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The Relationship Between Physical Activity and Sitting Dura-tion and the Incidence of Low Back Pain

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Research Article

The Relationship Between Physical Activity and Sitting Duration and the Incidence of Low Back Pain

Wendy Hendrika[1]*, Marcello Denito[2], Erica Gilda Simanjuntak[3]

[1] Department of Surgery, Faculty of Medicine, Universitas Kristen Indonesia, Jakarta, Indonesia; e-mail : wendy.hendrika@uki.ac.id
[2] Clinical Student, Faculty of Medicine, Universitas Kristen Indonesia, Jakarta, Indonesia; e-mail : Marcello.denito@uki.ac.id
[3] Department of Anesthesiology, Faculty of Medicine, Universitas Kristen Indonesia, Jakarta, Indonesia; e-mail : wendy.hendrika@uki.ac.id
* Corresponding Author : Wendy Hendrika

Abstract: Medical students are at high risk for musculoskeletal issues due to heavy academic workloads and prolonged sedentary habits. This study aims to investigate the relationship between physical activity intensity, sitting duration, and the incidence of low back pain (LBP) among students at the Faculty of Medicine, Universitas Kristen Indonesia, in 2025. An analytical observational research method with a cross-sectional design was employed. A sample of 104 participants was selected using simple random sampling, and data were collected through the Nordic Musculoskeletal Questionnaire (NMQ) and the International Physical Activity Questionnaire (IPAQ). The findings revealed that 51.9% of respondents experienced LBP, with 76.9% of students sitting for more than seven hours daily and 55.8% maintaining low physical activity levels. Statistical analysis using the chi-square test demonstrated a significant correlation between prolonged sitting duration and LBP incidence ($p = 0.021$). Conversely, physical activity levels showed no significant association with the occurrence of LBP ($p = 0.984$). In conclusion, excessive sitting duration is a primary risk factor for LBP in medical students, while physical activity levels do not directly influence its occurrence in this population. These results suggest an urgent need for ergonomic education and the promotion of active lifestyles to mitigate spinal health issues.

Keywords: Low Back Pain; Medical Students; Musculoskeletal Disorder; Physical Activity; Sitting Duration.

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1. Introduction

Low back pain (LBP) is a global health issue that significantly contributes to disability and requires extensive rehabilitation. Globally, this condition affected approximately 619 million individuals in 2020. In Indonesia, the prevalence of LBP reached 3.71% in 2021, while in Jakarta, medical diagnoses of LBP among individuals over 15 years old were reported at 6.76%. Medical students are a particularly high-risk group due to demanding academic schedules and heavy study loads. Their routine involves prolonged static sitting during lectures and independent study, which exerts mechanical pressure on the spine and surrounding tissues. Statistics from 2022 at the Faculty of Medicine, Universitas Kristen Indonesia (FK UKI) indicated that 40.95% of students experienced LBP in a single week.

Previous research has primarily utilized observational methods to identify risk factors. For instance, studies at Universitas Muslim Indonesia found a significant correlation between sitting duration and LBP severity ($p = 0.040$). Another study in Kuala Lumpur demonstrated a significant link between low physical activity and LBP ($p < 0.01$). These previous methods effectively highlight the scale of the problem but often focus on singular variables or specific regional demographics. A notable strength of these studies is their ability to identify sedentary behavior as a major driver ; however, a potential weakness is that results can vary significantly

based on nutritional status (BMI) and age, which may occasionally obscure the direct relationship between exercise intensity and pain.

The core research problem in this study is the high prevalence of musculoskeletal complaints among medical students at FK UKI, potentially driven by the combination of long sedentary hours and insufficient physical activity. Without intervention, chronic LBP can lead to reduced mobility, muscle atrophy, sleep disturbances, and decreased academic productivity. This study proposes an analytical observational approach with a cross-sectional design to specifically evaluate how physical activity and sitting duration interact to influence LBP incidence within the FK UKI student population in 2025.

The contributions of this research include: (1) providing empirical data on the prevalence of LBP among medical students at FK UKI, (2) establishing the specific correlation between prolonged sitting duration and LBP incidence in this academic environment, and (3) offering a scientific basis for preventive strategies and ergonomic education within the institution.

The rest of the paper is organized as follows: Section 2 details the research methodology, including the use of the Nordic Musculoskeletal Questionnaire (NMQ) and the International Physical Activity Questionnaire (IPAQ). Section 3 presents the univariate and bivariate analysis of the collected data. Section 4 provides a discussion of the findings in relation to existing theories and previous studies. Finally, Section 5 concludes the paper with recommendations for students and the institution.

2. Materials and Method

This research employed a quantitative approach with an analytical observational design, specifically utilizing a cross-sectional study framework. This design was selected to simultaneously examine the correlation between independent variables physical activity and sitting duration and the dependent variable, the incidence of low back pain (LBP), at a single point in time. The study was conducted within the Faculty of Medicine at Universitas Kristen Indonesia (FK UKI) in Jakarta. The research timeline spanned the 2025/2026 academic year, covering stages from initial preparation and data collection to final report synthesis. Medical students were chosen as the primary subject of investigation because their academic environment typically demands prolonged periods of static sitting, making them a representative population for studying the impacts of sedentary behavior in higher education.

The research population comprised all 140 active medical students from the class of 2023 at FK UKI. To ensure sufficient statistical power, the sample size was determined using the Slovin formula with a 5% margin of error, resulting in a minimum requirement of 104 respondents. Participants were selected through simple random sampling, ensuring that every student in the population had an equal probability of inclusion, thereby minimizing selection bias and enhancing the generalizability of the findings. Inclusion criteria required participants to be active students, at least 19 years of age, and willing to provide informed consent. Conversely, exclusion criteria were applied to students with a history of traumatic spinal injury, congenital spinal abnormalities, or systemic diseases such as rheumatoid arthritis. This exclusion was vital to ensure that reported LBP cases were predominantly associated with lifestyle factors rather than underlying clinical pathologies.

The research instruments consisted of three standardized components. The first section gathered demographic data, including age and gender. The second section utilized the Nordic Musculoskeletal Questionnaire (NMQ), a validated tool for identifying musculoskeletal symptoms. Through the NMQ, respondents reported the presence of pain or discomfort in the lower back region within the past 12 months and the last seven days. The third section employed the International Physical Activity Questionnaire (IPAQ) Short Form. This instrument measured physical activity intensity over the preceding week, categorized into low, moderate, and high levels based on Metabolic Equivalent of Task (MET-minutes/week). Furthermore, the IPAQ specifically recorded the average daily sitting duration to quantify sedentary behavior.

Data collection was executed digitally to ensure precision and efficiency. Once gathered, the data underwent a systematic processing phase involving editing, coding, entry, and cleaning. Statistical analysis was conducted in two distinct stages using specialized software. First, univariate analysis was performed to describe the frequency distribution of all variables. Second, bivariate analysis using the Chi-Square test was utilized to determine the significance of the relationship between variables, with a confidence level set at 95% ($\alpha = 0.05$). All research procedures adhered strictly to health research ethics, including the principles of respect for

persons, beneficence, and justice. Respondent confidentiality was maintained throughout the study, and participation remained entirely voluntary. This rigorous methodology ensures that the study provides accurate empirical insights into the spinal health risks faced by medical students.

3. Results and Discussion

Results

Respondent Age Characteristics

Table 1. Frequency Distribution of Respondents Based on Age at FK UKI in 2025

Age	Frequency	Percentage
19	14	13.5%
20	66	63.5%
21	22	21.2%
22	2	1.9%
Total	104	100%

Based on Table 1. it is evident that the majority of respondents belong to the 20-year-old age group, accounting for 66 individuals (63.5%). In contrast, the smallest number of respondents is in the 22-year-old age group, consisting of 2 individuals (1.9%).

Respondent Gender Characteristics

Table 2. Frequency Distribution of Respondents Based on Gender at FK UKI in 2025

Gender	Frequency	Percentage
Male	15	14.4%
Female	89	85.6%
Total	104	100%

Based on Table 2, it is observed that the majority of respondents are female, totaling 89 individuals (85.6%), while male respondents account for 15 individuals (14.4%).

Prevalence of Low Back Pain

Table 3. Frequency Distribution of Respondents Based on the Incidence of Low Back Pain at FK UKI in 2025

Low Back Pain	Frequency	Percentage
Yes	54	51.9%
No	50	48.1%
Total	104	100%

Based on Table 3, the research results indicate that out of a total of 104 respondents, 54 individuals (51.9%) experienced LBP, while the remaining 50 individuals (48.1%) did not experience LBP.

Overview of Respondents' Physical Activity

Table 4. Frequency Distribution of Respondents Based on Physical Activity at FK UKI in 2025

Physical Activity	Frequency	Percentage
Low	58	55.8%
Moderate	34	32.7%
High	12	11.5%
Total	104	100%

Based on Table 4, the majority of respondents have a low level of physical activity, totaling 58 individuals (55.8%). Respondents with moderate activity levels number 34 individuals (32.7%), while those with high physical activity levels constitute the smallest group, with 12 individuals (11.5%).

Overview of Respondents' Sitting Duration

Table 5. Frequency Distribution of Respondents Based on Sitting Duration at FK UKI in 2025

Sitting Duration	Frequency	Percentage
≤ 7 hours	24	23.1%
> 7 hours	80	76.9%
Total	104	100%

Based on Table 5, it is evident that the majority of respondents have a sitting duration habit of > 7 hours per day, totaling 80 individuals (76.9%). Meanwhile, respondents with a sitting duration of ≤ 7 hours per day number 24 individuals (23.1%).

The Relationship Between Physical Activity and the Incidence of Low Back Pain

Table 6. Analysis of the Relationship Between Physical Activity and the Incidence of Low Back Pain among FK UKI Students in 2025

Physical Activity	Low Back Pain (Yes)	Low Back Pain (No)	Total
Low	30 (51.7%)	28 (48.3%)	58 (100%)
Moderate	18 (52.9%)	16 (47.1%)	34 (100%)
High	6 (50%)	6 (50%)	12 (100%)
Total	54 (51.9%)	50 (48.1%)	104 (100%)

Based on Table 3.6, the distribution of the relationship between physical activity and the incidence of LBP among students at the Faculty of Medicine, Universitas Kristen Indonesia in 2025 shows that out of 104 respondents, 54 (51.9%) experienced LBP and 50 (48.1%) did not. In the low physical activity group, 30 out of 58 respondents (51.7%) experienced LBP, while 28 (48.3%) did not. In the moderate physical activity group, 18 out of 34 respondents (52.9%) experienced LBP and 16 (47.1%) did not. Meanwhile, in the high physical activity group, 6 out of 12 respondents (50%) did not experience LBP.

The statistical test results using Pearson Chi-Square yielded a p-value of 0.984 ($p > 0.05$). This indicates that there is no statistically significant relationship between the level of physical activity and the incidence of LBP among FK UKI students in 2025.

The Relationship Between Sitting Duration and the Incidence of Low Back Pain

Table 7. Analysis of the Relationship Between Sitting Duration and the Incidence of Low Back Pain among FK UKI Students in 2025

Sitting Duration	Low Back Pain (Yes)	Low Back Pain (No)	Total	P Value
≤ 7 hours	7 (29.2%)	17 (70.8%)	24 (100%)	0.021
> 7 hours	47 (58.8%)	33 (41.3%)	80 (100%)	
Total	54 (51.9%)	50 (48.1%)	104 (100%)	

Based on Table 7, the analysis of the relationship between sitting duration and the incidence of LBP among students at the Faculty of Medicine, Universitas Kristen Indonesia in 2025 reveals that out of 104 respondents, 54 (51.9%) experienced LBP and 50 (48.1%) did not. Within the group of students with a sitting duration of ≤ 7 hours per day, 7 out of 24 respondents (29.2%) experienced LBP, while 17 (70.8%) did not. Meanwhile, in the group with a sitting duration of > 7 hours per day, 47 out of 80 respondents (58.8%) experienced LBP and 33 (41.3%) did not.

The statistical test results using the Chi-Square test with continuity correction yielded a p-value of 0.021 ($p < 0.05$). This indicates that there is a statistically significant relationship between sitting duration and the incidence of LBP among students at the Faculty of Medicine, Universitas Kristen Indonesia in 2025.

3. Discussion

Characteristics of Research Results

The study involved 104 respondents, predominantly aged 20 years (63.5%) and mostly female (85.6%). Reporting the distribution of age and gender is essential as both factors can influence the incidence of LBP. According to research by Abdu et al. (2022), students face a high risk of LBP triggered by various determinant factors, ranging from academic demands to individual physical characteristics. Key triggers include sitting durations that exceed normal limits during lecture activities, exacerbated by non-ergonomic sitting postures such as slouching. Additionally, a high body mass index (BMI) and the habit of prolonged gadget use without stretching intervals further aggravate LBP complaints in the student environment.

Research by Haworth et al. (2024) indicates that women are more susceptible to chronic neck and back pain compared to men. Furthermore, women not only experience these conditions more frequently but also report more intense pain levels and higher degrees of disability. Anatomically, women tend to have wider pelvises; this structural difference can alter spinal biomechanics and affect how pressure is distributed across the back. Moreover, fluctuations in hormones such as estrogen and progesterone during the reproductive phase significantly influence pain perception and sensitivity levels.

Based on Table 3, the prevalence of LBP reached 51.9%, experienced by 54 respondents, while the remaining 48.1% had no such complaints. A previous study by Nova AD (2024) stated that medical students are at high risk for LBP due to daily habits and academic demands. The most dominant triggering factor is prolonged sitting, where 81.1% of students sit for more than 4 hours daily for lectures and self-study. This condition is worsened by the behavior of the majority of respondents (88.7%) who maintain non-ergonomic sitting positions, which triggers muscle fatigue and increases pressure on the intervertebral discs.

According to Table 4, the majority of respondents exhibited low physical activity levels (55.8%), while only 11.5% were categorized under high physical activity. This finding is consistent with the study by Rizki MR et al. (2025), which noted that most patients experiencing low back pain have low physical activity levels. It was recorded that 170 respondents (71.7%) fell into the low activity category, while only 23 individuals had high physical activity levels. This situation occurs because physical inactivity is a primary trigger for LBP. This is frequently found in individuals who spend significant time sitting while working, causing the lower back muscles to remain stretched without sufficient relaxation. Additionally, a lack of physical activity can lead to weakened muscle strength and impaired postural control.

In Table 5, the majority of respondents (76.9%) reported a sitting duration of > 7 hours per day. This is similar to research conducted by Auliya L.L. and Sim A.S (2025). Based on their study, as many as 112 people (57.7%) had a sitting duration of more than 7 hours each

day. This condition occurs due to static study patterns, both during classroom learning activities and while completing assignments at home. High academic demands force respondents to remain in a continuous sitting position, thereby increasing the mechanical load on the spine.

The Relationship Between Physical Activity and the Incidence of Low Back Pain

Based on Table 6, although many respondents exhibited low physical activity levels, bivariate analysis found no significant relationship between physical activity and the incidence of LBP (p = 0.984). This finding is consistent with the research by Pratiwi DA et al. (2024), which indicates that the decline in lower back health is a musculoskeletal disorder indicator that does not always correlate directly with physical activity. Most respondents (58.2%) had low physical activity levels. Nevertheless, statistical analysis (p = 0.07) demonstrated that there was no significant relationship between physical activity and the quality of the respondents' lower back health. The absence of this relationship may be attributed to the respondents' nutritional status (BMI), which was predominantly normal, preventing excessive pressure on the spinal area. Furthermore, the young age of the participants and optimal estrogen hormone regulation contribute to maintaining the health of their back tissues. In this study, sedentary behavior, specifically sitting posture and duration during study, was a more influential risk factor for back health compared to daily physical activity intensity.

Theoretically, physical exercises such as balance and hamstring strengthening, isokinetic rehabilitation, weight training, as well as core and breathing exercises, significantly enhance back muscle strength, abdominal muscle endurance, and hamstring power. Additionally, core stabilization exercises can significantly increase the pressure pain threshold in the lumbar area. This indicates that such exercises are effective in reducing local pain immediately and efficiently in patients with chronic low back pain.

The Relationship Between Sitting Duration and the Incidence of Low Back Pain

Based on Table 7, sitting duration of > 7 hours has a significant relationship with the incidence of LBP (p = 0.021). A total of 47 respondents (58.8%) with a sitting duration of > 7 hours experienced LBP, compared to only 7 respondents (29.2%) who sat for ≤ 7 hours. This finding is consistent with a study by Koswara J et al. (2024), which states that prolonged sitting duration is a major risk factor for LBP, with a 1.69 times higher risk for those sitting more than 7 hours per day (p = 0.041). The occurrence of lower back pain is closely related to extended sitting duration, where a static body condition for a long period can inhibit blood circulation. This impaired blood flow triggers anaerobic metabolic processes that lead to the accumulation of lactic acid in the local area, which the body then interprets as pain. Furthermore, monotonous sitting activities place excessive pressure on the spinal structures, tendons, and muscle tissues in supporting the weight of the upper body. This accumulation of static load gradually causes chronic fatigue in the muscle tissues of the lumbar area.

Research Limitations

This study has several limitations that should be considered. First, the use of a cross-sectional research design precludes the ability to establish causal relationships between physical activity, sitting duration, and the incidence of LBP, as it only captures associations at a single point in observation. Additionally, data regarding physical activity and sitting duration were obtained through self-reported questionnaires, which may introduce subjectivity bias from the respondents.

4. Conclusions

Based on the research findings regarding the relationship between physical activity, sitting duration, and the incidence of low back pain among students at the Faculty of Medicine, Universitas Kristen Indonesia in 2025, with a total of 104 respondents, the conclusions are as follows the prevalence of low back pain among students of the 2023 cohort is relatively high, with more than half of the respondents reporting symptoms. The majority of respondents are 20 years old, and most are female. Physical activity levels among most respondents fall into the low category. However, bivariate analysis shows no significant relationship between physical activity and the incidence of low back pain. Sitting duration for most respondents exceeds seven hours per day. Bivariate analysis indicates a significant relationship between sitting duration and the incidence of low back pain. Respondents with longer sitting durations show a higher proportion of low back pain compared to those with shorter sitting durations.

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