

Heart Rate Variability During Practical Examination Among 1st Year Medical Students of Medical College in South IndiaS. Selva Kumar¹, G. Radhika², K. Sarala³, G. Shravya Keeethi⁴,
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Conflict of interest: Nil

Abstract:**Introduction:** Stressors such as examination, cause an increase in sympathetic activity of the nervous system innervating the heart, and thus an increase in heart rate. Our study aimed to detect changes in heart rate variability (HRV) during an exam in a group of healthy medical students.**Methodology:** Cross-sectional study was conducted in GMC-Anantapuramu among 1st year medical students to compare HRV during and after practical examination. Convenient sample of 50 healthy students were enrolled in the study. Spandan ECG portable Device was used for the recording of the 5-minute Lead II HRV test. Institutional ethics committee approval obtained prior to study.**Statistics:** Data collected was entered into MS Excel and analysis was done using SPSS version 25, Descriptive statistics were presented using mean and standard deviation, Paired sample t test was used to test difference between two groups (During exams & After exams), correlation was done. P value <0.05 was considered to be statistically significant.**Results:** (mean age-19.42 with SD +/-0.992). Significant difference was observed in Low frequency /High frequency (LF/HF) ratio during exam and after exams (1.17+0.29 vs 0.96+0.15; p<0.0001) on paired sample t test. A positive correlation was found between female gender and Heart rate during exams as compared to male gender. RMSSD (Root Mean Square of Successive Differences) was higher in males during exams. A positive correlation was found between female and LF/HF ratio after exams (co-relation coefficient r=0.321) p Value=0.023.**Conclusion:** HRV was significantly high after the exam, indicating release from stress, as compared during the examination when stress was observable. Results also suggest that HRV in females is significantly lower than that in males after examination. In conclusion, the results of our study assessing stress in real-time examination show important gender differences, and lack of adaptation with academic study year.**Keywords:** HRV., LF/HF.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Heart rate variability (HRV) is a promising tool for assessing cardiovascular health and the degree of severity of cardiovascular diseases. It is a non-invasive and valuable method to assess autonomic functioning of the heart from a simple electrocardiogram (ECG) recording.

HRV is manifested by the variability in R-R intervals of successive heart beats, which reflects the sympathetic and parasympathetic activity of the

autonomic nervous system (ANS) innervating the heart.

Upon a mental stressor, the ANS balance of the body is disrupted, leading to an increase in the sympathetic activity and a decrease in the vagal activity of the heart.

Medical Students in 1st year generally pass through a stressful period during the examination time; the

main goal of this research was to study the changes in HR and HRV parameters, which reflect stress levels among university students just before, and after the exam takes place; subsequently, another aim was to assess such HRV changes based on gender.

Aim: To compare the ANS response, represented by HRV parameters, among 1st year medical students.

Objective: To demonstrate the difference in HRV during and after an exam among 1st year medical students.

Methods

Institutional ethics committee approval obtained prior to study. Convenient sample of 50 healthy students (mean age -19.42 with SD \pm 0.992) were enrolled in the study. Cross-sectional study was conducted in GMC Anantapuramu-Andhra Pradesh among 1st year medical students.

Inclusion criteria: Medical Students studying in 1st year, healthy, disease free and not under treatment with any drug or supplements.

Exclusion criteria: Comprised individuals with cardiovascular diseases, subjects suffering from severe tachycardia.

Study Procedure: Participants were asked to be present at the laboratory one hour in advance of their examination time for anthropometric measurements.

Students were explained about the study and procedure of recording HRV. Students signed the informed consent, then Spandan ECG portable Device was connected by the use of three lead cable electrodes, which were placed on the right arm, left arm and left foot to record 5-minute Lead II HRV test

Materials

Spandan smartphone-based portable ECG device developed by Sunfox Technologies Pvt. Ltd-India was used for recording lead II-based HRV test for a duration of a minimum of 5 minutes as recommended by the American Heart Association. Spandan ECG provides the HRV parameters in both the Time domain and frequency domain.

Statistics: Data collected was entered into MS-Excel and analysis was done using SPSS version 25, Descriptive statistics were presented using mean and standard deviation, Paired sample T test was used to test difference between two groups (During exams & After exams) P value was 0.05, Which was considered to be statistically significant.

Results

Significant difference were observed in LF/HF ratio during exam and after exams ($P < 0.0001$) on paired sample T test. During exam mean LF/HF (1.17 \pm 0.296) vs After exam mean LF/HF (0.96 \pm 0.15). A positive co-relation was found between female gender HR during exams as compared to male gender. RMSDDN was higher in males during exams. A positive co-relation was found between female and LF/HF ratio after exams (co-relation coefficient $R = 0.321$) P Value -0.023

Results

SOCIODEMOGRAPHIC DETAILS OF STUDY POPULATION:

- Mean age of study population was 19.43 ± 0.98 years

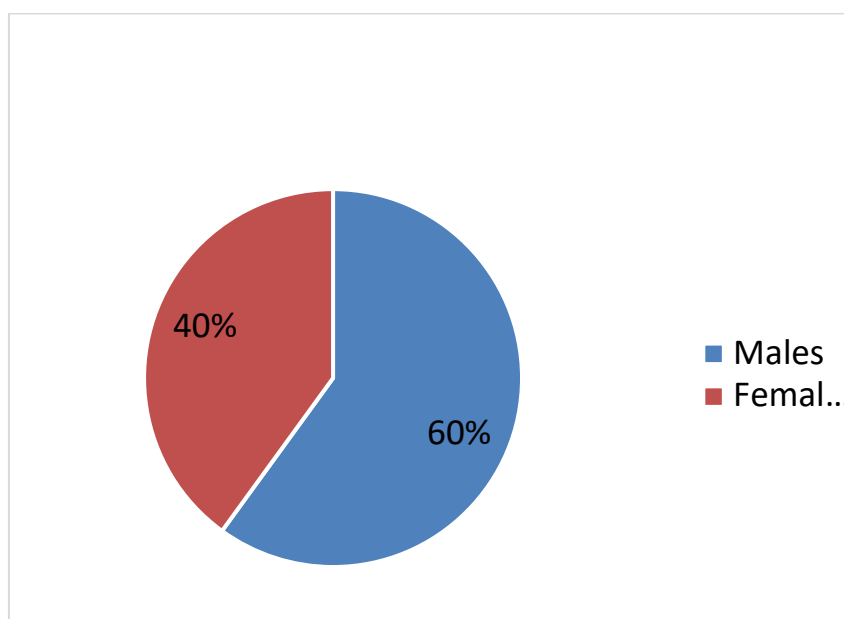


Figure 1: Distribution of Study subjects based on gender

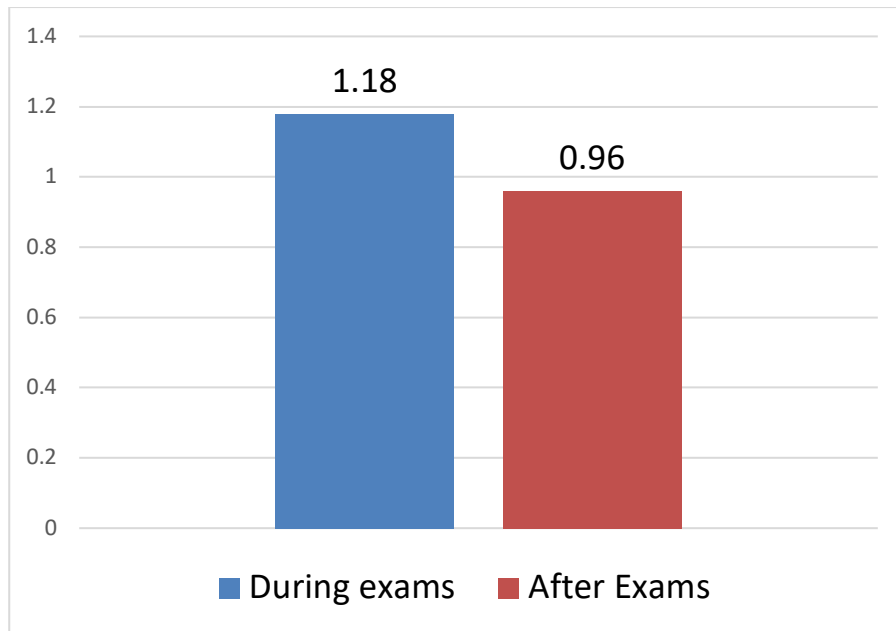


Figure 2: LF/HF Ratio During and After Exams

➤ A paired sample t test showed high LF/HF ratio during exams (mean =1.18, SD =0.29) compared to After exams (mean = 0.96, SD=0.15, t=4.68, p<0.0001, df=49)

Table 1 : Paired sample t-test of parameters of heart rate variability during and after exams

S.no	Parameter	During exams	After exams	t value	p value
1	Heart rate	90.68 ± 9.67	91.22 ± 8.81	-0.303	0.76
2	LF/HF ratio	1.18 ± 0.29	0.96 ± 0.15	4.678	<0.0001
3	SDANN	21.10 ± 13.87	24.03 ± 15.41	0.977	0.33
4	SDDN	31.47 ± 22.3	30.31 ± 15.37	0.301	0.76
5	RMSDDN	27.25 ± 30.30	22.01 ± 18.75	1.017	0.31
6	NN 50	0.0094 ± 0.01	0.0086 ± 0.01	0.291	0.77
7	RR	7.98 ± 1.06	8.12 ± 0.94	-0.653	0.517

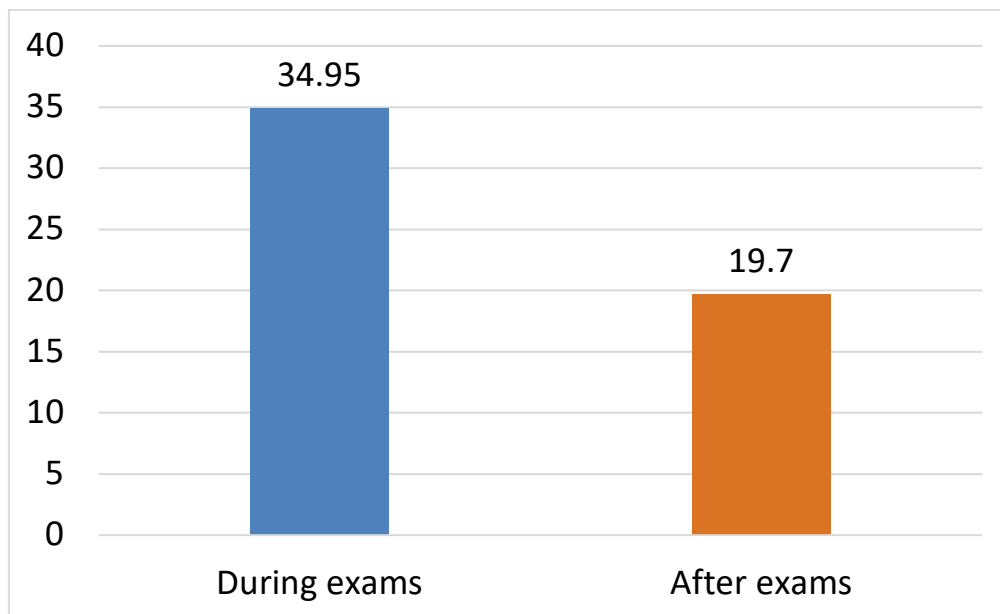


Figure 3: RMSSDN in males during and after exams

➤ A paired sample t test showed high RMSSD in in males during exams (mean =34.95, SD =36.9) compared to After exams (mean =19.7, SD=15.5, t=2.08, p=0.042, df=29)

Discussion

The goal of this research was to study the changes in HRV parameters, which reflect stress levels among 1st year medical students during, and after the exam; subsequently, another aim was to assess such HRV changes based on gender.

Conclusions

Stress levels were highest during the exam, indicated by a decrease in HRV, as opposed to the relaxation period after the exam. During the stress stimulant, components of the sympathetic nervous system increased as shown by an increase in LF and the LF/HF ratio. Females present higher HR during exams compared to males, and low HRV after exams thus are more prone to stress related to outcome. Males show higher parasympathetic activity indicated by increase in RMSDDN during exams. The results of our study assessing stress in real-time examination show important gender differences, and lack of adaptation with academic study year.

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