

Research Article

Effect of yoga on autonomic functions in medical students: a pilot study

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ABSTRACT

Background: Stress and anxiety being the major contributors of morbidity, leads to many chronic diseases and is known to invariably decrease the quality of life and even life span. Autonomic Nervous System (ANS), a part of the peripheral nervous system that controls the visceral system, functioning largely under the level of consciousness, capable of being influenced by the psychological factors and influences the physiological processes happening in the body. Non-pharmacological therapies play a major role to relieve stress and anxiety of which yoga takes first place compared to pharmacological treatment. Present study adopts a systematic approach in comparing the effects of practicing yoga for one year with novices on autonomic and respiratory variables.

Methods: We recruited sixty subjects from the Sri Dharmasthala Manjunatheshwara College of Naturopathy & Yogic Sciences, Ujire and their mean age group is 18.8 ± 2.3 fulfilling the selection criteria, after they gave written consent to participate. They were divided into 2 groups based on their experience of practicing yoga. Each group consisted of 30 subjects. Group 1 includes participants with no experience in yoga (Novices group) and Group 2 (Yoga group) includes individuals with one year experience of practicing yoga. Each group consists of 17 males and 13 females respectively. The study was approved by the ethical review committee. Informed written consent was obtained from all subjects. All students were subjected to Onetime Assessment for autonomic variables and respiration at base line and during deep breathing.

Results: In our study we observed that there was a significant decrease in heart rate ($P = 0.004^{***}$) following intervention in yoga group compared to novice group. There was a significant difference in Respiration rate ($P = 0.003^{***}$) and Mean RR ($P = 0.002^{***}$) which indicate increase parasympathetic activity in yoga group compared to novice group. There is also a significant difference in time domain parameter PNN50 ($P = 0.030^{**}$) which is an indicator of parasympathetic activity. There was no significant difference in other time domain and frequency domain parameter.

Conclusion: Practicing yoga regularly for one year can reduce the physiological arousal and develops the ability to adapt to a demanding situation.

Keywords: Autonomic nervous system, Stress, Anxiety, Yoga

INTRODUCTION

Stress is a condition where expectations are genetically programmed, established by prior learning or deduced from circumstances which do not match the current or anticipated perceptions of the internal or external environment.¹ Stress and anxiety, being the major contributors of morbidity, leads to many chronic diseases and is known to invariably decrease the quality of life and even life span. Perseverative cognition the series of processes mediating the prolongation of active cognitive representations thereby extending their physiological concomitants even after their removal, which can result in chronic over activity or under activity of allostatic systems, including the HPA axis, autonomic nervous system, metabolic² and immune systems carrying a potential role towards morbidity.³ Socio-economic factors and industrialization along with pollution is a known factor towards causing stress and altered emotions, which carry a definite and well established role in precipitating cardio-vascular events.⁴ Also, the worry intensity is known to prolong stress related physiologic activity and is proportionate to daily somatic complaints.⁵

Autonomic Nervous System (ANS), a part of the peripheral nervous system that controls the visceral system, functioning largely below the level of consciousness, capable of being influenced by the psychological factors and influences the physiological processes happening in the body. The ANS is capable of regulating the blood pressure, gastro-intestinal responses to food, responses to physical activity, thermoregulation etc., indicate the crucial role of ANS in the maintenance of homeostasis.⁶ With developing conclusive evidences suggesting the effect of stressors in mediating the HPA axis and altering the autonomic responses, triggering a series of events towards development of various pathologies in the human system, testing Autonomic functions are reliable indicators of understanding homeostasis.

Non-pharmacological therapies play a major role to relieve stress and anxiety of which yoga takes first place compared to pharmacological treatment.⁷ Yoga is an ancient Indian science well known presently all over the world for its potential therapeutic benefits both physical and mental, which commonly includes the practice of physical postures (Asanas), breathing practices (Pranayama) and meditation (Dhyana) practices being practiced in India since thousands of years to attain functional harmony between body and mind. Having a vast evidence of the beneficial role of immediate and short term yoga practices over autonomic functions, anxiety, depression, hypertension and other morbidities of stress, a necessity to understand the regulatory role of yoga in long term practitioners is warranted. Yoga, an ancient Indian science of wellbeing, is one of the many different techniques for achieving relaxation.⁸ Yoga took its origin in ancient India and in its original form consisted of a system of spiritual, moral and physical

practices.⁹ The most central and common aspects of yoga practice today are different bodily postures (Asanas) and voluntarily regulated breathing (Pranayamas).¹⁰ That aims at focusing the mind, achieve relaxation and increase wellness.¹¹ Yoga has been reported to provide potential health benefits in anxiety, stress reduction and general well-being.¹²⁻¹⁴ Bjorntop's hypothesis.¹⁵ postulates that psychosocial stress triggers the onset of visceral obesity, insulin resistance, and dyslipidemia. Globalization and technological innovations are bringing about new challenges to the study of mental health and stress management. It is important scientifically, practically, and financially to promote stress management programs for the betterment of people.¹⁶

Yoga helps therapeutically and promotes physical and mental health.¹⁷ Repeated practice of different techniques related to SRPs will increase physical and psychological comfort and at the same time create conditional relaxation responses in the nervous system.

The practice of yoga produces a physiological state opposite to that of the flight-or-fight stress response and with that interruption in the stress response, a sense of balance and union between the mind and body can be achieved.¹⁸

Due to the fact that stress is implicated in numerous diseases, it is a priority to include a focus on stress management and reduction of negative emotional states in order to reduce the burden of disease. Viewed as a holistic stress management technique, yoga is a form of CAM that produces a physiological sequence of events in the body reducing the stress response.

The scientific study of yoga has increased substantially in recent years and many clinical trials have been designed to assess its therapeutic effects and benefits.

There are no studies done till date to substantiate the gradual practice of yoga on anxiety and its role on autonomic variables. Hence this study was conducted with an objective to know the changes in Anxiety, Autonomic functions and Breathing among young adults with practicing of yoga and even without practicing yoga. While the immediate effects of Yoga are being studied extensively, its longitudinal effects are less documented. Practicing yoga for longer durations though has been known to produce health benefits, their underlying mechanisms need to be understood.

Hence, the present study was designed to understand the influence of Yoga with an emphasis to its duration on autonomic and respiratory measures.

METHODS

A total of 60 subjects fulfilling the selection criteria, were recruited from the Sri Dharmasthala Manjunatheshwara

College of naturopathy & yogic sciences, Ujire after they gave written consent to participate.

None of the patients had any history of diabetes, hypertension, cardiac disease, Asthma, skin diseases or other medical disorders. Sixty subjects (34 male and 26 female) belonging to two different groups were selected from a population of 102 subjects. They were divided into 2 groups based on their experience of practicing yoga. Each group consisted of 30 subjects.

Group 1 includes participants with no experience in yoga (Novices group) and group 2 (Yoga group) includes individuals with one year experience in yoga each group consists of 17 males and 13 females respectively.

The study was approved by the ethical review committee. Informed written consent was obtained from all subjects. All students were subjected to onetime assessment for autonomic variables and respiration at base line, during deep breathing.

Recruitment

All subjects were under graduate students of Sri Dharmasthala Manjunatheshwara College of naturopathy & yogic sciences, Ujire. Subjects were recruited only if they had fulfilled the selection criteria and given written consent to participate in the study

Inclusion criteria

1. Students with age ranging from 18 to 22 years, belonging to both the gender were recruited.
2. Novices group: The students having no experience of practicing yoga.
3. One year experience group: The students who have practised Yoga (As listed in section D. 2. intervention) for one year
4. Written informed consent to participate in the study.
5. Subjects who are healthy based on a routine clinical examination.

Exclusion criteria

1. Individuals with medical condition like cardiovascular disorder, Diabetes Mellitus, Bronchial Asthma, Endocrine disorder, Depression, Epilepsy, Psychological disorder.
2. Females during menstrual cycle or any other menstrual disorder.

Study design

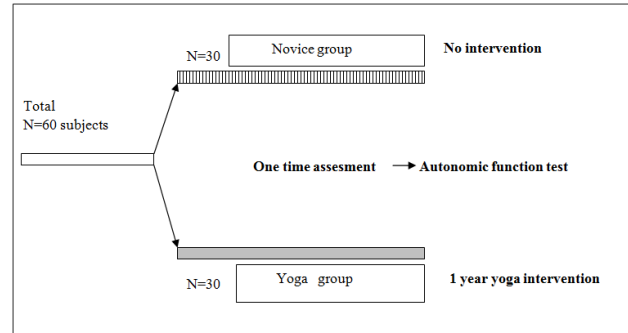


Figure 1: Study design.

Study outcome

1. Autonomic function test

Autonomic function tests were carried out in autonomic lab at SDM Nature Cure Hospital, under standardized conditions. Resting HRV, ECG and Respiration were recorded using a two channel polygraph (BIOPAC MP150 System, USA), ECG was recorded using standard limb lead II configuration. The data recorded were visually inspected off-line and only noise free data was included for analysis. Respiration was recorded using a respiratory transducer placed on the chest over the lower costal margins. The blood pressure was recorded with a sphygmomanometer by auscultation over the right brachial artery.

2. Deep breathing difference

The subject sits quietly and then breathes deeply and evenly at 6 breaths/min. The maximum and minimum heart rates during each breathing cycle are measured and the mean of the differences during three successive breathing cycles are taken to give the maximum-minimum heart rate.

Assessment intervals

All subjects were assessed with the above outcome measures after recruited in the study. It was onetime assessment.

Intervention

Novice group: All the 30 healthy subjects recruited were newly joined 1st year students of Sri Dharmasthala Manjunatheshwara College of naturopathy & yogic sciences, Ujire, who had no experience in yoga practise.

Yoga group: All the 30 healthy subjects recruited were 2nd year students of Sri Dharmasthala Manjunatheshwara College of naturopathy & yogic sciences, Ujire, who are practising yoga since 1 year. The Yogic practices comprise of Shithilikarana Vyayama (joint loosening exercises), Suryanamaskara (Sun salutation), Asanas

(Postures), Kriyas (Yogic Cleansing procedures) and relaxation techniques.

Data analysis

Data was analysed using Independent Sample t-test for between the groups in the study.

RESULTS

The mean age of the study population was age 18.8 ± 2.3 years

Autonomic function test

Resting HRV

In our study we observed that there was a significant decrease in heart rate (P = 0.004^{***}) (Table 1) following intervention in yoga group compared to novice group.

There was a significant difference in Respiration rate (P = 0.003^{***}) and Mean RR (P = 0.002^{***}) which indicate increase parasympathetic activity in yoga group (Table 2) compared to novice group.

There is also significant difference in time domain parameter PNN50 (P = 0.030^{*}) which is an indicator of parasympathetic activity (Table 3). There was no significant difference in other time domain and frequency domain parameter (Table 4 & 4a).

Table 1: Comparison of scores on heart rate changes between yoga group and novice group after intervention.

Group	Heart rate	P value
Yoga group, n=30 Mean ± SD	75.92 ± 9.01	0.004 ^{***}
Novice group, n=30 Mean ± SD	79.13 ± 13.07	

*P<0.05, **P<0.01, ***P<0.001 for within groups Independent sample test

Table 2: Comparison of scores on respiratory rate and mean RR changes between yoga group and novice group after intervention.

Group	Respiratory rate	P value	Mean RR	P value
Yoga group, n=30 Mean ± SD	13.04±2.51	0.003 ^{***}	807.3±140.2	0.002 ^{***}
Novice group, n=30 Mean ± SD	11.33±3.04		767.8±94.7	

*P<0.05, **P<0.01, ***P<0.001 for within groups Independent sample test

Table 3: Comparison of time domain scores on HRV scores between yoga group and novice group after intervention.

Group	PNN50	P value
Yoga group, n=30 Mean ± SD	22.3 ± 19.6	0.030 [*]
Novice, n=30 Mean ± SD	67.9 ± 22.1	

*P<0.05, **P<0.01, ***P<0.001 for within groups Independent sample test

Table 4: Comparison of Time domain scores on HRV scores between hydrotherapy and control groups after intervention using non parametric tests.

Group	SDNN	SDNN P value	RMSSD	RMSSD P value
Yoga group, n=30 Mean ± SD	68.8±37.5	0.072	51.6±37.4	0.138
Novice, n=30 Mean ± SD	69.3±34.2		52.1±34.2	0.138

*P<0.05, **P<0.01, ***P<0.001 for within groups Independent sample test

Table 4a: Comparison of frequency domain scores on HRV scores between yoga group and novice group after intervention.

Group	LF	P value	HF	P value	LF/HF pre	P value
Yoga group, n=30 Mean ± SD	68.2±25.3	0.688	31.7±23.3	0.693	4.8±5.1	0.738
Novice, n=30 Mean ± SD	67.9±22.1		32.1±22.1		4.1±4.9	

*P<0.05, **P<0.01, ***P<0.001 for within groups Independent sample test

DISCUSSION

Practicing yoga regularly for a year has been shown to influence autonomic status positively. When compared to novices, those practicing yoga for one year had significantly lower heart rates and respiratory rate.

Yoga has been used effectively for voluntarily controlling involuntary functions. Studies have shown the possibilities of attaining exceptional feats physiologically following long term practice of yoga.¹⁹ This was followed by series of studies on Transcendental meditation, suggesting that the long-term practitioners were physiologically distinct compared to novices.²⁰ As a first attempt in meditation research, when assessed using

Magnetic Resonance Imaging (MRI), long term meditators demonstrated increased cortical thickness suggesting active neural plasticity.²¹

A recent report demonstrated that long term meditation practitioners had higher gray matter density in lower brain stem regions compared to age-matched non meditators.

Lower heart rates in experienced yoga practitioners can hence be attributed to its influence on the autonomic nervous system through the brain stem region.²²

Also, the relaxation induced by Yoga can reduce physiological arousal. Hence, the results of the present study demonstrated that practicing Yoga for year duration has positive physiological implications. Further studies are required to understand these influences most comprehensively.

In this study, the main limitation is the small sample size and experience in yoga practise in subjects was only 1 year with low power significance on HRV.

Subjects of our study were the students of professional medical college where they have a break from regular yoga practice twice a year due to vacation; this could have partly confounded the results.

Further studies should compare the yoga intervention in very long term yoga practitioner in healthy individuals.

CONCLUSIONS

Practicing yoga regularly for one year can reduce the physiological arousal and develop the ability to adopt to a demanding situation.

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