

Original article

A study of Perceived stress and Autonomic function in Under Graduates Medical students

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Abstract:

Introduction: Stress - The result produced when a structure, system or organism is acted upon by forces that disrupt equilibrium or produce strain. Walter Canon early in the twentieth century showed increased plasma concentrations of catecholamines during stress and identified its sources as the sympathetic nervous system and the adrenal medulla

Material and methods: A study was carried out on voluntarily participating undergraduate Medical students of institution attached to a Tertiary Referral Centre. Medical students of 17-22 years fulfilling the inclusion criteria were included. Data was gathered between January 2013 and July 2014. Approval to conduct the study was obtained from the Institutional Review Board (IRB) of the Tertiary referral Centre where data was collected.

Results: Mean PSS score in male is 16.66 and female is 17.51 (score out of 40). There is no significant difference in mean PSS score between males and females (table 2). Regarding Mean basal heart rate, mean systolic blood pressure and mean diastolic blood pressure no significant difference was found ($p > 0.05$) between low stress group & high stress group. (Table 3,4, 5).

Conclusion: There is no correlation between perceived stress score and individual test results in this study. This could be because the test though well validated is based on perception.

INTRODUCTION

Stress - The result produced when a structure, system or organism is acted upon by forces that disrupt equilibrium or produce strain. Walter Canon early in the twentieth century showed increased plasma concentrations of catecholamines during stress and identified its sources as the sympathetic nervous system and the adrenal medulla⁽¹⁾. Later, Hans Selye revealed that stress caused a “nonspecific” response designed to restore homeostasis and involved the co-activation of the sympathetic system and the

hypothalamic- pituitary axis (HPA)⁽²⁾. This leads to stimulation of the autonomic nervous system resulting in immediate effects on the heart rate, blood pressure, temperature, respiratory rate and the plasma catecholamine levels as well as delayed effects by release of corticosteroids^(3, 4, 5, 6). The stress coping system is essential for individual and species survival. Normal stress coping system function is crucial for maintenance of physical and mental health.

Particularly examinations are a major cause of stress⁽⁷⁾. High level of stress may have adverse effect on academic achievement. Several studies both from the west^(8,9,10) and from Asia have reported that medical training is highly stressful particularly for those who are beginning their medical education. Stress in Medical education can lead to diseases in later life in susceptible individuals who need to be detected early and thus they could be prevented. The effect of stress on autonomic nervous function has most commonly been studied under laboratory conditions using standardized mental stress as the test stressor.^(12,13,14,15) These data, however, cannot be extrapolated to real life situations⁽¹¹⁾. This study was done to test the impact of real life stressors among undergraduate medical students on indices of resting cardiac autonomic regulation using conventional autonomic tests. This study calculated the stress level in undergraduate Medical students and effect of perceived stress on their autonomic nervous function.

Aims of the study:

The aim is to evaluate the autonomic dysfunction in undergraduate medical students due to examination and study perceived stress.

Objectives of the study:

- 1) To calculate stress level of the students by taking questionnaire test.
- 2) To check for autonomic dysfunction in the students.
- 3) To correlate autonomic function status with the perceived stress level in the students.

MATERIAL AND METHODS:

A study was carried out on voluntarily participating undergraduate Medical students of institution attached to a Tertiary Referral Centre. Medical students of 17-22 years fulfilling the inclusion criteria were included. Data was gathered between January

2013 and July 2014. Approval to conduct the study was obtained from the Institutional Review Board (IRB) of the Tertiary referral Centre where data was collected.

Selection of the Participants:

A “Perceived Stress Scale 10” (PSS) questionnaire was given to 300 undergraduate medical students. Medical students were divided into two groups i.e. Low Stress Group and High Stress Group on the basis of score obtained from the questionnaire. The questionnaire had scoring range from 0-40. Those students whose score was greater than 20 was included in High Stress Group and students whose score was up to 20 was included in Low Stress Group. Depending on these criteria 230 students were included in Low Stress Group and 70 students in High Stress Group.

Study Procedure:

- Proper consent of the volunteer individuals was obtained before the procedure.
- History taking, general examination and systemic examination was done before the procedure.

The volunteers were instructed not to take tea, coffee or any drinks 1 hour before and any food 2 hour before the recording. This was done to exclude the effects of food and water intake on the recording. All the recordings were performed in the evening in the Department Laboratory. Perceived Stress Scale 10 questionnaire was filled on the previous day of the Tests.

Resting pulse rate: The subjects were asked to take rest for 10 minutes in supine position and radial pulse rate was recorded in supine position and expressed as beats / min. Three readings were taken and the average of the three was taken as the resting pulse rate.

Resting blood pressure: The subjects were asked to take rest for 10 minutes in supine position. The resting blood pressure (BP) was recorded in supine position using automated sphygmomanometer and expressed in mmHg. Three readings were taken and the average of the three was taken as the resting blood pressure

The cardiovascular tests performed are detailed below. These tests were demonstrated to the subjects.

For assessing parasympathetic activity the tests done were:

1. **Heart rate response to deep breathing**
2. **Valsalva Ratio**
3. **30:15 Ratio**

For assessing sympathetic activity the tests done were;

1. **Blood pressure response to standing (Orthostasis):**
2. **Hand grip test:**

RESULTS

The study was conducted on 300 students as per study procedure described in materials and methods.

Data of various parameters measured were entered in Microsoft Excel (2010). The mean and standard deviation was calculated for all the parameters. Statistical analysis was done using Statistical Package for Social Sciences (SPSS-IS) software.

The statistical tests used were (as per data requirement and our objectives of study):

- Mann Whitney test to compare the perceived stress scale scores between males and females.
- Mann Whitney test to compare the autonomic function tests between low stress and high stress group.
- Pearson's correlation coefficient to find if there is any correlation between the individual autonomic function test and stress scores of the students.

The p value of less than 0.05 was considered as statistically significant.

r values were calculated for determination of correlation.

Table 1: Comparison of Demographical Parameters between two Groups using ANOVA Test and Chi square Test

	No.	Age(years)			Sex	
		Mean	S.D	Range	Male	Female
Low Stress Group	230	18.39	1.19	18-22	159 (69.13%)	71 (30.86%)
High Stress Group	70	18.74	1.34	18-22	44 (62.85%)	26 (37.14%)

p value 0.0633 Not significant

There is no significant difference in mean age between the Low Stress Group and High Stress Group (p>0.05)

Table 2: Comparison of PSS (Perceived stress test Scores) of Males and Females

Gender	PSS Score (Mean ± SD)
Male (203)	16.66 ± 5.68
Female (97)	17.51 ± 5.44

By Mann Whitney Test p Value: 0.1641 Not Significant

There is no significant difference between Males and Females in PSS Scores (p>0.05)

Table 3: Comparison of Basal Heart Rate in Two Groups

Groups	Basal Heart Rate (Mean \pm SD)
Low Stress	85.48 \pm 12.78
High Stress	85.41 \pm 13.32

By Mann Whitney Test p Value: 0.9366 Not Significant

There is no significant difference between the Low Stress Group and High Stress Group in Basal Heart Rate ($p > 0.05$)

Table 4: Comparison of Basal Systolic Blood Pressure between two Groups

Groups	Basal SBP (Mean \pm SD) (mm Hg)
Low Stress	119.89 \pm 7.29
High Stress	119.90 \pm 7.86

By Mann Whitney Test p Value: 0.8422 Not Significant

There is no significant difference between the Low Stress Group and High Stress Group in Basal Systolic Blood Pressure ($p > 0.05$)

Table 5: Comparison of Basal Diastolic Blood Pressure between two groups

Groups	Basal DBP (Mean \pm SD) (mm Hg)
Low Stress	78.03 \pm 6.08
High Stress	78.35 \pm 6.35

By Mann Whitney Test p Value: 0.8422 Not Significant

There is no significant difference between the Low Stress Group and High Stress Group in the Basal Diastolic Blood Pressure ($p > 0.05$)

Table 6: Comparison of Δ SBP (Lying- Standing) between two Groups

Groups	Δ SBP (Mean \pm SD) (mm Hg)
Low Stress	4.91 \pm 1.81
High Stress	5.07 \pm 2.29

By Mann Whitney Test p Value: 0.7576 Not Significant

There is no significant difference between the Low Stress Group and High Stress Group in Blood Pressure Response to Standing (Orthostasis) ($p > 0.05$)

Table 7: Comparison of Δ DBP on Isometric Hand Grip Test (IHG) between two groups

Groups	Δ DBP (Mean \pm SD) (mm Hg)
Low Stress	19.47 \pm 0.22
High Stress	19.38 \pm 0.36

By Mann Whitney Test p Value: 0.9768 Not Significant

There is no significant difference between the Low Stress Group and High Stress Group in change in mean diastolic Blood Pressure on isometric handgrip test ($p > 0.05$)

Table 8: Comparison of 30:15 Ratio in two Groups

Groups	30:15 Ratio (Mean \pm SD)
Low Stress	1.24 \pm 0.14
High Stress	1.25 \pm 0.17

By Mann Whitney Test p Value: 0.8097 Not Significant

There is no significant difference between the Low Stress Group and the High Stress Group in 30:15 Ratio ($p > 0.05$)

Table 9: Comparison of Valsalva Ratio in two Groups

Groups	Valsalva Ratio (Mean \pm SD)
Low Stress	1.49 \pm 0.21
High Stress	1.49 \pm 0.23

By Mann Whitney Test p Value: 0.5641 Not Significant

There is no significant difference between the Low Stress Group and High Stress Group in the Valsalva Ratio ($p > 0.05$)

Table 10: Comparison of E/I Ratio in two Groups

Groups	E/I Ratio (Mean \pm SD)
Low Stress	1.38 \pm 0.20
High Stress	1.40 \pm 0.20

By Mann Whitney Test p Value: 0.6234 Not Significant

There is no significant difference between the Low Stress Group and High Stress Group in the E/I Ratio ($p > 0.05$)

Table 11: Correlation between PSS Score and Autonomic Function Tests

Parameter	r Value
Blood pressure response to standing (Orthostasis)	0.01872
Blood pressure response to isometric hand grip(IHG)	0.1908

30:15 Ratio	-0.1119
Valsalva Ratio	0.04578
E/I Ratio	0.08307

There is no significant correlation between PSS Scores and Autonomic Function Tests ($p>0.05$).

DISCUSSION

On the basis of score obtained in Perceived stress scale 10 (PSS) questionnaire, 230 students were in low stress group and 70 students in high stress group. The low stress group with perceived stress score up to 20 had total 230 students out of which 159 were males and 71 were females. In high stress group with perceived stress score more than 20 there were 44 males and 26 females making up a total of 70 students.

Mean PSS score in male is 16.66 and female is 17.51 (score out of 40). There is no significant difference in mean PSS score between males and females (table 2). Regarding Mean basal heart rate, mean systolic blood pressure and mean diastolic blood pressure no significant difference was found ($p>0.05$) between low stress group & high stress group.(Table 3,4, 5).

The nature of the stress was relatively acute. This study considers the impact of adjusting to the demands of medical training among undergraduate medical and paramedical students. Medical Training is a stressor that is expected to affect the individual over a longer time frame.

The study was done over a period of one and half years and efforts were done to do the tests evenly through the year. But most of the readings were taken in the first six months of the course because students could not cooperate during the pre- examination and examination period.

In spite of perceived stress score being low in 230 students, the tests were done on these students because detecting even one case of autonomic dysfunction in these students that was not due to stress would have been worth the effort.

Fortunately not even a single case of autonomic dysfunction was detected. Ewing et al have advocated autonomic function tests out of which at least two (One for parasympathetic and one for sympathetic) must be abnormal for a definite diagnosis of autonomic dysfunction⁽¹⁶⁾

The tests reflecting sympathetic function:⁽¹⁷⁾

1. Blood pressure response to standing (fall in systolic blood pressure)
2. Blood pressure response to isometric handgrip (increase in diastolic blood pressure)

No significant difference was found in tests reflecting sympathetic function in low stress and high stress group.

The tests reflecting parasympathetic functions: ⁽¹⁷⁾

1. Immediate heart rate response to standing (30:15 ratio)
2. Heart rate response to valsalva manoeuvre (Valsalva ratio)
3. Heart rate (R-R interval) variation during deep breathing (maximum-minimum heart rates).

There was no significant difference in the tests reflecting parasympathetic function between the two groups. Some students showed borderline scores for individual tests but none had one parasympathetic and one sympathetic as abnormal. Main findings of this study indicate that autonomic function parameters in low stress group and high stress group have no significant difference ($p > 0.05$).

Findings of our study are comparable with the previous study done by K Srinivasan et al where they

found that there is no effect of stress on autonomic nervous functions by using conventional methods of testing autonomic functions. But by using heart rate variability equipment, the findings are suggestive of a shift in cardiac autonomic regulation towards sympathetic activation in response to real life stressors ⁽¹⁸⁾

Conclusion:

The results of all five autonomic function tests were correlated with perceived stress score of every individual using Pearson's correlation coefficient and there was no relationship between them. With increased perceived stress score in the subjects did not show more number of tests as abnormal.

There is no correlation between perceived stress score and individual test results in this study. This could be because the test though well validated is based on perception.

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