

Impact of Stress on Red Cell Indices and Serum Cortisol Levels in 1st Year Medical StudentsNadera Yasmeen^{1*}, Shweta Patil², Imtiyaz Ali³¹Associate Professor, Department of Physiology, Malla Reddy Medical College for Women, Hyderabad²Associate Professor, Department of Physiology, Yadgiri Institute of Medical Sciences Yadgiri, Karnataka, India³Professor, Department of Physiology, Faculty of Medical Sciences, Gulbarga, Karnataka, India

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Abstract:

Introduction: Academic stress in medical students is an important factor that leads to various health problems. The preclinical students are under constant stress since the time of admission as they have to follow a fixed schedule and stress exaggerates at the time of examination by producing changes in the blood indices and biochemical parameters like Serum Cortisol levels which need to be examined.

Aims and Objectives: (1) To demonstrate the effect of examination on blood indices and Serum Cortisol levels in 1st year medical students. (2) To prove that stress alters blood indices and Cortisol levels. (3) To prove that Serum Cortisol level is a good indicator for determination of stress.

Materials and Methods: About 30 1st year medical students between the age group of 18-19 yrs were selected for the study carried out for 10 months at KBNIMS, Gulbarga, Karnataka. Ethical committee clearance was taken and consent obtained from all the study subjects. Blood indices and Serum Cortisol levels were estimated. 2 samples of blood were obtained. 1st sample of about 5ml was collected at the time of admission & 2nd sample 6 months during their 2nd internal assessment viva-voce examination. Blood samples for blood indices were analysed using Celtac α Automated Hematology analyser from Nihon Kohden and for Serum Cortisol levels were analysed using Fully automated bidirectionally Interfaced Chemi Luminescent Immunoassay.

Results: When blood samples were compared, it was found that those samples taken during the exams showed a significant increase in MCH and MCHC. A significant increase in Serum Cortisol levels was also noted.

Conclusion: It is concluded that examination stress produce changes in Red cell indices and Serum Cortisol levels. A good social support and care from peers, parents and faculty minimizes the risk of stress. Healthy diet will improve their immune system and enable the students to cope up adequately with exam stress.

Keywords: Examination stress, Red cell indices and Serum Cortisol.

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Introduction

Exams are a crucial part of education and the source of stress for students. Stress alters biological processes and chronic stressors may induce maladaptive responses leading to psychiatric diseases, such as anxiety and major depression [1]. In most cases exam stress is caused by the fear of failing an exam, low motivation levels and lack of preparation and planning. It is proved that academic stress in medical colleges will affect the psychology of the student which in turn is reflected by changes in the haematological parameters and hormones. Academic examinations are mediated as one of the psychological stressors while achievement in examination is associated to future professional life of students [2] Stress generated by academic examination shows significant changes in haematological indices [3]. Anxiety induced stress is common and this

exaggerates at the time of examination. This altered state of mind results in variation in biochemical parameters like Serum Cortisol levels. It is well documented that stress whether in physical or psychological form derails normal functioning process of organ system which is mainly reflected in the form of altered autonomic nervous system[4].The role of increased autonomic nervous system activity with hypothalamic-pituitary-adrenal axis during stress is termed due to adaptive mechanisms [5,6] The present study attempts to demonstrate the effect of examination stress on Red cell indices and biochemical parameters like Serum Cortisol levels.

Materials and Methods: About 30 healthy 1st year medical students between the age group of 18-19 yrs were selected for the study carried out at

KBNIMS, Gulbarga, Karnataka. Ethical committee clearance was taken and blood indices like HCT, MCH, MCHC and RDW were estimated along with Serum Cortisol levels after taking informed consent.

Under aseptic precautions 2 samples of 5ml of blood were obtained. 1st sample was collected at the time of admission & 2nd sample was collected 6 months during their 2nd internal assessment viva voce examination. Blood samples for blood indices were analysed using Celta α Automated Hematology analyser from Nihon Kohden and for

Serum Cortisol levels were analysed using Fully automated bidirectionally Interfaced Chemi Luminescent Immunoassay.

Statistical analysis was done by Student “t” test using SPSS 20.0 version software. A p value of < 0.05 was considered to be statistically significant.

Results

The blood indices before and during exam were compared and results are presented in Table 1 and 2.

Table 1: Values of Red cell indices before and during exam

Parameters	Before Exam			During Exam		
	Mean	Std. Deviation	Std. Error Mean	Mean	Std. Deviation	Std. Error Mean
HCT	45.110	9.3940	1.7151	42.127	3.6733	0.6706
MCV	84.530	15.4846	2.8271	89.133	5.8209	1.0627
MCH	27.333	5.8762	1.0728	30.777	2.4004	0.4382
MCHC	31.050	5.5494	1.0132	34.517	0.6449	0.1177
RDW	13.273	1.1154	0.2036	13.400	0.5651	0.1032

Table 2: Comparison of Red cell indices before & during exam

Parameters	Mean	Std. deviation	Std. Error Mean	95% Confidence interval of the difference		t-value	P-value
				Lower	Upper		
HCT %	2.9833	10.4252	1.9034	-0.9095	6.8762	1.567	0.128
MCV fL	4.6033	16.6148	3.0334	-10.8074	1.6007	1.518	0.140
MCH pg	3.4433	5.9413	1.0847	-5.6619	-1.2248	3.174	0.004*
MCHC g/dL	3.4667	5.3822	0.9826	-5.4764	-1.4569	3.528	0.001**
RDW %	0.1267	1.1591	0.2116	-0.5595	0.3061	0.599	0.554

*p < 0.05 is significant and **p < 0.001 is highly significant and p > 0.05 is insignificant.

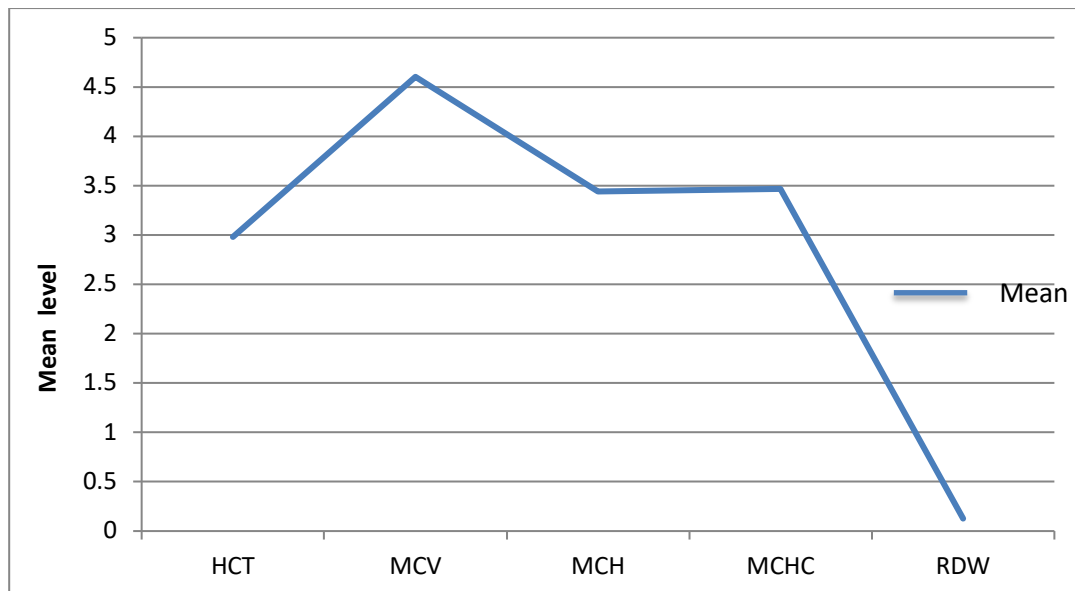


Figure 1: Mean values of Red cell indices

Table 3: Serum Cortisol levels before and during exam

Paired Samples Statistics				
	Mean	N	Std. Deviation	Std. Error Mean
Cortisol Before Exam	7.2620	30	2.46881	0.45074
Cortisol During Exam	10.6553	30	3.22017	0.58792

Table 4: Comparison of serum cortisol levels before and during exam

Paired Samples Test								
	Paired Differences					t	df	p-value
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Cortisol	3.39333	3.22963	0.58965	2.18737	4.59930	-5.755	29	0.000

The values obtained in Table 1 and 2 and Figure 1 show increase in MCH and MCHC during the exams. The difference is statistically significant. No significant changes were observed in HCT, MCV and RDW. The values obtained in Table 3 and 4 show increase in Serum Cortisol levels during the exam. The difference is statistically significant.

Discussion

The present study determined the Red cell indices and Serum Cortisol levels before and during the examination. Examinations in Medical students are so stressful to produce changes in haematological parameters [1]. Stress of academic examinations significantly affects the RBC indices. There is increase in MCV, MCH and MCHC in our study during the examination similar to the study done by Maes M. Vander Planken M, Van Gastel A, et al. but the increase is statistically significant in MCH and MCHC. The increase in MCH indicate that the blood cells are too big, which can be a result of not having enough vitamin B₁₂ or folic acid in the body further indicating that the increase in the number of large red blood cells with increased Hemoglobinization, cannot be explained by shifts of fluid out of the intravascular space, concentrating non-diffusible blood constituents [3].

Moreover, it has been suggested that stress induced pro-inflammatory cytokine production may stimulate the proliferation of hemopoietic cells[7]. Studies have confirmed a significant increase in haemoglobin and Mean corpuscular volume in volunteers put under stress. In our study no significant change in Haematocrit and RDW was observed. There are two kinds of stress. Acute stress is a normal part of everyday life and helps our stress response system stay on the ball. Problems arise when we are repeatedly exposed to the same stressor out of many different stressors for an extended period of time. When this happens, we can fall prey to the effects of chronic stress. Our study also showed significant increase in Serum Cortisol level during the exam when compared to before the exam. It is well documented that stress whether in physical or psychological form derails normal functioning process of organ system which is reflected in the form of altered Autonomic nervous system [4]. The response of stress varies from individual to individual based on their capacity and emotional state. The role of increased

autonomic nervous system activity with hypothalamo-pituitary-adrenal axis during stress is termed due to adaptive mechanisms [5,6] and lead to excess production of cortisol as observed in our study similar to the study demonstrated by Miller and Callaghan et al [9]. Hence suggesting academic stress at the level of 1st year medicine can lead to pathological state in students if proper counselling and care is not provided to students. Similar results were obtained by Goyal S et al [10] suggested chronic stress to be associated with increased cortisol levels.

Conclusion

Haemotological indices and Serum Cortisol levels are good indicators for determination of stress as demonstrated in our study. There are different types of stress - acute stress, episodic acute stress, and chronic stress - each with its own characteristics, symptoms, duration and treatment approaches. The amount of stress increases more when the students appear for the internals and university exams compared to the routine tests like part completion tests.

However exams emphasize the ability to understand, organise and recall information. In this competitive era students need to adapt themselves so as to cope up with any kind of stress effectively. High social support appears to attenuate the magnitude of changes in immune cells suggesting a role for social support in protecting against immune decrements during the times of stress [11]. If proper care and support from the faculty along with the parents is provided, it will boost their immune system and enable the students to cope up adequately with exam stress. Also eating a healthier diet in general can have an effect on the stress levels as well, so getting the right amount of nutrition on a daily basis is important.

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