

## Original Research Article

# Effect of yoga and meditation on serum cortisol level in first-year medical students

Kislay Kumar<sup>1</sup>, Vinay Singh<sup>1\*</sup>, Devesh Kumar<sup>1</sup>, A. B. Asthana<sup>1</sup>, Divya Mishra<sup>2</sup>

<sup>1</sup>Department of Physiology, BRD Medical College, Gorakhpur, Uttar Pradesh, India

<sup>2</sup>Department of Biochemistry, IIMSR, Lucknow, Uttar Pradesh, India

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### \*Correspondence:

Dr. Vinay Singh,

E-mail: [vinaysinghdr12@gmail.com](mailto:vinaysinghdr12@gmail.com)

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## ABSTRACT

**Background:** Yoga is a traditional technique to conserve and purify body, mind and soul. It is a mind-body bridge which involves relaxation, meditation and a set of physical exercises performed in association with breathing. In this new era of evolution, most of the population are depressed or in stress, irrespective of their age and gender.

**Methods:** This study is performed on 1<sup>st</sup> yr. medical students whose stress level is in higher side due to academic burden. An 55 medical students were selected as participants through counseling and were divided into yoga group (n= 27) and control group (n=28). Their morning serum cortisol level was assessed, and yoga group were instructed to practice yoga (1hr/day for 12 weeks) under supervision of yoga instructor. No such instruction was given to control group.

**Results:** Serum cortisol level is the marker of stress and inflammation. Higher cortisol level means high stress level. Yoga and meditation is documented to reduce stress level in regular practitioners. Statistical analysis has shown decrease in morning serum cortisol level ( $572.18 \pm 168.03$  to  $544.98 \pm 139.89$ , 4.8% decrease, P value <0.05, significant) in yoga group after study. Control group have shown marked increase in cortisol level ( $558.89 \pm 162.69$  to  $577.26 \pm 254.5$ , 3.4% increase, P value = 0.74, not significant) after three months of study.

**Conclusions:** This study concludes that practicing Yoga has a significant effect on the reduction of stress and anxiety level in medical students.

**Keywords:** Cortisol, Medical students, Stress, Yoga

## INTRODUCTION

Yoga is a traditional technique to conserve and purify body, mind and soul. It is a mind-body bridge which involves relaxation, meditation and a set of physical exercises performed in association with respiratory events. In this new era of evolution, most of the population are depressed or in stress, irrespective of their age and gender. Depression is well-recognized to be associated with hypercortisolemia as a result of hyperfunctioning of hypothalamo-pituitary-adrenal axis.<sup>1</sup>

The most common aspects of Yoga today are different techniques of concentration (Meditation), bodily postures (Asanas) and breathing exercises (Pranayamas). Being holistic, it is the best means for achieving physical, mental, social and spiritual wellbeing of the practitioners.<sup>2</sup>

Yoga produces consistent physiological changes and has sound scientific basis. Yoga may be as attractive as an alternative to traditional aerobics and strength training program because it requires little space and virtually no

equipment, limited or no harmful side effects and with its focus on relaxation of mind and body. It provides qualitatively different exercise experience which may be perceived as less strenuous and more pleasurable.<sup>3</sup> In general, Medical students experience more stress than the general population. This may be due to workload they face in their academic sessions. Yoga controls the levels of hormones and neurotransmitters that affect physiological functions. The hormonal response depends upon the type of meditation, its regularity and the duration of experience. Yogic practices result in increased peacefulness of the mind and attention with decreased irritation. It decreases the perceived stress through the cerebro-hypothalamic or cortico-limbic pathway by influencing the cortical areas that affect the neurotransmitter and hormonal release.<sup>4</sup> Malathi and Damodaran observed that extremes of stress can result in stress induced disorders and deteriorating performance in medical examinee.<sup>5</sup> They are exposed to stress and tension for long periods which may manifest in the form of many ailments like hypertension, high/low blood pressure, insomnia, depression, backaches, migraine, spondylitis, etc.

Yoga can decrease unwanted hormonal events in stressed individuals. According to neurobiology of spirituality, there is an activation of the prefrontal and inhibitory thalamic reticular nucleus and a decrease in the parietal lobe activity with deafferentation of posterior superior parietal lobule following meditation as seen by various neuroimaging techniques (PET scan). PET Scan during yognidra showed that meditation is accompanied by increased perfusion of the sensory system, hippocampus, association areas, and a decreased perfusion of the executive system namely the pons, striatum and the cerebellum.<sup>6</sup> Yoga continues to be perceived as a mode of activity leading to health benefits. A recent examination of national health interview survey data showed that 61% of yoga users felt that their practice was important in maintaining health, particularly mental health and musculoskeletal conditions and yoga is promoted in popular literature as a mean of augmenting conventional therapies.

Yoga is known to result in increased parasympathetic tone. Increased parasympathetic activity may cause reduced firing of paragigantocellular nucleus of medulla to locus ceruleus. Decreased stimulation of locus ceruleus could decrease norepinephrine output, resulting in relaxation, quiescence and reduced respiratory and heart rates. Reduced input of norepinephrine to paraventricular nucleus of hypothalamus may explain the decreased corticotropin-releasing hormone and cortisol.<sup>7</sup> Not only yogic asanas but meditation leads to greater physiological relaxation and better mood as compared to listening to an audio book. In addition, meditation, specifically open-monitoring meditation techniques such as integrative restoration Yognidra, lead to significant decreases in cortisol and increases in mood during.<sup>8</sup>

Previous works on yoga and meditation have established the thought that yoga exercise lowers stress but not cortisol in healthy individuals. It has been shown that healthy individuals showed little effect on plasma cortisol, whereas these exercises lowered the base levels of the stress.<sup>9</sup> Some school have established yoga labs. to recover students from anxiety and stress related disorders. Davidson and colleagues-suggested that the benefits of yoga that have been observed in adults were also relevant for children and adolescents in school-based settings.<sup>10</sup> Further researches also suggested beneficial effects of school-based yoga programs on several aspects of mental health such as concentration, attention, anxiety, stress, mood, resilience, emotional arousal, self-esteem, and coping frequency.

Yoga is known to result in enhancement of parasympathetic (vagal) tone Yoga is known to result in enhancement of parasympathetic (vagal) tone Yoga is known to result in enhancement of parasympathetic (vagal) tone. So, it is very clear from the above discussion that regular yoga training can be useful to maintain a healthy and happy life by reducing stress level as well as anxiety in all age groups especially millenials who are stressed due to their hectic academic schedule.

## METHODS

This study was conducted for a period of 12 weeks, where Yoga was practiced 6 days/week. Duration of yoga was 60 mins divided into 10 minutes for meditation, 15 minutes for pranayam and 35 minutes for Asanas. Subjects were selected from 1<sup>st</sup> yr M.B.B.S. Students and are put into two groups, yoga group (n = 27) and control group (n = 28). Following materials were part of study

- Yoga lab,
- Yoga instructor,
- Medical students,
- Equipped Pathology Lab,
- Lab Technicians.

### *Inclusion criterion*

- Willing to participate and to continue yoga practice,
- Subject should be physically fit,
- Normal personal and family health status.

### *Exclusion criterion*

- Previous history of Yoga Practice
- Any history of major illness like stroke, seizure, vertigo, hypertension, coronary artery disease, congenital heart disease, history of status asthmaticus, peptic ulcer disease, spondylitis, joint pain, prolapsed disc, CSOM, hernia, physical

inability to practice Yoga or any other disease condition which may exaggerate discomfort.

- Any addiction.

First year medical students were counselled and motivated for taking part in study. Informed and written consents were taken before their participation. All first year students were interviewed personally and their personal and family history were taken. Their personal history included their daily routines, dietary habit, exercise habit etc. The participants (N = 55, including males and females) were randomized into two groups (Yoga group and control group) by computer generated list of random numbers. Randomization were done by independent assistant with counselment. There were 27 (15 males and 12 females) in yoga group and 28 (20 males and 08 females) in control group.

Biochemical stress marker serum cortisol was analysed using ELISA technique in pathology lab. Subjects were instructed one night before to stay in fasting, till collection of blood at early morning. Blood is collected at around 8.00 AM from both yoga and control group and sent immediately to lab for further estimation. Serum cortisol was estimated through Enzyme Immuno Assay (EIA) for the quantitative determination of cortisol concentration. It is a one step immunoassay to determine the presence of cortisol in serum using competitive microplate enzyme immunoassay. Plates are coated with anti-cortisol antibodies. Serum reference, patient specimens, or control is first added to microplate well. Enzyme-cortisol conjugate is added. Cortisol present in

the sample competes with enzyme-cortisol conjugate for binding with anti-cortisol coated microplate to form an antigen-antibody complex. Unbound conjugate is removed by washing. The enzyme activity in the antibody-bound fraction is inversely proportional to the native cortisol concentration. The enzyme activity is revealed by a color change in TMB-Substrate solution. Cortisol reagent kit is supplied by D.S.I. S.R.L., Italy.

Yoga were standardised for yoga group according to their data which was to be recorded for study. Before study, Data were recorded using above mentioned scales and preserved for further analysis after study. No questionnaire was used before, during and after study, but health related history and subject's daily routine including sleep time, sleep duration and early morning awake time were recorded pre- and post-study.

Data were summarized as means  $\pm$  standard deviation and analysed using t test in SPSS-20. Table has been prepared using Microsoft office 2007 and graph was prepared with the help of Graphpad Prism 06.

## RESULTS

Table 1 shows change in serum cortisol level in yoga group (N= 27) where serum cortisol decreased in 16 (60%) participants (decrease by 5.7%) whereas increased in 11 (40%) participants (increased by 4.3%). Overall decrease in S. Cortisol level in yoga group after 12 weeks of yoga practice (1 hr./day for 6 days/week) were 4.8% (P value <0.05, significant).

**Table 1: Pre and post study serum cortisol level in yoga group.**

Yoga group	Pre-study (Mean $\pm$ SD)	Post-study (Mean $\pm$ SD)	% change
Total sample (n= 27)	572.18 $\pm$ 168.03	544.98 $\pm$ 139.89	4.8% decrease
Decreasing pattern (n=16)	606.73 $\pm$ 110.20	571.74 $\pm$ 124.97	5.7% decreasing
Increasing pattern (n=11)	414.64 $\pm$ 141.31	432.51 $\pm$ 136.87	4.3% increase

**Table 2: Pre and post study serum cortisol in control group.**

Control group	pre-study (Mean $\pm$ SD)	post-study (Mean $\pm$ SD)	% change
Total participants (n = 28)	558.89 $\pm$ 162.69	577.26 $\pm$ 254.5	3.4 % increase
Increasing pattern (n = 20)	442.19 $\pm$ 169.74	483.57 $\pm$ 187.48	9.2% increase
Decreasing pattern (n = 08)	619.90 $\pm$ 412.97	602.73 $\pm$ 373.37	3% decrease

**Table 3: Relative change in serum cortisol level in yoga and control group.**

	Yoga group	Control group
Sample size	27 participants*	28 participants*
Decreasing pattern	60% participants(N=16)	28% participants (N= 08)
Increasing pattern	40% participants (N=11)	72% participants (N= 20)
Overall changes in serum cortisol level	4.8% decreased (P value <0.05)	3.4% increase (P value = 0.74)

Table 2 Illustrates that among 28 participants in control group, 72% (N=20) have shown increasing pattern (increased by 9.2%) whereas 28% (N= 08) have shown decreasing pattern (decreased by 3%). Overall increase in S. Cortisol level in control group were 3.4% (P Value= 0.74, not significant).

Table 3 shows changes in serum cortisol level in both yoga and control group participants. There were more number of participants in yoga group whose serum cortisol level is decreased whereas lesser number of participants in control group whose cortisol decreased.

Inversely, increase in serum cortisol level were seen in control group (67%) participants but in yoga group only 40% participants have shown mild increase in cortisol.

## DISCUSSION

Serum cortisol level is the marker of stress and inflammation. Higher cortisol level means high stress level. Yoga and meditation is documented to reduce stress level in regular practitioners. Pre and post study morning serum cortisol level in yoga group was  $572.18 \pm 168.03$  and  $544.98 \pm 139.89$  respectively (P value <0.05, 4.8 % decrease).

Value was calculated in nmol/lit. There were 60% participants in yoga group where serum cortisol decreased from  $606.73 \pm 110.20$  to  $571.74 \pm 124.97$  (5.7% decreasing). 40% participants have shown increase in their hormone level from  $414.64 \pm 141.31$  to  $432.51 \pm 136.87$  (4.3% increase). Whereas in control group participants (N=28), there were overall increase in cortisol level from  $558.89 \pm 162.69$  to  $577.26 \pm 254.5$  (P value 0.74, 3.4% increase). In control group, 28% participants have shown decreasing pattern in their cortisol from  $619.90 \pm 412.97$  to  $602.73 \pm 373.37$  (8% decrease) and 72% have shown increasing pattern from  $442.19 \pm 169.74$  to  $483.57 \pm 187.48$  (9.2% increase).

Above mentioned serum cortisol levels in both yoga and control group states that yoga and meditation have beneficial effect on stress level. There were more yoga practitioners in whom serum cortisol level has decreased after 3 months of yoga with respect to control group who were non- yogic but occasional athletes. Although 40% of yoga practitioners have shown mild increase in their post study cortisol level but all levels were in normal limits.

## CONCLUSION

Yoga decreased stress by decreasing serum cortisol level in yoga practitioners (P value <0.05, significant) whereas control group have shown sharp increase in hormone level (P Value = 0.74, not significant). Hence yoga improved lifestyle in millenials who were stressed due to academic burdens.

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