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Original Article

Impact of High Workload on Students' Learning in Anatomy: Study How the Volume of Anatomy Content Affects Stress Levels and Academic Performance

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Abstract
Introduction: Anatomy is a core component of medical education that requires substantial study time and cognitive effort. The extensive and complex nature of anatomical content may contribute to increased academic workload, stress, and variability in academic performance among medical students. This study aimed to examine the relationship between anatomy study workload, perceived stress levels, coping strategies, and academic performance in undergraduate medical students.
Methods: A cross-sectional correlational study was conducted among 150 undergraduate medical students at Nandha Medical College and Hospital, Erode, Tamil Nadu, India. Data were collected using a validated self-administered questionnaire assessing weekly study hours, perceived stress levels using a 10-point Likert scale, coping strategies, and academic performance. Self-reported academic performance was verified using institutional records. Descriptive statistics, Pearson correlation analysis, analysis of variance, and chi-square tests were used for data analysis.
Results: Students who studied 31–35 hours per week reported the lowest mean stress levels (6.91), whereas students studying fewer than 25 hours or more than 40 hours per week experienced higher stress levels. A moderate negative correlation was observed between perceived stress and academic performance ($r = -0.24$, $P < 0.05$). Students with moderate stress levels (7–8) demonstrated slightly better academic performance compared with those in the low (5–6) and high (9–10) stress groups, although differences in GPA were not statistically significant. Peer support and time-management strategies were the most commonly reported coping mechanisms, while relaxation-based strategies such as meditation and social support were less frequently used by students experiencing sleep disturbances.
Conclusion: Moderate levels of academic stress were associated with relatively better academic performance, whereas both low and high stress levels were linked to less favorable outcomes. These findings highlight the importance of balancing anatomy workload and incorporating structured stress-management strategies, including peer support and time-management training, to promote student well-being and optimize academic performance.

Introduction

Anatomy is a medical science that provides the most important information about the body, explaining its structure and functionality.[1,2] Being one of the most difficult and contentious topics in the medical curricula, Anatomy still requires quite a lot of study time and mental effort. To most of the students, the key to their medical career can be linked to their ability to grasp the vast bulk of information related to Anatomy courses, not only to pass the course but also to practice their profession in the future.[1,3] Nevertheless, the number of materials would grow similarly to the academic load, which could affect the well-being and performance of students.

The vastness of anatomical content and intensive academic schedule can contribute to high workload stress, potentially affecting students' mental health, motivation, and academic outcomes. Medical students typically engage in lectures, tutorials, cadaver dissection, and examination. Which ultimately demands intellectual and emotional resilience.[4,5] The need to memorize complex structures and physiological processes often intensifies this burden.[5,6]

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This study aims to evaluate the connection between the workload used as part of the program in the Anatomy courses and the level of stress and performance of students. To be more precise, we will aim to discuss the impact that the amount of material presented in Anatomy has on the process of information preservation, coping with stress, and academics. Based on these dynamics, we will have an idea of how we can support the needs of students as they do their work, and this situation is something that we need to quite readily consider as important.

The relationship between academic workload and student well-being can be explained through two key theoretical perspectives. The Yerkes-Dodson law suggests that moderate levels of stress enhance learning performance, while too little or too much stress impairs the outcome. In parallel, self-determination theory highlights the importance of autonomy, competence, and motivation in sustaining well-being under academic pressure.

The previous studies from India and other countries reported that heavy anatomy workload contributes to anxiety, fatigue, and decreased satisfaction among medical students.[7-9]

Therefore, this study aims to evaluate the relationship between anatomy workload, stress level, and academic performance among medical students.

Materials and Methods

Study design and setting

A cross-sectional correlational study was conducted at Nandha Medical College and Hospital, Erode, Tamil Nadu, India, among undergraduate medical students enrolled in the Anatomy course.

Study population and sample size

A total of 150 undergraduate medical students participated in the study. The sample size was determined based on feasibility and accessibility within a single institution and is comparable to sample sizes used in similar educational and stress-related studies among medical students. As this was an exploratory observational study, a formal a priori power calculation was not performed.

Sampling technique

Participants were selected using convenience sampling, whereby students attending Anatomy classes during the study period were invited to participate. This approach was chosen due to ease of access, time constraints, and the exploratory nature of the study, which is common in educational research conducted within academic institutions.

Inclusion and exclusion criteria

Inclusion criteria

Undergraduate medical students currently enrolled in the Anatomy course who provided informed consent.

Exclusion criteria

Students not enrolled in the Anatomy course during the study period, or those who declined participation or submitted incomplete responses.

Data collection tools and measures

Questionnaire

Data were collected using a self-administered structured questionnaire adapted from previously validated studies.[2,5,7] The questionnaire included the following domains:

- Demographic characteristics: age, gender, and year of study
- Academic workload: average weekly study hours for anatomy, perceived difficulty, and frequency of examinations and practical sessions
- Perceived stress: measured using a 10-point Likert scale (1 = no stress, 10 = extreme stress), a format widely used in educational and psychological research
- Academic performance: self-reported anatomy grades and overall GPA

Validity and reliability

The adapted questionnaire underwent pilot testing among 20 undergraduate medical students to assess clarity, feasibility, and internal consistency. Reliability analysis was performed using Cronbach's alpha, yielding a value of 0.82, indicating good internal consistency. Cronbach's alpha was calculated for the stress and workload-related items to evaluate scale reliability.

Qualitative component

To explore student experiences in greater depth, semi-structured interviews were conducted with a randomly selected subset of 20 participants from the survey respondents. Each interview lasted approximately 20–30 minutes and focused on perceived workload, stress experiences, and coping strategies.

Academic performance verification

Academic performance data were verified using anonymized institutional records of Anatomy examination scores to enhance data accuracy and reduce reporting bias.

Data collection procedure

Questionnaires were distributed both electronically (via institutional email and learning management systems) and in printed format. Participants were given a two-week response window. Interviews were conducted after survey completion with consenting participants.

Data analysis

- *Quantitative data:* Descriptive statistics and Pearson correlation analysis were used to examine relationships between study workload, perceived stress, and academic performance. Analysis of variance (ANOVA) and chi-square tests were applied where appropriate.

- *Qualitative data:* Thematic analysis was conducted on interview transcripts and open-ended questionnaire responses to identify recurring themes related to stress and coping strategies.

Results

The distribution of mean stress levels across different ranges of weekly study hours for Anatomy. Students studying 31–35 hours per week reported the lowest mean stress level (mean = 6.90), whereas higher stress levels were observed among students studying fewer than 25 hours (mean = 7.90) and more than 40 hours per week (mean = 7.91).

Although stress levels varied across study-hour categories, Pearson correlation analysis showed no statistically significant linear association between weekly study hours and stress levels ($r = 0.32$, $P > 0.05$). This suggests that changes in stress were not linearly related to study time, indicating a pattern consistent with a workload–stress imbalance at both lower and higher extremes of study duration rather than a direct linear relationship (Table 1 and Figure 1).

Students were grouped into low (5–6), moderate (7–8), and high (9–10) stress categories (Table 2). Students in the moderate stress group demonstrated slightly higher mean GPA compared with those in the low and high stress groups. However, one-way ANOVA revealed no statistically significant difference in GPA across stress categories ($F(2,147) = 1.42$, $P = 0.26$) (Table 2, Figure 2).

Table 1. Comparison of study hours per week and stress level

Study hours range	Study hours per week	Stress level
20-25	21.58	7.90
26-30	26.52	7.2
31-35	31.27	6.90
36-40	36.88	7.62
41-45	42.25	7.91
46-50	47.18	7.13

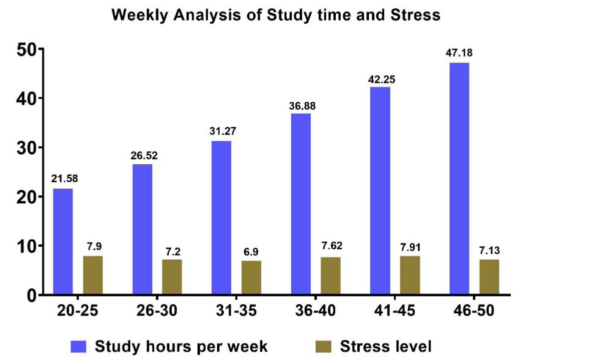

Figure 1. Weekly analysis of study time and stress

Despite this, Pearson correlation analysis demonstrated a statistically significant moderate negative association between perceived stress and GPA ($r = -0.24$, $P < 0.05$), indicating that higher stress levels were associated with lower academic performance overall.

The distribution of coping strategies across different stress-related symptoms. Peer support and time-management strategies were the most frequently reported coping mechanisms, particularly among students experiencing anxiety and fatigue. In contrast, meditation and social support were less frequently used, especially among students reporting sleep disturbances.

Chi-square analysis showed a significant variation in coping strategies across stress symptoms ($\chi^2 = 12.45$, $P < 0.05$), suggesting that students adopted different coping approaches depending on the nature of their stress-related symptoms (Table 3 and Figure 3).

Students with higher stress levels reported a greater frequency of fatigue and poor nutrition compared with those in the low and moderate stress groups. However, the association between stress category and overall health status was not statistically significant ($\chi^2 = 9.78$, $P > 0.05$), indicating that observed differences may be due to chance (Table 4 and Figure 4).

As shown in Table 5, the relationship between stress categories and frequency of illness. A weak positive correlation was observed between stress levels and illness frequency ($r = 0.18$, $P > 0.05$), suggesting a trend toward more frequent illness among students with higher stress levels, although this association was not statistically significant (Table 5 and Figure 5).

Similarly, analysis of physical fitness levels (Table 6) showed no significant difference in fitness across stress categories ($\chi^2 = 5.21$, $P > 0.05$). Nevertheless, students

Table 2. Relationship between stress level of various stress groups and academic performance

Stress level group	Stress level	Academic performance
High stress (9-10)	9.4	3.47
Low stress (5-6)	5.52	3.49
Moderate stress (7-8)	7.56	3.48

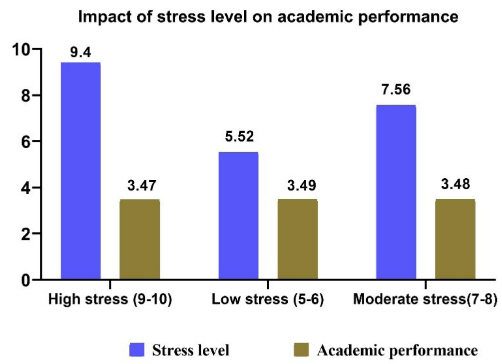

Figure 2. Impact of stress levels on academic performance

Table 3. Frequency of copies with strategies across different stress symptoms

Stress symptoms	Exercise	Meditation	Peer support	Social support	Time management
Anxiety	15	6	15	3	9
Fatigue	11	12	13	5	16
None	3	3	5	2	6
Sleep disturbance	4	1	12	1	8

Table 4. Comparison between stress categories and their impact on the health status of students

Stress category	Chronic illness	Fatigue	None	Poor nutrition	Total
Low stress (5-6)	12	22	14	5	53
Moderate stress (7-8)	11	13	16	4	44
High stress (9-10)	8	19	21	5	53
Total	31	54	51	14	150

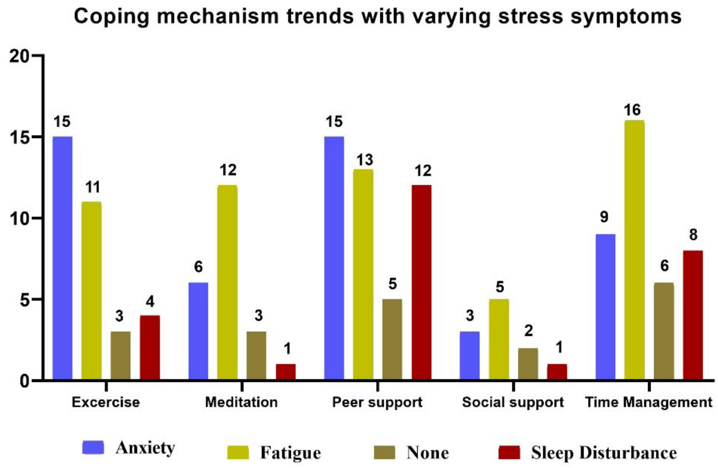

Figure 3. Coping mechanism trends with varying stress symptoms

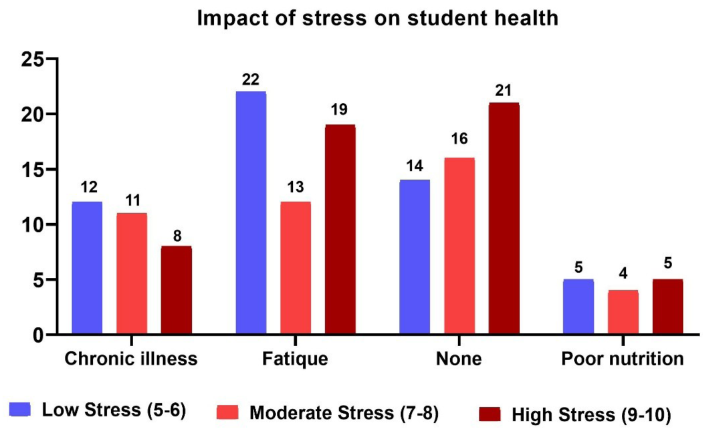

Figure 4. Impact of stress on students' health

with moderate stress levels reported relatively better overall fitness compared with low and high stress groups (Table 6 and Figure 6).

Discussion

The results of this research help to unveil the role of study hours, the level of stress, and coping skills when students can have difficulties regarding their achievements and general well-being, specifically in the field of medical education. In this study, it therefore sought to explore the correlation between the two factors; the findings are consistent with existing research, which highlights growing concern about students' well-being in medical education globally.[10,11]

Study hours and stress levels

There is a non-linear pattern between minutes of study per week and the stress levels. The group of students who study 20-25 hours weekly has resulted in the highest average of stress level (7.90), and this can be an indication that a moderate study time does not help to fully cope with the load of a subject that is as complicated as Anatomy. Characteristically, the students who study 31-35 hours per week were found to have the lowest average stress level (6.91), thus revealing a possibility of equating study hours and stress distribution. Interestingly, the level of stress begins to increase once more among students who spend 41-45 hours per week on their studies (7.92), which could be caused by an overstrain or even a burnout. The

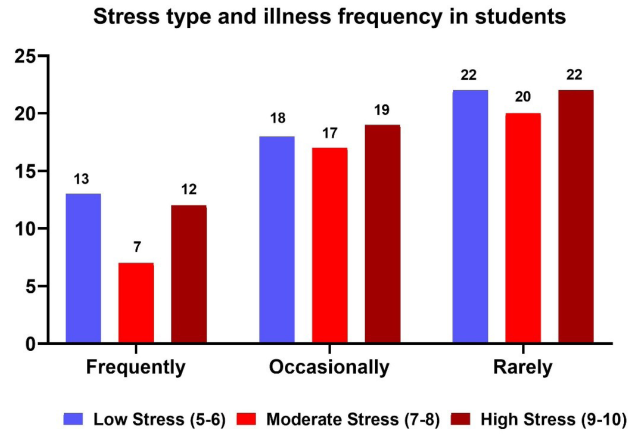

Figure 5. Stress type and illness frequency in students

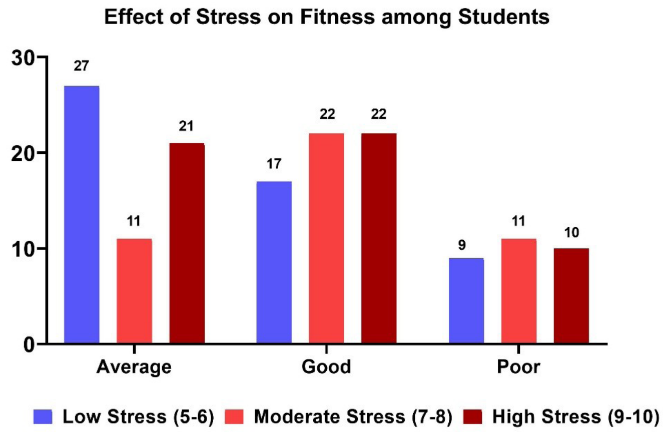

Figure 6. Effect of stress on fitness among students

Table 5. Stress category and illness frequency of the student population

Stress category	Frequently	Occasionally	Rarely	Total
Low stress (5-6)	13	18	22	53
Moderate stress (7-8)	7	17	20	44
High stress (9-10)	12	19	22	53
Total	32	54	64	150

Table 6. Impact of stress in relation to fitness level

Stress category	Average	Good	Poor	Total
Low stress (5-6)	27	17	9	53
Moderate stress (7-8)	11	22	11	44
High stress (9-10)	21	22	10	53
Total	59	61	30	150

stress level at the lowest position within the 46-50 hours group (7.14) may imply that these students have improved their time management, or they are well adapted to the requirements of the coursework. This pattern supports the Yerkes-Dodson law, which explains that moderate stress enhances academic performance while too little or excessive stress may impair it. Similar findings were reported by Nosair & Hamdy[6] and Estai & Bunt,[3] who observed that balanced academic workload correlates with reduced anxiety and improved concentration among medical students.

Stress level and academic performance

Table 2 results indicate some kind of correlation between the level of stress and academic performance (GPA). High Stress (9-10) students were the lowest scoring (GPA = 3.47), and this aligns with findings of a study that indicated that high levels of stress are capable of interfering with normal thinking capacity, memory, and concentration, which are the main pillars of academic performance. Conversely, students who were low stressed (5-6) had a slightly better GPA (3.49), possibly indicating that the reversed arousal caused by low stress may not actually be harmful to performance but may be a signal showing that the students are disengaged or not motivated to perform. Remarkably enough, the highest GPA (3.48) is linked to moderate stress (7-8), meaning that moderate-level stress may lead to increased concentration and academic achievements, which is consistent with the Yerkes-Dodson Law of optimal arousal, according to which moderate stress is the type of stress that leads to the highest performance. This outcome is comparable to studies conducted among Indian medical students, which also demonstrated that controlled levels of stress promote motivation and sustained learning efforts. These results reaffirm that moderate stress can function as a positive driver of performance rather than a purely negative influence.

Coping strategies and stress symptoms

It was identified in the study that exercise, support of peers, and time management were more common to help the students cope with stress as they felt anxious and fatigued. Most of the students responded to fatigue as being the most common stress symptom, and 16 students showed a coping strategy of time management, which indicates that this category of students could have learned to cope well with their work by studying at a good pace. This relatively low meditation and social support frequency among the students having sleep disturbances might indicate that students do not give much attention to relaxation practices or fail to find the appropriate support structures. These results show the significant importance of granting a diversity of coping strategies to the students, as various symptoms of stress demand various coping methods. Also, it was observed that peer support became a major stress management issue, which demonstrated that collaboration and support of the academic community are crucial. This aligns with principles of self-determination theory, which emphasizes autonomy, competence, and social connectedness as factors enhancing intrinsic motivation and stress resilience. It also parallels findings from Dyrbye et al who emphasized the role of structured wellness and peer support systems in improving medical students [10]

Health status, frequency of illness, and fitness level

With a review of the stress level and its correlation with health statuses, frequency of illnesses, and fitness levels, the study has shown that higher stress levels are linked to lower health conditions. Fatigue and Poor Nutrition were more common in the High Stress group than it was in the low stress one. This is an indication that there are students with a lot of stress, thus compromising their physical health, possibly because of time management or burnout. Even the distribution of the fitness level backs this up, as the High Stress category had a large percentage of students (10 students) in Poor Fitness, resulting in the physical impact that stress may have on the students. On the other side, low-stress students expressed Good Fitness (17 students), which can imply that low stress levels are also associated with overall health and fitness. These findings correspond with international studies that identified a direct link between chronic stress and declining physical health among medical students.[5]

There was also the study of the connection between the frequency of illness and stress. The Low Stress students also noted illness with few counts (22 students), whereas the High Stress students had a fair balance between the frequent and rare sicknesses. It could mean that moderate stress could result in illnesses once in a while, whereas massive stress would result in more frequent and occasional illnesses. The moderate stress students also reported frequent illnesses that were not as common as they were among the high stress students, but experienced some illnesses (17 students), which indicated that moderate stress might not be a major contributor to any serious health impairments, but still causes some effects related to physical conditions. However, as this cross-sectional study, causality cannot be established, data were self-reported, which may introduce recall bias, and a single-institution sample may limit generalizability. Despite these limitations, the findings carry important implications for anatomy education. Institutions should incorporate balanced scheduling, stress management training, and peer mentoring programs to help students manage workload effectively. Future research should include a longitudinal or intervention-based design to examine how workload adjustment and wellness programs affect stress and performance over time.

Conclusion

In summary, this paper has shown that moderate study hours (31-35 hours/week) and moderate stress levels (7-8) are associated with the lowest stress and the highest academic performance**.** Both insufficient and excessive study hours were linked to higher stress levels and relatively poorer outcomes. The interconnection between stress and academic achievement demonstrates that a moderate level of stress contributes most effectively to learning performances, confirming that stress is optimal when it is neither too low nor too high. Also, coping skills such as time management, peer support, and regular exercise are instrumental in reducing the adverse effects of stress among students, particularly those experiencing anxiety and fatigue.

These findings imply that curriculum planners and educators should balance the anatomy content load and integrate structured stress management and peer support programs into the learning process. Such initiatives can enhance student well-being and sustain academic efficiency.

Future studies should examine these relationships through longitudinal or interventional-based research to determine which coping strategies and workload adjustment most effectively improve well-being and academic success among medical students.

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Authors' Contribution

Conceptualization: G. Paramesh, G. Rekha.
Data curation: G. Rekha.
Investigation: G. Paramesh, G. Rekha.
Methodology: G. Paramesh.
Project administration: G. Paramesh.
Resources: G. Paramesh.
Supervision: G. Rekha.
Writing–original draft: G. Rekha.
Writing–review & editing: G. Rekha & G. Paramesh.

Competing Interests

The authors declare no conflict of interest.

Ethical Approval

Ethical approval was obtained from the Institutional Ethics Committee of Nandha Medical College and Hospital affiliated to The Tamil Nadu Dr. M.G.R. Medical University with the ethical approval number of IEC/NMCH/2025/024. Written informed consent was obtained from all participants before data collection. Participant anonymity and data confidentiality were strictly maintained.

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