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Article

Prevalence of Lower Back Pain (LBP) and its Associated Risk Factors Among Alfaisal University Medical Students in Riyadh, Saudi Arabia

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Abstract: This study investigated the prevalence and associated risk factors of Lower Back Pain (LBP) among medical students of Alfaisal University, Riyadh, Saudi Arabia. A cross-sectional study was employed where 331 medical students were evaluated using the Oswestry Disability Index (ODI) supplemented with demographic and lifestyle questions. Data analysis allowed identification of LBP-risk factor relationships. The study revealed a 73.4% prevalence of LBP among Alfaisal University medical students with a 4.61 average severity. Female students, those who spent long hours on computers, and those who did not exercise were more likely to experience LBP. Higher disability degree was associated with participants aged >21, used their devices for extended periods, and insufficient sleep. LBP is highly prevalent with several risk factors existing. These findings highlight the need for targeted interventions such as ergonomic/lifestyle improvements and reduced device use.

Keywords: lower back pain; medical students; Saudi Arabia; prevalence; Oswestry Disability Index; ergonomics; physical activity; risk factors; disability

Introduction

Lower back pain (LBP) is a highly prevalent condition that affects a large number of people around the world throughout their lifetime, including medical students. This lower back pain is defined as the pain that affects the lumbar region of the back that begins below the ribcage and ends in the buttock region, often lasting for less than three months [1,2]. This type of pain can be a significant detriment to a person's quality of life and hinder activities, work performance, and mental wellbeing.

The global impact of LBP is staggering. It is currently the leading cause of years lived with disability, affecting 619 million people and leading to almost a combined 69 million years of disability [3]. The mean prevalence of lower back pain globally ranges from 8-31% according to various studies, varying significantly with regards to age, gender, and region [4,5]. This widespread issue represents potentially massive economic losses in all sectors, especially the healthcare sector.

LBP accounted for the one of the topmost reasons workers consult their physicians for, costing both money and time [6,7]. In high-income countries, the total costs associated with LBP can be as high as €10.75 billion per population (2.6b direct and 8.15b indirect), costing individual patients up to \$10,143 over the course of the pain [8]. In middle and low-income countries, these costs were found to be even higher on a per-patient basis [9].

Among specific demographic identifiers of patients, the prevalence of LBP becomes more variable. The prevalence of LBP among teenagers (years 13-18) sits at about 19%, in university students it rises to around 60-80% [10,11]. Multiple studies have seen a discrepancy among females and males—with females having higher prevalence rates than males, ranging from 1-10% higher than males across all settings [5,12]. In all, back pain is on the increase across all demographics and will

continue to represent a significant cause of disability in the global population—estimated to increase by almost 36.4% new cases of lower back pain (although the total prevalence rate is expected to decrease slightly from 7.30% to 7.08) [5].

Several factors contribute to the development of LBP, with both behavioral and psychological etiologies playing a role. Interestingly, less than 1% of LBP cases presenting to primary care clinics have diagnosed pathological causes as seen in one study [13]. As such, the vast majority of LBP cases remain idiopathic and/or multifactorial rather than associated with one specific etiology [14]. The main mechanism of developing LBP is a disturbance to the natural curvature of the spine. Factors such as increased BMI, obesity, poor sitting and standing posture, poor lumbar support, sedentary lifestyle, poor exercise regime, and insufficient sleep all contribute to an increased risk of developing LBP [2,15].

The point prevalence of LBP among Saudi university students was shown to range from 22-66% in two recent studies tallying students from both province-specific universities and across Saudi Arabia [12,16]. With regards to Saudi medical students this has been seen to be anywhere from 80-94% among three studies from separate medical colleges across the Kingdom of Saudi Arabia [17–19].

Among the general population, medical students are particularly susceptible to LBP due to their long hours of study and sedentary lifestyle caused by the increased curriculum rigor. All being potential factors that can predispose them to developing a sedentary, study-based lifestyle that can increase the likelihood of developing back pain [20]. It is critical to further understand LBP in this cohort, as medical students are a significant part of the health system and point of access between patient and the healthcare system [21]. As such, the significant loss of productivity and gain of disability due to LBP in medical students and healthcare workers (HCWs) is critical to consider when looking at losses in the healthcare system.

However, the question of whether being a medical student itself is the factor at play or whether it is any extraneous disturbances to a normal healthy state caused by a shifting to medical curricula then arises. Medical students themselves undergo significant lifestyle changes to adapt to the curriculum which often go unexplored in a majority of studies regarding lower back pain.

Previous studies on this issue were able to reach conclusions on prevalence rates among general university students and medical students however gaps exist in understanding the exact mechanism behind high rates of LBP. Alshehri et. al's study does not analyze medical students themselves and as such the demographic factors are limited in activities that medical students are specifically more prone to [12]. Aljohani et. al extends off of Alshehri's study by utilizing the Oswestry Disability Index (ODI) questionnaire but again does not account for study degree [16]. Alwashmi et.al and Alrabai et. al's studies analyzes the lifestyle factors that can affect LBP prevalence in medical students but does not extend this to the severity of this disability and the correlation of factors on degree of disability by using an index/tool like previous studies [17,18].

Given these gaps in the existing research, there remains a significant need to understand the role of various lifestyle and demographic factors on the prevalence and severity of LBP in medical university students in Saudi Arabia. This study seeks to address these knowledge gaps by examining both novel and previously studied factors implicated with LBP. By investigating the prevalence and severity of lower back pain among the medical students of Alfaisal University and its relation to various factors, this research aims to provide a more comprehensive understanding of LBP in this population. The study will employ the Oswestry Disability Index (ODI) to assess the degree of disability, coupling an examination of LBP with an analysis of its severity in the studied population.

To guide this investigation, the authors formulated the following hypotheses:

H0: There is no statistically significant association/difference between the presence of lower back pain/Oswestry Index score and the variables analyzed. This is if the p-value is found to be above or equal to 0.05.

HA: There is a statistically significant association/difference between the presence of lower back pain/Oswestry Index score and the variables analyzed. This is if the p-value is found to be below 0.05.

Through this comprehensive approach, the study aims to contribute valuable insights to the understanding of LBP among medical students, potentially informing future interventions and preventive measures in this crucial population.

2. Materials and Methods

2.1. Study Design

This cross-sectional study was conducted at Alfaisal University from March to April 2024, involving medical students from Years 1-5, if they consented to participate. The authors opted for a cross-sectional design due to its efficiency in collecting data from a large sample simultaneously, which is particularly advantageous given the busy schedules of medical students. This study utilized STROBE cross-sectional study guidelines and adhered to them.

2.2. Study Eligibility Criteria

Participants were eligible to be considered in this study if they were:

- Currently Enrolled Medical Students at Alfaisal University (Years 1-5, MBBS program)
- Consented to the study IRB disclosure agreement

2.3. Study Sample

The target population for this study comprised all medical students at Alfaisal University in Riyadh (approximately 1200 students). Multiple channels were used to maximize recruitment including emails, broadcast messages, and in-person invitations through QR codes of the study form. Reminders were sent to encourage students' participation.

2.4. Sample Size Calculation

To ensure statistical validity, the authors calculated the required sample size, for a precision of 5% and a prevalence of 50% in a population of 1200 students. A minimum required sample of 292 participants was yielded based on a 95% confidence interval (CI). This calculation was performed utilizing the sample size calculator available at <https://www.calculator.net/sample-size-calculator.html>. The final sample of 331 students exceeded this requirement, enhancing the study's statistical power.

2.4. Survey Instrument

The survey instrument comprised three main components:

1. Author-developed questions: These were specifically designed to gather demographic information and explore factors potentially associated with lower back pain (LBP) among medical students. These questions were pilot tested on a group of 15 students which were not included in the study population and minor adjustments were done based on their feedback.
2. Validated Oswestry Disability Index (ODI): The authors incorporated the chiropractic version of the ODI [22], which is a widely recognized tool for assessing LBP-related disability. This version consists of 10 questions, each with six possible answers scored from 0 to 5 [23].
3. Additional validated questions: The authors also included questions on posture, medical advice-seeking behavior, device usage, and lifestyle choices, drawn from previous studies [18,24,25].

The Oswestry Disability Index (ODI) score calculation and interpretation that was applied included:

1. The ODI score was calculated by summing the scores from all 10 questions, resulting in a total score ranging from 0 to 50.
2. This total score was then used to determine the degree of LBP-related disability experienced by the respondent.
3. The interpretation of ODI scores is as follows:
 - 0-4: No disability
 - 5-14: Mild disability

- 5-24: Moderate disability
- 25-34: Severe disability
- 35-50: Complete disability

By combining these validated tools with custom questions, the authors aimed to comprehensively assess both the prevalence and severity of LBP among Alfaisal University medical students, as well as identify potential risk factors associated with this condition.

2.5. Data Collection

Data was collected via a Google form distributed to students through multiple modalities, such as in person pop-ups where participants anonymously filled out their data, through university-wide broadcast emails, and social media platforms such as WhatsApp. The data collection duration lasted approximately one month, from March to April 2024. Participants were assured of the confidentiality of their responses, which were strictly for research purposes and guided by the strict protocols by the university's ethics board. The survey automatically excluded non-medical students, ensuring that only the target population, Alfaisal University College of Medicine students could proceed to complete the survey.

2.6. Statistical Analysis

Data was first stored, cleaned, and then imported into Google Sheets for analysis using IBM SPSS Statistics software. Responses that did not consent to the disclosure agreement in addition to improperly filled/missing responses were discarded. To conduct hypothesis testing, Chi-squared analysis was utilized to identify associations between categorical demographics and the occurrence of lower back pain (LBP) and further analysis regarding the role of gender among significant determinants of LBP. As for assessing the relationship between mean Oswestry Disability Index (ODI) scores and demographic factors, we conducted Analysis of Variance (ANOVA) and t-tests. Regression analysis was carried out on variables like age with adjustments made for variables. In this study we set an alpha value of 0.05 considering results with $p < 0.05$ being considered as significant. This thorough analytical approach allowed us to deeply explore the associations between various factors and LBP among students.

2.7. Ethical Considerations

The respondents were surveyed through an anonymous Google Forms survey tool that did not collect any form of identifier apart from the examined variables for the study. All data was stored on a secure server only accessible to the study team and data will be destroyed following the study conclusion. This study was conducted under the oversight of the Alfaisal institutional board.

This study was not funded by any entities nor did any of the authors possess any conflicts of interests.

3. Results

3.1. Descriptive Results

Over the course of the data collection period, 338 responses were gathered with 336 respondents consented to participate and of those only 331 providing complete responses. Thus formed our final study data sample of 331 students.

The respondents were from all five years of study of Alfaisal University and ranged from ages 17 to above 22. The average age of the respondent was 20, average BMI was around 23, and the responses displayed a high female:male ratio. Most students surveyed were in the 17-21 age range ($n=278$), with respondents primarily being concentrated in the first two years of Alfaisal University medical school (44.7% and 25.4% for study years 1 and 2 respectively). A significant majority of respondents were in the normal BMI range (57.7%), followed by those in the overweight category

(23.9%) and small amounts of underweight and obese respondents (10.3% and 8.2% respectively) (Table 1).

As for the lifestyle of the respondents, a majority (51.4%) experienced lower back pain before beginning medical school. A supermajority of surveyed students also spend long hours on their computer/laptop for various purposes (94%). Regarding phone usage, a majority of students use their phone for an average of 2-5 hours (42.9%) with a sizable minority using it 5-8 hours a day (33.8%). Additionally, the majority of students exercise (50.1%) with the largest percentage exercising for more than five hours. Most students are not smokers, do not lift weights, and commute to university in less than 30 minutes. Most respondents sleep 4-6 hours (55.0), yielding an average sleep duration of 4.45 hours. The sitting position of respondents was also questioned, which revealed that most students lean forward when they sit in any situation (39.0). Regarding backpack usage and habits, the majority of respondents do regularly wear a backpack (40.2) however the second-largest contingent of students following backpack wearers is the group of students who wear a shoulder-bag or a crossbody (34.7) (Table 1).

Table 1. Demographics & Lifestyle Habits of Respondents.

Variable		Frequency
Age, mean ±sd (yrs)		20.01 ±1.81
Age (yrs)	17-21	278(84.0)
	22+	53(16.0)
Gender	Female	206(62.2)
	Male	125(37.8)
BMI, mean ±sd (kg/m²)		23.63 ±4.60
BMI Category	Underweight	34 (10.3)
	Normal	191 (57.7)
	Overweight	79 (23.9)
	Obese	27 (8.2)
Year In Medical School	Year 1	148(44.7)
	Year 2	84(25.4)
	Year 3	52(15.7)
	Year 4	26(7.9)
	Year 5	21(6.3)
Experienced Back Pain Before Medical School	No	161(48.6)
	Yes	170 (51.4)
Spend Long Hours on Computers	No	20 (6.0)
	Yes	311 (94.0)
Exercise	No	165 (49.8)
	Yes	166 (50.2)
Weekly exercise (hrs)	1-2	47 (28.3)
	3-5	53 (31.9)
	5+	66 (39.7)
Lift Weights	No	217 (65.6)
	Yes	114 (34.4)
Smoke	No	296 (89.4)
	Yes	35 (10.6)
Average daily phone usage (hrs)	<1	4 (1.2)
	1-2	31 (9.4)
	2-5	142 (42.9)
	5-8	112 (33.8)
	8+	42 (12.7)
University Commute Length (Minutes)	Less than 30	180 (54.4)
	More than 30	151 (45.6)

Average sleep time (hrs)	4>	24 (7.3)
	4-6	182 (55)
	6-8	103 (31.1)
	8+	22 (6.6)
Sitting Position	Upright	33 (10)
	Leaning Back	136 (41.1)
	Leaning forward	129 (39)
	Sitting at edge	33 (10)
Wear Backpack	Yes	133 (40.2)
	Sometimes	57 (17.2)
	No	26 (7.9)
	Carry shoulder bag or crossbody	115 (34.7)

Regarding lower back pain data, a significant majority of students did admit to suffering from lower back pain (LBP) in any capacity (73.4%, n=253). From a scale of 1-10 where 10 is the most severe, the average LBP severity was 4.61 out of 10 (Table 2).

Table 2. Prevalence of Lower Back Pain in Alfaisal University Medical Students.

Variable		Frequency (%)
Experience Back Pain	Yes	78 (23.6)
	No	253 (73.4)
Severity of Back Pain, mean $\pm$ sd (1-10)		4.61 $\pm$ 2.16

3.2. Analytical Results

Table 3 includes the results of the chi-square analysis of the data. Various lifestyle and demographic factors were analyzed with regards to the presence or absence of lower back in participants.

Regarding the demographic profile of the participants, analysis discerned that there exists a statistically significant relationship between gender and the presence of LBP. LBP presence seems to strongly skew towards females rather than male participants ($p= <0.001$). There was no other statistically significant relationship in the demographics profile of the participants.

Surrounding the lifestyle factors and behaviors of the participants, numerous statistically-significant relationships exist. For instance, exercise and LBP also display a statistically significant relationship, however the duration of that exercise does not seem to have an association ($p=0.001$ and 0.287 respectively). Regarding exercise, lifting weights also displayed strong significance with back pain with larger numbers of weight-lifting participants possessing back-pain than their counterparts who do not ($p= <0.001$). The duration of average daily phone use is also another important lifestyle factor noted in the analysis, with a slight relationship existing ($p=0.042$). Regarding the sitting position of participants, there is a strong relationship between it and LBP, with most participants leaning either forward or backward ($p=0.014$). Additionally, participants' habit of wearing backpacks, similar items, or not, displays a strong relationship with LBP ($p=0.001$). Most participants either wear a backpack or a shoulder bag/crossbody to university.

Table 3. Chi-Square Analysis of Lower Back Pain v. Various Factors.

Variable		Do Not Suffer Back Pain (%)	Suffer Back Pain (%)	P-value
Age	17-21	50 (64.1)	75 (29.6)	0.218
	22+	28 (35.9)	178 (70.4)	
Gender	Male	69 (88.5)	209 (82.6)	<.001
	Female	9 (11.5)	44 (17.4)	

BMI	Underweight	10 (12.8)	24 (9.5)	0.836
	Normal	45 (57.7)	146 (57.7)	
	Overweight	17 (21.8)	62 (24.5)	
	Obese	6 (7.7)	21(8.3)	
Year of Study	Year 1	35 (44.9)	113 (44.7)	0.302
	Year 2	21 (26.9)	63 (24.9)	
	Year 3	16 (20.5)	36 (14.2)	
	Year 4	4 (5.1)	22 (8.7)	
	Year 5	2 (2.6)	19 (7.5)	
Spend Long Hours on Computers	No	6 (7.7)	14 (5.5)	0.484
	Yes	72 (92.3)	239 (94.5)	
Exercise	No	26 (33.3)	139 (54.9)	0.001
	Yes	52 (66.7)	114 (45.1)	
Weekly exercise (hrs)	1-2	11 (20.8)	37 (32.5)	0.287
	3-5	18 (34.0)	35 (30.7)	
	5+	24 (45.3)	42 (36.8)	
Lift Weights	No	38 (48.7)	179 (70.8)	<0.001
	Yes	40 (51.3)	74 (29.2)	
Smoke	No	70 (89.7)	226 (89.3)	0.917
	Yes	8 (10.3)	27 (10.7)	
Average daily phone usage (hrs)	<1	0 (0.0)	4 (1.6)	0.042
	1-2	5 (6.4)	26 (10.3)	
	2-5	45 (57.7)	97 (38.3)	
	5-8	20 (25.6)	92 (36.4)	
	8+	8 (10.3)	34 (13.4)	
University Commute Length (Minutes)	Less than 30	48 (61.5)	132 (52.2)	0.147
	More than 30	30 (38.5)	121 (47.8)	
Average sleep time (hrs)	4>	2 (2.6)	22 (8.7)	0.272
	4-6	46 (59.0)	136 (53.8)	
	6-8	26 (33.3)	77 (30.4)	
	8+	4 (5.1)	18 (7.1)	
Sitting Position	Upright	7 (9.0)	26 (10.3)	0.014
	Leaning Back	44 (56.4)	92 (36.4)	
	Leaning forward	20 (25.6)	109 (43.1)	
	Sitting at edge	7 (9.0)	26 (10.3)	
Wear Backpack	Yes	8 (10.3)	18 (7.1)	0.001
	Sometimes	10 (12.8)	47 (18.6)	
	No	45 (57.7)	88 (34.8)	
	Carry shoulder bag or crossbody	15 (19.2)	100 (39.5)	

Following the chi-square analysis of how each factor relates to the presence or absence of lower back pain, a subsequent analysis focused on gender differences among the statistically-significant variables uncovered. ($p<0.05$). Gender was cross tabulated with factors such as exercise, lifting weights, average phone usage duration, sitting position, and backpack use. Figure 1 illustrates these gender-specific patterns.

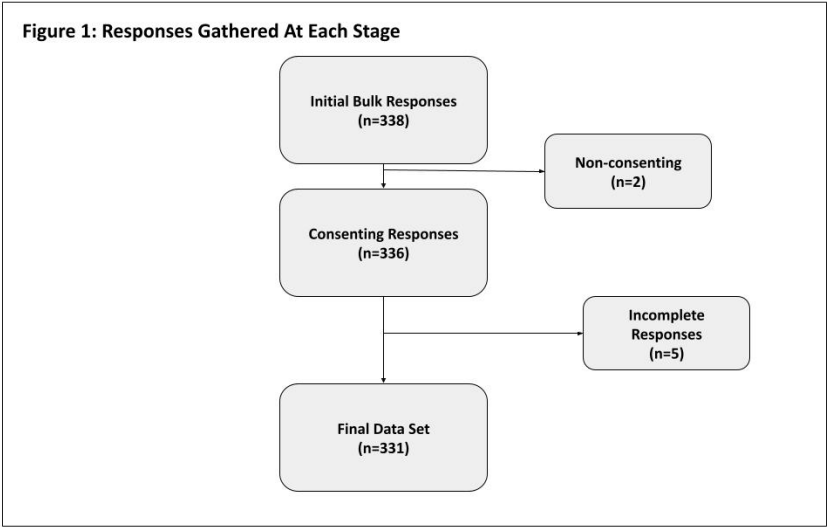


Figure 1. Responses Gathered At Each Stage.

Results revealed distinct patterns between male and female students (Table 4, Figure 1). Both genders reported high rates of long computer usage, with 92.8% of males and 94.7% of females spending extended periods on computers. However, significant disparities were observed in physical activities. Male students showed higher engagement in exercise (72.0% exercising regularly) compared to female students (only 36.9%). Similarly, weight lifting was more prevalent among males (56.0%) than females (21.4%).

Regarding daily phone usage, a higher percentage of male students (48.8%) reported using their phones for 3-5 hours compared to female students (39.3%). However, for 6-8 hours of daily usage, the trend reversed slightly with 35.9% of females versus 30.4% of males.

Sitting posture analysis indicated gender-specific preferences. Male students were more likely to lean back (52.0%) compared to female students (34.5%), while a higher proportion of female students (43.7%) tended to lean forward when seated versus male students (31.2%).

In terms of bag preferences, a stark contrast was observed. The majority of male students (65.6%) opted for backpacks, while only 24.8% of female students did so. Conversely, shoulder bags or crossbody bags were overwhelmingly preferred by female students (53.4%) compared to male students (4.0%).

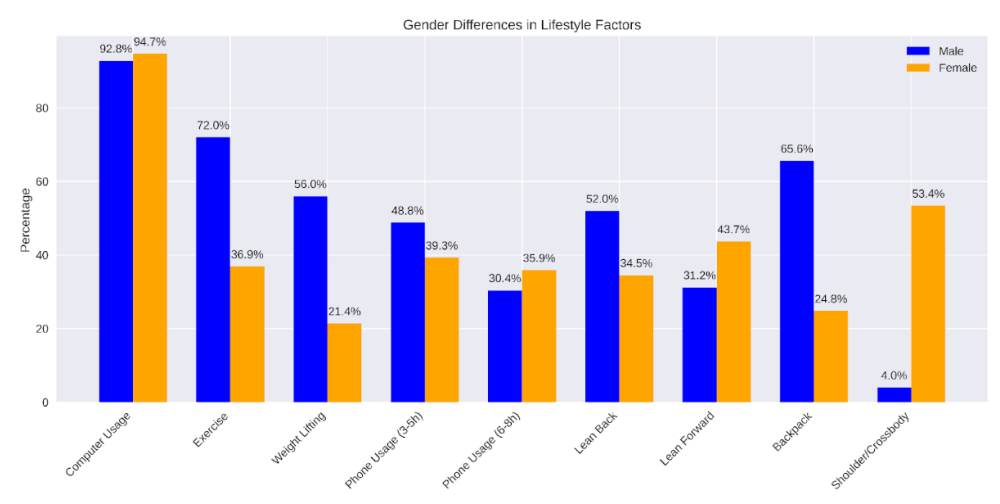


Figure 2. Gender Differences in Statistically Significant Lifestyle Factors and Behaviors.

Table 4. Further Analysis of Gender v. Factors Found Associated With Back Pain ($p < 0.05$).

Variable		Frequency of Males	Frequency of Females
Spend Long Hours on Computers	No	9 (7.2)	11 (5.3)
	Yes	116 (92.8)	195 (94.7)
Exercise	No	35 (28.0)	130 (63.1)
	Yes	90 (72.0)	76 (36.9)
Lift Weights	No	55 (44.0)	162 (78.6)
	Yes	70 (56.0)	44 (21.4)
Average daily phone usage (hrs)	<1	2 (1.6)	2 (1.0)
	1-2	9 (7.2)	22 (10.7)
	3-5	61 (48.8)	81 (39.3)
	5-8	38 (30.4)	74 (35.9)
	8+	15 (12.0)	27 (13.1)
Sitting Position	Upright	13 (10.4)	20 (9.7)
	Leaning Back	65 (52.0)	71 (34.5)
	Leaning forward	39 (31.2)	90 (43.7)
	Sitting at Edge	8 (6.4)	25 (12.1)
Carry a Backpack	No	11 (8.8)	15 (7.3)
	Sometimes	27 (21.6)	30 (14.6)
	Yes	82 (65.6)	51 (24.8)
	Instead carry shoulder bag or crossbody	5 (4.0)	110 (53.4)

The Oswestry Disability Index (ODI) was used to assess the level of disability that admitted to suffering from Lower back pain (LBP). As depicted in Table 5, the majority of respondents (56.9%, n=144) were classified as having "No Disability." A substantial proportion (37.2%, n=94) fell into the "Mild Disability" category. A smaller fraction of participants were categorized with more significant impairment: 4.3% (n=11) showed "Moderate" disability, while only 1.6% (n=4) were classified with "Severe Disability". These findings suggest that while LBP was prevalent in the study population, the impact on daily functioning, as seen by the severity levels uncovered by the ODI, was relatively minimal for most participants. Over 94% of the respondents experienced either no disability or only mild disability, indicating that the majority of individuals with LBP in this study were able to manage their daily activities with little to no significant impairment (Table 5).

Table 5. Oswestry Disability Index Categorization of Participants Suffering from LBP.

Oswestry Index Degree of Disability	Frequency (%)
No Disability	144 (56.9)
Mild Disability	94 (37.2)
Moderate	11 (4.3)
Severe Disability	4 (1.6)

The respondents’ Oswestry Disability Index score (ODI scores) was also analyzed with regards to the various demographic and lifestyle factors using Analysis of Variance (ANOVA) and independent t-test statistical analyses, yielding mean ODI scores for each demographic and lifestyle factor in addition to the degree of statistical significance of those relationships. Most categories of factors were correlated with a mean ODI between 5-14 points—categorizing them as “low-disability” with small numbers of specific factors with mean scores below 5 leading to a categorization of “no-disability.”

The age range of the participants displayed statistically significant variance ($p=0.08$) between participants aged 17-21 and participants 22 years and over, with the former having an average ODI score of 4.86 (thus categorizing them as “No Disability” per the Oswestry Disability Index) and the

latter 7.14 (“Mild Disability”). No other demographic factors displayed statistically significant variance among ODI scores.

Regarding demographic factors, a number of them displayed valid relationships with regards to average ODI scores. Firstly, participants who admitted to spending long hours on their displayed markedly higher Oswestry index scores compared to those who did not (5.47 vs. 1.57; $p=0.008$). Additionally, daily phone usage duration was shown to display statistically significant variance among participants—those who utilized their phones for less than an hour or more than 8 hours (10.75 for those >1 Hour and 7.21 for those 8+; $p=0.28$). Those who used their phones for intermediate durations had similar scores. Average sleep time of the participants was also shown to be statistically significant with regard to Mean ODI score, possessing an inverse relationship on ODI scores ($p=0.023$). These results are summarized in Table 6.

Table 6. Comparison and Correlation of LBP-Stricken Student Oswestry Disability Index Score By Variables.

Variable		Mean ODI Score ± SD	<i>p</i>
Age	17-21	4.86 ±4.87	0.008
	22+	7.14 ±7.29	
Gender	Male	4.68 ±5.65	0.778
	Female	5.50 ±5.32	
BMI	Underweight	5.46 ±5.84	0.141
	Normal	4.62 ±4.76	
	Overweight	6.13 ±6.30	
	Obese	6.86 ±6.21	
Year of Study	Year 1	5.12 ±5.02	0.635
	Year 2	5.56 ±5.54	
	Year 3	4.81 ±5.54	
	Year 4	4.50 ±4.06	
	Year 5	6.84 ±8.08	
Experienced Back Pain	No	5.23 ±5.29	0.765
Before Medical School	Yes	5.28 ±5.55	
Spend Long Hours on Computers	No	1.57 ±1.51	0.008
	Yes	5.47 ±5.49	
Exercise	No	5.23 ±5.06	0.170
	Yes	5.29±5.86	
Weekly exercise (hrs)	1-2	4.62 ±3.80	0.054
	3-5	7.26 ±7.30	
	5+	4.24 ±5.73	
Lift Weights	No	5.46 ±5.59	0.573
	Yes	4.77 ±5.00	
Smoke	No	5.04 ±5.33	0.763
	Yes	7.11 ±5.93	
Average daily phone usage (hrs)	<1	10.75 ±6.90	0.028
	1-2	5.15 ±4.93	
	2-5	5.18 ±5.05	
	5-8	4.41 ±4.52	
	8+	7.21 ±7.86	
University Commute Length (Minutes)	Less than 30	5.08 ±5.77	0.388
	More than 30	5.45 ±5.03	
Average sleep time (hrs)	4>	8.23 ±7.13	0.023
	4-6	5.37 ±5.58	
	6-8	4.23 ±4.35	

	8+	5.17 ±4.96	
Sitting Position	Upright	4.58 ±4.53	0.333
	Leaning Back	5.86 ±6.54	
	Leaning forward	4.70 ±4.37	
	Sitting at edge	6.15 ±5.82	
Wear Backpack	Yes	6.61 ±6.85	0.337
	Sometimes	5.72 ±5.38	
	No	4.49 ±4.81	
	Carry shoulder bag or crossbody	5.47 ±5.65	

In order to further explore the relationship between age (as a continuous variable) and the Oswestry Disability Index (ODI) Score of the participants, a linear regression analysis was conducted with adjustment for the other statistically significant variables impacting Oswestry Disability Index Score (phone usage duration, spending long hours on devices, and sleep duration). Following adjustment of other statistically significant determinants of ODI scores uncovered through ANOVA and t-test analysis, the model displayed that age did indeed possess a statistically significant relationship on ODI score ($p=0.026$). Age was shown to have a positive correlation with Oswestry Disability Index score ($\beta=.137$), indicating that as age increases so too will ODI scores. Additionally, the regression model uncovered that duration of sleep had a negative relationship on the ODI score of participants ($\beta=-.140$; $p=0.025$), suggesting that sleeping more decreases ODI score while spending long hours increases ODI score due to the positive relationship uncovered ($\beta=.170$; $p=0.006$). Duration of phone usage did not meet the alpha of the study ($p>0.05$). These results are summarized in Table 7.

Table 7. Regression Analysis of Participant Age on Oswestry Index Score, Adjusted for Spending Long Hours on Devices, Avg. Duration of Sleep, and Avg. Duration of Phone Usage*.

Variable*	Beta	Std. Error	p
Constant	n/a	4.128	0.207
Age (cont.)	.137	.182	0.026
Duration of sleep (Ranges)	-.140	.451	0.025
Spend Long Hours on Computer (y/n)	.170	1.453	0.006

*Average daily phone usage duration results not included in the table as it did not meet alpha ($p=0.934$).

4. Discussion

4.1. General Discussion

Results of this study reveal that a significant number of students (73.4%) experience LBP, which is consistent with findings from previous studies worldwide. This discovery corresponds with research from a school in Bangladesh, where 63.3% of students reported LBP over a 12 month period [27]. Previous studies conducted in cities in Saudi Arabia have also shown a prevalence of LBP among medical students; for instance 82% at Qassim University [19]. However it is important to note that some studies have indicated rates of LBP among students, such as 33.3% and 20.8% at Taif University in Saudi Arabia and a similar study carried out in Serbia respectively [28,29]. These discrepancies could stem from the cross-sectional design of these studies potentially introducing biases along with variations in lifestyles, across different geographical regions.

This study found that among medical students, LBP is closely linked to a few factors; weightlifting ($p<0.001$), being female ($p<0.001$), physical activity ($p=0.001$), and carrying a backpack ($p=0.001$). It's noteworthy that the majority (70.8%) of students with LBP mentioned not participating in weightlifting even though some engaged in exercise. This intriguing discovery hints at an aspect

of proper weightlifting against LBP. One possible explanation is that correct weightlifting techniques could help strengthen the back and core muscles potentially reducing or preventing LBP [30].

This study also revealed that most medical students suffering from LBP carry a backpack at least occasionally. This finding is consistent with a previous study on college students, which demonstrated a significant association between regular backpack use and increased chance of experiencing LBP ($p=0.044$) [31].

This study also indicates a strong and significant association between LBP and gender ($p<0.001$), showing that more female than male medical students are affected. This is consistent with a previous study that also found a strong association between gender and LBP ($p=0.000$), with female students being more prone to LBP than male students [26]. Female risk factors for LBP were not examined thoroughly in the past, with previous studies stating that females could face higher risks of LBP due to the nature of the female gender (hormonal fluctuations) and bad postures [18,26]. To further understand why females are at higher risk for having LBP, the authors of this study ran a cross-tabulation between gender and all statistically significant variables. It was found that 78.8% of participants who do not exercise are females, and that 74.7% of participants who do not lift weights are also females. Regarding sitting postures, there was not a significant difference between males and females, as 90% of participants of each gender reported that they sat in wrong postures. Ultimately, insufficiency in exercise, insufficiency in weight-lifting, and hormonal fluctuations, are the main reasons as to why LBP is generally more prevalent in females.

Factors like BMI, year of study, and smoking, did not display any statistically significant correlations with LBP. Some results yielded by different studies are consistent with results of this study, while others are not. For instance, authors of a study conducted in Al-Taif university also found that BMI and smoking were not statistically significant variables; however, year of study was found to have a strong association with LBP ($p=0.002$) [26].

Additionally, our analysis of the Oswestry Disability Index (ODI) scores revealed important insights. The ODI data shows that the majority of participants (56.9%) fall into the "No Disability" category, followed by 37.2% in the "Mild Disability" category. Only a small percentage of participants are classified as having "Moderate" (4.3%) or "Severe Disability" (1.6%). This distribution suggests that while LBP is prevalent among medical students, the impact on their daily activities and quality of life varies considerably, with most experiencing no or mild disability [19,32].

Furthermore, our linear regression model revealed a statistically significant relationship between age and ODI scores ($p=0.026$), with a positive correlation ($\beta=0.137$). This demonstrates that as age increases, ODI scores increase as well, suggesting that older medical students may be more susceptible to LBP-related disability. This finding was not mentioned in the original discussion and provides valuable insight into the age-related aspects of LBP among medical students.

The regression model also exhibited significant associations for other variables that were not previously discussed. Sleep duration showed a negative correlation with ODI scores ($\beta=-0.140$, $p=0.025$), suggesting that longer sleep durations were associated with lower ODI scores and potentially less LBP-related disability. This demonstrates the importance of adequate sleep for medical students to decrease the chances of facing LBP.[19,27].

Prolonged device use also exhibited a positive association with ODI scores ($\beta=0.170$, $p=0.006$), indicating that extended use of devices was correlated with higher ODI scores and potentially more severe LBP-related disability. This finding is particularly relevant in the context of modern medical education, where students usually spend long hours using electronic devices for studying and research [28–30].

Regarding study generalizability, this study entailed a strict inclusion criterion so that the population being studied was clearly defined. As such, the generalizability is limited to the studied population: medical students. Regarding this generalizability, the study yielded many results that are consistent with results of studies from all around the world (as discussed previously), suggesting that this study possesses strong external validity, and that its results are applicable to different populations of medical students in different settings. Although there could be limitations in the sense that participation in the study was completely voluntary (meaning that not everyone that matched

the conditions of the inclusion criteria participated). Furthermore, the factors that were examined in the study did not include laboratory tests, and resembled real-life situations to ensure generalizability and applicability to those who didn't participate.

4.2. Limitations and Strengths of the Study

Regarding the limitations of the study, there are several avenues that can be improved in future investigations. Firstly, the study is of a cross-sectional design and therefore could be liable to both causality bias and selection-bias. Causality bias can limit the study in that it is not possible to conclude that participants experience LBP more/less due to medical school. On the other hand, selection-bias might have affected this study in that participants who suffer from LBP might have been more open to participating in this study and those who do not to abstain from it. Aside from study design, the study also did not go over the characteristics of the lower back pain itself, such as pain duration. Temporal analysis of the pain might have uncovered further relationships with the variables evaluated with respect to LBP.

The strengths of this study primarily arise from the fact that the study examined a large sample size from Alfaisal University and the usage of a validated tool (Oswestry Disability Index) to analyze the characteristics of Lower Back Pain. Additionally, including validated questions and examining a large number of demographic and lifestyle variables allowed the exploration of numerous relationships between them and LBP.

5. Conclusions

5.1. General Conclusions

In conclusion, this study allowed a comprehensive examination of the prevalence of lower back pain and a construction of the profile of those who suffer from it among medical students in Alfaisal University. 73.4% of surveyed Alfaisal University Medical Students possessed lower back pain, averaging a severity of 4.61 from 1-10. These students are majority female, within the age of 18-21, and use their devices for long hours among other demographic trends.

Statistical analyses of the data collected uncovered numerous relationships with various demographic and behavioral factors. The profile of Alfaisal University medical students who are prone to lower back pain are those who are female, spend long hours on their computers, do not exercise, and do not lift weights. This supports the findings of previous literature which also found LBP correlated with female, sedentary, and computer-bound students [18,19]. Further analysis into gender as a factor itself following initial analysis showed that these LBP-prone female students exercise less, are less likely to lift weights, and use shoulder bags to carry their items.

Regarding the degree of disability of LBP per the Oswestry Disability Index most students who suffer from LBP can be categorized as "No Disability" followed by a sizable minority of those classified as "Mild Disability." Factors associated with a higher degree of disability are those such as being above the age of 21, spending long hours on computers, using their phone for more than 8 hours, and sleeping very little.

Strengths of this study include a large sample size from a single institution, the usage of validated tools and questions, and a comprehensive examination of demographic and lifestyle factors.

Limitations of this study include a cross-sectional design limiting causality exploration, potential selection bias, and reliance on self-reported data. Additionally, temporal and psychosocial aspects of LBP were not explored.

As LBP is a complex and oftentimes idiopathic condition, these results hold promise in narrowing down its potential determinants—however, more studies are needed, especially in this cohort.

5.2. Future Directions

Further investigation into this topic should look to go deeper into all aspects of LBP (severity, temporal characteristics, and degree of disability) with regards to a multitude of factors. This may include studies employing approaches other than a cross-sectional one. Further investigation can also look at modalities of objective measurements such as imaging studies or physical examination to rule out any issues arising from self-reporting data. Additionally, among the Saudi medical student population, there is limited information regarding the relationship between the various characteristics of LBP and as such could be an area of further investigation.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org, S1: STROBE Checklist of the study. S1: This is the STROBE checklist with the guidelines that were used to guide the composition of this manuscript.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study including publication consent.

Data Availability Statement: The original contributions presented in the study are included in the article material, further inquiries can be directed to the corresponding author.

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