

ORIGINAL ARTICLE

EFFECT OF EXAMINATION STRESS ON THE PLASMA CORTISOL LEVEL

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ABSTRACTS

Background: Medical profession has been always a noble and prestigious path but the endeavour behind it has been truly known by the persons who undergone the training of becoming a doctor. Medical students face many stresses in their academic life. This study is carried out to provide data and re-establish the effect of academic examination stress on the plasma cortisol levels.

Methods: A longitudinal follow up study was carried out on the first MBBS medical students who were appearing for their first credit examination by measuring their plasma cortisol levels in pre-examination and post-examination stage in fasting condition. Serum Cortisol was estimated by using Byer's Advia Centure advanced Chemiluminescence's technique with inbuilt calibrators and controls; the results obtained were statistically analysed using paired 't' test.

Results: On statistically analysing the results of our study we found that medical students in stage – I had significantly higher values of plasma cortisol than when they were in stage – II.

Conclusion: The results cover a significant correlation of examination stress factors to changes in plasma cortisol values. It is important for medical students to use stress reducing measures, or reduce them as much as possible in order to avoid factors that can affect themselves and their patients in stressful way.

Key Words: Examination stress, plasma Cortisol, Chemiluminescence's technique

INTRODUCTION

A medical student in his or her life goes through several academic stresses. Singh et al in their study have defined stress as "a physical or psychological stimulus that can produce mental or physiological reactions that may lead to illness."¹

Mild stress may be beneficial in cognitive tasks and performance while persistently high stress may lead to anxiety and depression, which are definable neuropsychiatric disease entities.¹

'Almost any type of physical or mental stress can lead within minutes to greatly enhanced secretion of Adrenocorticotrophic Hormone and consequently cortisol as well. In case of mental stress this is believed to result from increased activity in the limbic system, especially in the region of the amygdala and hippocampus, both of which then transmit signals to the posterior medial hypothalamus. Cortisol has direct negative feedback effects on 1) the hypothalamus to decrease the formation of Corticotrophin releasing

hormone and 2) the anterior pituitary gland to decrease the formation of ACTH. Both of these feedback help regulate the plasma concentration of cortisol. However, the stress stimuli are the prepotent ones; they can always break through this direct inhibitory feedback of cortisol, causing either periodic exacerbations of cortisol secretion at multiple times during the day or prolonged cortisol secretion in times of chronic stress.²

Students react to college in a variety of ways. Abrupt change from high school could be stressful, as would be separation from home, drastic changes in the education system and advances in science, over the past half a century has also added the burden of medical students. There has been a tremendous increase in size of institutions making them more complex and the student population is now more diverse as regards socio-economic status and culture. This has led to a decline in personal attention to students. Medical education is above all, rigorous and lengthy. A major stressor for first year students is the amount and complexity of the material to be learned. Academic

pressure further increases because nearly all their classmates were superior in their respective schools. The stressors discussed above add to stress of exams, which most students perceive as an evil, they would rather do away with. In a medical student the situation is aggravating by the added pressure to secure better grades than his peer for securing the residency programme of his choice. The cumulative effect has the potential of precipitating a myriad of symptoms in the subject, ranging from the autonomic and psychological to somatic. As the Medical education, the schedule for the academic curriculum as the time to time assessment creates lots of stress in medical students particularly the First year MBBS students who are in the transition phase of their life. In a light of above discussion, we conducted a study on First MBBS students of B J Medical College, Ahmedabad.

MATERIAL AND METHODS

A longitudinal follow up study was carried out on the subjects for cortisol levels at two times. As per the method used by Elizabeth et al³ one fasting blood sample in the stressed condition stage -I (on the day of examination) and another in the relaxed state stage -II (two days after the examination) was taken.

55 male students who were appearing for the first credit test were selected for the test after informed written consent. The subjects were explained the purpose and importance of study. Permission from the ethical committee of B J Medical College, Ahmedabad was taken and only those who were motivated were selected. Students with the psychiatric disorders, endocrinological disorders, addicted to tobacco or alcohol and having past and family history of diabetes mellitus and hypertension or any subject taking regular

medicines were excluded. Subjects before collection of blood were instructed not to take any food in the morning. After tourniquet application on the right/left upper arm blood was collected in 5 c syringe through 16-gauge needle taking all aseptic precautions from the right/left cubital vein. Blood samples were collected between 8 and 9 am in both the conditions to avoid diurnal variations. 3 ml of blood was transferred to plain bulb and kept undisturbed for half an hour for the separation of serum from it. The serum collected from this bulb was used to estimate the serum cortisol level. Serum Cortisol was estimated by using Byer's Advia Centuse advanced Chemiluminescence's technique with inbuilt calibrators and controls.

The data collected before and after the examination was compared statistically using paired 't' test to find out the any significant difference.

RESULT

Serum cortisol levels and anthropometric measurement results of the students in stage -I and stage-II were obtained and compared using paired 't' test. The following table show the mean, standard deviation, combined standard deviation, standard error of probability and 'p' values.

Table 1: Mean and SD values for Age, Height and Weight of 1st MBBS male students (N=55)

Parameters	Mean	SD
Age (Yrs)	17.60	0.48
Height (Cm)	167.70	5.67
Weight (Kg)	57.73	5.35

Table 2: Effect of examination stress on Serum Cortisol (mcg/dl) in I MBBS students (N=55)

Parameter	Stage - I (Mean ± SD)	Stage - II (Mean ± SD)	Difference (Mean ± SD)	SEp	't'	P
Serum Cortisol (Mcg/dl.)	9.97±2.50	5.49±3.34	4.48±3.64	0.66	6.74	<0.001

SEP = Standard Error of probability; p < 0.001 (Highly significant)

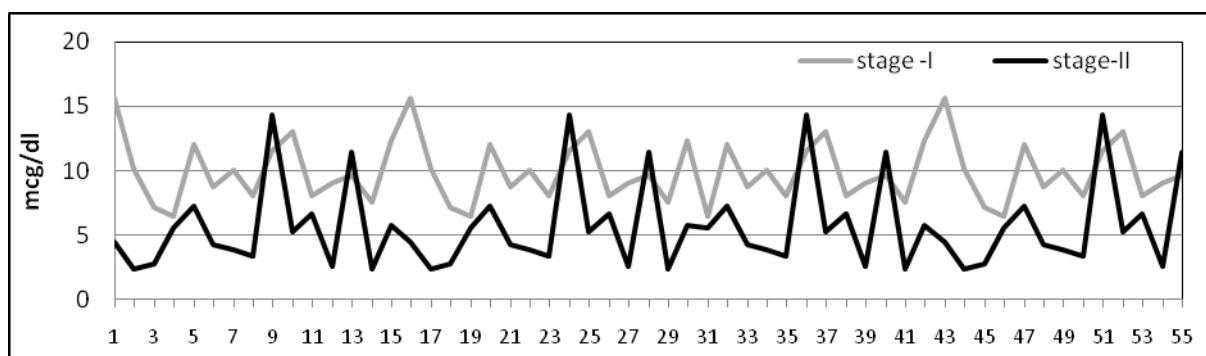


Fig 1: Serum Cortisol level on the day of examination (stage I) & two days after the examination (stage II)

DISCUSSION

In this study we found that individuals undergoing the natural stress of academic examinations exhibited distinct differences in level of plasma cortisol. The result of the study showed that the serum cortisol was found to be significantly higher ($p < 0.001$) in pre-examination period (9.97 ± 2.50 mcg/dl) than the post-examination period (5.49 ± 3.34 mcg/dl).

Elizabeth ET al³ in their study on 34 first year medical students found a similar result with significant increase in plasma cortisol levels. They also tried to correlate it with plasma leptin levels and found that both cortisol and leptin may respond inversely to academic stress. Cortisol levels sharply decline from stressful to post-stressful situation indicating the wane of stress.

A comparison study with 35 medical students, who at the time of the study, and sampling, were under stress with exams, reached similar results. The cortisol concentration of the blood tests performed also resulted in significant increase under the stress condition as found at by Whitehouse ET al⁴ in 1996.

Medical curriculum is stressful and varied levels of stress have been reported amongst medical students and healthcare worker as suggested by Siddiqui ET al⁵ and Lacy ET al⁶. Vaidya and Mulgaonkar⁷ also found increased level of stress and anxiety among first year medical students and they found academic pressure to be most responsible for this. Van Eck et al⁸ concluded in their study that the concentration of cortisol in the total saliva correlates with the plasma values, this parameter can be valued as reliable indicator of the free cortisol in the plasma.

Krahwinkel ET al⁹ found increased levels of salivary cortisol on their 38 healthy post graduate dental students when they were appearing for civil service examination. They suggested that primary factors of psychological stress situations, possible reactions and recognizable, symptomatic organic changes show multi-factorial appearances. The individual perception and self-assessment as well as coping with stress situations play an important role. Only with reliable, subjective self assessment and objective evaluation of stress inducing factors, can a stressful situation be addressed, so that meaningful measure for corrective treatment and remedy can be taken.

Several research works have shown increase levels of cortisol secretion in response to academic or laboratory stressor like Kirschbaum ET al¹⁰, Amario ET al¹¹, Lacey Et al⁶, fortuyn ET al¹².

Others have reported increased plasma cortisol during an examination period only if students reported increased perceived stress like Malarkey ET al¹³.

Patricia L et al¹⁴ in their study found contradictory to our study lower levels of cortisol during examination stress. Several researchers like Dobbin et al¹⁵, Glaser et al¹⁶, Larson et al¹⁷ report no difference in plasma cortisol before, during and after examination.

The results reveal that examinations act as an unavoidable natural stressor and lead to increased stress, anxiety and depression in students, consequently excited HPA axis, resulting in increased release of cortisol levels. To an extent cortisol may be helpful in dealing with the increased demands of the body during stress but an excessive a persistent increase may lead to various ailments. Due to certain limitations, we were not able to assess post examination changes in mood and cortisol levels for longer duration which may be evaluated on a large sample size along with various other factors.

CONCLUSION

It can be concluded with the help of results obtained that examination is as situational stress resulting in anxiety, reflected as disturbed homeostasis of the body such as change in hypothalamus-pituitary-adrenal axis activity, resulting into increased levels of plasma cortisol. The medical students and teachers should be made aware of the negative consequences of stress faced and an efficient relaxation program as well as counselling services should be provided to such stressed students to enhance their academic performance. Education system needs to develop better evaluation techniques which cause less distress among students and teachers, need to develop and promote better support programmes for struggling students for their well being and for future generations to whom they are going to serve.

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