

Research Article

Examination Stress and Its Correlation with Blood Pressure, Pulse Rate and Respiratory Rate in First-Year Mbbs Students

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ABSTRACT

Background: Examination stress is a common acute psychological stressor in medical education. It can activate autonomic and neuroendocrine pathways and produce measurable changes in cardiovascular and respiratory function. First-year MBBS students are exposed to a major transition in academic workload and repeated examinations.

Methods: A hospital-based cross-sectional observational study was conducted in the Department of Physiology, Shyam Shah Medical College, Rewa, during April 2024 to June 2025. Two hundred first-year MBBS students were included. Stress was assessed using the 40-item Medical Student Stressor Questionnaire (MSSQ). Blood pressure, heart rate and respiratory rate were recorded using standardized procedures. The results presented in the thesis compare measurements 15 days before examination with those obtained 30 minutes before examination.

Results: Of 200 participants, 91 (45.5%) had slight stress and 109 (54.5%) had moderate stress. No participant was classified as having no stress or high/extreme stress. SBP >120 mmHg increased from 73.5% to 100%, DBP >80 mmHg from 77.0% to 97.0%, heart rate >80 bpm from 76.5% to 100%, and respiratory rate >16/min from 77.0% to 91.5%. Mean SBP increased from 119.72 ± 14.06 to 144.88 ± 9.10 mmHg, DBP from 78.71 ± 9.13 to 89.61 ± 6.03 mmHg, heart rate from 79.31 ± 10.10 to 96.50 ± 7.39 bpm, and respiratory rate from 16.72 ± 2.78 to 18.94 ± 2.05 /min; all reported comparisons were $p < 0.001$.

Conclusion: Examination-related stress was associated with significant acute cardiovascular and respiratory changes. The findings support early recognition of examination stress and institution-based stress-management strategies.

Keywords: Examination Stress, Medical Students, MBBS, Blood Pressure, Pulse Rate, Respiratory Rate, MSSQ, Sympathetic Activation, Academic Stress.

Highlights

- All 200 participants reported at least slight or moderate stress.
- Moderate stress was the predominant category (54.5%).
- All participants had SBP >120 mmHg and heart rate >80 bpm at 30 minutes before examination.
- Mean SBP, DBP, heart rate and respiratory rate all increased significantly ($p < 0.001$).

INTRODUCTION

Medical education requires sustained attention, memorization, clinical reasoning, practical learning and repeated assessment. The first year of MBBS represents a major transition from school-level education to professional education. The thesis describes this transition as an important background for psychological

stress, particularly when students approach university examinations.

Stress is a physiological and psychological response to a perceived demand or threat. In acute situations, the body activates the sympathetic nervous system and hypothalamic-pituitary-adrenal axis. Sympathetic activation increases cardiac

activity and vascular tone, while neuroendocrine responses support the immediate adaptation to stress.

Examination stress is a specific academic stressor. Anticipation of examination performance, fear of failure, extensive syllabus, uncertainty about results and comparison with peers may increase arousal. Such arousal may be reflected in objective parameters such as heart rate, blood pressure and respiratory rate. The thesis literature review emphasizes that examination stress is not merely a subjective emotional experience. It can have measurable effects on cardiovascular and respiratory parameters. This makes physiological measurement useful as an adjunct to questionnaire-based assessment.

Rationale of the Study

A major strength of evaluating examination stress is the possibility of comparing the same physiological parameters at different stages of the examination cycle. An earlier measurement can provide a reference point, while a measurement shortly before the examination can capture anticipatory acute stress. The present study therefore evaluates the change in physiological parameters and documents the distribution of perceived stress among first-year MBBS students.

Research Question

Does examination-related stress among first-year MBBS students coincide with measurable changes in blood pressure, heart rate and respiratory rate as the examination approaches?

Aim

To evaluate the impact of examination-related stress on physiological parameters—blood pressure, pulse rate and respiratory rate—among first-year MBBS students.

Objectives

1. To assess the psychological impact of examination-related stress among first-year medical students.
2. To evaluate the well-being of first-year MBBS students during the examination period.
3. To identify and analyze coping and stress-related factors described in the study protocol.
4. To examine the relationship between stress and physiological parameters.

5. To determine the effects of examination stress on blood pressure, pulse rate and respiratory rate.
6. To estimate the prevalence and level of stress among first-year MBBS students.
7. To compare physiological and psychological stress responses across demographic groups where supported by the available dataset.

REVIEW OF LITERATURE

Medical Education and Examination Stress

Medical education is academically demanding, and first-year MBBS students may experience substantial stress during the transition to professional education. The thesis describes examination stress as an acute psychological stressor capable of activating sympathetic and hypothalamic–pituitary–adrenal pathways, with measurable effects on cardiovascular and respiratory function.

Physiological response to examination stress

Acute stress increases sympathetic activity, which can raise heart rate, cardiac output and vascular tone. Consequently, systolic and diastolic blood pressure may rise. Respiratory rate may also increase as part of generalized autonomic arousal. Blood pressure, heart rate and respiratory rate therefore provide objective physiological markers that complement questionnaire-based assessment.

Previous evidence

Studies cited in the thesis have reported increased blood pressure and pulse rate during examination periods. Kharche et al. observed significant increases in systolic and diastolic blood pressure among first-year MBBS students, while Majeed et al. reported increases in blood pressure and pulse rate during the pre-examination period. Thimmappa et al. described mild-to-moderate stress and increases in cardiovascular parameters, and Sen and Baruah reported increased pulse rate and blood pressure before examinations. The thesis also cites evidence of increased respiratory rate and sympathetic activation during acute stress.

Stress level and medical-student well-being

The thesis literature indicates that academic workload, examination frequency, competition, career concerns, sleep disturbance and coping patterns can contribute to medical-student stress. Most studies reviewed reported mild-to-moderate stress rather than extreme stress. Some literature also suggests differences in physiological responses between male and female students; however, the present

manuscript does not make gender-specific inferential claims because complete stratified statistical results were not available in the principal results.

Study gap and relevance

The present study adds to this literature by assessing psychological stress together with systolic blood pressure, diastolic blood pressure, heart rate and respiratory rate in 200 first-year MBBS students and comparing examination-related measurements at two reported time points. This provides an integrated view of anticipatory physiological stress as the examination approaches.

Conceptual framework

Examination pressure → perceived psychological stress → sympathetic/neuroendocrine activation → increased cardiovascular and respiratory activity. Individual and demographic factors may modify this response.

The literature review was intentionally shortened for the publication manuscript while retaining the principal studies and concepts documented in the thesis.

MATERIALS AND METHODS - I

Study Design

The source thesis describes the work as a hospital-based, cross-sectional observational study conducted in the Department of Physiology, Shyam Shah Medical College, Rewa, from April 2024 to June 2025.

Study Variables

Domain	Variables
Demographic	Age, sex, residence, birth order, family type, medical professional in family
Psychological	MSSQ stress score/category
Cardiovascular	SBP, DBP, heart rate
Respiratory	Respiratory rate

MATERIALS AND METHODS – II

Physiological Measurements

Pulse Rate

Pulse rate was measured by palpating the radial artery and counting beats for one complete minute using a stopwatch. The value was recorded as beats per minute.

Respiratory Rate

Respiratory rate was assessed by observing chest movements for one complete minute. The thesis notes that counting was performed discreetly to minimize voluntary alteration of breathing.

Blood Pressure

Study Population

The study population comprised first-year MBBS students of Shyam Shah Medical College, Rewa. The thesis reports an approximate sample of 200 students, and the results presented in the master data and comparative tables include 200 participants.

Eligibility

Inclusion Criteria

- First-year MBBS students in the 18–25-year age group.
- Students who provided written informed consent.
- Students present and available during the study period.

Exclusion Criteria

- Known history of smoking and hypertension.
- Personal or family history of psychiatric illness or significant mental stress.
- Students currently undergoing treatment for a psychiatric disorder.

Ethical Considerations

Institutional Ethics Committee approval was obtained before initiation of the study. Written informed consent was obtained from participants. The study procedures and their purpose were explained to participants.

Blood pressure was measured over the right brachial artery using a mercury sphygmomanometer. The cuff was applied above the cubital fossa and the manometer was kept at heart level. Systolic pressure was initially assessed by palpatory method followed by auscultatory recording of systolic and diastolic pressures.

Standardization

Measurements were performed in the sitting position after a period of quiet rest. The thesis describes morning measurements in a quiet environment and two readings separated by

five minutes, with the average used to improve measurement reliability.

Stress Questionnaire

The thesis used the Medical Student Stressor Questionnaire (MSSQ). The instrument contains

40 items covering sources of stress in college life. Each item is rated from no stress to extreme stress. The study's reported total-score categories were: 0–40 no stress, 41–80 slight stress, 81–120 moderate stress, and 121–160 high/extreme stress.

Category	Score range	Interpretation
No stress	0–40	No perceived stress
Slight stress	41–80	Mild level
Moderate stress	81–120	Moderate level
High/Extreme stress	121–160	High or extreme level

Data Collection

The thesis methods section contains an internal timing inconsistency: one methods description states three months before and one week before examination, while the principal results tables and summary compare 15 days before and 30 minutes before examination. Because the requested paper is based on the reported results, the 15-day versus 30-minute comparison is used throughout this manuscript. The original study protocol and raw records should be checked before submission.

Statistical Presentation

The thesis reports statistically significant differences in SBP, DBP, heart rate and respiratory rate, with $p < 0.001$ for each comparison. The manuscript therefore presents these as statistically significant pre-examination changes.

Important Interpretation Point

The original thesis title contains the term 'correlation'. However, the reported comparative table provides mean values at two time points and p-values; correlation coefficients are not shown in the results used here. Accordingly, this manuscript describes the principal analysis as a comparison of physiological parameters rather than claiming a Pearson or Spearman correlation that is not documented.

MATERIALS AND METHODS – III

Data Management and Statistical Approach

Data Management

Collected information was entered into a computerized data catalogue for analysis. Demographic characteristics were summarized using frequency and percentage. Continuous physiological measurements were summarized using mean and standard deviation.

Flow of Study

Stage	Activity
1	Identify eligible first-year MBBS students
2	Obtain informed consent
3	Record demographic information
4	Assess stress using MSSQ
5	Measure SBP, DBP, heart rate and respiratory rate
6	Repeat/compare examination-related measurements
7	Enter and analyze data
8	Interpret physiological response

Quality Considerations

- Use of standardized clinical instruments.
- Quiet resting conditions before measurements.
- Repeated blood pressure measurements with averaging.
- Use of a structured questionnaire.
- Consistent physiological variables across assessment points.

RESULTS – I:

Demographic Characteristics

Variable	N	%
Age 18–20 years	130	65.0

Age 21–23 years	56	28.0
Age 23–25 years	14	7.0
Male	136	68.0
Female	64	32.0
Urban	125	62.5
Rural	75	37.5
First born	102	51.0
Second born	88	44.0
Third born	10	5.0
Nuclear family	132	66.0
Joint family	68	34.0
Medical family member: Yes	10	5.0
Medical family member: No	190	95.0

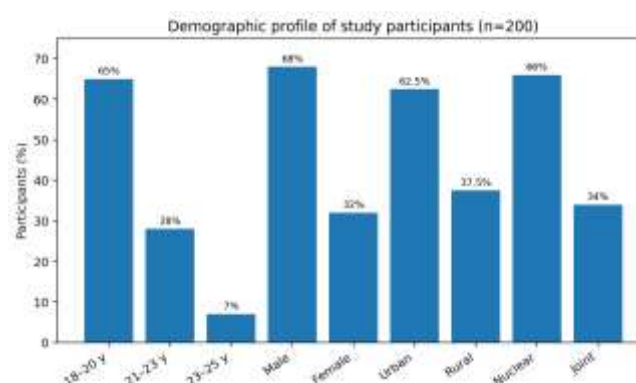


Figure 1. Demographic Profile of the Study Population.

The population was predominantly young: 65% were 18–20 years old. Males represented 68% and females 32%. Urban students constituted 62.5% and rural students 37.5%. First-born students constituted 51%, and 66% belonged to nuclear families.

Ninety-five percent of students had no family member in the medical field. The thesis interprets this as a predominance of first-generation medical learners, although the current study does not directly assess the effect of family medical background on physiological stress.

RESULTS – II

Stress Distribution

Stress Category	Score	N	%
No Stress	0–40	0	0
Slight Stress	41–80	91	45.5
Moderate Stress	81–120	109	54.5
High/Extreme Stress	121–160	0	0

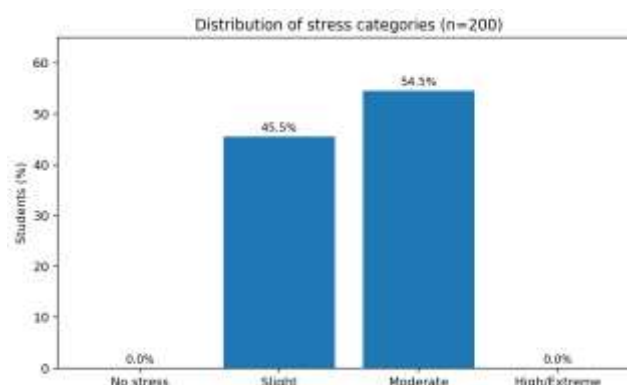


Figure 2. Distribution of MSSQ Stress Categories

Interpretation

The largest group was the moderate-stress category, comprising 109 students (54.5%). Slight stress was present in 91 students (45.5%). No participant was categorized as having no stress or high/extreme stress. Thus, the study population showed a concentration of perceived stress in the slight-to-moderate range. The thesis compares this distribution with previous studies that also reported predominance of mild-to-moderate stress among medical students.

Clinical Interpretation

The absence of high/extreme questionnaire scores should not be interpreted as absence of physiological stress. The physiological results demonstrate substantial cardiovascular and respiratory activation close to the examination, indicating that perceived stress and physiological arousal can coexist even when questionnaire categories remain within mild-to-moderate ranges.

RESULTS – III

Physiological Stress Thresholds

Parameter	15 Days Before N (%)	30 Min Before N (%)	Absolute Increase In Proportion
SBP >120 Mmhg	147 (73.5)	200 (100.0)	26.5 Percentage Points
DBP >80 Mmhg	154 (77.0)	194 (97.0)	20.0 Percentage Points
Heart Rate >80 Bpm	153 (76.5)	200 (100.0)	23.5 Percentage Points
Respiratory Rate >16/Min	154 (77.0)	183 (91.5)	14.5 Percentage Points

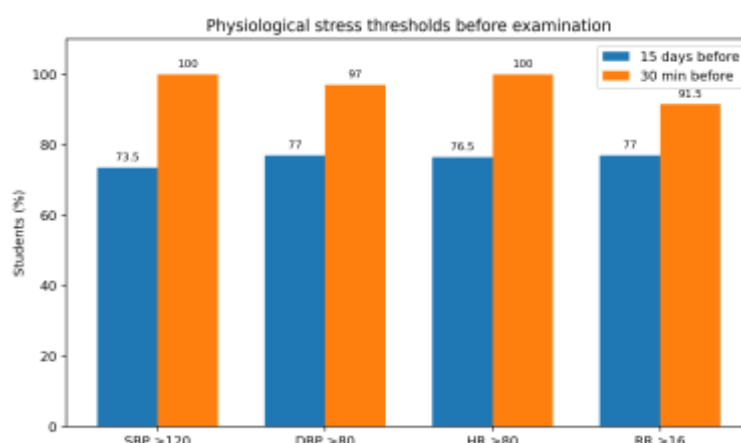


Figure 3. Comparison of Physiological Threshold Categories at the Two Examination-Related Time Points.

At 15 days before examination, elevated values were already common: SBP >120 mmHg occurred in 73.5%, DBP >80 mmHg in 77%, heart rate >80 bpm in 76.5%, and respiratory rate >16/min in 77%.

Thirty minutes before examination, the proportion increased to 100% for SBP and heart rate, 97% for DBP, and 91.5% for respiratory rate. The largest proportional shift was therefore observed in systolic pressure and heart rate.

RESULTS – IV

Mean Physiological Values

Parameter	15 Days Before Mean $\pm$ SD	30 Min Before Mean $\pm$ SD	P-Value	Absolute Change
SBP (Mmhg)	119.72 $\pm$ 14.06	144.88 $\pm$ 9.10	<0.001	+25.16
DBP (Mmhg)	78.71 $\pm$ 9.13	89.61 $\pm$ 6.03	<0.001	+10.90
Heart Rate (Bpm)	79.31 $\pm$ 10.10	96.50 $\pm$ 7.39	<0.001	+17.19
Respiratory Rate (/Min)	16.72 $\pm$ 2.78	18.94 $\pm$ 2.05	<0.001	+2.22

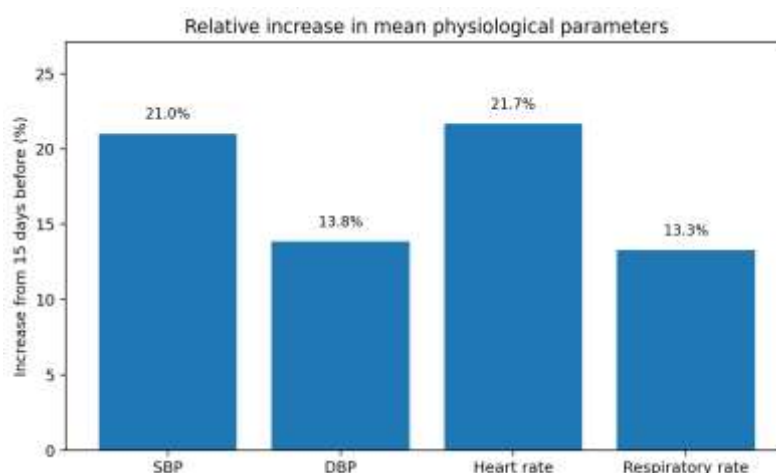


Figure 4. Relative Increase in Mean Physiological Parameters.

The mean SBP increased by 25.16 mmHg, approximately 21.0% relative to the earlier mean. Mean DBP increased by 10.90 mmHg, approximately 13.8%. Heart rate increased by 17.19 bpm, approximately 21.7%, while respiratory rate increased by 2.22/min, approximately 13.3%.

All four reported comparisons were statistically significant at $p < 0.001$. The direction of change was consistent across cardiovascular and respiratory variables, supporting the thesis interpretation of an acute anticipatory stress response.

RESULTS – V

Integrated Findings

Summary of Major Findings

- The study included 200 first-year MBBS students.
- Most participants were 18–20 years old.
- Males constituted 68% and females 32%.
- Urban students constituted 62.5%.
- Moderate stress was present in 54.5%; slight stress in 45.5%.
- No student was classified as having no stress or high/extreme stress.
- SBP >120 mmHg increased from 73.5% to 100%.
- DBP >80 mmHg increased from 77.0% to 97.0%.
- Heart rate >80 bpm increased from 76.5% to 100%.
- Respiratory rate >16/min increased from 77.0% to 91.5%.
- All mean physiological parameters increased significantly with $p < 0.001$.

Integrated Interpretation

The combined findings demonstrate that the approach of an examination was associated with increasing physiological activation.

Importantly, elevated values were already present at the earlier assessment point, suggesting that examination-related anticipation may begin well before the examination itself.

The greatest acute changes occurred close to the examination. This temporal pattern is consistent with the concept of anticipatory stress and heightened sympathetic arousal.

What the Data Establish

The data establish a significant difference between the two reported examination-related measurement points. They do not, from the presented results alone, establish a causal relationship between an MSSQ score and an individual physiological parameter, nor do they demonstrate long-term cardiovascular effects.

DISCUSSION – I

The present study provides evidence that examination-related stress among first-year MBBS students is accompanied by measurable cardiovascular and respiratory changes. The most striking result is the consistency of the direction of change: SBP, DBP, heart rate and respiratory rate all increased as the examination approached.

Blood Pressure Response

Mean SBP increased from 119.72 to 144.88 mmHg. This represents an absolute increase of 25.16 mmHg. Mean DBP increased from 78.71 to 89.61 mmHg. The simultaneous increase in systolic and diastolic pressure suggests increased cardiovascular activation rather than an isolated change in pulse rate.

The thesis compares this pattern with Kharche et al., Majeed et al., Thimmappa et al. and Sen et al., who reported increases in blood pressure during examination stress. The present

increase is directionally consistent with these reports.

Heart Rate Response

Heart rate increased from 79.31 to 96.50 bpm. This 17.19-bpm increase is compatible with sympathetic activation. Heart rate is especially useful in examination-stress research because it can change rapidly in response to anticipatory anxiety.

Respiratory Response

Respiratory rate increased from 16.72 to 18.94/min. Although the absolute increase was smaller than the changes in blood pressure and heart rate, it was statistically significant and accompanied by an increase in the proportion of students exceeding 16/min.

DISCUSSION – II

Stress Category and Physiological Response

A notable finding is that questionnaire stress was predominantly slight to moderate, whereas physiological activation was widespread. This illustrates that questionnaire categories and physiological markers capture related but not identical aspects of stress. A student may describe stress as moderate while still demonstrating marked autonomic activation immediately before an examination.

Comparison with Previous Studies

The thesis cites Thimmappa et al. as demonstrating mild-to-moderate stress and relationships between selected stressor domains and DBP. Sen and Baruah reported increases in pulse rate and blood pressure before examination. Soomro et al. reported increased heart rate during examination periods. The current findings fit the general pattern described in these studies.

The thesis also discusses studies reporting gender differences in physiological responses. However, because the present results provided for this manuscript do not include complete gender-stratified inferential results, the current paper does not claim a gender-specific effect.

Possible Physiological Mechanism

The likely physiological pathway involves perception of examination threat followed by increased sympathetic outflow and catecholamine activity. Increased cardiac rate and contractility can increase cardiac output, while vascular effects can increase peripheral resistance and blood pressure. Increased

respiratory rate can occur as part of generalized arousal.

Implications for Medical Education

The results support a broader approach to student well-being. Examination stress should be considered a physiological as well as psychological phenomenon. Preventive programs can include breathing exercises, yoga, meditation, counselling, peer support, time-management education and student-friendly assessment practices.

Strengths, Limitations and Recommendations

Strengths

- Relatively large sample of 200 first-year MBBS students.
- Objective physiological measurements were combined with a structured stress questionnaire.
- The same major physiological variables were assessed at two examination-related points.
- The study was conducted in a real medical-education environment.
- The findings are internally consistent across cardiovascular and respiratory parameters.

Limitations

- Single-centre design limits generalizability to other medical colleges.
- Cross-sectional/observational design limits conclusions about long-term effects.
- Potential influences such as sleep, caffeine intake, recent physical activity and individual coping were not fully quantified in the reported results.
- Psychological assessment relied on questionnaire scoring and did not include a detailed psychiatric diagnostic assessment.
- The thesis contains inconsistent timing descriptions in the methods section; the principal results use 15 days versus 30 minutes before examination.
- The title refers to correlation, but correlation coefficients are not reported in the principal results used here.

Recommendations

- Introduce structured examination-stress screening in first-year students.
- Provide accessible counselling and peer-support systems.
- Encourage regular breathing exercises, yoga, meditation and relaxation techniques.
- Teach time management, study planning and examination preparation strategies.

- Develop student-friendly teaching and assessment practices.
- Consider repeated monitoring of students with persistent or marked stress symptoms.

CONCLUSION

This study demonstrates a clear association between the approach of university examination and acute physiological activation among first-year MBBS students. Stress questionnaire scores showed that all participants experienced at least slight or moderate stress, with moderate stress being the predominant category. Physiological measurements demonstrated a marked increase in SBP, DBP, heart rate and respiratory rate immediately before examination.

The findings emphasize that examination stress is measurable not only as a psychological experience but also through objective cardiovascular and respiratory changes. Early identification and institution-based stress-management interventions may help promote student well-being and create a healthier academic environment.

Declarations

Ethics approval: Institutional Ethics Committee approval was obtained as reported in the thesis.

Informed consent: Written informed consent was obtained from participants.

Funding: Not reported in the thesis.

Conflict of interest: Not reported in the thesis.

Data availability: The thesis contains the master chart and supporting study records.

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