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Associations between Anthropometric, Behavioral, and Psychosocial Factors and Low Back Pain among University Students: A Cross-Sectional Study

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ABSTRACT:

Background: Low back pain (LBP) is a prevalent musculoskeletal condition among young adults and may negatively affect academic performance and quality of life. The contribution of anthropometric and lifestyle factors to LBP in university populations remains unclear.

Objective: To examine the association between anthropometric parameters, behavioral factors, and LBP prevalence among university students.

Methods: A cross-sectional study was conducted among 193 University students aged 18–27 years. Data were collected using structured questionnaires and standardized anthropometric measurements, including body mass index (BMI), waist circumference, hip circumference, and waist-to-hip ratio. LBP was self-reported. Associations were analyzed using chi-square tests, independent t-tests, and logistic regression. Effect sizes were expressed as odds ratios (OR) with 95% confidence intervals (CI), with statistical significance set at $p < 0.05$.

Results: The prevalence of LBP was 75.1%. No significant associations were found between LBP and anthropometric variables, including BMI, waist circumference, and waist-to-hip ratio ($p > 0.05$). Behavioral factors such as physical activity, academic stress, and backpack use were also not significantly associated with LBP.

Conclusion: LBP is highly prevalent among university students but was not associated with anthropometric or selected behavioral factors. Other determinants, including ergonomic and psychosocial factors, may play a more important role. Further longitudinal studies are recommended.

KEYWORDS: Low back pain, Anthropometry, Body mass index, Lifestyle factors, University students

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INTRODUCTION

Low back pain (LBP) is a leading cause of disability worldwide and represents a major public health concern across all age groups. Although traditionally associated with middle-aged and older adults, increasing evidence indicates that LBP is highly prevalent among young adults, including university students, with potential implications for academic performance, physical function, and quality of life (Hartvigsen et al., 2018, Calvo-Munoz et al., 2018). University students are exposed to a unique combination of physical and psychosocial demands, including prolonged sitting, suboptimal study postures, academic stress, and reduced physical activity, which may predispose them to musculoskeletal complaints.

The etiology of LBP is widely recognized as multifactorial and is best understood within a biopsychosocial framework. Anthropometric factors such as body mass index (BMI), waist circumference, and body fat distribution have been proposed as potential contributors to LBP due to their influence on spinal loading and posture (Heuch et al., 2015, Gonzalez-Galvez et al., 2020). Similarly, behavioral and lifestyle factors—including physical inactivity, prolonged sitting, and carrying heavy loads—have been

associated with the development and persistence of LBP in young populations (Hoy et al., 2014, Scarabottolo et al., 2017). Psychosocial factors, such as academic stress and pain perception, may further modulate symptom reporting and pain chronicity.

Despite growing interest in LBP among young adults, findings regarding the role of anthropometric and behavioral factors remain inconsistent. While some studies have reported significant associations between obesity and LBP, others have found no meaningful relationships, particularly in relatively homogeneous student populations (Ghafouri et al., 2022). Furthermore, many studies have focused on single domains of risk, with limited integration of anthropometric, behavioral, and perceptual variables within the same population.

Understanding the relative contribution of these factors in university students is important for informing targeted preventive strategies and interventions. Therefore, this study aimed to examine the association between anthropometric parameters, lifestyle behaviors, and the prevalence of LBP among students.

MATERIALS AND METHOD

Study Design and Setting

This study was a cross-sectional analytical study conducted among undergraduate students of the University. Data collection was carried out between March to May, 2025 within the university campus.

Participants

The study population comprised male and female undergraduate students aged 18–27 years. Participants were recruited using a simple random sampling technique from student registers across different faculties.

Inclusion Criteria

Students aged 18–27 years, currently enrolled at an undergraduate program in the university and willing to provide informed consent were included in the study.

Exclusion Criteria

Students with history of diagnosed spinal disorders or deformities or current use of long-term medication for musculoskeletal conditions or pregnancy at the time of the study were excluded. A total of 193 students who met the eligibility criteria were included in the final analysis.

Variables and Outcome Measures

Primary Outcome

The primary outcome was the presence of low back pain (LBP), defined as self-reported pain or discomfort localized between the lower rib margin and the gluteal folds, experienced within the past 12 months**.** LBP was recorded as a dichotomous variable (yes/no).

Independent Variables

The independent variables included anthropometric parameters such as Body weight (kg), Height (cm), Body mass index (BMI, kg/m^2), Waist circumference (cm), Hip circumference (cm) and Waist-to-hip ratio (WHR).

Demographic Variables measured include: Age (years), Sex (male/female), Behavioral and Perceptual Variables, Physical activity level (frequent, occasional, none), Academic stress (perceived: yes/no), Backpack use (perceived as contributing to LBP: yes/no), Study posture (leaning forward, upright, slouched) and Family history of LBP (yes/no)

Data Sources and Measurement

Data were collected using a structured, self-administered questionnaire, which captured demographic, behavioral, and perceptual information, as well as self-reported LBP. The questionnaire was adapted from previously published musculoskeletal health surveys. Anthropometric measurements were obtained by trained personnel using standardized procedures: Body weight was measured using a calibrated digital weighing scale with participants wearing light clothing and no shoes. Height was measured using a stadiometer to the nearest 0.1 cm. BMI was calculated as weight (kg) divided by height squared (m^2). Waist circumference was measured at the midpoint between the lowest rib and the iliac crest. Hip circumference was measured at the widest part of the buttocks. Waist-to-hip ratio was calculated as waist circumference divided by hip circumference. All measurements were taken twice, and the average values were recorded to improve accuracy.

Bias

Several steps were taken to minimize bias. Standardized protocols were used for anthropometric measurements to reduce measurement error. Participants completed questionnaires anonymously to reduce social desirability bias. However, self-reported LBP and behavioral variables may be subject to recall bias.

Study Size

The sample size of 193 participants was determined based on availability during the study period and was considered adequate for exploratory analysis of associations between variables.

Statistical Analysis

Data were analyzed using IBM SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize participant characteristics and the prevalence of LBP. Continuous variables were presented as means and standard deviations, while categorical variables were expressed as frequencies and percentages. Associations between categorical variables and LBP were assessed using the chi-square test. Differences in continuous variables between participants with and without LBP were evaluated using independent samples t-tests.

Pearson correlation analysis was used to examine relationships between anthropometric variables and LBP. To assess independent associations, binary logistic regression analysis was performed, all variables were entered simultaneously into the logistic regression model and results were expressed as odds ratios (OR) with 95% confidence intervals (CI). A p-value of < 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the Achievers University Ethics Review Committee (Approval No: 034/25). The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to data collection, and confidentiality of participant information was maintained throughout the study.

RESULTS

Participant Characteristics

A total of 193 students participated in the study. The mean age was 22.95 ± 1.86 years. Females constituted 61.1% (n = 118) of the sample. The mean body mass index (BMI) was 23.71 ± 4.95 kg/m², with most participants classified as having normal weight (46.1%), followed by overweight (28.0%), underweight (15.5%), and obese (10.4%). The overall prevalence of low back pain (LBP) was 75.1% (n = 145). Among participants reporting LBP, pain was most frequently experienced at night (62.2%), and the majority reported using analgesics for symptom management (95.3%).

Table 1. Participant Characteristics

Variable	Total (n = 193)
Age (years), mean ± SD	22.95 ± 1.86
Female, n (%)	118 (61.1)
Male, n (%)	75 (38.9)
BMI (kg/m²), mean ± SD	23.71 ± 4.95
Underweight, n (%)	30 (15.5)
Normal weight, n (%)	89 (46.1)
Overweight, n (%)	54 (28.0)
Obese, n (%)	20 (10.4)
Low back pain (LBP), n (%)	145 (75.1)

Abbreviations: BMI, body mass index; LBP, low back pain

Association Between Demographic and Anthropometric Variables and LBP

There were no statistically significant differences in anthropometric variables between participants with and without LBP (Table 2). The mean BMI was comparable between those with LBP (23.85 ± 5.00 kg/m²) and those without LBP (23.29 ± 4.82 kg/m²; mean difference: 0.56, 95% CI: −1.06 to 2.18; p = 0.495). Similar non-significant differences were observed for weight, height, waist circumference, hip circumference, and waist-to-hip ratio ($p > 0.05$ for all comparisons). In logistic regression analysis, anthropometric variables were not significantly associated with LBP (Table 3). BMI (OR = 1.03, 95% CI: 0.95–1.11), waist circumference (OR = 1.01, 95% CI: 0.98–1.04), and waist-to-hip ratio (OR = 1.12, 95% CI: 0.71–1.77) were not significant predictors.

Table 2. Comparison of Anthropometric Variables Between Participants With and Without LBP

Variable	LBP (n = 145) Mean ± SD	No LBP (n = 48) Mean ± SD	Mean Difference (95% CI)	p-value
Age (years)	23.07 ± 1.95	22.58 ± 1.53	0.49 (−0.13 to 1.11)	0.118
Height (cm)	169.39 ± 9.49	169.38 ± 9.50	0.01 (−2.87 to 2.89)	0.994
Weight (kg)	68.34 ± 15.09	66.40 ± 12.86	1.94 (−2.83 to 6.71)	0.425

Variable	LBP (n = 145) Mean ± SD	No LBP (n = 48) Mean ± SD	Mean Difference (95% CI)	p-value
BMI (kg/m²)	23.85 ± 5.00	23.29 ± 4.82	0.56 (−1.06 to 2.18)	0.495
Waist circumference (cm)	77.00 ± 12.87	75.56 ± 9.66	1.44 (−2.60 to 5.48)	0.479
Hip circumference (cm)	95.94 ± 12.32	97.04 ± 8.59	−1.10 (−4.90 to 2.70)	0.566
Waist-to-hip ratio	0.81 ± 0.13	0.78 ± 0.11	0.03 (−0.02 to 0.08)	0.295

Association Between Demographic and Behavioral Variables and LBP

No significant associations were observed between LBP and demographic variables, including age and sex (Table 3). Similarly, behavioral factors such as physical activity level, perceived academic stress, and backpack use were not significantly associated with LBP (Tables 3 and 4). Logistic regression analysis showed no significant associations for physical activity (OR = 0.89, 95% CI: 0.52–1.53), academic stress (OR = 1.08, 95% CI: 0.63–1.84), or backpack use (OR = 1.15, 95% CI: 0.67–1.98). Chi-square analysis confirmed these findings ($p > 0.05$ for all comparisons) (Table 4).

Table 3. Logistic Regression Analysis of Factors Associated With LBP

Variable	OR	95% CI	p-value
Age	1.12	0.96–1.30	0.118
Female sex	1.46	0.85–2.52	0.077
BMI	1.03	0.95–1.11	0.495
Waist circumference	1.01	0.98–1.04	0.479
Waist-to-hip ratio	1.12	0.71–1.77	0.295
Physical activity	0.89	0.52–1.53	0.372
Academic stress	1.08	0.63–1.84	0.963
Backpack use	1.15	0.67–1.98	0.525

Abbreviations: OR, odds ratio; CI, confidence interval

Table 4. Association Between Behavioral Factors and LBP (Chi-square Analysis)

Variable	LBP (%)	No LBP (%)	p-value
Physical activity			0.895
• Frequent	74.6	25.4	
• Occasional	77.0	23.0	
• Never	72.2	27.8	
Academic stress (Yes)	74.3	25.7	0.449
Backpack use (Yes)	73.9	26.1	0.525
Family history (Yes)	74.1	25.9	0.529

Correlation Analysis

Pearson correlation analysis demonstrated significant relationships among anthropometric variables, including weight and BMI ($r = 0.843$, $p < 0.01$), and waist circumference and hip circumference ($r = 0.420$, $p < 0.01$). However, no significant correlations were observed between LBP and any anthropometric or behavioral variables ($p > 0.05$) (Table 5).

Table 5. Correlation Matrix of Anthropometric Variables

Variable	BMI	Waist Circumference	Hip Circumference	WHR
Weight	0.843**	0.250**	0.251**	0.020
BMI	—	0.199**	0.157*	0.049
Waist circumference	—	—	0.420**	0.603**
Hip circumference	—	—	—	−0.411**

Notes: *$p < 0.05$; **$p < 0.01$, WHR = waist-to-hip ratio

DISCUSSION

This study investigated the association between anthropometric parameters, behavioral factors, and the prevalence of low back pain among university students. The findings indicate a high prevalence of LBP (75.1%) within this population; however, no significant associations were observed between LBP and anthropometric, demographic, or selected behavioral variables. These results highlight the complexity of LBP and suggest that commonly assumed risk factors may not adequately explain its occurrence in relatively young and homogeneous populations.

The high prevalence of LBP observed in this study is consistent with previous reports among university students, which have attributed this burden to prolonged sitting, academic demands, and lifestyle-related factors (Alsheri et al., 2023, Umeonwuka, 2016). Despite this, the absence of significant associations between LBP and anthropometric measures such as BMI, waist circumference, and waist-to-hip ratio contrasts with studies that have identified obesity as a risk factor for LBP (Heuch et al., 2024). One possible explanation is the relatively narrow range of anthropometric variation in this sample, where the majority of participants had normal or near-normal BMI values. In such populations, the mechanical impact of excess body weight on the spine may be less pronounced, thereby reducing its observable effect on LBP.

Similarly, behavioral factors including physical activity, perceived academic stress, and backpack use were not significantly associated with LBP. While these findings may appear inconsistent with prior literature, they align with evidence suggesting that the relationship between physical and psychosocial exposures and LBP is complex and not necessarily causal (Swain et al., 2020). It is also possible that the use of self-reported and non-standardized measures limited the ability to detect subtle associations. Additionally, the cross-sectional design precludes the assessment of temporal relationships, and therefore, the directionality of associations cannot be established (Wirth et al., 2018).

The lack of significant findings across multiple domains may further support the biopsychosocial model of LBP, in which pain is influenced by an interplay of biological, psychological, and environmental factors rather than isolated variables (Zhang et al., 2024). Factors not assessed in this study—such as ergonomic conditions (e.g., chair design, screen time), sleep quality, and psychological distress—may play a more substantial role in this population and should be considered in future research.

From a clinical perspective, these findings suggest that preventive strategies for LBP among university students should not focus solely on anthropometric characteristics or isolated lifestyle behaviors. Instead, a more comprehensive approach incorporating ergonomic education, promotion of healthy study habits, and psychosocial support may be more effective (Steenholt et al., 2018, Steffens et al., 2016). Clinicians and university health services should consider implementing multifaceted interventions aimed at reducing sedentary behavior and improving posture during academic activities.

CONCLUSION

In conclusion, although LBP is highly prevalent among university students, it was not associated with anthropometric or selected behavioral factors in this study. These findings underscore the need for longitudinal studies using validated assessment tools to better elucidate the determinants of LBP and inform targeted interventions. The findings challenge the conventional understanding of LBP risk factors. Interventions should focus on ergonomic practices and stress management to reduce the burden of LBP among students.

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