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Association of Musculoskeletal Symptoms with Body Mass Index and Perceived Stress Among College Students: A Cross-Sectional Study

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Abstract:

- ***Background:***

Musculoskeletal disorders (MSDs) are increasingly prevalent among college students and may adversely affect physical functioning and daily activities. Prolonged sitting, sustained postures, extensive academic demands, and psychological stress may contribute to the development of musculoskeletal symptoms. Body mass index (BMI) may also influence musculoskeletal health. However, the relationship between MSDs, academic stress, and BMI among college-going students remains insufficiently explored.

- ***Objective:***

To determine the relationship between musculoskeletal disorders, academic stress, and body mass index among college-going students aged 18–25 years.

- ***Methods:***

A cross-sectional study was conducted among 185 eligible students. Musculoskeletal symptoms were assessed using the Nordic Musculoskeletal Questionnaire, perceived stress using the Perceived Stress Scale, and BMI was calculated from measured height and weight. Spearman's correlation analysis was performed using SPSS, with statistical significance set at $p < 0.05$.

- ***Results:***

Of 257 students assessed, 72 were excluded and 185 were included (117 females, 68 males). The 12-month prevalence of musculoskeletal symptoms was 74.3%, with the neck most affected (44.7%), followed by the lower back (36.1%) and shoulders (18.4%). 7-day prevalence was 94.3%. Most participants reported moderate perceived stress (81.62%). Perceived stress showed significant positive correlations with symptoms in the neck, shoulder, upper back, and lower back ($p < 0.05$). BMI showed positive correlations with wrist/hand, upper back, knee, and ankle/foot symptoms; however, these were not significant. No significant correlation was observed between perceived stress and BMI ($p = 0.607$).

- ***Conclusion:***

The study concludes that there is a significant positive correlation of MSDs with academic stressors and BMI among college going students. BMI and stress should be considered while assessing MSDs in students.

Keywords: *Musculoskeletal Disorders; Academic Stress; Body Mass Index; College Students; Nordic Musculoskeletal Questionnaire; Perceived Stress Scale.*

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I. INTRODUCTION

Musculoskeletal disorders (MSDs) are a major health concern and encompass a broad range of conditions affecting muscles, tendons, joints, ligaments, peripheral nerves, and other supporting tissues. Musculoskeletal pain is increasingly reported during adolescence and young adulthood, with epidemiological studies demonstrating substantial prevalence of neck, shoulder, and back pain among adolescents [1,2]. The presence of musculoskeletal symptoms during these formative years is of particular concern because persistent or recurrent pain may extend into adulthood and contribute to long-term functional limitations.

College-going students may be particularly susceptible to musculoskeletal symptoms because of prolonged sitting, sustained postures, reduced physical activity, and increasing reliance on electronic devices for academic and recreational activities. The widespread use of smartphones, laptops, tablets, and computers has increased the duration of screen-based activities among university students. Prolonged static or awkward postures and repetitive activities may increase mechanical loading on the musculoskeletal system. Previous literature has identified prolonged abnormal postures and repetitive physical exposures as factors associated with musculoskeletal symptoms, particularly involving the neck and upper limb [3]. Recent evidence among university students has also highlighted the contribution of academic, personal, and environmental factors to musculoskeletal pain during prolonged periods of study and online learning [4]. In addition to physical exposures, psychosocial factors may contribute to the experience of musculoskeletal pain. Psychological distress and psychosocial stressors have been associated with the onset and reporting of musculoskeletal pain across multiple anatomical regions [5]. University students may be exposed to several sources of stress, including academic workload, examinations, time constraints, financial concerns, interpersonal relationships, and perceived pressure regarding academic performance. Importantly, research conducted specifically among college students has reported an association between academic stressors and musculoskeletal disorders, supporting the relevance of academic stress as a potential factor in student musculoskeletal health [6]. However, the relationship between academic stress and MSDs may be complex and multifactorial, and therefore warrants further investigation within different student populations.

Body mass index (BMI) represents a commonly used anthropometric measure calculated from body weight and height and may also be relevant to musculoskeletal health. Previous research has demonstrated associations between BMI and musculoskeletal symptoms, although the strength and anatomical distribution of these associations may vary according to the population and the physical demands experienced by individuals [7]. In addition, chronic psychosocial stress has been proposed to interact with behavioural and physiological mechanisms that may influence body weight and obesity-related outcomes [8]. These findings suggest that BMI and psychological stress may represent potentially relevant factors when examining musculoskeletal symptoms among young adults.

Although previous studies have investigated academic stress and BMI in relation to musculoskeletal symptoms, these factors have not always been examined concurrently within college-going populations. Furthermore, the relationship between academic stress, BMI, and MSDs may vary across different anatomical regions. A better understanding of these associations may assist physiotherapists and other healthcare professionals in identifying potentially modifiable physical, anthropometric, and psychosocial factors relevant to musculoskeletal health among college students.

Therefore, the present study aimed to determine the relationship between musculoskeletal disorders, academic stress, and body mass index among college-going students aged 18–25 years.

II. MATERIALS AND METHODS

- *Study Design and Setting:*

A cross-sectional observational study was conducted among college-going students aged 18–25 years from different colleges and universities of Ahmedabad who were enrolled in undergraduate or postgraduate academic programmes were considered eligible for participation. The study was conducted for 2 months duration and participants were recruited using convenience sampling.

- *Inclusion Criteria:*

Age between 18 and 25 years; enrolment in an undergraduate or postgraduate programme; and ability to understand and complete the study questionnaires.

- *Exclusion Criteria:*

Participants were excluded if they had a history of musculoskeletal injury or trauma, previous surgical intervention, a diagnosed psychological disorder preceding university enrolment, severe physical disability associated with pain, or a diagnosed blood disorder such as sickle cell anaemia or thalassemia.

- *Participant Flow and Reasons for Exclusion:*

A total of 257 students were initially recruited. Following screening against the predefined eligibility criteria and data completeness requirements, 72 participants were excluded from the final analysis, resulting in 185 participants included in the analytical sample.

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Table 1 Participant Flow and Reasons for Exclusion

Reason for exclusion	n
Did not meet age criteria	7
Previous musculoskeletal injury/trauma	13
Previous surgery	6
Diagnosed psychological disorder	4
Severe physical disability/pain	12
Blood disorder	3
Incomplete data/questionnaire	27
Total excluded	**72**

➢ *Data Collection Procedure:*

All participants were informed about the purpose, procedures, potential benefits and risks of the study. Written informed consent was obtained from all participants before enrolment. Demographic and academic information was collected using a self-administered data collection form. Information included age, sex, academic year, academic programme, height, body weight, and other relevant academic or behavioural characteristics assessed in the study. Participants were subsequently assessed for musculoskeletal symptoms, perceived stress, and body mass index (BMI). Musculoskeletal symptoms were assessed using the Nordic Musculoskeletal Questionnaire (NMQ) which assesses musculoskeletal symptoms across nine anatomical regions: neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, and ankles/feet. The questionnaire assesses the occurrence of musculoskeletal symptoms during the preceding 12 months and preceding 7 days, as well as whether symptoms during the preceding 12 months had interfered with normal activities. Perceived stress was assessed using the Perceived Stress Scale (PSS) to evaluate the extent to which individuals perceive their situations and experiences as stressful during the preceding month. Each item is scored on a five-point response scale ranging from 0 (*never*) to 4 (*very often*), with total scores ranging from 0 to 40. In the present study, PSS scores were categorized as low (0–13), moderate (14–26), and high (27–40) perceived stress. Height and body weight were measured using measure tape and a weighing scale. BMI was calculated as body weight in kilograms divided by height in metres squared: BMI = weight (kg) / height² (m^2) Participants were categorized according to the BMI classification system used in the study: underweight, normal weight, overweight, and obese.

➢ *Statistical Analysis*

Was performed using IBM SPSS Statistics version 20.0 (IBM Corp., Armonk, NY, USA). Continuous variables were summarized using mean and standard deviation (SD), while categorical variables were presented as frequencies and percentages. The distribution and characteristics of the study variables were examined before inferential analysis. Because the variables representing musculoskeletal symptoms were analysed in relation to BMI and perceived stress using a non-parametric correlation approach, Spearman's rank correlation coefficient (ρ) was used to assess the direction and strength of the associations between BMI, perceived stress, and musculoskeletal symptoms across the nine anatomical regions. Statistical significance was set at $p < 0.05$.

III. RESULTS

A total of 257 students were initially recruited for the study. Following application of the eligibility criteria, 72 students were excluded, resulting in a final sample of 185 participants. Comprising of 117 females and 68 males, with a mean age of 21 ± 1.9 years. Participants represented multiple academic disciplines, including medicine, physiotherapy, dentistry, commerce, engineering, arts, and other programmes. The majority of participants were in their final academic year. The BMI of participants ranged from 14.84 to 39.54 kg/m^2, with a mean BMI of 23.30 ± 6.34 kg/m^2. Based on the reported BMI categories, 29 participants were underweighted, 96 had normal BMI, 39 were overweight, and 21 were classified as obese. Perceived stress scores ranged from 7 to 33, with a mean score of 23.28 ± 8.90. Among the 185 participants, 151 (81.62%) reported moderate levels of perceived stress, 22 (11.89%) reported low stress, and 12 (6.48%) reported high stress. The prevalence of perceived stress was higher among female participants than male participants. According to the Standardized Nordic Musculoskeletal Questionnaire, 74.3% of participants reported musculoskeletal symptoms in at least one anatomical region during the preceding 12 months. The neck was the most frequently affected region (44.7%), followed by the lower back (36.1%) and shoulders (18.4%). Furthermore, 41.2% of participants reported that their musculoskeletal symptoms were sufficiently severe to interfere with activities of daily living. The lower back was the most frequently reported region associated with activity limitation (19.3%), followed by the neck (16.9%), shoulders (10.2%), and upper back (9.1%). The reported 7-day point prevalence of musculoskeletal symptoms was 94.3%. The neck was the most frequently affected anatomical region (44.7%), followed by the lower back (36.0%) and shoulders (18.4%).

Table 2 Demographic and Participant Characteristics of the Study Population (n = 185)

Characteristic	N (%)
Age, [mean ± SD] (years)	21.0 ± 1.9
Gender	
Male	68 (36.8%)
Female	117 (63.2%)

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Academic year	
First year	30 (16.2%)
Second year	17 (9.2%)
Third year	26 (14.1%)
Final year	69 (37.3%)
Others	43 (23.2%)
Academic programme	
Medicine	21 (11.4%)
Physiotherapy	43 (23.2%)
Dentistry	32 (17.3%)
Commerce	30 (16.2%)
Engineering	29 (15.7%)
Arts	11 (5.9%)
Others	20 (10.8%)
BMI category	
Underweight	29 (15.7%)
Normal	96 (51.9%)
Overweight	39 (21.1%)
Obese	21 (11.4%)
Perceived stress category	
Low	22 (11.9%)
Moderate	151 (81.6%)
High	12 (6.5%)

➢ *Correlation Analysis:*

Spearman's rank correlation analysis was performed to examine the associations between perceived stress, BMI, and musculoskeletal symptoms among the 185 participants. Perceived stress demonstrated weak positive correlations with musculoskeletal symptoms involving the neck (ρ = 0.205, p = 0.005), shoulder (ρ = 0.262, p < 0.001), upper back (ρ = 0.190, p = 0.009), and lower back (ρ = 0.266, p < 0.001), all of which were statistically significant. Positive but non-significant correlations were observed for the elbow (ρ = 0.075, p = 0.312), wrist/hand (ρ = 0.112, p = 0.129), hip/thigh (ρ = 0.133, p = 0.071), knee (ρ = 0.037, p = 0.621), and ankle/foot (ρ = 0.028, p = 0.710) regions. BMI demonstrated very weak positive correlations with musculoskeletal symptoms involving the wrist/hand (ρ = 0.078, p = 0.293), upper back (ρ = 0.043, p = 0.557), and ankle/foot (ρ = 0.055, p = 0.455). Negative correlations were observed for the neck (ρ = −0.070, p = 0.345), shoulder (ρ = −0.096, p = 0.195), elbow (ρ = −0.030, p = 0.682), lower back (ρ = −0.078, p = 0.289), hip/thigh (ρ = −0.050, p = 0.501), and knee (ρ = −0.009, p = 0.904). None of the observed correlations between BMI and musculoskeletal symptoms were statistically significant. A negligible negative correlation was observed between BMI and perceived stress (ρ = −0.038, p = 0.607), which was not statistically significant.

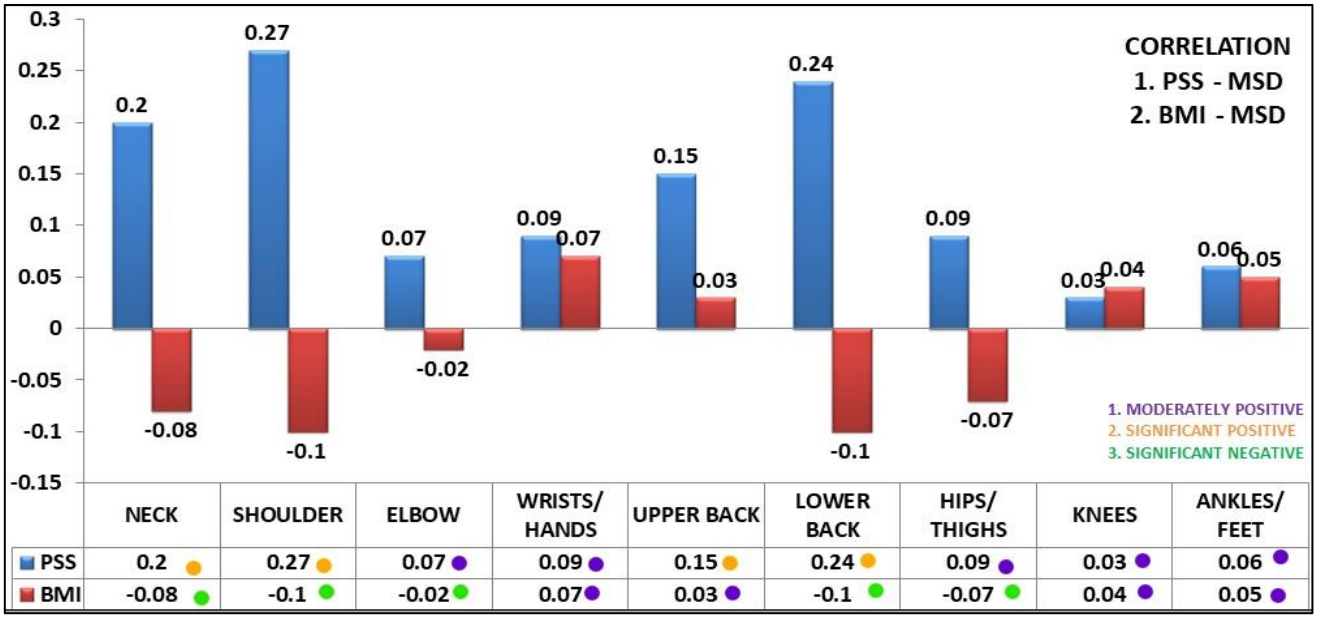

Fig 1 Spearman Correlation Coefficients between Perceived Stress, Body Mass Index, and Musculoskeletal Symptoms Across Anatomical Regions.

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Table 3 Spearman's Rank Correlation Coefficients between Body Mass Index, Perceived Stress, And Musculoskeletal Symptoms Among College-Going Students

VARIABLE / MSD ANATOMICAL SITE	BODY MASS INDEX [BMI]		PERCIEVED STRESS SCORE [PSS]	
	ρ	*p- value*	ρ	*p- value*
Neck	−0.070	0.345	0.205	0.005
Shoulder	−0.096	0.195	0.262	<0.001
Elbow	−0.030	0.682	0.075	0.312
Wrist/Hand	0.078	0.293	0.112	0.129
Upper back	0.043	0.557	0.190	0.009
Lower back	−0.078	0.289	0.266	<0.001
Hip/Thigh	−0.050	0.501	0.133	0.071
Knee	−0.009	0.904	0.037	0.621
Ankle/Foot	0.055	0.455	0.028	0.710
CORRELATION BETWEEN BMI AND PSS				
BMI	—	—	−0.038	0.607

NS = not significant, ρ = Spearman's rank correlation coefficient

IV. DISCUSSIONS

The present study examined the relationship between musculoskeletal symptoms, perceived stress, and BMI among college-going students. A high burden of musculoskeletal symptoms was observed, with the neck and lower back being among the most commonly affected regions. More importantly, perceived stress showed significant positive associations with symptoms in the neck, shoulder, upper back, and lower back, whereas BMI was not significantly associated with musculoskeletal symptoms or perceived stress. These findings suggest that psychosocial factors may have greater relevance than BMI alone in understanding musculoskeletal symptoms within this student population. The prevalence of musculoskeletal symptoms observed in the present study is comparable with findings reported among university students in previous studies. Abledu and Offei reported a 12-month prevalence of 70.1% among undergraduate nursing students, while Hayes et al. and Smith et al. also identified a substantial burden of musculoskeletal symptoms among dental hygiene and medical students, respectively [9–11]. The predominance of symptoms involving the neck and lower back in the present study is also consistent with previous reports [9,10]. These similarities may reflect common characteristics of student life, including prolonged sitting, sustained postures, repetitive academic activities, and extended use of computers and other electronic devices. However, differences in academic disciplines, assessment instruments, lifestyle characteristics, and study populations may contribute to variation in reported prevalence between studies. The observed relationship between perceived stress and musculoskeletal symptoms is particularly noteworthy. Significant positive associations were identified for the neck, shoulder, upper back, and lower back, although the magnitude of these associations was weak. This finding is consistent with previous research indicating that psychosocial and psychological factors may be associated with the development or persistence of musculoskeletal pain [5]. Ekpenyong et al. also reported an association between academic stressors and musculoskeletal disorders among college students, providing further support for the potential relevance of stress within this population [12]. Psychosocial and environmental factors have additionally been implicated in musculoskeletal disorders in other populations [4].

Several mechanisms may potentially explain the relationship between perceived stress and musculoskeletal symptoms. Psychological stress may be accompanied by increased muscle tension, altered posture, reduced physical activity, sleep disturbances, and changes in pain perception. Prolonged academic demands may further combine psychological and physical exposures, particularly when students spend extended periods in static sitting or computer-based activities. Nevertheless, these mechanisms should be interpreted as plausible explanations rather than causal pathways, because the cross-sectional design of the present study does not establish temporal relationships between stress and musculoskeletal symptoms. The absence of significant associations between perceived stress and symptoms involving the elbow, wrist/hand, hip/thigh, knee, and ankle/foot indicates that the relationship may be anatomically heterogeneous. This may reflect differences in the mechanical loading and postural demands experienced by different body regions. The cervical, shoulder, and lumbar regions, for example, may be more consistently exposed to sustained postural loading during academic activities. Further studies incorporating objective assessment of posture, physical activity, screen exposure, and duration of sitting could help determine whether these factors modify the relationship between stress and musculoskeletal symptoms. The present study did not identify a statistically significant association between BMI and musculoskeletal symptoms. Although previous research has examined BMI in relation to musculoskeletal symptoms, findings have not been uniform across populations. Viester et al. reported an association between BMI and musculoskeletal symptoms in a working population, whereas differences in age, occupational exposure, physical demands, and lifestyle may limit direct comparison with the present student population [15]. The relatively young age and predominantly normal BMI distribution of the current sample may also distinguish it from occupational populations in which prolonged physical loading and higher BMI may coexist. Therefore, the absence of a significant association in the present study should not be interpreted as evidence that BMI is unrelated to

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musculoskeletal health in all populations. The lack of a significant relationship between BMI and perceived stress is also consistent with findings reported among biomedical science students by Mohd Saat et al. [16]. Although physiological and behavioural pathways linking chronic stress and body weight have been proposed, body weight is influenced by multiple interacting factors, including dietary intake, physical activity, sleep, socioeconomic circumstances, and individual coping behaviours. These variables were not comprehensively examined in the present study and may partly explain the absence of an observable relationship between perceived stress and BMI. Differences in findings between the present study and previous research may also arise from methodological variation. Studies differ in participant characteristics, sample size, academic disciplines, definitions of musculoskeletal symptoms, BMI distributions, stress measurement tools, and analytical approaches. Furthermore, the present study used self-reported measures, which may be subject to recall and reporting bias. These considerations highlight the importance of interpreting associations within the specific characteristics of the study population rather than generalizing findings across all student or young-adult populations. From a physiotherapy and preventive-health perspective, the high burden of musculoskeletal symptoms among college students warrants attention. The observed relationship between perceived stress and symptoms in several commonly affected regions suggests that assessment of psychosocial factors may complement conventional physical and ergonomic assessment. Preventive strategies incorporating ergonomic education, postural awareness, regular physical activity, appropriate exercise, and stress-management strategies may be relevant for promoting musculoskeletal health among students. However, intervention studies are required to determine whether modification of perceived stress or other associated factors can reduce musculoskeletal symptoms.

V. CONCLUSION

The present study demonstrated a high prevalence of musculoskeletal symptoms among college-going students aged 18–25 years, with the neck, lower back, and shoulder being the most frequently affected anatomical regions. Perceived stress demonstrated weak but statistically significant positive correlations with musculoskeletal symptoms involving the neck, shoulder, upper back, and lower back. In contrast, BMI was not significantly correlated with musculoskeletal symptoms in any anatomical region and was also not significantly associated with perceived stress. These findings suggest that perceived stress may be an important factor to consider during the assessment and management of musculoskeletal symptoms among college-going students. Further longitudinal and interventional studies are warranted to investigate the temporal relationships between psychosocial factors, BMI, and musculoskeletal health in this population.

CLINICAL AND PRACTICAL IMPLICATIONS

The findings have potential implications for physiotherapy and preventive health practice in college-going populations. The high prevalence of musculoskeletal symptoms, particularly involving the neck and lower back, highlights the importance of early identification of musculoskeletal complaints among students. Furthermore, the significant positive associations observed between perceived stress and symptoms involving the neck, shoulder, upper back, and lower back suggest that assessment of psychosocial factors may be relevant when evaluating students presenting with musculoskeletal symptoms. A biopsychosocial approach incorporating postural and ergonomic education, physical activity promotion, appropriate exercise strategies, and stress-management interventions may therefore be considered when addressing musculoskeletal health in college students. However, intervention studies are required to establish whether modifying stress or other potentially modifiable factors can reduce musculoskeletal symptoms in this population.

LIMITATIONS

The findings should be interpreted in light of several limitations.

- First, the cross-sectional design limits the ability to establish temporal or causal relationships between perceived stress, BMI, and musculoskeletal symptoms.
- Second, musculoskeletal symptoms and perceived stress were assessed using self-reported questionnaires, which may be influenced by recall and reporting bias.
- Third, the sample contained a greater proportion of females than males, which may limit the generalizability of sex-specific findings.
- Fourth, most participants had a BMI within the normal range, resulting in relatively limited representation of participants with higher BMI values.
- Finally, physical activity level was not assessed, although it may represent an important confounding factor in the relationship between BMI, stress, and musculoskeletal symptoms.

These limitations should be addressed in future studies through larger and more representative samples, objective or repeated assessments, and inclusion of relevant behavioural and lifestyle variables.

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