

Effect of Yoga On Anxiety Score And Resting Heart Rate In Young Healthy Individuals

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Abstracts: Background : Modern age is the age of 'anxiety and stress', which is posing a great challenge to the health of society. Stresses of modern life precipitate various cardiovascular and other disorders by distorting basic neuroendocrine mechanism and poses risk to cardiovascular system. Objectives : The objectives for the study were to assess effect of yoga practices on anxiety score (using Taylor's manifest anxiety scale) and resting heart rate. Methods: Study group included subjects who participated in yoga practices for a period of 3 months. Control group included subjects who did not perform yoga or any exercise. Anxiety score and resting heart rate were recorded in both the groups before start of study and at end of the study. Anxiety score was estimated with the help of Taylor's manifest anxiety scale questionnaire and resting heart rate was estimated by using electrocardiogram (ECG). Collected data was analysed using Mann Whitney test and paired 't' test. Results: At the end of three months statistically significant decrease in anxiety score and resting heart rate was observed in the study group. Whereas, there was no statistically significant difference in anxiety score and resting heart rate of control group. Conclusion & Interpretation: It is evident from the study that yoga practices of even short duration (3 months) can reduce anxiety status and decrease resting heart rate. This probably indicates that parasympathetic activity was increased while sympathetic activity was decreased with yoga practices in young subjects. [Mehrotra R et al NJIRM 2012; 3(2) : 142-146]

Key words: Yoga, Anxiety Score, Heart rate

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Introduction: Modern age is the age of 'anxiety and stress', which is posing a great challenge to the health of society¹. Anxiety is a diffuse, unpleasant, vague sense of apprehension, often accompanied by autonomic symptoms such as headache, perspiration, palpitations, tightness in the chest, stomach discomfort and restlessness².

Stresses of our modern life precipitate various cardiovascular and other disorders by distorting basic neuroendocrine mechanisms. They activate limbic system and hypothalamus which control autonomic nervous system. When this system is stimulated, increase in secretion of both adrenaline and nor-adrenaline occurs from sympathetic nerve fibres as well as from adrenal medulla causing increase in heart rate. The harmful effects of stresses on bodily systems can be reduced effectively by enhancing the adaptive mechanisms of our body like yoga that can restore the equilibrium.

Since time immemorial, the ancient culture of India has professed the virtues of yoga, a system of integral education, an education not only of the

body and mind or intellect but also of the inner spirit³.

Yoga practices are known to have beneficial effects in stress and anxiety management⁴. It is necessary to study the effect of yoga upon quantifiable parameters of stress and anxiety to elucidate its mechanism of action. Anxiety can be estimated using simple measure like Taylor's Manifest Anxiety scale (TMAS) and vagal tone can be measured by resting heart rate. This study was planned to find out the effects of yoga on these parameters in young healthy students.

Material and Methods : After obtaining institutional ethical committee approval, the present study was carried out between July 2010 and October 2010. Study was performed in two groups of student volunteers; study group and control group. Study group consisted of total 74 students (36 boys and 38 girls) who were students of Vidyarthi Sahayak Samiti, Pune. Control group consisted of total 67 students (35 boys and 32 girls) who were students of local medical college, Pune. Both groups were age, sex and anthropometrically matched.

Inclusion criteria for the study were- age group between 18-21 years and students who were willing to participate in the study. Students engaged in other exercises & having habit of smoking and alcohol & with chronic diseases like cardiovascular diseases, renal diseases, endocrinal disorders, neurological disorders or any psychiatric disorders were excluded from the study.

A written consent was taken from all the subjects of both the groups after explaining the nature of the study to them. Detailed medical history was taken and thorough clinical examination was carried out to rule out presence of any disease

Study group performed yoga, 7 days a week, daily in the morning for 1 hour (5:00 – 6:00 am), for 3 months without any vacation or holidays.

Following yoga practices were done on empty stomach. Every asana was repeated 3 times. Suryanamaskar, Tadasana, Utkatasana, Ushtrasana, Ardhamatsyendrasana, Pawanmuktasana, Paschimottanasana, Halasana, Sarvangasana, Matsya sana, Bhujangasana, Dhanurasana and Pranayama i.e Anuloma viloma, Kapalbhati, Bhastrika, Bhramari, Udgeeth, Omkar, Pranav . Pranayam was performed in sitting position either in Padmasana or Sukhasana^{5,6,7}. Control group did not perform any form of yoga or exercises during this period of 3 months.

Estimation of anxiety was done using Taylor's manifest anxiety scale. It consisted of fifty self reported questions to assess anxiety. True or false responses were used for each and the responses indicating anxiety were counted, giving a score from 0 to 50. This scale was administered in both, study group and control group before and after 3 months of study period⁸. TMAS score ≥ 16 was considered as a person having high anxiety while TMAS score < 16 was considered as normal⁹.

Resting heart rate was recorded in all the subjects using ECG after giving 10 minutes of rest^{10,11}.

First set of readings were taken in both the groups in the first week of July 2010. Second set of readings were taken in both the groups after 3 months (October 2010).

Results were compared by using Mann Whitney test and paired 't' test. SPSS software version II was used for statistical analysis

Result: Table 1 : Comparison of Anxiety score in males in both groups before and after 3 months.

Group (Males)	Anxiety score		t Value	p Value
	Before	After		
	Mean \pm SD	Mean \pm SD		
Control group (n=35)	16.62 \pm 2.66	16.32 \pm 2.55	1.30	>0.05
Study group (n=36)	18.44 \pm 2.49	13 \pm 1.88	13.64	<0.0001*

* Statistically Significant

There was no significant difference in anxiety score in control group but there was statistically significant decrease in anxiety score in males of study group, after performing yoga practices for 3 months .

Table 2 : Comparison of Anxiety score in females in both groups before and after 3 months.

Group (Females)	Anxiety score		t Value	p Value
	Before	After		
	Mean \pm SD	Mean \pm SD		
Control group (n=32)	18.66 \pm 2.44	19.31 \pm 1.99	2.26	>0.05
Study group (n=38)	25.82 \pm 3.49	16.05 \pm 1.89	21.39	<0.0001*

* Statistically Significant

There was no significant difference in anxiety score in control group after 3 months. There was statistically significant decrease in anxiety score in females of study group, 3 months after the practice of yoga.

There was no significant difference in resting heart rate in males of control group after 3 months. But there was a statistically significant decrease in

resting heart rate in males of study group 3 months after the practice of yoga .

Table 3: Comparison of resting heart rate in males in both groups before and after 3 months.

Group (Males)	Resting heart rate (/minute)		t Value	p Value
	Before	After		
	Mean \pm SD	Mean \pm SD		
Control group (n=35)	80.59 \pm 14.04	79.76 \pm 13.64	0.33	>0.05
Study group (n=36)	77.08 \pm 11.28	70.14 \pm 8.59	4.42	<0.0001*

* Statistically Significant

Table 4: Comparison of resting heart rate in females in both groups before and after 3 months.

Group (Females)	Resting heart rate(/minute)		t Value	p Value
	Before	After		
	Mean \pm SD	Mean \pm SD		
Control group (n=32)	81.68 \pm 11.01	82.35 \pm 11.45	0.29	>0.05
Study group (n=38)	86.84 \pm 13.42	72.97 \pm 11.27	6.96	<0.0001*

* Statistically Significant

There was no significant difference in resting heart rate in females of control group after 3 months. But there was a statistically significant decrease in resting heart rate in females of study group after performing yoga practices for 3 months.

Discussion: The practice of yoga having favorable effects on different body systems has been convincingly shown by various studies from time to time. The present study was undertaken to see the effects of yoga practices on anxiety score and resting heart rate in young healthy students. From the results of the present study, it is evident that yoga practices are having a positive effect on anxiety score. Various studies have shown similar findings^{6,7,12}.

Increase in the sympathetic activity & decrease in GABA levels are associated with many anxiety disorders. Probable mechanism underlying reduction in anxiety score following yoga practices could be increase in GABA levels in brain causing decrease in anxiety as explained by Chris Streeter et al¹³. Decreased levels of catecholamines in brain due to yoga practices could be another reason for decreasing the activity of reticular formation and thus reducing the anxiety¹⁴.

Studies have shown that Shavasana, Makrasana and pranayama are specially useful in reducing anxiety¹⁵. As our subjects were also performing these postures and pranayama. We have also found reduction in anxiety scores.

Jerath et al have put the hypothesis that voluntary slow deep breathing functionally resets the autonomic nervous system through signals propagated via both neural and non-neural tissues synchronising neural elements in limbic system and cortex¹⁶.

K. Harinath et al have shown anxiolytic effects of yoga to increased levels of melatonin with yoga posture and pranayama¹⁷. These could be probably other mechanisms involved in reduction of anxiety. Studies have shown that 'Ujjayi' pranayama was observed to delay the onset of mental fatigue and helped subjects to improve their mental efficiency. It has been observed experimentally that the cardiac output is increased in Ujjayi pranayama due to change in intrathoracic and intrapulmonary pressure various interoceptors get stimulated. These interoceptors send the sensory nerve impulses to the respiratory center as well as thalamus and hypothalamus in the brain. The prolonged exhalation in rechaka produces parasympathetic predominance and therefore one feels calm, relaxed as well as balanced mind¹⁸.

All the three practices of Ujjayi, Kapalbhati and Bhastrika produce increased synchronization of EEG, as indicated by higher amplitude and longer period of α burst. These change concur with the subjective report of feeling of mental quietude and reduction in distraction due to thought process¹⁹. Bhramari pranayama during puraka a vibrational sound is produced by controlling the pharyngeal

muscles and soft palate. Mouth remains closed. While exhaling for the phase of rechaka this sound is produced again but this time it is softer. It is a nasal sound produced due to vibrations of soft palate. It helps integration of internalized awareness and extra-sensory perception. It reduces instability of mind, calms it down and reduces stress²⁰.

During the practice of Anuloma- viloma pranayama the cortical activity in relation with the intellectual planning, analysis, ego-consciousness and the thought processes is greatly reduced to a minimal. It therefore appears that the rhythmic and proportionate as well as consciously controlled breathing through two nostrils alternately, brings about a harmony in the two oppositely working neural activities and establishes the balance in them. It brings tranquility and peace to the mind, making it more balanced and stable²¹.

We have also found statistically significant decrease in resting heart rate in males and females after the practices of yoga. Many other studies have shown similar findings^{22,23,24,25}.

Probable mechanisms for decrease in heart rate following yoga practices could be; modulation of autonomic nervous system towards parasympathetic dominance i.e. decrease in sympathetic activity and increase in vagal tone²⁶. Modulation from higher cortical centers could be mediated via limbic system resulting in decreased activity of posterior nuclei of hypothalamus leading to decreased discharge through descending autonomic fibers.

Limitations of our study are that we have not estimated serum cortisol and catecholamine levels and anxiety status was measured by subjective questionnaire than objective tests.

Conclusion: Thus, our study concludes that yoga practices help in reducing anxiety as well as resting heart rate. So, they can be used as a therapeutic measure in alleviating anxiety and improving cardiovascular fitness.

It is worth noting that yogic practices are distinct from muscular exercise. As they have low caloric expenditure, induce less fatigue and low risk of

injury, they seem to confer the same benefits as exercise to the individual. So they can be safely prescribed to older individuals having co-morbidities.

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References:

1. Anand BK. Yoga and medical sciences. Indian Journal of Physiology and Pharmacology, 1991; 35(32): 84-87.
2. Harold I. Kaplan, Benjamine J.S. Concise textbook of clinical Psychiatry. 7th Edition, 1996: 189-192.
3. Sandeep B, Pandey U.S, Verma N.S. Improvement in oxidative status with yogic breathing in young healthy males. Indian Journal of Physiology and Pharmacology, 2002; 46(3): 349-354.
4. A. Malathi, A. Damodaran, N. Shah, G. Krishnamurthy, P. Namjoshi and S. Ghodke. Psychophysiological changes at the time of examination in medical students before and after the practice of yoga and relaxation. Indian Journal of Psychiatry, 1998; 40 (1): 35-40.
5. Amresh Kumar. Encyclopedia of yoga, Khel Sahitya Kendra publisher 2007; Part II: 37-228.
6. Nidhi G, Shveta K, Vempati R. P. Ratna S, Bijlani R. L. Effect Of yoga based lifestyle intervention on state and trait anxiety. Indian Journal of Physiology and Pharmacology, 2006; Vol .50 (1): 41-47.
7. Javanbakht M., R.H. Kenari, M. Ghasemi. Effects of yoga on depression and anxiety of women. Complementary therapies in clinical practice, 2009; Vol. 15(2): 102-104.
8. Janet A. Taylor. A personality scale of manifest anxiety. Journal of Abnormal and Social Psychology. 1953; Vol. 48(2): 285-290.
9. Mancevska S, Bozinovska L, Tecce J, Pluncevik-Gligoroska J, Sivevska-Smilevska E. Depression, anxiety and substance use in medical students in the republic of

- Macedonia. Bratislava Medical Journal. 2008;109(12): 568-572.
10. A. S.Fauci, E.Braunwald,D.L.Kasper, S.L.Hauser, D. L. Longo, J. Larry Jameson . Harrison's principle of internal medicine,Manual of medicine, 17th edition, Mc Graw Hill Publishers, 2010: 665-669.
 11. Vipin Gupta. Normal Electrocardiogram. Fundamentals of ECG. 1st edition, Arya publishers,2007:8-34.
 12. Sushilkumar S. K, Nagendra H., R Rao, Raghuram N. Immediate Effects of two relaxation techniques on healthy volunteers. Indian Journal of Physiology and Pharmacology,2009;53(1):67-72.
 13. Chris C. S, Theodore H. W, Liz Owen, Tasha R ,Surya K. Karri et al. Effects of yoga versus walking on mood, anxiety and brain GABA levels :A Randomized Controlled MRS Study. The Journal Of Alternative And Complementary Medicine, 2010, Vol. 16(11),1145–1152.
 14. Sarika Arora, Jayashree B . Modulation of immune responses in stress by Yoga. International Journal of Yoga, 2008; 1(2): 45-55.
 15. Gore .M.M. Textbook of anatomy and physiology of yogic practices. New Age Books publisher .4th Edition,2010:15-19.
 16. Jerath R, Edry JW, Barnes VA, Jerath V. Physiology of long pranayamic breathing: neural respiratory elements may provide a mechanism that explains how slow deep breathing shifts the autonomic nervous system.Epub, 2006 ;67(3):566-571.
 17. K.Harinath,MalhotraAS, Karan Pal, Rajendra Prasad, Rajesh Kumar. Trilok Chand Kain et al. Effects of Hatha yoga and omkar meditation on cardiorespiratory performance, psychologic profile and Melatonin secretion. The Journal of Alternative and Complementary medicine. 2004;Vol.10(2):261-268.
 18. Gore .M.M. Textbook of anatomy and physiology of yogic practices. New Age Books publisher .4th Edition,2010:197.
 19. Shrikrishna. Structure and functions of human body and effects of yogic practices on it. I. C. yogic health centre Kaivalyadhama. 1st revised edition,1988:85.
 20. Gore .M.M. Textbook of anatomy and physiology of yogic practices. New Age Books publisher .4th Edition,2010:206-207.
 21. Gore .M.M. Textbook of anatomy and physiology of yogic practices. New Age Books publisher .4th Edition,2010:190-191.
 22. Sahoo JK, Vatve M, Sahoo KD, Patil VV.Effect of specific yogasanas on cardiovascular autonomic function test. Pravara Medical Review 2010;5(1):10-15.
 23. R D Srivastava, Nidhi Jain, Anil Singhal . Influence of alternate nostril breathing on cardiorespiratory and autonomic functions in healthy young adults. Indian Journal of Physiology and Pharmacology, 2005; 49(4):475- 483.
 24. N.K.Subbalakshmi,S.K. Saxena, Urmimala, Urban J.A. D'Souza. Immediate effect of 'nadi - shodhana pranayama'on some selected parameters of cardiovascular, pulmonary, and higher functions of brain. Thai journal of physiological sciences .August 2005; Vol. 18 (2):10-16.
 25. Khadka R, Paudel B, Sharma V, Kumar S, Bhattacharya. Effect of yoga on cardiovascular autonomic reactivity in essential hypertensive patients. Health Renaissance, 2010; Vol 8 (2):102-109.
 26. Samina Malik, Mohsin Shah , Shahid Hasan, Mohammad Bilal. The Physiological Responses of Yogic Breathing Techniques: A Case-Control Study. Journal of Exercise Physiology,June 2011; 14(3): 74-79.