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# To Study the Effect of Examination Stress on Some of the Autonomic Functions in First Year Medical Students.

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**KEYWORDS**

Examination Stress, Autonomic Functions, Medical Student.

**ABSTRACT:**

**Aim:** To study the effect of examination stress on some of the autonomic functions in first year medical students.

**Methods:** The present study was carried out in the Post Graduate Department of Physiology, Government Medical, College Jammu, over a period of one year from November, 2020 to October, 2021. for assessing sympathetic system activity - pulse rate, BP , orthostasis and mental arithmetic test were calculated. For assessing parasympathetic system activity - pulse rate, heart rate response, heart rate variability, standing lying ratio were calculated. The physical parameters recorded were height, weight and body surface area.

**Results**: In the present study, there was a significant increase in pulse rate, systolic and diastolic blood pressure as such and during mental arithmetic test in before examination stress period which clearly indicates an increase sympathetic activity in students under examination stress. Also it was found that heart rate variability significantly decreased in students before examination stress which is suggestive of altered autonomic homeostasis with shift towards sympathetic activation and vagal withdrawal ( reduced parasympathetic system activity).

**Conclusion:** From our study, it can be concluded that there is statistically significant change in both sympathetic and parasympathetic system due to examination stress. To overcome the examination stress in medical students, they can be recommended relaxation techniques like meditation, yoga, deep breathing exercises, appropriate healthy diet and physical exercises. Counselling Sessions could be provided to overcome stress.

## Introduction

Modern age has been called the age of anxiety. Stress like Einstein's theory of relativity is a scientific concept which has suffered from the mixed blessing of being too well known and little understood. Stress is much more recognized now, than it used to be, we have become very aware of the potential negative effect of stress on our lives. The American Psychological Association defines stress as "any uncomfortable emotional experience accompanied by predictable biochemical, physiological and behavioural changes **( Shah SJ, 2014).** The term "stress" was employed in 1930 's by Selye, an endocrinologist **( Selye H, 1956).** Stress is a state of mental or emotional strain or tension

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resulting from adverse or demanding circumstances. The stress among students is growing at an alarming rate **( Thangaraj S *et al* ., 2014).** Stress is often associated with an increased occurrence of autonomic, cardiovascular and immune system pathology **( Gopal A *et al* .,2014).** Physiologically stress is a reaction of body to a change that requires a physical, mental or emotional adjustment or response **( Sharma B *et al.,* 2011).**

Examinations are the part of academic curriculum and are often tiresome and extremely stressful for students at any level of education. Intense stress before and during examination, has consequences for mental health and somatic symptoms **( Lee M *et al.,* 2000).**

Autonomic system response to stress prepares the body for fight or flight. The general response to stress is activation of the sympathetic nervous system ( SNS) with inhibition of the parasympathetic nervous system (PSNS). When the stress system becomes severe or uncontrolled, adrenomedullary release of epinephrine (EPI) ensures. As stress increases further corticotropin releasing factor not only activates the SNS but leads to release of adrenocortical steroids. Sympathetic nervous stimulation to the muscles activates vasoconstriction and increases activation of the skin sympathetic pathway which can precipitate a "cold sweat" or perspiration and flushing of the skin. Autonomic responses include feeling of warmth and cold, palpitation, tachycardia, nausea, abdominal pain, diarrhea and constipation **( Michael G. Ziegler, 2004).**

Stress can stimulate the autonomic sympathetic nervous system to increase vasoconstriction, which can mediate an increase in blood pressure, an increase in blood lipids, disorders in blood clotting, vascular changes and atherogenesis, all of which can cause arrhythmias and subsequent myocardial infarction **(Etalk SA, 1998; Rozanski A *et al.,* 1999, Vrijkotte TG *et al.,* 2000).** Autonomic dysregulation represents a hallmark of coronary artery disease **( Badav MB *et al.,* 2019).**

In teaching students how they can improve dealingwith stress and reduce the feeling of stress, learning behaviour can be optimized. Better concentration, emotional resilience and alertness and the negative long term effects of stress can be avoided. All these aspects have been demonstrated in studies on Yoga in school sports utilizing psychometric data **( Chen DD *et al.,* 2014 , Nagendra H *et al.,* 2015).**

Although many studies have been reported in the literature on this subject, but it is the first of its kind study in Jammu region. This study will help to design effective prevention and intervention strategies for stress management and to achieve better academic performance of students which can influence the quality of patient care in a medical student's future professional life.

The aim of the present study is to study the effect of examination stress on some of the autonomic functions in first year medical students.

**Material and Methods**

The present study was carried out in the Post Graduate Department of Physiology,

Government Medical, College Jammu, over a period of one year from November, 2020 to October, 2021. The study was undertaken after approval of Institutional Ethics committee vide No. IEC/GMC/2021/694, dated 07.12.2021. The study included 70 healthy volunteer medical students.

Since age, height, weight affect the autonomic functions, following criteria were used for selection of subjects for the present study.

**Inclusion criteria:**

- The students in the age group of 17 to 19 years were included in the study.
- The height of all students ranged from 152-174 cm.
- The weight of all students ranged from 42- 64 kg.

**Exclusion Criteria**

- The students who were hospitalized in the last 5 years, due to any illness.
- The students who were having history of any other major illness viz; hypertension, diabetes mellitus, heart disease etc.
- The students with Neuropsychiatric disorders or any other illness known to affect the functioning

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of the autonomic nervous system were excluded from the study. Students using any medication or any hormonal preparation were also excluded from the study.

- The students who had a history of smoking, tobacco chewing were excluded from the study.
- Systemic diseases were ruled out in the selected students by taking their detailed history and by their thorough clinical examination.

**Procedure:**

The volunteer students, subjects were explained the purpose and importance of the study. Prior written consent was taken for participation in research. Those who consented were registered for the study.

The study was conducted on 70 first year medical students, 35 males and 35 females students of first year MBBS of Government Medical College Jammu. The data of parameters of autonomic functions was taken 5-7 days before and 5-7 days after examination stress. All the parameters were taken at the same time of the day i.e. between 10 am to 1 pm to avoid diurnal variation at a room temperature of 25 degree Celsius to 28 degree Celsius. The parameters were taken in a quiet room in order to alleviate the emotional and psychological stresses.

Physical parameters noted in each subject were age (in years) height (in cms) weight (in kgs) and body surface area in (sq.mtrs) calculated from Dubois nomogram. Pulse and blood pressure were recorded by palpatory method and auscultatory method respectively. ECG was recorded by a simple compact electrocardiography with twelve conventional leads, a galvanometer to measure the strength and duration of electrical current and a magnet to change it into mechanical oscillations. The recording paper was run at a speed of 25 mm/sec.

Heart rate variability was calculated from **KUBIOS** HRV software.

**( A)** For assessing **sympathetic system** activity, following parameters were recorded:

**1. Pulse rate:**

It was recorded by palpatory method using three fingers

**2. Blood Pressure:**

It was measured under casual conditions using a sphygmomanometer, by auscultatory method**.**

**3. Orthostasis:**

The test was performed by measuring the subject's blood pressure with a sphygmomanometer while they were lying down quietly and when they stood up. The change in systolic and diastolic blood pressure in response to change in position from supine to standing position was determined.

**4. Mental Arithmetic Test:**

Blood pressure was recorded when the subject was made to solve some mathematical problem like multiplication problem.

**( B)** For assessing **Para-sympathetic system** activity, following parameters were recorded:

1. **Pulse rate:** It was used for assessing both parasympathetic and sympathetic reactivity because of dual innervations of hearts. It was recorded by palpatory method using three fingers.
2. **Heart rate response:** Subject were made to change their positions from the supine to erect position, and ECG recording was taken in both positions. The response was taken as the difference in heart rate in two positions .
3. **Heart Rate Variability:** It is taken as the maximum and minimum heart rate during quiet breathing.
4. **Standing Lying Ratio:** The subjects were asked to lie down after standing quietly for 2 minutes. The ECG was recorded during both positions and the Standing Lying Ratio was calculated as the ratio of the longest R-R interval during the 5 beats before lying down to the shortest interval during the 10 beats after lying down.

**The Physical Parameters recorded were:**

**1. Height:**

The height was measured by using a vertical measuring rod fixed to the wall. The individual was asked to stand straight on flat floor in front of the measuring rod with shoes taken off, a headboard

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was brought in contact with the uppermost part of head lightly compressing the hair for accuracy in measurement. The height was recorded to the nearest centimeter (cm) .

**2. Body Weight:**

Weight of the subjects was measured in kilograms by using calibrated weighing machine with minimum on and with shoes taken-off by thesubject. The individual stood still with body weight evenly distributed between both feet .

**3. Body Surface Area (BSA):**

Body surface area was calculated from the Dubois Nomogram in square

meters ($m^2$ ) .

**Statistical analysis:**

Data was collected and expressed in Microsoft Excel. Statistical analysis was performed using statistical software SPSS version 21.0. Mean, standard deviation and range were calculated for quantitative variables. Paired 't' test was applied and t value and P value were calculated using the computer software. Comparison was done between the variables before and after the exam stress. A p value of <0.05 was considered statistically significant.

**Results**

A total of 70 students were included in our study. The mean age of presentation among males was 18.89±0.32 , females was 18.91±0.28 and combined was 18.90 ± 0.30 . The mean height of presentation among males was 170.43 ± 3.7 , females 157. 59+-5.44and combined was 164.16 ± 7.82. Mean weight among males was 60.97 ± 3.25 , females was 58.06 ± 5.59 and combined was 59.51 ± 4.77 .The mean body surface area of presention among males was 1.71 ±0.05 , females was 1.58 ±0.08 and combined was 1.65 ±0.09.

**Table 1:** Comparison of Mean physical parameters in male students, female students and combined study group.

| Physical parameter | Males (n=35) | Females (n=35) | Combined study group (n=70) |
|---|---|---|---|
| Age (years) | 18.89 ± 0.32 | 18.91 ± 0.28 | 18.90 ± 0.30 |
| Height (cm) | 170.43 ± 3.70 | 157.59+_ 5.44 | 164.16 ± 7.82 |
| Weight (kg) | 60.97 ± 3.25 | 58.06 ± 5.59 | 59.51 ± 4.77 |
| Body Surface Area ( Sqmt) | 1.71 ± 0.05 | 1.58 ± 0.08 | 1.65 ± 0.09 |

**Assessment of Sympathetic and Parasympathetic Nervous System**

**Table 2:** Comparison of Pulse rate in male students, female students and combined study group before and after examination stress.

| Pulse Rate PR | Mean ± S.D | | *t*- stat | *p*- value |
|---|---|---|---|---|
| | Before Examination Stress | After Examination Stress | | |

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| | | | | |
|---|---|---|---|---|
| Males (n=35) | 88.20 ± 5.42 | 72.69 ± 3.61 | 20.246 | *<0.05* |
| Females (n=35) | 88.63 ± 4.62 | 71.94 ± 3.77 | 19.086 | *<0.05* |
| Combined study group (n=70) | 88.41 ± 5 | 72.31 ± 3.69 | 27.695 | *<0.05* |

In above given table the mean value of pulse rate before examination stress in male students was 88.20 ± 5.42 beats / min and after examination was 72.69 ± 3.61 beats / min. In the female students the mean value of pulse rate before examination was 88.63 ± 4.62 beats / min and after examination was 71.94 ± 3.77 beats per minute. In combined students group the mean value of pulse rate before examination was 88.41 ± 5 beats per minute; and after examination was 72.31 ± 3.69 beats per minute. The increase in mean value of pulse rate before examination stress was found to be statistically significant (p<0.05> in all the three groups.

**Assessment of Sympathetic Nervous System**

**Table 3:** Comparison of Blood Pressure–SBP, DBP in male students, female students and combined study group before and after examination stress.

| | **Mean ± S.D** | | **t-stat** | **p-value** |
|---|---|---|---|---|
| **BP** | **Before Examination Stress** | **After Examination Stress** | | |
| **Systolic BP** | | | | |
| Males (n=35) | 124.63 ± 4.33 | 116.26 ±3.65 | 13.2 | *<0.05* |
| Females (n=35) | 123.17 ± 3.85 | 114.86 ±3.88 | 15.47 | *<0.05* |
| Combined study group (n=70) | 123.90 ± 4.13 | 115.56 ±3.81 | 20.22 | *<0.05* |
| **Diastolic BP** | | | | |
| Males (n=35) | 82.60 ± 2.77 | 77.80 ± 2.03 | 10.57 | *<0.05* |
| Females (n=35) | 81.34 ± 2.67 | 76.71 ± 2.78 | 8.508 | *<0.05* |
| Combined study group (n=70) | 81.97 ± 2.77 | 77.26 ± 2.48 | 13.4 | *<0.05* |

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In the above table the mean value of systolic Blood pressure in male students before examination stress was 124.63 ± 4.33 mm Hg and after examination stress 116.26 ± 3.65.. In female students the mean value of systolic blood pressure before examination stress was 123.17 ± 3.85 mm Hg. Considering the total group under the value of the mean systolic blood pressure before examination stress was 123.90 ± 4.13 mmHg and after examination was 115.56 ± 3.81 mmHg.. The change in the mean values of systolic blood pressure and diastolic blood pressure before and after examination stress was found to be significant statistically ($p<0.05$) in all the three groups.

In the study the mean value of diastolic blood pressure before examination stress in male students was 82.60 ± 2.77 mmHg. In the female students the mean value of diastolic blood pressure was 81.34 ± 2.67 before examination stress. Considering the total group of students under study the mean diastolic blood pressure value was 81.97 ± 2.77 before examination stress compared to 77.26 ± 2.48 which was the mean value of diastolic blood pressure after examination stress. The increase in diastolic blood pressure values in students was statistically significant.

**Assessment of Sympathetic Nervous System**

**Table 4:** Comparison of orthostasis (Difference in Systolic Blood Pressure in response to change in position from supine to standing) in male students, female students and combined study group before and after examination stress.

| **Difference in Systolic BP ( Orthostasis)** | **Mean ± S.D** | | **t-stat** | **p-value** |
|---|---|---|---|---|
| | **Before Examination Stress** | **After Examination Stress** | | |
| Males (n=35) | 7.71± 4.12 | 6.80 ± 1.47 | 1.207 | .236 |
| Females (n=35) | 5.29 ± 2.70 | 6.09 ± 2.06 | -1.525 | .137 |
| Combined study group (n=70) | 6.50 ± 3.67 | 6.44 ± 1.81 | .122 | .903 |

In the given table, the change in mean value of systolic blood pressure during orthostasis before examination stress was 7.71 ± 4.12 mmHg in male, 5.29 ± 2.70mmHg in females and 6.50 ± 3.67 in the combined study group. The change in mean value of systolic blood pressure during orthostasis after examination period was 6.80 ± 1.4mmHg in males 6.09 ± 2.06 in females and 6.44 ± 1.81 in the combined group of students under study. The was no statistically significant change in the systolic blood pressure during orthostasis in students before examination in the presence study.

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**Assessment of Sympathetic Nervous System**

**Table 5:** Comparison of orthostasis ( Difference) in Diastolic Blood Pressure in response to change in position from supine to standing) in male students, female students and combined study group before and after examination stress.

| **Difference in Diastolic BP ( Orthostasis)** | **Mean ± S.D** | | **t-stat** | **p-value** |
|---|---|---|---|---|
| | **Before Examination Stress** | **After Examination Stress** | | |
| Males (n=35) | 8.57 ± 3.71 | 5.71 ± 1.69 | 5.015 | *<0.05* |
| Females (n=35) | 7.26 ± 3.73 | 5.26 ± 1.88 | 3.098 | *<0.05* |
| Combined study group (n=70) | 7.91 ± 3.75 | 5.49 ± 1.79 | 5.641 | *<0.05* |

In this table the change in the mean value of diastolic blood pressure during orthostasis before examination was 8.57 ± 3.71 mmHg, 7.26 ± 3.73 mmHg, 7.91 ± 3.75 mmHg in male students, female students and combined study group respectively. After examination the mean value of diastolic blood pressure were 5.71 ± 1.69 mmHg, 5.26 mmHg and 5.49 ± 1.79 mmHg in male students, female students and combined study group. The change was statistically significant.

**Assessment of Sympathetic Nervous System**

**Table 6:** Comparison of Systolic Blood Pressure during Mental Arithmetic Test in in male students, female students and combined study group before and after examination stress.

| **Mental Arithmetic Test Systolic BP** | **Mean ± S.D** | | **t-stat** | **p-value** |
|---|---|---|---|---|
| | **Before Examination Stress** | **After Examination Stress** | | |
| Males (n=35) | 135.26 ± 5.21 | 124.14 ± 3.57 | 16.95 | *<0.05* |

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| | | | | |
|---|---|---|---|---|
| Females (n=35) | 133.80 ± 5.56 | 123.37 ± 3.38 | 15.73 | *<0.05* |
| Combined study group (n=70) | 134.53 ± 5.40 | 123.76 ± 3.47 | 23.18 | *<0.05* |

In the above table the mean value of systolic blood pressure before examination stress during mental arithmetic test in male students was 135.26 ± 5.21 mmHg and after examination stress was 124.14 ± 3.57 mmHg.. The mean value of systolic blood pressure in female students before examination stress during mental arithmetic test 133.80 ± 5.56 mmHg and after examination stress in female students was 123.37 ± 3.47 mmHg. The mean value of combined group before and after examination was 134.53 ± 5.40 and 123.76 ± 3.4 respectively and the increase was statistically significant.

**Assessment of Sympathetic Nervous System**

**Table 7:** Comparison of Diastolic Blood Pressure during Mental Arithmetic Test in male students, female students and combined study group before and after examination stress.

| **MENTAL ARITHMETIC MEAN DIASTOLIC BP** | **Mean ± S.D** | | **t-stat** | **p-value** |
|---|---|---|---|---|
| | **Before Examination Stress** | **After Examination Stress** | | |
| Males (n=35) | 88.97 ± 2.66 | 82.37 ± 2.66 | 13.27 | *<0.05* |
| Females (n=35) | 88.17 ± 2.72 | 81.69 ± 2.58 | 11.23 | *<0.05* |
| Combined study group (n=70) | 88.57 ± 2.70 | 82.03 ± 2.62 | 17.29 | *<0.05* |

In this table the change in the mean value of diastolic blood pressure during orthostasis before examination was 8.57 ± 3.71 mmHg, 7.26 ± 3.73 mmHg, 7.91 ± 3.75 mmHg in male students, female students and combined study group respectively. After examination the mean value of diastolic blood pressure were 5.71 ± 1.69 mmHg, 5.26mmHg and 5.49 ± 1.79 mmHg in male students, female students and combined study group. The change was statistically significant.

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**Assessment of Parasympathetic Nervous System**

**Table 8:** Comparison of Heart rate response to difference in lying down and standing position in male students, female students and combined study group before and after examination stress.

| HR Response | Mean ± S.D | | t-stat | p-value |
|---|---|---|---|---|
| | Before Examination Stress | After Examination Stress | | |
| Males (n=35) | 15.40 ± 6.16 | 16.34 ± 6.84 | -1.432 | .161 |
| Females (n=35) | 13.23 ± 7.23 | 15.23 ± 6.92 | -3.821 | *<0.05* |
| Combined study group (n=70) | 14.31 ± 6.76 | 15.79 ± 6.85 | -3.484 | *<0.05* |

In the above given table heart rate response in male students before examination stress was 15.40 ± 6.16 after examination stress was 16.34 ± 6.84.. In female students before examination stress the heart rate response to difference in lying down and standing position was 13.23 ± 7.23 and after examination stress was 15.23 ± 6.92. Heart rate response in the combined study group had a mean value of 14.31 ± 6.76 before examination stress and a mean value of 15.79 ±6.85 after examination stress.

The change in the mean values of Heart rate response to posture before and after examination stress was found to be significant statistically ($p<0.05$) in female students and combine study group but not in male students.

**Assessment of Parasympathetic Nervous System**

**Table 9:** Comparison of Heart rate variability (HRV) in male students, female students and combined study group before and after examination stress.

| HEART RATE VARIABILITY HRV | Mean ± S.D | | t-stat | p-value |
|---|---|---|---|---|
| | Before Examination Stress | After Examination Stress | | |
| Males (n=35) | 7.17 ± 2.99 | 7.97 ± 3.08 | -2.503 | *<0.05* |

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| | | | | |
|---|---|---|---|---|
| Females (n=35) | 6.60 ± 2.90 | 7.31 ± 2.81 | -2.257 | *<0.05* |
| Combined study group (n=70) | 6.89 ± 2.94 | 7.64 ± 2.94 | -3.390 | *<0.05* |

In this table the heart rate variability was 7.17 ± 2.99, 6.60 ± 2.90, and 6.89 ± 2.94 in male students, female students and combined study group respectively before examination stress. After the examination stress the heart rate variability was 7.97 ± 3.08 , 7.31 ± 2.81 and 7.64 ± 2.94 in male students, female students and combined study group respectively. There is a decrease in heart rate variability due to examination stress in all male students, female students and the combined study group. This decrease was significant statistically.

**Assessment of Parasympathetic Nervous System**

**Table 10:** Comparison of Standing-Lying ratio of Heart rate in male students, female students and combined study group before and after examination stress.

| **Standing Lying Ratio** | **Mean ± S.D** | | **t-stat** | **p-value** |
|---|---|---|---|---|
| | **Before Examination Stress** | **After Examination Stress** | | |
| Males (n=35) | 1.02 ± 0.19 | 1.07 ± 0.21 | -1.266 | .214 |
| Females (n=35) | 1.03 ± 0.14 | 1.03 ± 0.11 | -.245 | .808 |
| Combined study group (n=70) | 1.02 ± 0.17 | 1.05 ± 0.16 | -1.256 | .213 |

In this table the standing lying ratio of heart rate before examination stress was 1.02 ± 0.19 , 1.03 ± 0.4 and 1.02 ± 0.17 in male students, female students and combined study group respectively. Whereas after the examination stress the standing lying ration of heart rate was 1.07 ± 0.21, 1.03 ± 0.11 and 1.05 ± 0.16 in male students, female students and combined study group respectively.

The change in the mean value of standing lying ratio of heart rate was not significant statistically in male students,female students and combined study group.

**Discussion**

Stress is a condition that puts mind in a state of fear or anxiety. Stressors can be physical conditions such as heat or inflammation, exercise etc. or psychological like examination, interview, etc **. (Sharma R *et al.*, 2006).** Pre-examination stress is one of the most widely suffered problems in medical

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students throughout the world. Acute stress challenge causes altered cortisol secretion and cardiovascular response ( ***Loft P,*** **etal 2007).**

First Year Medical students are at more stress as they are exposed to professional course first time in their life with a lot of expectation ( **Kharche JS *et al.*, 2012).** The students of 1 st year M.B.B.S probably face major stress especially during the 1 st term credit examination ( **Malathi, A *et al.*, 1992).** The examination inducted stress affects the performance of students adversely **( Tilwani M. 2021).**

**Pulse Rate**

In the present study the mean value of pulse rate before examination stress in male students was 88.20 ± 5.42 beats / min and after examination was 72.69 ± 3.61 beats / min. There was an increase in pulse rate before examination stress and the change was statistically significant. In the female students the mean value of pulse rate before examination was 88.63 ± 4.62 beats / min and after examination was 71.94 ± 3.77 beats per minute. There was an increase in pulse rate and the change was statistically significant. In combined students group the mean value of pulse rate before examination was 88.41 ± 5 beats per minute; and after examination was 72.31 ± 3.69 beats per minute. There was increase in pulse rate before examination and the change was statistically significant.

Similar findings are consistent with **Shah SJ *et al.*, (2014)** , **Tokaeva LK *et al.*, (2012) Fejes I *et al.*, (2020)**

**Blood Pressure**

**Systolic Blood Pressure**

In the present study the mean value of systolic Blood pressure in male students before examination stress was 124.63 ± 4.33 mm Hg and after examination stress 116.26 ± 3.65. There was an increase in systolic blood pressure before examination stress and the change was statistically significant. In female students the mean value of systolic blood pressure before examination stress was 123.17 ± 3.85 mm Hg. There was an increase in systolic blood pressure in female students before examination stress and the change was statistically significant. Considering the total group under study the value of the mean systolic blood pressure before examination stress was 123.90 ± 4.13 mmHg and after examination was 115.56 ± 3.81 mmHg. There was increase in systolic blood pressure before examination stress and the change was statistically significant. Similar findings were reported by **Tokaeva LK *et al.*, (2012)** , **FejesI *et al.*, (2020)** , **Shah SJ *et al.*, (2012)** , **Nair DR *et al.*, (2020)**, **Taskin S (2021)** .

**Diastolic Blood Pressure**

In the present study the mean value of diastolic blood pressure before examination stress in male students was 82.60 ± 2.77 mmHg. There was an increase in diastolic blood pressure before examination stress and the change was statistically significant. In the female students the mean value of diastolic blood pressure was 81.34 ± 2.67 before examination stress and this increase in diastolic blood pressure was statistically significant.

Considering the total group of students under study the mean diastolic blood pressure value was 81.97 ± 2.77 before examination stress compared to 77.26 ± 2.48 which was the mean value of diastolic blood pressure after examination stress. The increase in diastolic blood pressure values in students was statistically significant.

Similar findings were reported by **Shah SJ *et al.*, (2012)** , **Tokaeva LK *et al.*, (2012)**

, **Nair DR *et al.*, (2020)** , **Taskin S (2021)**

**ORTHOSTASIS BLOOD PRESSURE**

Orthostatic hypotension, most often defined as systolic blood pressure fall greater than 30mmHg upon standing, is caused mainly by gravity and lack of increase in peripheral vascular resistance upon standing up, due to dysfunction of sympathetic vasoconstrictor nerves **( Hilsted J, 1983).**

**Change in systolic blood pressure**

In the present study the change in mean value of systolic blood pressure during orthostasis before examination stress was 7.71 ± 4.12 mmHg in male, 5.29 ± 2.70mmHg in females and 6.50 ± 3.67 in combined study group.

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The change in mean value of systolic blood pressure during orthostasis after examination period was 6.80 ± 1.4mmHg in males 6.09 ± 2.06 in females and 6.44 ± 1.81 in combined group of students under study. The was no statistically significant change in the systolic blood pressure during orthostasis in students before examination in the presence study.

**Change in Diastolic Blood Pressure**

In the present study the change in the mean value of diastolic blood pressure during orthostasis before examination was 8.57 ± 3.71 mmHg, 7.26 ± 3.73 mmHg, 7.91 ± 3.75 mmHg in male students, female students and combined study group respectively. After examination the mean value of diastolic blood pressure were 5.71 ± 1.69 mmHg, 5.26mmHg and 5.49 ± 1.79 mmHg in males students female students and combined study group. The change was statistically significant.

**Sharma M *et al.*, (2014) , Fejes I *et al.*, (2020) a** lso reported similar findings that both systolic and diastolic pressure during orthostasis increase in examination stress.

**Mental Arithmetic Test**

Blood pressure was recorded before and after examination stress when the subject was made to solve some mathematical problems like multiplication problem.

**Systolic Blood Pressure during mental arithmetic test**

In the presence study the mean value of systolic blood pressure before examination stress during mental arithmetic test in male students was 135.26 ± 5.21 mmHg and after examination stress was 124.14 ± 3.57mmHg. The increase in systolic blood pressure before examination stress in males was statistically significant. The mean value of systolic blood pressure in female students before examination stress during mental arithmetic test 133.80 ± 5.56 mmHg and after examination stress in female students was 123.37 ± 3.47 mmHg. There was an increase in mean systolic blood pressure in female students before examination stress during mental arithmetic test and the increase was statistically significant.

**Diastolic blood pressure during mental arithmetic test**

In the present study the mean value of diastolic blood pressure during mental arithmetic test in before examination stress in male students was 88.97 ± 2.66 mmHg and after examination stress was 82.37 ± 2.66 mmHg. A statistically significant increase in diastolic blood pressure in male students during mental arithmetic test before examination stress was observed. The mean value of diastolic blood pressure during mental arithmetic mean test in female students before examination stress was 88.17 ± 2.72 mmHg. Whereas after examination it was 81.69 ± 2.58 mmHg. There was an increase in diastolic blood pressure during mental arithmetic test before examination in female students and this increase was statistically significant. In the combined study group the diastolic blood pressure during the mental arithmetic test before examination had mean values of 88.57 ± 2.70 and after examination the mean value of 82.03 ± 2.62 mmHg. There was an increase in diastolic blood pressure during a mental arithmetic test in the combined study group before examination stress and the increase was statistically significant.

**Srinivasan K *et al.*, (2006)** also found similar results in their study.

**Heart Rate Response**

Heart rate is determined predominantly by parasympathetic activity changing from supine to erect position causes an increase in heart rate **( Mcleod JG *et al.*, 1987).** In present study heart rate response in male students before examination stress was 15.40 ± 6.16 after examination stress was 16.34 ± 6.84. The change was not significant. In female students before examination stress the heart rate response to difference in lying down and standing position was 13.23 ± 7.23 and after examination stress was 15.23 ± 6.92. The change was statistically significant. Heart rate response in the combined study group had a mean value of 14.31 ± 6.76 before examination stress and a mean value of 15.79 ±6.85 after examination stress.

**Heart Rate Variability**

Heart rate variability is mainly determined by the parasympathetic influence on the sinus node, this is

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able to cause fast beat to beat jumps in sinus rhythm **(Karemaker JM, 2015).** It is now considered as an important tool to assess the influence of resting autonomic tone on cardiovascular system **( Sharma RK *et al.*, 2004).** In present study heart rate variability was 7.17 ± 2.99, 6.60 ± 2.90, and 6.89 ± 2.94 in male students female students and combined study group respectively before examination stress. After the examination stress the heart rate variability was 7.97 ± 3.08, 7.31 ± 2.81 and 7.64 ± 2.94 in males students, female students and combined study group respectively. There is decrease in heart rate variability due to examination stress in all male students, female students and the combined study group. This decrease was significant statistically. Similar findings were reported by study of **Hammound S *et al.*, (2019) .**

**Standing Lying Ratio Of Heart Rate**

Standing lying ratio of heart rate was calculated as the ratio of the longest R-R interval during 5 beats before lying down to the shortest interval during 10 beats after lying down. This parameter is a measure of cardiac vagal function **( Hilsted J, 1983).** In the present study the standing lying ratio of heart rate before examination stress was 1.02 ± 0.19 , 1.03 ± 0.4 and 1.02 ± 0.17 in male students, female students and combined study group respectively. Whereas after the examination stress the standing lying ration of heart rate was 1.07 ± 0.21, 1.03 ± 0.11 and 1.05 ± 0.16 in male students, female students and combined study group respectively.

The change in the mean value of standing lying ratio of heart rate was not significant statistically in male students,female students and combined study group.

**Sharma M *et al.*, (2014)** also found that standing lying ratio heart rate was not changed due to examination stress.

**Conclusion**

From our study, it can be concluded that there is statistically significant change in sympathetic and parasympathetic system due to examination stress.To overcome the examination stress in medical students, relaxation techniques like meditation, yoga, deep-breathing exercises, appropriate healthy diet and physical exercises can be recommended. Counselling Sessions could be provided to overcome stress. The present study will help.

a) In designing effective prevention and intervention strategies for stress management, and
b) To achieve better academic performance of students which can influence the quality of patient care in medical students future professional life.

**Limitations of present study** :

The present study has used only non-invasive methods for assessing activity of autonomic nervous system in times of examination stress. The data was restricted to cardio-vascular autonomic activity.

Other sources of stress such as familial or interpersonal problems were not examined. Biochemical parameters of stress such Plasma or salivary cortisol was not measured. This study can be done on a larger platform with bigger sample size using hormonal assays which would allow a better evaluation and obtaining a more reliable and accurate conclusion.

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