JOURNAL OF PHARMACEUTICAL ANALYSIS

STRESS AND FATIGUE LEVELS INDUCED BY STUDYING FOR THREE CONSECUTIVE SEMESTERS AMONG MEDICAL STUDENTS IN SAUDI ARABIA

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Abstract

***Background*:** The rigorous nature of medical education and the extended academic schedule can exert significant psychological and physical demands on students.

The aim of this study to investigate the stress and fatigue levels experienced by medical students in Saudi Arabia that enrolled in three consecutive semesters implemented by the Ministry of Education.

***Method*:** A cross-sectional survey was conducted among different medical faculties across Saudi Arabia.Data were collected using an online questionnaire and included items of respondents' stress ,fatigue levels, mental well-being, academic achievements, and perceptions of the quality of their educational experience. Data were analyzed using SPSS25. ***Results*:** The study participants (n=373) had a mean ageof 22.23±1.86 years, with 60.3% being female students. 96.8%, were Saudi nationals. 11.3% reported smoking and (82.8%) lived with their families. Additionally, 28.2% of the students in fifth academic year. It was observed that exposure to three consecutive semesters explained approximately 42% (R^2=0.42) of the variability in stress and fatigue levels among the study participants. In the three-semestersystem, 70% of students experienced concentration issues due to stress, work-life balance was unhealthyfor many (44.5% somewhat, 18.2% significantly), physical health was affected for most (74.3%), and mental health compared to a two-semester system was slightly worse (35.4%) or much worse (20.4%). Overall, as about the same (38.3%), reported the apparent quality of learning (38.3%), (24.9%) somewhatlower, or (18.8%) much lower, with few indicating any improvements. ***Conclusion*:** Our study highlightsthe notable stress and fatigue experienced by medical students through three consecutive semesters.

Keywords: Educational, Academic ,, Health, Impact, Mental, Health

Introduction

Medical education is commonly associated with significant stress levels, and this elevated stress can potentially hinder medical school students' cognitive abilities and learning capabilities (1). In the Kingdom of Saudi Arabia (KSA), like in many parts ofthe world, medical students undergo a rigorous curriculum that prepares them to save lives and improve patient care. However, this arduous path has its challenges (2,3) Meanwhile, medical students tend to experience a higher prevalence of psychological distress than the general population. The consequences of this elevated stress level encompass the emergence of mental health disorders, substance misuse, heightened anxiety, depressive symptoms, and inclinations towards self-harm (4).

The rigorous curriculum, the volume of information to be absorbed, and the high stakesinvolved in healthcare can all contribute to elevated stress levels among medical students (5). Moreover, the prevalence of stress among medical students has been well-documented in various countries, including the KSA (6). This chronic stress can manifest in physical and psychological symptoms, which can affect students' well- being (7). It is worth noting that while a certain degree of stress is commonplace in their daily lives, excessive stress can lead to many health issues, including frequent headaches (8). One of the contributing factors to increased stress levels among medical students in the KSA is the structure of the educational system. Unlike many other countries, where medical programs are divided into distinct pre-clinical and clinical phases with scheduled breaks, some medical schools in the KSA offer a continuous three-semester academic calendar without extended vacations (9). This condensed academic schedule, though designed to expedite the training of medical professionals,may inadvertently expose students to prolonged periods of academic pressure, leadingto increased stress and fatigue levels (10).

Fatigue is frequently reported by medical students and is known to be linked with stress,with

researchers believing it has an adverse impact on academic performance(11). The demanding nature of medical studies and the lack of extended breaks in a continuous three-semester system [9] can lead to physical and mental exhaustion. Fatigue can furtherexacerbate the negative effects of stress on students' academic performance and overall quality of life, as well as sleeping problems(12,13). Additionally, fatigue can pose risks to patient safety when these exhausted students transition to clinical practice, as it mayimpair their decision-making abilities and attention to detail (14).

The rationale for investigating stress and fatigue levels induced by studying for three consecutive semesters among medical students in the KSA lies in the region's unique academic calendar structure of medical education. The continuous three-semester system, which lacks extended breaks, potentially exposes medical students to prolonged academic pressure, making them susceptible to heightened stress and fatigue. Understanding the extent and impact of these stressors is crucial, not only for safeguarding the well-being of future healthcare professionals but also for enhancing their academic performance and ensuring their preparedness for clinical practice. This ultimately contributes to the overall quality of healthcare delivery in the KSA. Recognizing and addressing stress and fatigue levels is vital for several reasons. First and foremost, the well-being of medical students should be a priority, as they are the future healthcare providers who will serve the population. Moreover, identifyingeffective strategies to mitigate stress and fatigue can lead to improved academic outcomes and the development of more competent, empathetic, and resilient healthcareprofessionals. Therefore, the present study was designed to investigate the stress and fatigue levels induced by studying for three consecutive semesters among medical students in KSA.

Materials and Methods

Study design and participants

This cross-sectional study was conducted in June 2023 and involved collecting data from various institutions within the Faculty of Medicine located across different provinces in KSA, encompassing both male and female medical students (n=373). Ourprimary research objectives centered on determining the prevalence of stress and fatigue among medical students who are enduring consecutive semesters. An electronicquestionnaire was used as the data collection method and was distributed among medical students in the KSA. The inclusion criteria included male and female medicalstudents who were over 18 years old and studied in colleges that applied the three-semester system. Exclusions from the study comprised medical students who were enrolled in the traditional two-semester system, individuals pursuing fields other than medicine, and those who declined to participate. Ethical approval for this study was diligently secured from the Research Ethical Committee (REC) at the University of Ha'il, with reference number H-2023-355.

Data collection instrument and procedure

In this study, data collection was facilitated through a well-structured questionnaire thatwas divided

into two primary sections. The initial section encompassed demographic information, including age, gender, geographic location, city of residence, and academic year. The subsequent section comprised questions about the impact of three consecutive semesters on participants' stress and fatigue levels, mental health status, academic performance, and perception of the quality of education received.

Regarding the distribution and gathering of data, all eligible students were contacted, employing an online questionnaire distribution method. It was explicitly communicatedto the students that their participation was voluntary, and written consent was obtained before administering the questionnaire. Furthermore, each questionnaire contained an information page that outlined the study's details, assuring participants of the utmost privacy and anonymity. Importantly, no personally identifiable information, such as names, academic numbers, or national identification numbers, was solicited.

Statistical analysis

Statistical analysis was performed utilizing the Statistical Package for the SocialSciences version 25 (SPSS 25). Frequencies and percentages were employed to compute all variables. Furthermore, a chi-square test was employed to ascertain the presence of any noteworthy distinctions in sociodemographic characteristics among thegroups. A significance level of $p<0.01$ was established to determine statistical significance.

Results

The mean age of the study participants was 22.23±1.86 years, indicating a relatively narrow age distribution within the sample. Most participants, constituting 60.3% (225),were female students. Marital status revealed that a significant proportion, approximately 96.2%, of the students were single, suggesting that the majority had notyet entered marital partnerships. Regarding smoking habits, 11.3% of the students reported smoking, indicating a relatively low smoking prevalence among this cohort. A vast majority, 96.8%, of the students were Saudi nationals, underscoring the homogeneity of the study population in terms of nationality. In terms of living arrangements, a significant proportion of the students (82.8%) resided with theirfamilies, indicating the presence of strong familial support networks. Lastly, concerning academic progression, 28.2% of the students were studying in their fifth

academic year, which provides insight into the distribution of students across differentstages of their medical education (Table 1).

Table 1: Baseline characteristics of study participants (n=373).

Characteristics	Frequency (n)	Proportion (%)
Age (mean ± SD) (years)	22.23 ± 1.86	
18–22	191	51.2
23–27	182	48.8

Gender		
Male	148	39.7
Female	225	60.3
Marital Status		
Single	359	96.2
Married	14	3.8
Nationality		
Saudi	361	96.8
Non-Saudi	12	3.2
Resident in Different Regions of Saudi Arabia		
Central	89	23.9
Western	86	23.1
Eastern	62	16.6
Northern	61	16.4
Southern	75	20.1
Living with Family		
Yes	309	82.8
No	64	17.2
Academic Year of Study		
First	23	6.2
Second	58	15.5
Third	65	17.4
Fourth	82	22
Final	105	28.2
Internship Year	40	10.7
Smoking		
Ever	331	88.7
Never	42	11.3

Abbreviations: SD = standard deviation.

In the regression analysis, it was observed that exposure to three consecutive semestersexplained approximately 42% (R^2=0.42) of the variability in stress and fatigue levels among the study participants. After adjusting the regression analysis, it was found that various fundamental characteristics of the participants were significantly associated

with stress and fatigue. Firstly, for every one percent increase in age, there was a notable 83% reduction in the likelihood of experiencing stress and fatigue. This suggests that older participants tended to report lower stress and fatigue levels. Secondly, with eachpassing academic year, there was a 21% increase in the risk of exhibiting stress and fatigue. Furthermore, individuals who

reported living with their families demonstrated a substantial 93% decrease in the risk of experiencing stress and fatigue. Lastly, participants who identified as ever-smokers showed a 2% increased risk of experiencingstress and fatigue. Importantly, all these results were statistically significant (Table 2).These findings collectively highlight the multifaceted nature of stress and fatigue among medical students and emphasize the importance of considering various demographic and behavioral factors when it comes to understanding and addressing these issues.

Table 2: Prediction of stress and fatigue after exposure to three semesters in anacademic year among study participants.

Characteristics	**β (95% Confidence Interval) (p-value)**	**R-Square Change (R^2)**
Age	-0.175 (-0.45 – -1.250) (0.035)	0.42
Gender	0.137 (0.45 – 3.42) (0.005)	0.42
Academic Year of Study	0.217 (0.26 – 1.83) (0.004)	0.42
Marital Status	0.039 (-1.94 – 4.32) (0.457)	0.42
Living with Family	-0.073 (-3.25 – 0.58) (0.005)	0.42
Nationality	-0.054 (-6.17 – -1.97) (0.312)	0.42
Smoking	0.027 (-2.86 – 1.69) (0.003)	0.42
Resident	0.042 (-0.29 – 0.68) (0.427)	0.42

When participants were asked about difficulties concentrating or experiencing issues with focus due to stress in the three-semester system, the majority (70%) responded affirmatively. In terms of work-life balance, a significant proportion of studentsreported having somewhat unhealthy (44.5%) or very unhealthy (18.2%) balances, while only a small percentage indicated having very healthy (1.6%) or somewhat healthy (10.5%) balances. Regarding physical health issues attributed to workload, a substantial majority (74.3%) acknowledged experiencing such issues. When comparingmental health in the three-semester system to the two-semester system, the responses were mixed. A considerable portion of respondents reported slightly worse (35.4%) ormuch worse (20.4%) mental health. Lastly, when assessing the overall quality of learning, the largest group indicated "about the same" (38.3%), followed by "somewhat

lower quality learning" (24.9%), and "much lower quality learning" (18.8%), with onlya minority suggesting improvements in learning quality (Table 3).

Table 3: Response rate for concerns related to the three-semester system, work life, physical and mental health, and quality of learning.

Questions/Responses	**Frequency**	**% age**
Have you experienced any difficulties concentrating or focus issues due to stress in the three-semester system?		
Yes	261	70
No	112	30
How would you describe your work-life balance in the three-semester system?		
Very healthy balance	6	1.6

Somewhat healthy balance	39	10.5
No impact either way	94	25.2
Somewhat unhealthy balance	166	44.5
Very unhealthy balance	68	18.2
Have you experienced any physical health issues (e.g., headaches and fatigue) due to the workload in the three-semester system?		
Yes	277	74.3
No	96	25.7
How would you rate your overall mental health in the three-semester system compared to the two-semester system?		
Much better mental health	18	4.8
Slightly better mental health	28	7.5
About the same	119	31.9
Slightly worse mental health	132	35.4
Much worse mental health	76	20.4
How would you rate the overall quality of your learning in the three-semester system compared to the two-semester system?		
Much better-quality learning	21	5.6
Somewhat better-quality learning	46	12.3
About the same quality of learning	143	38.3
Somewhat lower quality learning	93	24.9
Much lower quality learning	70	18.8

Discussion

In recent years, medical education has witnessed significant changes and faced numerous challenges. One of the most noteworthy challenges is the increasing demandfor medical students to pursue a rigorous academic schedule. This phenomenon is particularly evident in KSA, where most medical schools follow the three-semester system without substantial breaks. While this extended academic calendar is intended to expedite the training of future healthcare professionals and address the shortage of

medical professionals in the country, it has raised concerns about the potential impact on the stress and fatigue levels experienced by these students. Thus, this study aims toinvestigate the factors that contribute to heightened stress and fatigue levels among medical students in KSA. Specifically, it focuses on the demanding three-semester system and its implications for the mental and physical well-being of these students.

In the present study, there was a significant 21% increase ($p<0.01$) in the risk of experiencing stress and fatigue with each passing academic year. Moreover, most of the participants rated this new system as slightly stressful (26.8%) and much more stressful (36.2%). This finding implies

that as students progressed through their academic years, they were more likely to experience stress and fatigue, potentially dueto the increasing academic demands and responsibilities. However, stress levels showeda consistent pattern of decline as students progressed through their academic years, withone exception being the final year (1). Meanwhile, the most frequent stressors among the students were primarily associated with academic and psychosocial aspects of theirlives in KSA (15,16). Furthermore, among undergraduate medical students in Syria, 17.4% of female students and 11.3% of male students reported experiencing severe academic-related stress levels. In comparison, 53% of females and 50.4% of males reported experiencing moderate stress levels (17). Moreover, stress was most prevalentamong first-year students (78.7%), with the subsequent years showing decreasing rates:second year (70.8%), third year (68%), fourth year (43.2%), and fifth-year students (48.3%). A strong and statistically significant association was observed between the study year and stress levels ($p<0.0001$) (1). Meanwhile, the implementation of the newthree-semester system has led to increased stress levels among students. This isprimarily due to the compressed academic schedule and the subsequent increase in workload. This adjustment disrupted the students' accustomed learning pace and reduced the time available for mastering course content, ultimately affecting their ability to effectively manage academic demands. The heightened stress levels could have negatively impacted academic performance. Increased stress often results in decreased concentration, motivation, and overall cognitive functioning, which can potentially lead to lower grades and reduced academic achievement.

Individuals who reported living with their families demonstrated a substantial 93% decrease in the risk of experiencing stress and fatigue (Table 2). Similar findings werereported in another study, which revealed that medical students who resided with theirfamilies tended to experience lower stress levels and reported less stress than their

counterparts who lived independently (18). Furthermore, students indicated that they employed different constructive approaches for managing stress, which encompassed engaging in non-academic activities, maintaining connections with friends and family,and participating in physical exercise (19). This suggests that familial support and a strong social network may act as protective factors against stress and fatigue among medical students. Conversely, individuals living with family may also encounterheightened stress levels, often stemming from the complexities of shared responsibilities and interpersonal dynamics within the household. These stressors can impact one's overall well-being and ability to effectively manage stress, emphasizing the significance of considering living arrangements as a contributing factor to stress levels. As a study observed, there was no notable impact on the stress levels of medicalstudents, regardless of whether they resided with their families friends, or livedindependently(20).

Participants in the present study who identified as ever-smokers showed a 2% increasedrisk of experiencing stress and fatigue. Although this increase is relatively modest, it underscores the potential impact of smoking behavior on stress and fatigue levels in this context. Similarly, there was a notable and statistically significant association between stress and smoking, as indicated by an adjusted odds ratio (AOR) of 4.55 anda 95% confidence interval (CI) ranging from 1.05 to 19.77(15). Moreover, according to Parrott (21), smokers commonly misperceive cigarettes as

stress relievers, althoughthey are not effective in alleviating stress. Nevertheless, adult smokers exhibit slightly higher stress levels than nonsmokers, especially when they establish regular smoking patterns. Interestingly, quitting smoking has been observed to reduce stress levels, indicating the complex relationship between smoking and stress.

The transition to a three-semester academic system appeared to have a positive impacton students in the present study, with a notable 39.4% of respondents expressing an increased interest in their studies. This positive response could be attributed to severalfactors. For example, the condensed semester structure may have led to more focused and intensive learning experiences, thereby piquing students' interest and engagement in their courses. Additionally, the shorter duration of each semester may have reducedacademic stress and fatigue, allowing students to sustain their enthusiasm for learning. Furthermore, the novelty of the three-semester system could have motivated students by introducing a new approach to their education, potentially sparking greater curiosityand interest in their coursework. Meanwhile, among the students, those in the fourth year provided the most favorable ratings for this factor, while the sixth-year students were assigned the lowest ratings ($p<0.001$). This observation can be interpreted as indicative feedback regarding the current academic framework of the university. It is worth noting that, in the Indian system, the second-year curriculum is distributed acrossthree semesters (22). At the same time, a notable contrast was observed in the influenceof stress and anxiety on the academic performance of non-medical students enrolled intwo-semester versus three-semester courses in KSA. In the two-semester course,students who experienced lower stress and anxiety levels tended to achieve higher academic performance compared to their counterparts who had higher stress and anxiety levels in the three-semester course (23).

The responses from the present study highlight challenges and concerns linked to the three-semester system. A significant majority of students (70%) reported difficulties concentrating or experiencing focus issues due to stress in this system, underscoring the academic pressure it imposes. Furthermore, a substantial proportion noted an unhealthy work-life balance (44.5%), highlighting the impact on students' personal lives. Similarly, in another study, only 41.6% of students believed they had received assistance or direction concerning their healthy work-life balance (24). The high prevalence of physical health issues among 74.3% of respondents underscores the impact that the workload can have on their well-being. In terms of mental health, a notable portion expressed worsened mental health (35.4%) and much worse mental health (20.4%) in the three-semester system, suggesting its potential negative psychological effects. Similarly, 32.1% of the participants in another study exhibited poor mental health due to academic stress (25). Meanwhile, in a curriculum that focuseson building competencies, the first year saw a notable decline in physical, emotional, and overall well-being, which then showed signs of improvement in the subsequent years, and perceived stress levels remained consistent throughout (26). However, it is noteworthy that a considerable number of students (38.3%) in the present studyindicated that both systems offered the same quality of learning. This indicates that while the three-semester system poses challenges, it may also have advantages or be seen as equally effective in certain aspects. These findings collectively emphasize the complex interplay of factors when

evaluating the impact of the three-semester system,considering academic, physical, and mental well-being, as well as individual perceptions and experiences.

Conclusions

Our study sheds light on the significant stress and fatigue experienced by medical students in KSA as they navigate three consecutive semesters of intense studying. Thefindings underscore the importance of implementing effective stress management and support programs within medical education to safeguard the well-being of future healthcare professionals. Addressing these challenges can help ensure that students excel academically and maintain their physical and mental health throughout their educational journey. This, in turn, will contribute to the development of a resilient andthriving healthcare workforce in KSA. Further research and tailored interventions are needed to better understand and mitigate the specific stressors and fatigue factors that medical students face in this context.

Authors' Contributions

ESA, MZ, RA, HKFA, MA, AA, and SHA: Conceptualized, constructed the study and gathered the data. ESA, MZ and RA:Participated in data interpretation. ESA, MZ, RA, HKFA, MA, AA, and SHA: Have written the manuscript draft. ESA, MZ,RA, HKFA, MA, AA, SHA,SME and HME: Revised the article and made the required amendments. SME and HME: approved the final version to be published There has been unanimous approval of the final version.

Conflicts of Interest

The authors declare that there is no conflict of interests.

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