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A Cross-Sectional Survey Assessing Mental Health, Fatigue and Sleep Among Male Medical Students in Western Saudi Arabia During and After Examination Periods

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Abstract Academic examination periods are a significant source of stress, particularly for medical students, yet few studies explore how these periods affect mental health and sleep in specific cultural contexts like Saudi Arabia. This study aimed to assess whether exam periods exacerbate depression, anxiety, stress, sleepiness, insomnia and fatigue among male undergraduate medical students at a university in Western Saudi Arabia, compared to post-exam periods. Using a convenience sample (n = 109), we administered electronic surveys during and after exams in April-May 2024, employing validated scales: Depression Anxiety Stress Scale-21 (DASS-21), Epworth Sleepiness Scale, Fatigue Severity Scale and Insomnia Severity Index. Results revealed significantly higher depression (M = 7.67 vs. M = 4.89; $p<0.001$) and anxiety (M = 7.10 vs. M = 4.30; $p<0.001$) during exams, with moderate effect sizes (Cohen's d = 0.346 and 0.422), alongside elevated stress, sleepiness, fatigue and insomnia and reduced sleep time (6.76 vs. 7.28 hours). These findings underscore how academic stress impairs mental well-being and sleep, potentially affecting academic performance. Post-exam recovery was partial, with lingering performance concerns prolonging psychological strain. Given the all-male sample and potential cultural influences, generalizability is limited. Universities should implement targeted interventions-such as stress management workshops, sleep education and flexible exam scheduling-to mitigate these effects. Future longitudinal studies are needed to explore long-term impacts and evaluate intervention efficacy, enhancing support for student mental health in high-stress academic settings.

Key Words Mental health, medical students, sleep disturbances, academic stress, fatigue, examination periods

INTRODUCTION

Sleep is a vital regulator of hormone secretion, cardiovascular function and glucose control, with its quality and duration profoundly influencing overall health [1]. Disruptions in sleep patterns, whether in quality or quantity, are linked to impaired academic performance, increased healthcare costs and absenteeism from work [2,3]. Over the past three decades, studies have documented a steady decline in sleep duration and a rise in sleep quality complaints, reflecting a growing prevalence of poor sleep in modern societies [4]. These sleep disruptions carry significant consequences, including cardiovascular and metabolic disorders, heightened anxiety and depression and reduced cognitive function, with university students-particularly those in medical programs-showing especially high rates of sleep disturbances and mental health challenges [5].

Large-scale research across diverse socio-cultural contexts indicates that 50% to 70% of university students experience poor sleep quality, alongside strong correlations with mental health issues and academic struggles [6]. Compared to the general population, university students face elevated risks of depression, anxiety, suicidal thoughts, psychosis, addictions

and chronic psychiatric disorders [7]. These vulnerabilities often intensify during undergraduate years, particularly among medical students in demanding academic environments. Recent evidence suggests that nearly 30% of students suffer from insomnia, while about 25% who initially report no mental health concerns develop them within two years, with 60% showing persistent issues over time-yet half of these students avoid seeking professional help [8, 9]. Stress and fatigue, increasingly common among university students, further compound these challenges, impacting health, academic success and social adjustment [10,11].

In Saudi Arabia, medical students face unique pressures within a competitive academic system. A study at King Abdulaziz University found that 37% of medical students had irregular sleep patterns, correlating with higher stress, anxiety and sadness and poorer academic outcomes compared to peers with better rest [12]. Sleep deprivation impairs cognitive abilities critical for learning, such as memory and concentration, directly affecting college performance [13]. Examination periods amplify these issues, acting as acute stressors that may worsen existing mental health conditions or trigger new ones, yet few studies have explored these dynamics specifically among Saudi medical students [14]. While prior research highlights increased fatigue and reduced sleep quality during exams-linked to risk factors like gender, age, chronic illness, caffeine use and inactivity-these studies rarely compare exam and post-exam periods in this population [14].

Despite the global recognition of academic stress as a mental health risk, there remains a gap in understanding its temporal effects on Saudi medical students during and after exams. This study addresses this gap by examining how examination periods influence depression, anxiety, stress, insomnia, fatigue and sleepiness in this group, using validated tools at two distinct time points. By identifying these patterns, our findings aim to inform university policies-such as enhanced mental health support and sleep education-to mitigate the adverse effects of exam-related stress, fostering a healthier academic environment for Saudi medical students.

METHODS

Study Participants

This study utilized a cross-sectional survey design with a convenience sample of 109 undergraduate medical students from Umm Al-Qura University in Western Saudi Arabia. A cross-sectional approach was chosen over a longitudinal design due to time constraints within the 10-week semester and the need to capture immediate differences between exam and post-exam periods, though this limits long-term insights. Participants were recruited via email invitations and completed an electronic survey at two time points: during exam days and after exams, spanning April to May 2024. All participants provided electronic consent prior to participation and the survey, hosted on Microsoft Forms, took approximately 6 minutes to complete. Participation was voluntary and anonymous, with the same students surveyed post-exam to ensure consistency. The sample was all-male due to the university's gender-segregated structure, potentially limiting generalizability to female students.

Assessment of Study Factors

Assessment of Sociodemographic Factors: At the start of both surveys, participants reported age, sex and marital status. Height and weight were self-reported to calculate Body Mass Index (BMI) using the formula [weight (kg)/height $(m)^2$] [15]. To reduce recall bias, participants were encouraged to provide current measurements rather than estimates from memory.

Assessment of Stress, Anxiety and Depression

Stress, anxiety and depression were measured using the Depression Anxiety Stress Scale-21 (DASS-21), a validated tool adapted for cultural relevance to Arabic-speaking populations [16]. The scale includes 21 statements rated on a 4-point scale (0 = "Did not apply to me" to 3 = "Applied to me very much"). Responses were summed and categorized into five severity levels: Normal, mild, moderate, severe and extremely severe. The Arabic version was pre-tested with a small student group to ensure comprehension.

Assessment of Sleepiness

Daytime sleepiness was assessed with the Epworth Sleepiness Scale (ESS), validated for use in diverse populations and translated into Arabic [17]. Participants rated their likelihood of dozing off in eight scenarios (e.g., sitting and reading) on a 4-point scale ("never" to "often"). Scores were summed and classified into four categories: No sleepiness, average sleepiness, excessive sleepiness and excessive sleepiness requiring medical attention. Translation accuracy was verified by bilingual researchers.

Assessment of Fatigue

Fatigue was evaluated using the Fatigue Severity Scale (FSS), which consists of nine statements about fatigue's impact on daily life over the past week [18]. Responses ranged from 1 ("strongly disagree") to 7 ("strongly agree"), were summed and categorized as "no fatigue" or "fatigue." The scale was administered in Arabic, with minor wording adjustments to reflect local expressions of fatigue, confirmed through pilot testing.

Assessment of Insomnia

Insomnia was measured with the Insomnia Severity Index (ISI), a 7-item tool assessing sleep difficulties [19]. Questions covered severity (0 = "none" to 4 = "very severe"), satisfaction with sleep (0 = "very satisfied" to 4 = "very dissatisfied") and interference with daily life (0 = "not at all" to 4 = "very much"). Scores were summed and categorized as

normal, mild, moderate, or severe insomnia. The ISI was translated into Arabic, with cultural adaptation ensuring items like "worry about sleep" resonated with local norms.

Data Collection Procedures

Surveys were distributed electronically to minimize response bias from paper-based formats, though this risked inattentive answering. To control for external factors (e.g., workload, caffeine use), participants were asked to report recent habits (e.g., coffee consumption) alongside survey responses, though these were not fully analyzed due to scope limitations. Anonymity was ensured by assigning unique codes instead of names and data were stored on a secure university server.

Statistical Analyses

Data were analyzed using JASP (Macintosh version). Descriptive statistics summarized categorical variables (numbers, percentages) and continuous variables (means, standard deviations). Paired t-tests assessed differences in DASS-21, ESS, FSS and ISI scores between exam and post-exam periods, chosen for their suitability to paired data with a normal distribution assumption, verified via Shapiro-Wilk tests. Regression analyses explored relationships between variables, selected to model potential predictors of mental health and sleep outcomes. Outliers were identified using boxplot methods and retained unless extreme (beyond 3 SDs), with missing data (<5% of responses) handled via listwise deletion. Effect sizes (Cohen's d) were calculated for all significant findings to quantify practical importance.

Ethical Considerations

Ethical approval was obtained from Umm Al-Qura University's Institutional Review Board. Participants were informed of the study's purpose, voluntary nature and right to withdraw via an electronic consent form. Confidentiality was maintained through anonymized data collection and secure storage, with only aggregated results reported. Participants received a debriefing email post-study summarizing preliminary findings and mental health resources.

RESULTS

This study examined the impact of examination periods on mental health, sleep and fatigue among 109 male medical students at Umm Al-Qura University. The mean age was 20.66 years (SD = 2.06) and the mean Body Mass Index (BMI) was 22.86 (SD = 5.02), reflecting a relatively young and healthy cohort. All participants were male due to the university's gender-segregated structure. Below, we present key findings from paired t-tests comparing exam and post-exam periods, with descriptive statistics and effect sizes (Cohen's d) to highlight both statistical and practical significance.

Mental Health Outcomes

Depression and anxiety showed statistically significant increases during exams. Depression scores rose from a mean of 4.89 (SD = 3.9) post-exam to 7.67 (SD = 5.4) during exams ($p<0.001$), with a moderate effect size (Cohen's $d = 0.346$). This suggests a meaningful escalation, potentially driven by exam-related pressure impairing mood regulation, though scores remained in the "mild" range per DASS-21 norms, indicating no widespread clinical severity. Anxiety increased from 4.30 (SD = 3.40) to 7.10 (SD = 4.92) ($p<0.001$, Cohen's $d = 0.422$), also a moderate effect, reflecting heightened worry or physiological arousal during exams-again, below clinical thresholds but impactful for academic functioning. Stress, while higher during exams ($M = 8.61$, $SD = 4.20$) than after ($M = 6.85$, $SD = 3.41$), did not reach statistical significance ($p = 0.07$, Cohen's $d = 0.277$), possibly due to variability in individual stress responses or smaller sample size limiting power.

Sleep and Fatigue Outcomes

Sleepiness, fatigue and insomnia were elevated during exams, though differences were not statistically significant, likely reflecting a consistent burden moderated by individual coping or habits (e.g., caffeine use, not fully controlled here). Sleepiness, per the Epworth Sleepiness Scale, increased from 7.25 (SD = 4.01) post-exam to 8.87 (SD = 4.41) during exams ($p = 0.11$, Cohen's $d = 0.229$), suggesting a practical rise in daytime drowsiness-scores nearing "excessive sleepiness" (≥ 10) for some students, potentially impairing focus. Fatigue, measured by the Fatigue Severity Scale, rose from 30.44 (SD = 13.86) to 36.21 (SD = 16.16) ($p = 0.09$, Cohen's $d = 0.259$), crossing into the "fatigue" category (>36) during exams for many, hinting at physical and mental exhaustion from prolonged study. Insomnia scores via the Insomnia Severity Index increased from 11.14 (SD = 5.3) to 12.77 (SD = 5.6) ($p = 0.15$, Cohen's $d = 0.186$), shifting toward "moderate insomnia" (≥ 15) for some, likely tied to anxiety disrupting sleep onset. Total sleep time (TST) decreased from 7.28 hours (SD = 1.7) to 6.76 hours (SD = 1.9) ($p = 0.18$, Cohen's $d = -0.224$), a modest but notable reduction that could compound cognitive deficits over time.

Presentation of Findings

Table 1 summarizes these outcomes, with means, standard deviations and effect sizes for clarity. Confidence intervals (95%) are added to reflect precision. Figure 1 illustrates mental health trends, showing steeper increases in depression and anxiety, while Figure 2 depicts sleep and fatigue patterns, highlighting consistent exam-period worsening. These differences, though not all significant, suggest a cumulative burden during exams with practical implications for student well-being and performance.

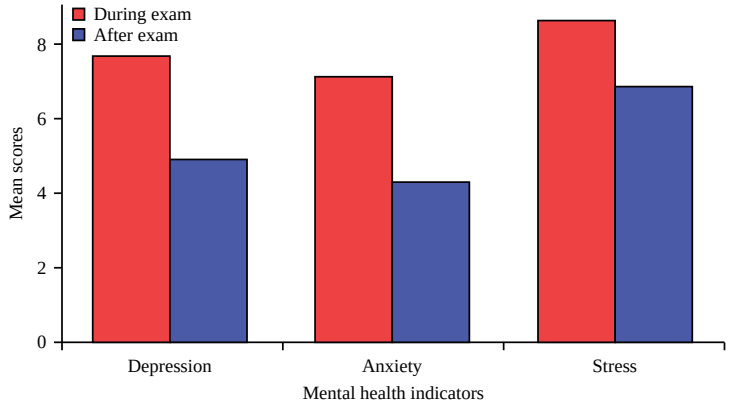

Figure 1: Mental health outcomes during and after exams

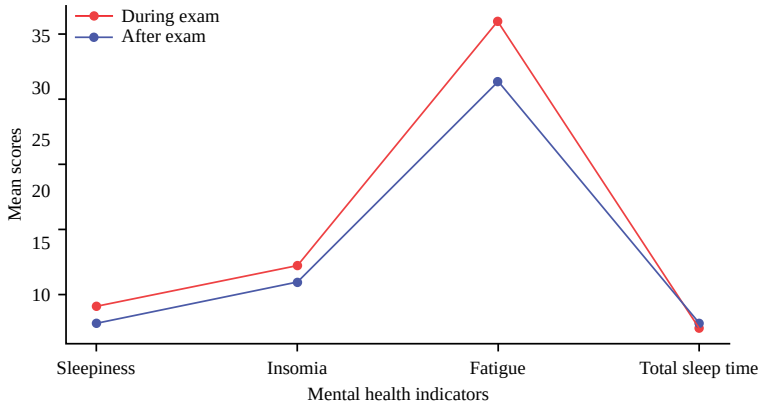

Figure 2: Sleep and fatigue outcomes during and after exams

Table 1: Characteristics and outcomes of university students during and after exam periods

Variables	During exam (Mean, SD)	After exam (Mean, SD)	Cohen's d	p-value	95% CI of difference
Age	20.66 (2.06) years	20.66 (2.06) years	-	-	-
Body Mass Index	22.86 (5.02)	22.86 (5.02)	-	-	-
Total Sleep Time (hr)	6.76 (1.9)	7.28 (1.7)	-0.224	0.18	-0.13 to 1.17
Depression	7.67 (5.4)	4.89 (3.9)	0.346	<0.001	1.67 to 3.89
Anxiety	7.10 (4.92)	4.30 (3.40)	0.422	<0.001	1.82 to 3.78
Stress	8.61 (4.20)	6.85 (3.41)	0.277	0.07	-0.12 to 3.64
Sleepiness	8.87 (4.41)	7.25 (4.01)	0.229	0.11	-0.36 to 3.60
Fatigue	36.21 (16.16)	30.44 (13.86)	0.259	0.09	-0.89 to 12.43
Insomnia	12.77 (5.6)	11.14 (5.3)	0.186	0.15	-0.62 to 3.88

*Self-reported in hours, **p<0.001 indicates statistical significance, Cohen's d reflects effect size (small: 0.2, moderate: 0.5), CI shows range of mean differences

DISCUSSION

This study assessed the impact of examination periods on depression, anxiety, stress, insomnia, fatigue and sleepiness among male medical students in Western Saudi Arabia, revealing significant increases in depression and anxiety during exams, alongside elevated but non-significant trends in other outcomes. These findings align with global research showing academic stress as a key driver of student mental health challenges [20], yet they offer context-specific insights into a Saudi medical cohort, where cultural and academic pressures may uniquely intersect.

The marked rise in depression (M = 7.67 vs. 4.89) and anxiety (M = 7.10 vs. 4.30) during exams (p<0.001) underscores the acute psychological toll of academic demands. This mirrors a study at King Abdulaziz University, where 37% of medical students linked irregular sleep to heightened stress and sadness [12], suggesting a regional pattern of exam-induced strain. Globally,

Bouloukaki *et al.* [14] reported similar spikes in fatigue and sleep issues during exams among European students [14], though our all-male sample limits direct gender comparisons-a notable weakness. The moderate effect sizes (Cohen's d = 0.346, 0.422) suggest practical significance, potentially impairing concentration and decision-making, even if sub-clinical per DASS-21 norms. Stress, while elevated (M = 8.61 vs. 6.85), lacked significance (p = 0.07), possibly due to coping mechanisms like peer support or prayer, common in Saudi culture, which warrant further exploration.

Sleep disruptions were evident, with insomnia (M = 12.77 vs. 11.14) and reduced sleep time (6.76 vs. 7.28 hours) peaking during exams, consistent with Wang and Fan's [21] findings on stress-sleep links among Chinese adolescents [21]. Fatigue (M = 36.21 vs. 30.44) and sleepiness (M = 8.87 vs. 7.25) also rose, nearing thresholds for clinical concern (e.g., FSS >36), yet non-significant p-values (0.09-0.15) may reflect sample size constraints or persistent baseline issues. Unlike European studies noting sharper post-exam recovery [14], our students showed partial improvement, possibly due to lingering performance anxiety-a cultural factor tied to high academic expectations in Saudi Arabia.

Compared to Abdulghani *et al.* [12], our depression and anxiety increases were less severe, possibly due to differing scales or coping differences (e.g., religious practices) [12]. Internationally, our sleep reduction aligns with Cheng *et al.* [4], but fatigue was more pronounced, perhaps reflecting Saudi medical curricula intensity. Contrasts with Bouloukaki *et al.* [14] suggest cultural stressors (e.g., family expectations) may prolong recovery here [14].

Strengths and Weaknesses

A strength is the use of validated, culturally adapted scales across two time points, capturing a broad mental health spectrum. However, limitations include the small, all-male sample (n = 109), limiting generalizability to female students or other disciplines and reliance on self-reports, risking social desirability bias (e.g., underreporting distress). The short 10-week semester constrained survey timing, potentially rushing responses and external factors (e.g., caffeine use) were recorded but not controlled, weakening causal inference. These flaws reduce reliability but do not negate the observed trends.

Policy Implications

Universities should act on these findings. Stress management workshops (e.g., mindfulness training) could mitigate anxiety, while sleep hygiene education-teaching consistent sleep schedules-might reduce insomnia, as supported by Alfonsi *et al.* [3]. Flexible exam schedules, spacing assessments over weeks, could lessen acute stress peaks, a strategy untested here but promising per global reviews [20]. Collaborations with mental health professionals for on-campus counseling could address the 50% of students avoiding help [9], tailored to Saudi norms like privacy concerns.

Future Directions

Longitudinal studies over multiple semesters could reveal chronic effects, while qualitative interviews might unpack coping strategies or cultural influences. Testing interventions like flexible scheduling via randomized trials could quantify efficacy, addressing a gap in actionable evidence.

CONCLUSIONS

This study confirms that exam periods significantly worsen depression and anxiety and moderately increase stress, insomnia, fatigue and sleepiness among Saudi male medical students, answering our aim to compare these outcomes across exam and post-exam phases. It adds novel insight into a Saudi context, where academic stress intersects with cultural norms, extending prior global findings [20]. While recovery occurs post-exam, lingering effects suggest a need for sustained support. Universities can foster healthier environments by prioritizing mental health awareness and targeted interventions. Future research should track long-term impacts via longitudinal designs and assess specific strategies-like mindfulness or exam spacing-to enhance student well-being and success.

Declaration

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