



Original Research Article

Effects of academic stress on lipid profile, liver function tests and electrolytes in healthy medical students

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ABSTRACT

Academic stress is common for students who are preparing for examinations. This pressure gets converted into anxiety that leads to nervousness which works in combination and is commonly referred to as academic stress. In this study, the effects of examination stress on lipid profile, liver function tests and electrolytes are measured. Plain blood samples were collected from 40 healthy medical students one week before and one week after the theory examinations. Electrolytes, Lipid Profile, Liver function tests (LFT) were measured. The results showed a significant increase in potassium, chloride and triglyceride values and a significant decrease in AST and ALT during pre-examination compared to post-examinations. Decreased insulin level during stressful conditions leads to decreased activity of Na/K ATPase pump leading to the flux of potassium ions outside the cell. Low insulin also causes decreased reabsorption and increased excretion of sodium ions from the distal convoluted tubules. The reason for increase in the triglyceride values before examination is due to the decreased insulin leading to activation of hormone sensitive lipase and more turnover of stored fat and production of excess triglyceride. But our study showed a contradictory results of increase in AST and ALT post examination, the reason may be due to the food habits usually the students have after the examination. Thus by taking care of the stress the students can decrease the ill effects of stress on the health.

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1. Introduction

Stress is defined as 'state of psychological and physiological imbalance resulting from the disparity between situational demand and the individual's ability and motivation to meet those needs'. Academic Stress is common for students who are preparing for examinations.¹ This pressure gets converted into anxiety that leads to nervousness which works in combination and is commonly referred to as academic stress.² Medical education course curriculum, system of education, fear of failure, inability to cope up with first exposure to a very different system of education are stressful conditions for students. Stress causes an imbalance of the parasympathetic and sympathetic nervous system due to psychic stimuli which lead to disturbance of homeostasis in the body. Stress has been reported to influence

the development and progression of atherosclerosis and differential cardiovascular and cerebrovascular mortality.³ Stress is a physical, chemical, or emotional factor that causes bodily or mental tension and may be a factor in disease causation. According to the study, academic stress can be "dangerous" as it affects students both physically and mentally.⁴ Examination stress not only affects mind but also causes heart beat variations which is very dangerous. Most of the students "do not have proper sleep and care for hygiene" during exams. A certain amount of stress can help to prepare for exams because it helps to get motivated. When the stress goes to the high level it can be a big problem. College students experience high stress due to various reasons such as lack of preparation, style of their study, nervous feel and lack of information.⁵ When stress is perceived negatively or becomes high, it leads to anxiety, before and during examinations and ultimately affects their academic progress. Academic stress is one of

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the body's natural responses to something that is threatening or frightening. Many aspects of student life have the potential to cause stress, including adjusting to a new living environment, fulfilling academic requirements, and developing friendships and preparing and appearing for exams. Academic stress is not necessarily harmful, mild forms of stress can motivate and energize the person. Small amount of increased stress levels may make the individual more alert and motivated to do the work.⁶ If stress level is too high then it can cause difficulties. Academic stress is mental distress with some anticipated frustration associated with fear of academic failure. Students have many academic dreams, for academic expectations. These demand may exceed available resources of the students. Stress level control includes both awareness of stress and lifestyle changes.⁷ Proper stress management can lead to numerous health benefits. Oxidative stress reflects on imbalance between the systemic manifestation of reactive intermediates or to repair the resulting damage. The society believes that graduations from a famous ranking university is a passport to a good job, high salaries, and rich social status. As a result, the students are indirectly subjected to a variety of stress or mainly linked to academic stress.

Academic stress will effect on physiological and biochemical parameters of students. Academic performance is mainly a function of students study habits referring to the student's way of study whether systematic, efficient or inefficient. The study management that influence the academic performance of a student include time management, setting realistic academic targets. In this study, the effects of examination stress on lipid profile, liver function tests and electrolytes are measured. The present study helps to know the effect of stress on different parameters. Proper stress management can reduce the ill effects on health.

2. Materials and Methods

Ethics Clearance was obtained from Institutional Ethics Committee.

Plain blood samples were collected in a plain vacutainers from 40 healthy medical students one week before and one week after the theory examinations. After centrifugation, the serum was used to analyze the Electrolytes (Na, K, Cl), Lipid Profile: Total cholesterol, Triglyceride, LDL and HDL), LFT (Total Bilirubin, Bilirubin Direct, Aspartate Amino Transaminase (AST), Alanine Transaminase (ALT) and Alkaline Phosphatase (ALP).

Electrolytes, lipid profile were analyzed on Cobas 6000 auto analyzer.

Total and direct bilirubin was estimated by Vandenberg method, AST, ALT and ALP were estimated by colorimetric assay manually.

3. Results

The results showed a significant increase in potassium, chloride and triglyceride values pre examination compared to post-examinations. A significant decrease in AST and ALT was found pre examination compared to post-examinations. There was also a non-significant increase in LDL and HDL cholesterol and decrease in sodium, total cholesterol, total and direct bilirubin and ALP values pre examination compared to post-examinations was found.

The results were analyzed by using SPSS by paired samples t test.

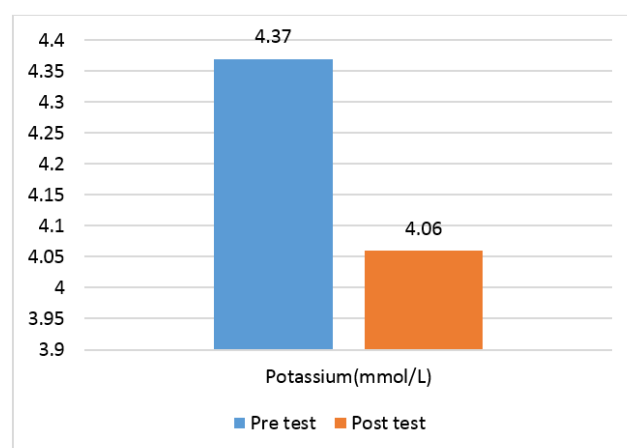


Fig. 1: Comparison of serum Potassium

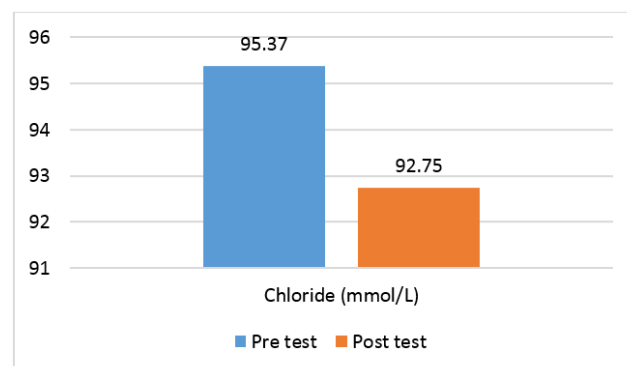


Fig. 2: Comparison of serum Chloride

4. Discussion and Conclusion

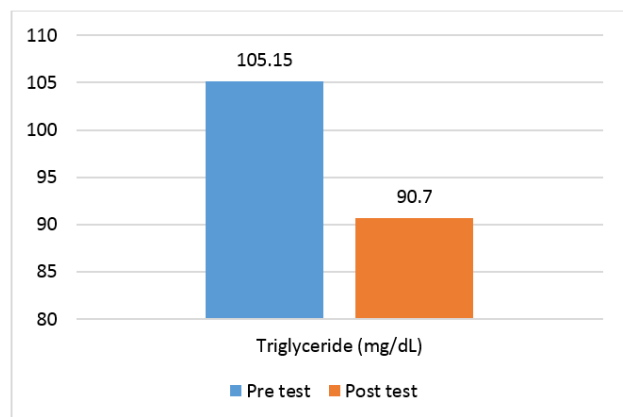
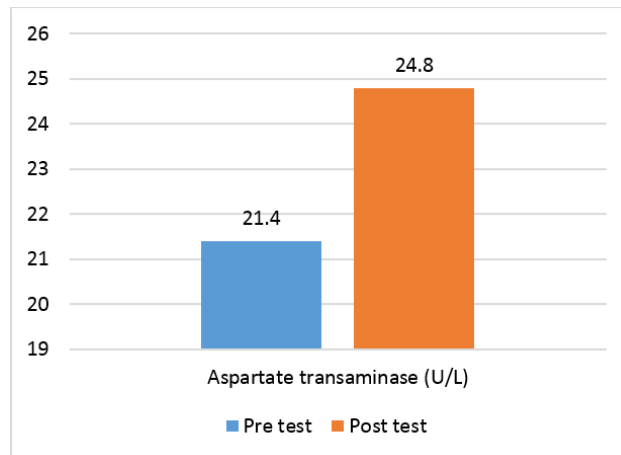
Stress during examination among medical students is a well-known phenomenon encountered worldwide. Our study showed a significant increase in the serum potassium and chloride values before the examination. Serum sodium values are slightly decreased before examination which was not significant. Stress causes increased secretion of epinephrine and corticosteroids which suppresses the

Table 1: Mean and SD of biochemical parameters in pre and post examination (Paired Samples Statistics)

		Mean	N	S D
Pair 1	Serum_sod_1	132.575	40	5.4155
	Serum_sod_2	133.725	40	6.1727
Pair 2	serum_pot_1	4.370	40	.4298
	Serum_pot_2	4.0660	40	.44925
Pair 3	serum_chlo_1	95.375	40	4.9873
	serum_chol_2	92.755	40	5.1584
Pair 4	Total_chol_1	163.275	40	16.5204
	Total_chol_2	165.700	40	21.2134
Pair 5	Trigly_1	105.150	40	36.9078
	Trig_2	90.700	40	34.6115
Pair 6	LDL_1	83.965	40	18.7648
	LDL_2	81.630	40	16.5323
Pair 7	HDL_1	53.885	40	10.4381
	HDL_2	52.168	40	15.9802
Pair 8	Total_bil_1	.317	40	.1781
	Total_bil_2	.405	40	.5931
Pair 9	Bilirubin_dir_1	.1270	40	.04564
	Bilirubin_dir_2	.130	40	.0464
Pair10	AST_1	21.400	40	9.6948
	Ast_2	24.800	40	11.6425
Pair11	ALT_1	14.225	40	7.0438
	ALT_2	17.075	40	8.8474
Pair12	ALP_1	65.100	40	11.7229
	ALP_2	66.200	40	12.0835

1- Pre examination

2- Post examination

**Fig. 3:** Comparison of Triglyceride**Fig. 4:** Comparison of a spartate transaminase

secretion of insulin.⁸ Decreased insulin level during stressful conditions leads to decreased activity of Na/K ATPase pump leading to the flux of potassium ions outside the cell.⁹ Low insulin also causes decreased reabsorption and increased excretion of sodium ions from the distal convoluted tubules.¹⁰ Similar findings were observed in our study also.

The study also showed significant increase in the triglyceride and slight increase in the LDL and HDL values

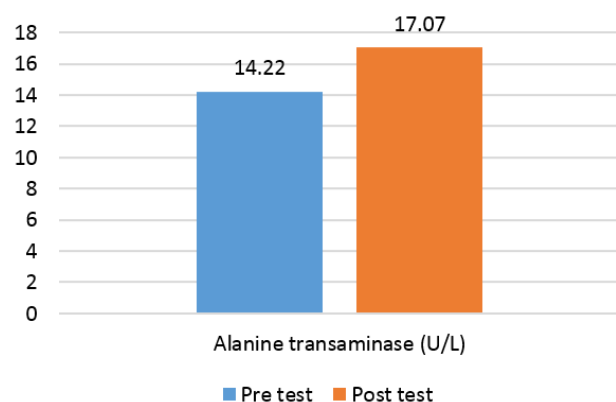
before examination. But total cholesterol value was low before examination which was not significant. The reason for increase in the triglyceride values before examination is due to the decreased insulin leading to activation of hormone sensitive lipase and more turnover of stored fat and production of excess triglyceride. Excess triglyceride produced is exported out of the liver in the VLDL leading to production of more LDL. There was a significant

Table 2: Comparison of biochemical parameters in pre and post examination (Paired Samples Test)

		Paired Differences			95% Interval Difference	Confidence of the	t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean					
Pair 1	Serum_sod_1 - Serum_sod_2	-1.1500	4.1172	.6510	Lower -2.4667	Upper .1667	-1.767	39	.085
Pair 2	Serum_pot_1 - Serum_pot_2	.30400	.38938	.06157	.17947	.42853	4.938	39	<0.001
Pair 3	Serum_chlo_1 - Serum_chol_2	2.6200	3.2945	.5209	1.5664	3.6736	5.030	39	<0.001
Pair 4	Total_chol_1 - Total_chol_2	-2.4250	14.4929	2.2915	-7.0601	2.2101	-1.058	39	.296
Pair 5	Trigly_1 - Trig_2	14.4500	16.0255	2.5339	9.3248	19.5752	5.703	39	<0.001
Pair 6	LDL1 - LDL_2	2.3350	8.8380	1.3974	-.4915	5.1615	1.671	39	.103
Pair 7	HDL1 - HDL_2	1.7175	13.1967	2.0866	-2.5030	5.9380	.823	39	.415
Pair 8	Total_bil_1 - Total_bil_2	-.0875	.5876	.0929	-.2754	.1004	-.942	39	.352
Pair 9	Bilirubin_ dir_1 - Bil_dir_2	-.00300	.02954	.00467	-.01245	.00645	-.642	39	.524
Pair 10	AST1 - Ast_2	-3.4000	6.2749	.9921	-5.4068	-1.3932	-3.427	39	.001
Pair 11	ALT1 - ALT_2	-2.8500	6.0279	.9531	-4.7778	-.9222	-2.990	39	.005
Pair 12	ALP1 - ALP_2	-1.1000	8.6255	1.3638	-3.8586	1.6586	-.807	39	.425

1- Pre examination

2- Post examination

**Fig. 5:** Comparison of a lanine transaminase

increase in the AST and ALT values post examination but increase in total bilirubin, direct bilirubin and ALP were not significant. During examination stress, cell mediated immune responses are reported as being suppressed during times of high stress. The academic stress causes increase in oxidative stress and involve the increased lipid profile values and liver function test values. The urinary excretion

of cortisol, adrenaline, noradrenaline, and 3-methoxy-4-hydroxy-phenylethylene glycol increased in both sexes. But our study showed a contradictory results of increase in AST and ALT post examination, the reason may be due to the food habits usually the students have after the examination.

Examinations in medical school are stressful to produce changes in heart rate, blood pressure and body mass index and stress can effects on biomarkers which may affect their health and day to day work. Exams emphasize the need to understand, organize and recall information. The students are expected to show the depth of knowledge. All these can be affected by the stress. Thus- Transcendental meditation (TM) program, review of academic curriculum and exam pattern, proper guidance, counseling time to time will help them to cope up with stressful life. Thus by taking care of the stress the students can decrease the ill effects of stress on the health.

5. Source of funding

None.

6. Conflict of interest

None.

References

1. Maes M, Planken MVD, Gastel V, A. Influence of academic stress on hematological measurements in subjectively healthy volunteers. *Psychiatry Res.* 1998;80:201–212.
2. Michael M, Mark VDP. Influence of academic examination stress on hematological measurements in subjectively healthy volunteers. *Psychiatry Res.* 1998;80(3):201–212.
3. Sanjay K, Kunal, Jha DK, Shipra D. Effect of stress during university examination on differential leucocyte count (DLC), heart rate (HR) and blood pressure (BP). *Indian J Clin Anat Physiol.* 2016;3(2):163–166.
4. Zeitlin, Diane. Immunological effects of message therapy during academic stress. *Psychosom Med.* 2000;62(1):83–84.
5. Folkman, Susan, Lazarus, Richard S. If it changes it must be a process: Study of emotion and coping during three stages of a college examination. *J Personal Soc Psychol.* 1985;48(1):150–170.
6. Smriti G. Academic stress among government and private high school students. *Int J Indian Psychol.* 2016;3(2):119–125.
7. Sansqiry SS, Bhosle M, Sail K. Factors that affect academic performance among pharmacy students. *J Pharm Educ.* 2006;70(5):104.
8. Schalch DS. The influence of physical stress and exercise on growth hormone and insulin secretion in man. Translational research. *J Lab Clin Med.* 1967;69(2):256–269.
9. Vivo Pathophysiology. Physiologic effects of insulin; Available from: www.vivo.colostate.edu/hbooks/pathphys/endocrine/pancreas/insulin_phys.html.
10. DeFRONZO RA, COOKE CR, ANDRES R, FALOONA GR, DAVIS PJ. The effect of insulin on renal handling of sodium, potassium, calcium, and phosphate in man. *J Clin Invest.* 1975;55(4):845–855.

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