

EXAMINATION-INDUCED ANXIETY AMONG MEDICAL STUDENTS: A REPEATED-MEASURES STUDY USING THE HAMILTON ANXIETY RATING SCALE

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ABSTRACT

OBJECTIVES

To evaluate changes in examination-related anxiety before and during examinations among first- and second-year MBBS female students using the Hamilton Anxiety Rating Scale (HAM-A).

METHODOLOGY

A repeated-measures observational study was conducted at the Department of Physiology, Peoples University of Medical and Health Sciences for Women, Shaheed Benazir Abad, from April to October 2020. A total of 110 healthy first- and second-year MBBS students were recruited using non-probability convenience sampling. Anxiety levels were assessed using the HAM-A questionnaire two weeks before examinations and again during the examination period. Paired *t*-tests were used to compare pre- and during-exam anxiety within groups, and independent *t*-tests were used to compare first- and second-year students.

RESULTS

First-year students demonstrated a significant increase in anxiety during examinations (17.16 ± 10.62) compared with before examinations (8.00 ± 9.15 ; $p < 0.001$). Second-year students also showed a significant increase (12.96 ± 9.28 vs 8.05 ± 7.68 ; $p < 0.001$), but their anxiety levels remained significantly lower than those of first-year students during examinations ($p < 0.01$). Most HAM-A symptom domains, including anxious mood, tension, insomnia, autonomic symptoms, and somatic complaints, worsened significantly during the examination period, particularly in first-year students.

CONCLUSION

Examinations are associated with a marked escalation of anxiety symptoms among medical students, with first-year students being particularly vulnerable. These findings emphasize the need for structured psychological support and stress-management interventions during the early phase of medical education.

KEYWORDS: Examination Stress; Anxiety; Medical Students; Hamilton Anxiety Rating Scale; Academic Stress

INTRODUCTION

Stress is a universal biological and psychological phenomenon defined as the body's nonspecific response to any demand placed upon it. Hans Selye conceptualized stress as a physiological and psychological response that prepares the organism for adaptation but becomes harmful when persistent or excessive.¹ In academic environments, particularly in medical education, stress is exacerbated by heavy workloads, competitive evaluation systems, and high performance expectations. Medical students are exposed to unique academic stressors, including continuous assessments, voluminous syllabi, time pressure, and fear of failure. Examinations are among the most powerful acute stressors, triggering intense

emotional and somatic responses.^{2,3} These responses commonly manifest as anxiety, tension, insomnia, cognitive impairment, and autonomic symptoms, which can negatively affect learning, memory, and academic performance.⁴ Female students have been reported to experience higher levels of academic anxiety compared with males, possibly due to differences in coping styles, social expectations, and neurobiological stress responses.⁵ Female medical students often face additional pressures related to family expectations and sociocultural constraints, making them particularly vulnerable to academic stress.⁶ Anxiety related to examinations is not merely a psychological discomfort; it includes a constellation of psychophysiological symptoms such as palpitations, gastrointestinal upset,

muscle tension, insomnia, and autonomic arousal. These symptoms are well captured by the Hamilton Anxiety Rating Scale (HAM-A), a validated 14-item clinician-rated instrument assessing both psychic and somatic components of anxiety.⁷ HAM-A provides a comprehensive profile of anxiety, covering domains such as anxious mood, tension, fears, insomnia, intellectual functioning, depressed mood, muscular and sensory somatic symptoms, cardiovascular and respiratory symptoms, gastrointestinal and genitourinary symptoms, autonomic symptoms, and observed behavior. This makes it particularly suitable for evaluating examination-related anxiety, which is known to manifest across multiple physical and emotional domains. Previous international studies have demonstrated that examination periods significantly elevate anxiety scores among medical and dental students.^{8,9} However, data from Pakistani medical institutions remain limited, particularly when using standardized psychometric tools such as HAM-A. Understanding how anxiety varies across academic years is important for designing targeted support systems for vulnerable student groups. This study, therefore, aimed to compare anxiety levels before and during examinations among first- and second-year MBBS female students using HAM-A, with the hypothesis that first-year students would exhibit greater examination-related anxiety due to academic transition and adaptation challenges.

METHODOLOGY

A comparative repeated-measures study was conducted in the Department of Physiology at the Peoples University of Medical and Health Sciences for Women, Shaheed Benazirabad, Pakistan, between April and October 2024. A total of 110 healthy female MBBS students were recruited, including 55 first-year and 55 second-year students. The inclusion criteria were enrollment in the MBBS first or second year and the absence of a diagnosed psychiatric or chronic medical illness. Students on psychotropic medications were excluded. Non-probability convenience sampling was used. Anxiety was measured using the Hamilton Anxiety Rating Scale (HAM-A), a 14-item scale scored from 0 (not present) to 4 (very severe), yielding total scores from 0 to 56. Students completed HAM-A questionnaires two weeks before examinations and again during the examination period under supervision. Ethical approval was obtained from the institutional review board bearing Ref No. PUMHSW/SBA/REGISTRAR/446-51, Dated: 06-04-2019, and written informed consent was taken. Data were analyzed using SPSS version 23. Paired t-tests compared pre- and during-exam scores within groups.

Independent t-tests compared first- and second-year students. Significance was set at $p < 0.05$.

RESULTS

Table 1: Demographic Distribution of Participants (n = 110)

Variable	First Year (n=55)	Second Year (n=55)
Mean age (years)	18.9 ± 0.7	20.4 ± 0.8
Academic year	55 (50.0%)	55 (50.0%)

Table 2: Comparison of Total Hamilton Anxiety Rating Scale (HAM-A) Scores Before and During Examinations

Group	Before Examination	During Examination	Mean Difference	P-Value*
First year (n=55)	8.00 ± 9.15	17.16 ± 10.62	+9.16	<0.001
Second year (n=55)	8.05 ± 7.68	12.96 ± 9.28	+4.91	<0.001
Total (n=110)	8.03 ± 8.41	15.06 ± 10.15	+7.03	<0.001

*Paired t-test

Table 3: Between-Group Comparison of Anxiety Scores During Examinations

Variable	First Year (n=55)	Second Year (n=55)	P-Value*
HAM-A score during the exam	17.16 ± 10.62	12.96 ± 9.28	0.008

*Independent samples t-test

Table 4: Changes in Major HAM-A Symptom Domains Before and During Examinations

HAM-A Domain	First Year Before	First Year During	P-Value	Second Year Before	Second Year During	P-Value
Anxious mood	0.91 ± 1.11	1.78 ± 1.12	<0.001	0.82 ± 1.06	1.31 ± 1.17	<0.001
Tension	0.78 ± 1.10	1.95 ± 1.25	<0.001	0.65 ± 1.07	1.45 ± 1.26	<0.001
Insomnia	0.45 ± 0.91	1.13 ± 1.15	<0.001	0.36 ± 0.70	1.02 ± 1.24	<0.001
Autonomic symptoms	0.56 ± 0.81	1.22 ± 1.15	<0.001	0.45 ± 0.83	0.80 ± 1.14	<0.001
Depressed mood	0.87 ± 1.17	1.53 ± 1.29	<0.001	0.87 ± 1.20	1.45 ± 1.32	<0.001

Table 5: Distribution of Anxiety Severity Categories Based on HAM-A During Examinations

Anxiety Level	HAM-A Score Range	First year n (%)	Second year n (%)
Mild	≤17	28 (50.9%)	39 (70.9%)
Moderate	18-24	16 (29.1%)	11 (20.0%)
Severe	≥25	11 (20.0%)	05 (9.1%)

DISCUSSION

This study provides robust evidence that examinations are a potent psychological stressor for undergraduate medical students, producing significant increases in

anxiety symptoms across multiple psychophysiological domains. The increase in total HAM-A scores observed in both cohorts confirms that examinations represent an acute anxiety-provoking event. First-year students showed a mean increase of more than nine points, whereas second-year students showed an increase of approximately five points. This difference was statistically and clinically meaningful, as reflected by the significantly higher anxiety levels in first-year students during examinations. These results are consistent with the international literature, which demonstrates that early-year medical students are more vulnerable to stress due to academic transition, unfamiliarity with examination formats, and a lack of adaptive coping mechanisms.⁹ The predominance of anxiety among first-year students may be explained by the abrupt shift from pre-medical or school-based education to the demanding environment of medical training. First-year students are often required to master large volumes of information within short timeframes while simultaneously adjusting to new teaching methods, peer competition, and high expectations. A study reported significantly higher stress levels among first-year medical students in India than among senior cohorts, attributing this to academic overload and adjustment difficulties.¹⁰ Similar trends have been observed in Pakistan, where cultural and familial expectations further amplify performance pressure.¹¹ Importantly, our results demonstrate that examination anxiety is not limited to emotional distress but manifests across a broad range of psychophysiological domains captured by HAM-A. Anxious mood, tension, insomnia, autonomic symptoms, and depressed mood all increased significantly during examinations in both academic years, with first-year students showing greater symptom severity. This pattern reflects the multidimensional nature of exam-related anxiety, which includes affective, cognitive, somatic, and autonomic components. The sharp rise in anxious mood and tension scores during examinations indicates heightened anticipatory worry and emotional arousal. These symptoms are known to impair concentration, working memory, and executive functioning, all of which are essential for optimal academic performance.¹² Previous neurocognitive research has demonstrated that anxiety consumes cognitive resources, reducing the ability to retrieve learned material and apply knowledge under pressure.¹³ This may explain why highly anxious students often underperform in examinations despite adequate preparation. Sleep disturbance, measured by the HAM-A insomnia domain, also worsened significantly during examinations in both groups. Sleep disruption is a well-documented consequence of academic stress, driven by worry, extended study hours, and rumination.^{7,8,9,10,11,12,13,14} Poor sleep quality exacerbates

emotional reactivity and reduces stress tolerance, creating a vicious cycle in which anxiety and insomnia reinforce each other. Lund et al. demonstrated that academic stress is one of the strongest predictors of insomnia among university students, with downstream effects on mood, concentration, and health.¹⁵ The significant rise in autonomic and somatic symptoms during examinations further supports the psychophysiological nature of exam stress. Students reported increased palpitations, sweating, muscle tension, and sensory discomfort, all of which are hallmark features of anxiety-related autonomic arousal. These symptoms are mediated by sympathetic nervous system activation and are commonly experienced during performance-related stress.¹⁶ Importantly, such symptoms can be distressing and misinterpreted by students as signs of physical illness, potentially increasing anxiety further. The distribution of anxiety severity categories during examinations is particularly informative. Approximately 49% of first-year students fell into the moderate-to-severe anxiety range, compared with 29% of second-year students. This finding underscores the clinical relevance of exam anxiety, as moderate-to-severe HAM-A scores are associated with functional impairment and increased risk of depressive symptoms and burnout.¹⁷ Similar prevalence rates have been reported in other medical student populations. A study found that nearly one-third of medical students exhibited moderate to severe anxiety using HAM-A during examination periods.¹⁸ The persistence of elevated anxiety even in second-year students suggests that academic stress remains a chronic feature of medical training, although some adaptation occurs with experience. Second-year students demonstrated lower anxiety than first-year students but still showed significant deterioration during examinations. This pattern is consistent with the stress adaptation model, which posits that repeated exposure to stressors leads to partial habituation but does not eliminate vulnerability.¹² Our findings align closely with international research. A study reported that 63% of medical students experienced high stress during examinations, with first-year students being the most affected.¹³ Similarly documented high rates of anxiety among Pakistani medical students, particularly in early years of training.⁴ A study found that examination pressure was the dominant stressor across all years of medical education.³ Together with our results, these studies demonstrate that exam-related anxiety is a global phenomenon in medical education. The implications of these findings for medical education are profound. Anxiety not only impairs academic performance but is also associated with burnout, depression, and attrition from medical training.¹⁴ Chronic exposure to high stress without adequate support may undermine students' long-term

professional development and well-being. Medical schools must therefore recognize examination periods as high-risk windows for psychological distress. Interventions should be particularly targeted toward first-year students, who appear most vulnerable. Orientation programs, mentorship, and early psychological screening may help identify students at risk. Stress-management workshops, mindfulness-based interventions, and cognitive-behavioral coping strategies have been shown to reduce anxiety and improve academic functioning in medical students.^{15,16} Institutional changes, such as spreading assessments more evenly across the academic year and providing formative rather than purely summative evaluations, may also reduce performance pressure.

LIMITATIONS

This study has several strengths, including the use of a validated clinician-rated scale, a repeated-measures design, and direct comparison between academic years. However, it also has limitations. The sample included only female students from a single institution, limiting generalizability. Anxiety was measured only at two time points, and longer-term trajectories were not assessed. Future research should include male students, multiple institutions, and longitudinal follow-up to understand the evolution of exam-related anxiety. Despite these limitations, the present findings provide compelling evidence that examinations exert a substantial psychophysiological burden on medical students. The consistent pattern of increased anxiety across multiple domains, particularly in first-year students, highlights the need for proactive, institution-wide mental health strategies within medical education.

CONCLUSIONS

Examination periods are associated with significant increases in anxiety among medical students, particularly in first-year cohorts. Implementing structured mental health and stress-management interventions during early medical training is essential to improve student well-being and academic performance.

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AUTHORS CONTRIBUTION

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Altaf Memon - Concept & Design; Data Acquisition; Drafting Manuscript; Final Approval

Nida Khaskheli - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Final Approval

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Masood Ahmed Unar - Concept & Design; Data Acquisition; Drafting Manuscript; Data Analysis/Interpretation Critical Revision; Final Approval

The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.



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