72 ± **0.533**	(p<0.000).



Graph showing effects of cold pressor test on basal Systolic Blood Pressure(mm Hg), Diastolic Blood Pressure(mm Hg), Pulse rate/ min & Serum Cortisol in study group

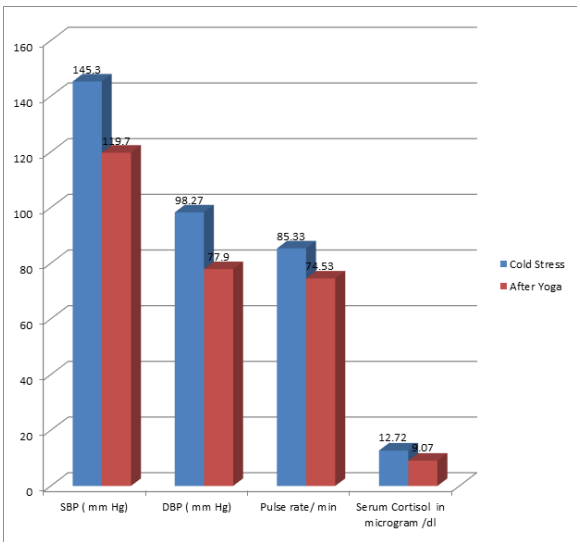
Table No (0 2)

Show effects of cold pressor test & Yoga practices (Asana, Pranayama & Meditaion) on basal Systolic Blood Pressure(mm Hg), basal Diastolic Blood Pressure (mm Hg), basal Pulse rate/ min & resting / basal Serum Cortisol level in study group.

Parameters	Effect of cold pressor test Mean value & Standard deviation	**Effect of Yoga** Practices of three month Mean value & Standard deviation	P Value
Systolic Blood Pressure (mm Hg)	145.3 ± 2. 803	119.7 ± 1.96	(p<0.000).

Volume : 5 | Issue : 4 | April 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Diastolic Blood Pressure(mm Hg)	98.27 ± 3.74	77.9 ± 4.20	(p<0.000).
Pulse rate/ min	85.33 ±.5.10	74.53 ± 4.85	(p<0.000)
Serum Cortisol in microgram /dl	12.72 ± 0.533	9..07 ± 0.95	(p<0.000).



Graph showing the effects **of** cold pressor test & **Yoga practices** (Asana, Pranayama & Meditaion) on **basal S**ystolic Blood Pressure(mm Hg), basal Diastolic Blood Pressure (mm Hg), basal Pulse rate/ min & resting / basal Serum Cortisol level in **study group.**

5 REFERENCES:

1. Quelle:-http://kukaimikkyo.wordpress.com.The science of pranayama. 2007;10:20
2. Dr. Manmohan MD JIPMER 2002)
3. Arnljot Flaa, Ivar K. Eide, Sverre E. Kjeldsen, Morten Rostrup. Sympathoadrenal Stress Reactivity Is a Predictor of Future Blood Pressure. An 18-Year Follow-Up Study. American Heart Association. Inc. *Hypertension.* 2008; 52:336.
4. 4. Indla Devasena* , Pandurang Narhare. Effect of yoga on heart rate and blood pressure and its clinical significance. Int J Biol Med Res. 2011; 2(3): 750-753
5. *J. of Science* . 2013
6. Nagendra HR, Nagaratna R. New perspectives in stress management. 3,d ed. Vivekananda Kendra Yoga Anusandhana Samathan. 1994
7. Hines EA Jr, Brown GE. A Standard Stimulus for Measuring Vasomotor Reactions; Its Application in the Study of Hypertension. Proc Staff Meet Mayo Clin. 1932;7:332.
8. Hines EA, Brown GE. Cold pressor test for measuring the reactibility of blood pressure. American Heart J. 1936;11:1-9.
9. Yates and Wood J E. Effect of cold pressor test in different age groups Proe . Soc. Biol. 1936;N .Y. 34:560.
10. Wood DL, Sheps SG, Elveback LR, Schirger A. Cold Pressor test as a predictor of Hypertension. Hypertension. American Heart Association. 1984;6:301-6.
11. Karen A. Matthews, PhD; Charles R. Katholi, PhD; Heather Mc. Creath, PhD; Mary A. Whooley, MD; David R. Williams, PhD, MPH; Sha Zhu, PhD; Jerry H. Markovitz, MD, MPH. Blood pressure reactivity to psychological stress predicts hypertension in the CARDIA study. March 13, 2004.
12. Garg S, Kumar A. Singh KD. Blood pressure response to Cold Pressor Test in the children of hypertensives. Journal. (On-line/Unpaginated). 2010.
13. Woolery A, Myers H ,Stemlieb B, Zeltzer)L. A yoga intervention for young adults with elevated symptoms of depression. Altern Ther Health Med.2004;10(2); 60-63.
14. Uddupa KN, Sing RN, Yadav RA, Certain studies on physiological and biochemical responses to the practice of hatha yoga in normal volunteers. *Ind J Med Res* 1973;61: 237-244.
15. Udupa KN. Stress and its management by yoga 2nd ed. Narendra Prakash Jain, Delhi, 1985.
16. K.N. Sharma, W. Selvamurthy, and N. Battacharya. Brain and psychophysiology of stress. Indian Council of Medical Research 1983.
17. Iyengar BKS. Light on yoga. 7th ed. New Delhi: Harpercollins Publishers; 2002.
18. Gharote ML. Effect of yogic training on physical fitness. Yoga mimansa. 1973;15:31-35.
19. Gopal KC, Bhatnagar OP, Subramanian N, Nishith SD. Effect of ypgasanas & pranayamas on blood pressure , pulse rate & some respiratory functions. Indian J Physiol Pharmacol. 1973;17(3):273–6.
20. Vyas, Rashmi, Nirupama Dikshit. Effect of meditation on respiratory system, cardiovascular system and lipid profile. Indian Journal of Physiol and Pharmacol. 2002; 46(4):487-91.
21. Udupa, Kaviraja, Madanmohan, Anand Balayogi, P. Vijaylakshmi, Krishamurthy. Effect of pranayama training on cardiac function in normal young volunteers. Indian J Physiol Pharmacol. 2003;47(1):27-33.
22. R. R. Michaels, J. Parra, D. S. McCann, and A. J. Vander, "Renin, cortisol, and aldosterone during transcendental meditation," Psychosomatic Medicine, vol. 41, no. 1,
23. K. G. Walton, J. Z. Fields, D. K. Levitsky, D. A. Harris, N. D. Pugh, and R. H. Schneider, "Lowering cortisol and CVD risk in postmenopausal women: a pilot study using the transcendental meditationprogram," Annals of the New York Academy of Sciences, vol. 1032, pp. 211–215, 2004.
24. C. R. K. MacLean, K. G. Walton, S. R. Wenneberg et al., "Effects of the transcendental meditation program on adaptive mechanisms: changes in hormone levels and responses to stress after 4 months of practice," Psychoneuroendocrinology, vol. 22, no. 4, pp. 277-295, 1997.
25. C. R. K. MacLean, K. G. Walton, S. R. Wenneberg et al., "Altered responses of cortisol, GH, TSH and testosterone to acute stress after four months' practice of transcendental meditation (TM)," Annals of the New York Academy of Sciences, vol. 746, pp. 381–384, 1994
26. Santha Joseph, Sridhar K, Patel SKB, Kumaria ML, Selvamurthy W, Joseph NT et al. Study of some physiological and biochemical parameters in subjects undergoing yoga training. Indian J medicine res 1981; 74; 120 –124.
27. Anand BK. Yoga and medical seicences. Indian J Physio Pharmocol 1991; 35(2): 84 – 87.
28. Selvamurthy W, Nayar HS, Joseph NT, Joseph S. Physiological effects of yogic practice. Nimhans journal 1983; 71 – 80.
29. Vijayalakshmi P, Madan Mohan, Bhavanani AB, Asmita Patil, Kumar Babu P. Modulation of stress induced by isometric hand grip test in hypertensive patients following yogic relaxation training. Indian J Physiol Pharmacol 2004; 48(1): 59-60.
30. Vatve M, Sahoo KD, Patil VV. Effect of specific "yogasanas" on cardiovascular autonomic function test. Pravara Med Rev. 2010; 5(1).
31. Herur Anita, Kolagi Sanjeev, Chinagudi Surekharani. Effect of yoga on cardiovascular and mental status in normal subjects above 30 years of age. Al Ameen J Med Sci. 2010; 3(4):337-44.
32. Malathi A.. and. Damodaran.A.. Stress due to exams in medical students - role of yoga. Indian J Physiol Pharmacol 1999; 43 (2) : 218-224.
33. Anand BK. Yoga and medical seicences. Indian J Physio Pharmocol 1991; 35(2): 84 – 87.
34. Selvamurthy W, Nayar HS, Joseph NT, Joseph S. Physiological effects of yogic practice. Nimhans journal 1983; 71 – 80.
35. Vijayalakshmi P, Madan Mohan, Bhavanani AB, Asmita Patil, Kumar Babu P. Modulation of stress induced by isometric hand grip test in hypertensive patients following yogic relaxation training. Indian J Physiol Pharmacol 2004; 48(1): 59-60.
36. Vatve M, Sahoo KD, Patil VV. Effect of specific "yogasanas" on cardiovascular autonomic function test. Pravara Med Rev. 2010; 5(1).
37. Herur Anita, Kolagi Sanjeev, Chinagudi Surekharani. Effect of yoga on cardiovascular and mental status in normal subjects above 30 years of age. Al Ameen J Med Sci. 2010; 3(4):337-44.
38. Malathi A.. and. Damodaran.A.. Stress due to exams in medical students - role of yoga. Indian J Physiol Pharmacol 1999; 43 (2) : 218-224.