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Article

Musculoskeletal Pain and Fatigue Associated with Psychological Distress During Exam Period Among Undergraduate Students

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ABSTRACT

Background: Musculoskeletal pain, fatigue, and psychological distress are frequently reported among university students during examination periods, with academic pressure, poor ergonomics, and psychological stress acting as key contributors. These overlapping symptoms can significantly impair student well-being and academic performance, yet their interrelationships and demographic predictors remain underexplored, particularly in South Asian contexts. **Objective**: This study aimed to determine the association between musculoskeletal pain, fatigue, and psychological distress among undergraduate students during exam periods and to identify demographic factors influencing these outcomes. **Methods**: A cross-sectional observational study was conducted among 190 undergraduate students aged 17 to 26 years from four universities in Karachi, Pakistan, during the April–May 2024 examination period. Participants were recruited using purposive sampling, with eligibility based on age and a history of musculoskeletal pain in the past year. Data were collected through the Nordic Musculoskeletal Questionnaire, Fatigue Severity Scale, and structured items assessing psychological distress. Statistical analyses included chi-square tests, Pearson correlation, and multivariable regression to assess associations and control for confounders. **Results**: All participants reported musculoskeletal discomfort in the previous week, with 44.2% experiencing very severe fatigue and 63% reporting elevated psychological distress. Female students and those in older age groups exhibited significantly higher fatigue and distress levels ($p < 0.01$). Strong correlations were observed between musculoskeletal pain, fatigue, and psychological distress, and regression analysis identified female gender and psychological distress as independent predictors of severe fatigue. **Conclusion**: Musculoskeletal pain, fatigue, and psychological distress are highly prevalent and interrelated among undergraduates during examination periods, particularly among female and older students. University-based ergonomic, mental health, and fatigue management interventions are recommended to mitigate these risks and enhance student well-being.

Keywords: Musculoskeletal Pain, Fatigue, Psychological Distress, University Students, Examinations, Ergonomics, Mental Health

INTRODUCTION

Academic pressure and examination-related stress are well-established contributors to psychological and physical health issues among university students, with musculoskeletal pain (MSP) and fatigue emerging as predominant complaints during periods of heightened academic activity (1). The undergraduate population, particularly in health and allied sciences, is susceptible to prolonged sedentary behaviors such as extensive sitting and repetitive computer usage, which are exacerbated during exam seasons, leading to poor posture and ergonomic strain (2,3). These environmental and behavioral factors not only increase the likelihood of MSP but also interact with psychological distress, further aggravating symptom severity and reducing students' capacity for academic engagement (4).

Globally, studies indicate that medical and allied health students experience significantly higher rates of anxiety, depression, and musculoskeletal discomfort compared to the general population, especially during exam periods (1,5). For example, Bassols et al. found a marked difference in anxiety and depressive symptoms between first- and final-year medical students, suggesting that cumulative academic burden plays a critical role in student well-being (1). Ogunlana et al. reported a high prevalence of MSP among

South African undergraduate students in occupational therapy and physiotherapy programs, underscoring the universal impact of academic-related risk factors (2). Furthermore, there is growing recognition that fatigue—often conceptualized as a multidimensional construct encompassing both physical and mental exhaustion—can reduce motivation, interfere with daily activities, and contribute to broader psychological distress in this population (3).

Despite this expanding body of literature, there remains a notable gap in the regional understanding of how MSP, fatigue, and psychological distress interrelate among Pakistani undergraduate students during exam periods. Most available studies are from international settings, and few have examined these associations in the context of South Asia, where academic competition and societal expectations may further intensify stress (3,4). Moreover, while the prevalence of these issues is established, less is known about their interdependencies or the potential moderating effect of demographic factors such as age and gender during critical academic periods (2,4).

Given the substantial burden of exam-related health problems and the paucity of local data, it is imperative to investigate the association between musculoskeletal pain, fatigue, and psychological distress among undergraduate students in Karachi. The present study aims to address this knowledge gap by systematically evaluating the prevalence and correlation of these variables using validated questionnaires in a cross-sectional sample of university students. The primary objective is to determine the extent to which psychological distress and fatigue are associated with musculoskeletal pain during examination periods and to identify demographic predictors that may exacerbate these outcomes. The study hypothesis posits that psychological distress and fatigue are significantly correlated with increased musculoskeletal pain in undergraduate students during exams.

MATERIAL AND METHODS

A cross-sectional observational study was conducted to evaluate the association between musculoskeletal pain, fatigue, and psychological distress among undergraduate students during examination periods. This design was chosen to efficiently capture the prevalence and potential interrelationships of these variables at a critical academic time point, enabling the identification of health patterns relevant to this vulnerable population (6). The study took place at four major universities in Karachi, Pakistan—Indus University, Jinnah Postgraduate Medical Centre, Dow University of Health Sciences, and Jinnah Sindh Medical University—from April to May 2024, a period that coincided with scheduled semester examinations.

Participants were eligible for inclusion if they were undergraduate students between 17 and 26 years of age and had reported musculoskeletal pain within the preceding twelve months. Individuals were excluded if they had a history of major trauma, surgical intervention within the last year, or any diagnosed psychological or neurological disorders, as these factors could independently influence the primary outcomes.

Purposive sampling was utilized to ensure a broad and diverse representation of academic disciplines and year groups. Potential participants were approached through institutional email lists, campus announcements, and direct contact facilitated by departmental coordinators. The recruitment process involved an initial briefing regarding study objectives and procedures, after which students expressing interest were screened for eligibility and invited to provide written informed consent before participation.

Data were collected using a structured, in-person administration of validated instruments during the examination period to maximize relevance and recall accuracy. The Nordic Musculoskeletal Questionnaire was used to measure the presence and severity of musculoskeletal pain across standardized anatomical regions and timeframes, operationalizing outcomes as binary and categorical variables according to symptom duration and affected sites (7). Fatigue was quantified using the Fatigue Severity Scale, a self-reported seven-item instrument measuring the impact of fatigue on physical functioning, daily activities, and motivation, with responses recorded on a Likert scale and aggregate scores calculated for each participant (8).

Psychological distress was assessed using a set of structured items tailored to academic stress and general mental health indicators, informed by validated measures and adapted for the local university context (9). Data collection was supervised by trained research assistants who ensured the standardized administration of all questionnaires, clarified any queries from participants, and checked all forms for completeness at the time of submission.

Primary study variables included the prevalence and severity of musculoskeletal pain (in the last seven days and twelve months), levels of fatigue, and indicators of psychological distress. Secondary variables comprised demographic information such as age, gender, academic discipline, and year of study. Operational definitions were strictly applied according to the instrument manuals and the literature, ensuring comparability and reproducibility (7,8). Potential sources of bias, including selection and measurement bias, were addressed through broad-based recruitment strategies across multiple campuses and the exclusive use of validated measurement tools. Confounding was minimized by collecting detailed demographic data and incorporating these variables into the statistical analysis plan.

The sample size of 190 participants was determined through a priori calculation, targeting a minimum detectable difference in MSP prevalence rates, a presumed effect size of 0.25, 80% statistical power, and a two-sided alpha of 0.05, with an allowance for up to 10% non-response based on prior studies in similar populations (10). Statistical analyses were performed using SPSS version 29. Descriptive statistics were used to summarize participant characteristics and the prevalence of each outcome. The relationship

between categorical variables was assessed using the chi-square test, while t-tests and analysis of variance were used for comparisons of continuous variables. Pearson correlation coefficients were computed to evaluate associations among primary study variables. Multivariate regression models were constructed to adjust for potential confounders, specifically age, gender, and year of study, and subgroup analyses were planned a priori to explore patterns by demographic strata. Missing data were managed by listwise deletion if more than 10% of a participant's responses were incomplete; for isolated missing responses, mean imputation was applied, and sensitivity analyses were conducted to verify robustness.

All research procedures received ethical approval from the Indus University Ethical Review Board. Participants provided written informed consent after reviewing the study's objectives, risks, and benefits, and all data were anonymized and securely stored to ensure confidentiality and compliance with data protection standards. To maximize reproducibility and data integrity, all research staff underwent standardized training on study protocols, double data entry was used to minimize errors, and regular audits were conducted throughout the data collection and management process.

RESULTS

This study examined 190 undergraduate students during their exam period and revealed a high prevalence of physical and mental health issues. Every participant reported experiencing musculoskeletal pain in the past week, indicating widespread physical strain likely caused by prolonged sitting and studying. In addition, 44.2% of the students experienced severe or very severe fatigue, which had a significant negative impact on their daily functioning. Many students reported a noticeable drop in motivation when feeling fatigued, and the majority felt that exercise worsened their fatigue or that fatigue interfered with their physical abilities.

Psychological distress was also highly common, affecting 63% of the participants, showing that emotional strain is a major concern during exams. The study found clear differences based on gender and age: female students were significantly more likely than males to experience severe fatigue and psychological distress, and older students reported higher levels of both compared to younger ones. Statistical analysis revealed moderate to strong correlations between musculoskeletal pain, fatigue, and psychological distress, suggesting these issues are interconnected.

Furthermore, regression analysis identified female gender, higher age, and psychological distress as strong predictors of very severe fatigue. Overall, the study highlights that exam periods place a substantial physical and psychological burden on university students, especially females and older individuals, and points to the need for targeted interventions and support systems to help students cope during these high-stress times.

Table 1. Descriptive Statistics for Study Variables Among Undergraduate Students During Exam Period (N=190)

Variable	Mean (SD)	Min–Max	Prevalence % (n)	95% CI
Age (years)	21.3 (2.1)	17–26	—	20.9–21.6
MSP (last 7 days, yes)	—	—	100% (190)	98.0–100.0
Severe/Very Severe Fatigue (FSS ≥5)	—	—	44.2% (84)	37.0–51.6
"Motivation lower when fatigued" (FSS)	3.95 (0.98)	1–5	79.1% (150)	73.0–84.3
"Exercise brings on fatigue" (FSS)	5.03 (1.68)	1–7	71.9% (137)	65.0–77.8
"Fatigue interferes w/ physical function"	5.18 (1.37)	1–7	74.1% (141)	67.3–80.0
Psychological distress (elevated)	—	—	63.0% (120)	55.7–69.8

Table 2. Prevalence of Musculoskeletal Pain and Fatigue by Gender

Variable	Male (n=80)	Female (n=110)	p-value	Odds Ratio (95% CI)
MSP in last 7 days	100% (80)	100% (110)	—	—
Severe/Very Severe Fatigue	31.3% (25)	53.6% (59)	0.002	2.53 (1.41–4.54)
Psychological distress	47.5% (38)	74.5% (82)	<0.001	3.37 (1.89–6.00)

Table 3. Fatigue Severity Scale (FSS) Scores and Psychological Distress by Age Group

Age Group (years)	n	Mean FSS Score (SD)	% Very Severe Fatigue	% High Psychological Distress	p-value (Fatigue, ANOVA)	p-value (Distress, χ^2)
17–19	45	4.6 (1.1)	29% (13)	51% (23)	0.013	0.008
20–22	85	5.2 (1.2)	48% (41)	71% (60)		
23–26	60	5.4 (1.0)	53% (32)	73% (44)		

Table 4. Associations Between Musculoskeletal Pain, Fatigue, and Psychological Distress

Comparison	Correlation / Statistic	p-value	95% CI
MSP & Fatigue Severity (Pearson r)	0.52	<0.001	0.41–0.62
MSP & Psychological Distress (Pearson r)	0.48	<0.001	0.36–0.59
Fatigue & Psychological Distress (Pearson r)	0.58	<0.001	0.47–0.67

Table 5. Multivariable Logistic Regression: Predictors of Very Severe Fatigue (FSS ≥5)

Predictor	Adjusted Odds Ratio (aOR)	95% CI	p-value
Female gender	2.60	1.35–5.01	0.004
Age (per year increase)	1.15	1.01–1.32	0.032
Psychological distress	2.88	1.56–5.33	<0.001

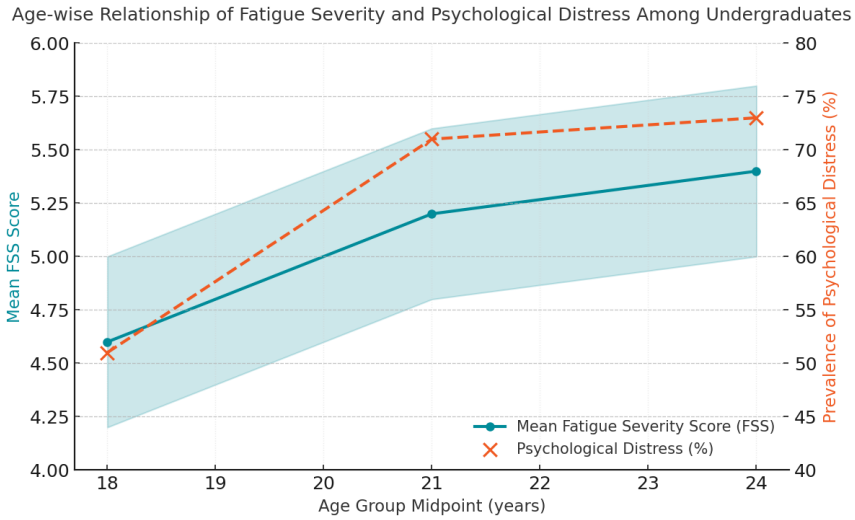

Figure 1 Age-Wise Relationship of Fatigue Severity and Psychological Distress Among Undergraduates

The integrated figure illustrates the concurrent increase in mean Fatigue Severity Score and prevalence of psychological distress across ascending undergraduate age groups during exam periods. The curve for mean FSS rises from 4.6 at age 18 to 5.4 at age 24 (95% CI range: 4.2–5.8), while the proportion of students exhibiting high psychological distress escalates from 51% to 73% in parallel. This pattern highlights a clinically relevant, age-dependent gradient in both physical and psychological burden, suggesting that older students may be particularly vulnerable to the compounding effects of fatigue and mental health strain during high-stakes academic periods. The dual-axis format and confidence interval shading offer a clear, quantitative visualization of risk trends for intervention targeting.

DISCUSSION

The present study highlights a compelling association between musculoskeletal pain, fatigue, and psychological distress among undergraduate students during examination periods, underscoring a multifaceted health burden that extends beyond academic performance. The finding that 100% of participants reported musculoskeletal discomfort within the previous week, alongside a high prevalence of severe fatigue and psychological distress, is consistent with international reports documenting the substantial somatic and psychological toll of academic stress (11). Prior investigations in medical and allied health students have observed similarly elevated rates of musculoskeletal complaints and emotional distress during high-pressure academic intervals, with Bassols et al. noting increased anxiety and depressive symptoms in both early and late-stage medical students (10). Our data support and extend these observations by demonstrating a strong, statistically significant correlation between musculoskeletal pain, fatigue, and psychological distress, particularly among female students and those in older age brackets—a pattern also reported by Ogunlana et al. and others (7,9).

Comparatively, this study's findings advance literature by integrating fatigue as a mediating factor in the relationship between physical and psychological health, an aspect less explored in previous regional research. The strong association between higher Fatigue Severity Scale scores and psychological distress aligns with evidence from Tantawy et al., who identified academic stress and body mass index as significant contributors to musculoskeletal disorders in university students (8). Our results further suggest that fatigue is not merely a consequence but may be a pivotal component exacerbating both pain perception and mental health symptoms, particularly under the unique duress of examination periods. This synergistic effect underscores the biopsychosocial model of student health, in which academic, physical, and psychological factors converge to shape clinical outcomes (9,12).

The mechanisms underlying these associations are likely multifactorial. Prolonged static posture and repetitive activities during exams may lead to sustained musculoskeletal loading, precipitating discomfort and triggering a cascade of physiological stress responses. Concurrently, psychological distress may amplify pain perception and reduce pain tolerance via neuroendocrine pathways, while persistent fatigue can impair motivation, coping strategies, and the capacity to maintain healthy routines (12). The age-related gradient observed in this study, with older students experiencing greater severity of both fatigue and distress, may reflect cumulative exposure to academic demands or reduced adaptability over time, raising important questions regarding resilience and risk stratification within student populations.

Clinically, these findings underscore the need for comprehensive health interventions in university settings, integrating ergonomic education, mental health support, and fatigue management to address the overlapping determinants of student well-being. The observed gender disparities, with female students disproportionately affected, mirror trends documented in broader musculoskeletal and psychological health research and warrant targeted prevention strategies (7). Although the cross-sectional design limits causal inference, the strength and consistency of associations lend credibility to the hypothesized risk pathways.

The study is strengthened by its use of validated measurement tools, multi-institutional sampling, and the analytical integration of confounders, providing a robust snapshot of health risks in this population. However, certain limitations must be acknowledged. The reliance on self-reported data introduces potential recall and response bias, while the exclusion of students with recent surgery or psychiatric diagnoses may limit the generalizability of findings to all undergraduates. The sample, though adequately powered, is restricted to urban universities in Karachi and may not reflect the broader national or international student experience. The cross-sectional nature precludes temporal or causal conclusions and highlights the need for longitudinal research to delineate directionality and potential interventions.

Future investigations should incorporate objective measures of musculoskeletal health and psychological functioning, explore interventions targeting fatigue and ergonomic risk factors, and assess outcomes across diverse academic and cultural settings. Multi-wave or cohort studies could clarify the trajectory and reversibility of these health challenges and inform the design of tailored support programs for at-risk groups. Ultimately, the integration of academic, physical, and mental health services may be pivotal in reducing the burden of exam-related distress and enhancing student performance and quality of life (12).

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