**Original Research Article**

**Effect of yoga on salivary cortisol in medical student**

Pooja Tripathi Pandey¹*, Vinay Singh¹, Devesh¹, Jamal Haider²

¹Department of Physiology, ²Department of Pharmacology, Baba Raghavdas Medical College, Gorakhpur, Uttar Pradesh, India

Received: 12 September 2016  
Revised: 15 September 2016  
Accepted: 07 October 2016

*Correspondence:  
Dr. Vinay Singh,  
E-mail: vinaysinghdr12@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**ABSTRACT**

**Background:** Yoga is a spiritual discipline for the development of a state of mental and physical health, well-being, it has also been used clinically as a therapeutic intervention. This study observes the effects of yoga poses on salivary cortisol. Salivary cortisol is potential biomarker of psychological stress. Nonetheless, psychobiological mechanisms stimulate the hypothalamus-pituitary-adrenal axis (HPAA) can only indirectly be assessed by salivary cortisol measures. The unlike instances that control HPAA sensitivity (e.g., hippocampus, hypothalamus, pituitary, adrenals) and their respective modulators, receptors, or binding proteins possibly will all have an effect on salivary cortisol measures. Possible fundamental mechanisms proposed leading to enhanced vagal activity and decrease cortisol. The drop in cortisol, sequentially, may give positive outcome.

Methods: Healthy medical student volunteers (N=40), males and females, ranged in age from 18 to 25 years (mean age: 23.3years), participated in the present study. They are divided in two groups one is Yoga Group and second is Control Group. Each group consist 20 subjects. Morning saliva samples were collected of both groups. Levels of cortisol in the saliva samples were determined and compared with levels in comparison samples of saliva obtained after three-month of yoga practice.

Results: In all subjects who received yoga (n=20), the change in salivary cortisol level was significant (10.27±2.54 ng/ml; 4.023±1.82ng/ml; P= 0.00); it was not so in those who were not practicing yoga (11.43±3.77ng/ml; 10.27±2.54 ng/ml; P=0.06). Salivary cortisol level significantly decreased and reacted positively to yoga practicing subjects.

Conclusions: The effort of comparing the effects of yoga on salivary cortisol seems to indicate that it is a promising modality for stress management. Everyone should practice yoga for stress management to improve their day today life because yoga as one of the approaches of stress reduction.

Keywords: Saliva, Salivary cortisol, Stress, Yoga

**INTRODUCTION**

Over the decade, hundreds of studies have specifically focused on the effects of stressors on cortisol activation. The process by which this regulation is achieved is complex and our understanding of it has evolved markedly over the last century. Physical stressors, psychological stressors are capable of activating the HPA axis; a number of studies have reported that laboratory tasks can increase cortisol levels. Salivary cortisol offers a non-invasive and stress-free alternative to serum. In the last few years, saliva analysis has been a useful method of choice for hormone analyses. Numerous articles have described the use of saliva for analytical purposes in clinical investigations (i.e. in the field of endocrinology, neuroendocrinology) and in physiological research.

A growing body of research evidence supports the belief that certain yoga techniques may improve physical and mental health through down-regulation of the hypothalamic–pituitary–adrenal (HPA) axis and the sympathetic nervous system (SNS). The HPA axis and
SNS are triggered as a response to a physical or psychological demand (stressor), leading to a cascade of physiologic, behavioral, and psychological effects, primarily as a result of the release of cortisol and catecholamine’s (epinephrine and norepinephrine).

This response leads to the mobilization of energy needed to combat the stressor through the classic “fight or flight” syndrome. Over time, the constant state of hypervigilence resulting from repeated firing of the HPA axis and SNS can lead to deregulation of the system and ultimately diseases such as obesity, diabetes, autoimmune disorders, depression, substance abuse, and cardiovascular disease.3,4

In the ancient system of education of 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.5 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.5,6 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 and elevated cortisol levels act as a potential trigger for mental illness and decreased resilience especially in adolescence.7

“Yogic” postures are now, one of the non-pharmacological therapies against stress and strain. “Yoga” practice has shown to be effective in improving mood and decreasing stress and depression6 The aim of this study was to address the effect of yoga on salivary cortisol level.

Salivary cortisol

Cortisol has a strong circadian rhythm, with cortisol levels peaking during the first hour after awakening, and decreasing for the rest of the day, with cortisol reaching its nadir around midnight.6,10 Thus, careful consideration of time of testing is crucial, as single assessments of cortisol levels are dependent on the time of day. To avoid these potential confounds, collecting saliva samples at multiple test times throughout the day to reflect differing points of the circadian pattern of cortisol secretion for 3-4 days is recommended.11 Alternatively, repeated measurement of free cortisol levels within the 60 min after awakening in the morning considered a stable and reliable biological marker of adrenocortical activity.9 Therefore, instructions for saliva collection should provide specific information regarding timing of first morning collection for data consistency.

Yoga

Yoga is the best lifestyle modification, which aims to attain the unity of mind, body and spirit through asanas, pranayama, and meditation.6 At critical times necessary energy gets evoked to deal with the stressful state. At intellectual level, yoga can sharpen memory, concentration, decrease anxiety levels.6,12 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.5,8

Total growth of personality at physical, mental, intellectual and social level can result with the regular practice of yoga.6 At physical level regular practice of asanas, pranayama bestows a proportionate, flexible, normally relaxed body with an ability to withstand stress efficiently.12 Yoga is the best lifestyle modification, which aims to attain the unity of mind, body and spirit through asanas, pranayama, and meditation.13 At critical times, necessary energy evoked to deal with the stressful state.3 At intellectual level, yoga can sharpen memory, concentration, decrease anxiety levels.6,12 At spiritual level, yoga creates an awareness to look for happiness from within oneself and to be at peace with oneself.

METHODS

A total of 40 healthy medical student volunteers, males and females, ranged in age from 18 to 25 years (mean age: 23.3 years), participated in the present study. The study protocol was explained to the subjects and written consent obtained. Approval by ethical committee of B.R.D. Medical College, Gorakhpur, Uttar Pradesh, India, was obtained. All the volunteers were clinically examined to rule out any systemic diseases. All subjects were non-alcoholic and non-smokers.

Questionnaires administered prior to the experiment indicated that no volunteers had a physical or mental illness, were taking corticosteroids. 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. They randomly divided into 2 groups. Each group consisted of 20 subjects. One Group includes participants with no yoga experience (Control group). Subjects in the control group asked to maintain their routine activities and second group includes individuals practicing yoga (Yoga group).

All 20 volunteers of study group were trained under the guidance of a certified “yoga” teacher for three months in the Department of Physiology, B.R.D. Medical College. They carried out “Yogasanas, Pranayama, and Meditation” 60 minutes daily.

Collection of saliva sample for salivary cortisol levels

Saliva samples were collected via plastic salivates. Subjects were instructed to provide saliva samples immediately upon awakening on two different mornings.
(pre-yoga test and post-yoga test). Subjects returned samples on the same days that they collected them, and the samples were immediately stored in a freezer. Cortisol measured using a high sensitivity Diametra Cortisol Saliva ELISA kit. After 3 month of yoga practice from the start of study second saliva sample taken in both study groups. We used independent-sample t-test for both variables comparisons and paired t-test for within one variable comparisons. To get the result Mean, Standard deviation difference and t'-test were calculated.

RESULTS

The 40 healthy medical student volunteers were comparable as regards salivary cortisol before doing yoga (control group: 11.43±3.768 ng/ml; yoga group: 9.03±2.38 ng/ml; P=0.02). After practicing yoga for three months the total salivary cortisol dropped significantly in test group (n=20; control: 10.27±2.54 ng/ml; yoga group: 4.023±1.82 ng/ml; P=0.00). However, the drop in salivary cortisol level was not statistically significant in control group (n=20; 3-month: 10.27±2.54 ng/ml; P=0.06) (Figure 1).

There was a significant direct correlation between the drops in salivary cortisol in yoga group in comparison to control group.

DISCUSSION

From the result of this study, it observed that healthy control group which was not practicing yoga had higher levels of salivary cortisol than the healthy yoga group. It is due to regular practices of yoga, mean salivary cortisol 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 salivary cortisol after practicing “yoga” indicates decrease in sympathetic activity and increase in parasympathetic activities, which is mainly due to increase in vagal tone. On Transcendental Meditation, the cortisol levels was a significant drop in the yoga group, mainly due to decrease release of stress hormone “cortisol” from adrenal cortex.

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. Combined practice of physical posture, breathing exercises, and meditation, needs of society, thus yoga to stop the stress response. In a tension-filled society, yoga, pranayama, and meditation alone will bring solace from problems and hence they are essence of the life.

CONCLUSION

The effort of comparing the effects of yoga on salivary cortisol seem to indicate that, in both healthy and diseased populations, yoga may be as effective as or
better than any other non-pharmacological therapy at improving a variety of health-related measures.

Yoga is a promising modality for stress management. Everyone should practice yoga for stress management to improve their day today life because yoga as one of the approaches of stress reduction.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES
