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Effect of quality of sleep, duration of gadget use, and level of physical activity on the incidence of neck pain : a cross-sectional study

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ABSTRACT

Introduction: Neck pain or cervical pain is a common complaint. At least two-thirds of the population have experienced neck pain. It can cause disturbances in daily activities. In young adults, neck pain can lead to a decline in quality of life and productivity. There have been studies on factors that increase the risk of neck pain, including sleep quality, duration of gadget use, and physical activity levels. However, research on this subject among medical students is still lacking. This study aims to determine the effect of sleep quality, duration of gadget use, and physical activity on the incidence of neck pain in Faculty of Medicine students.
Methods: This study uses an unpaired categorical comparative analytic design with a cross-sectional method. The Nordic Musculoskeletal Questionnaire assesses neck pain, the Pittsburgh Sleep Quality Index assesses sleep quality, the Screen Time Questionnaire assesses gadget use duration, and the Global Physical Activity Questionnaire assesses physical activity levels. Data will be analyzed using the Statistical Program for Social Science (SPSS) and statistically tested using Chi-Square.
Result: The analysis revealed a significant relationship between sleep latency and neck pain (OR = 3.210), between sleep disturbance and neck pain (OR = 3.106), and between the duration of PC/laptop use on weekdays (OR = 1.781). There is no significant relationship between physical activity and neck pain (OR = 1.182).
Conclusion: Sleep latency, sleep disturbance, and duration of PC/laptop use on weekdays affect neck pain. Physical activity has no effect on neck pain.

INTRODUCTION

Neck pain, also known as cervical pain, is a widespread issue affecting a significant portion of the global population. In 2019, the global prevalence of neck pain was 2,696 per 100,000 people, while in Indonesia, it was around 965 per 100,000 [1]. Although the prevalence increases with age, young adults aged 18-29 years also experience a high rate of neck pain, ranging from 42-67% [2]. This condition ranks fourth in the global burden of musculoskeletal disorders and can significantly impact daily activities, quality of life, and productivity, especially among young adults [3-4].

Several risk factors contribute to neck pain, including sleep quality, gadget usage duration, and lack of physical activity. Sleep, a fundamental human need with crucial functions, is often compromised among students due to busy schedules and numerous tasks. The CDC recommends at least 7 hours of sleep per night for adults aged 18-60 years [5]. Sleep quality encompasses not only duration but also factors like sleep latency and subjective aspects of deep sleep and rest [6]. Research has shown that poor sleep quality increases the risk of neck pain [7].

The COVID-19 pandemic has led to a significant increase in gadget use, with online duration in Indonesia rising by 52% compared to pre-pandemic levels [8]. Young adults, particularly students, rely heavily on gadgets for various activities, including social interactions, studying, and completing assignments. Studies have found a correlation between increased gadget usage duration and neck pain in students and young adults [9].

Physical activity plays a crucial role in overall health, with a lack of it associated with reduced life expectancy and increased risk of various diseases [10]. According to the 2018 Basic Health Research in Indonesia, a significant proportion of young adults are physically inactive [11]. Research has also indicated that a lack of physical activity may increase the risk of neck pain [12].

While previous studies have explored the relationships between sleep quality, gadget usage duration, and physical activity levels with neck pain occurrence, there is a lack of research on this topic specifically focusing on young adults, especially faculty of medicine students. Therefore, this study was conducted to determine the influence of these factors on neck pain among students of the Faculty of Medicine

RESEARCH METHODS

Study area: This study was conducted by distributing questionnaires online in January 2023 to students of the Faculty of Medicine at UPH, class of 2020-2022.

Study design: This study used an unpaired categorical comparative analytic design with a cross-sectional approach. The collected data were analyzed using Microsoft Excel and the Statistical Program for Social Science (SPSS). Analysis of the study data used the chi-square method.

Study population: This study involved students of the Faculty of Medicine at UPH, class of 2020-2022.

Inclusion criteria: students who agree to participate in the study and complete the entire questionnaire.

Exclusion criteria: students with a history of cervical trauma, students with a history of neck surgery, and students with a history of pathological conditions that can cause neck pain.

Questionnaires: This study uses Nordic Musculoskeletal Questionnaire to assess the neck pain, Pittsburgh Sleep Quality Index to assess the quality of sleep, Screen Time Questionnaire to assess the duration of gadget use, and Global Physical Activity Questionnaire to assess the level of physical activity.

Ethical approval: Approval was granted by the Ethics Committee of the Faculty of Medicine at Universitas Pelita Harapan, with the ethical clearance number 069/K-LKJ/ETIK/I/2023, and permission to conduct the research was obtained from the university authorities.

RESULTS AND DISCUSSION

Description of the study subjects: Out of 241 respondents, there were 179 (71.3%) female respondents and 72 (28.7%) male respondents. The respondents' ages ranged from 17 to 27 years, with the majority being 20 years old, comprising 85 (33.9%) respondents. This was followed by 18-year-olds with 72 (28.7%) respondents, and 19-year-olds with 57 (22.7%) respondents. Among the respondents, 95 (38.8%) were students from class 2020, 55 (21.9%) were from class 2021, and 101 (40.2%) were from class 2022.

Nordic Musculoskeletal Questionnaire: 121 (50.2%) respondents experienced pain, ache, or discomfort in the neck area, while 120 (49.8%) respondents did not have such complaints.

Pittsburgh Sleep Quality Index: the majority of respondents reported good subjective sleep quality (component 1), with 139 (57.7%) respondents. Component 2, which indicates sleep latency, showed that the majority of respondents had a low score, with 101 (41.9%) respondents. A total of 104 (43.2%) respondents had insufficient sleep duration (component 3). Most respondents, 182 (75.5%), had good sleep efficiency (component 4). Component 5 reflects the respondents' sleep disturbance scores. Component 6 shows the use of sleeping medication, with the majority of respondents, 232 (96.3%), not having used sleeping medication in the past month. Component 7 indicates the score for daytime dysfunction experienced by the respondents. The PSQI global score, which is the cumulative result of the seven components, showed that 182 (75.5%) respondents had poor sleep quality, while 59 (24.5%) respondents had good sleep quality.

Global Physical Activity Questionnaire : The most common activity level among respondents was moderate, with 92 (38.2%) respondents, followed by low activity level with 87 (36.1%) respondents, and high activity level with 62 (25.7%) respondents.

Screen Time Questionnaire : The highest duration of gadget use was for smartphones during weekdays, with 121 (50.2%) respondents, followed by nighttime use with 41 (17.0%) respondents, and weekend use with 116 (48.1%) respondents. This was followed by computer/laptop use during weekdays with 84 (34.9%) respondents. The majority of respondents had low background screen time, with 185 (80.9%) on weekdays, 222 (92.1%) at night, and 201 (83.4%) on weekends.

Correlation between sleep quality and neck pain: The analysis results show no significant relationship between sleep quality and the occurrence of neck pain (OR = 1.386, P = 0.350). However, there was a significant association of sleep latency (OR = 3.210, P = 0.001) and sleep disturbance (OR = 3.106, P = 0.030) to neck pain in the population.

Correlation between level of physical activity and neck pain: The analysis results indicate that there is no significant relationship between the level of physical activity and the occurrence of neck pain (OR = 1.182, P = 0.626).

Correlation between duration of gadget use and neck pain: The analysis results indicate that there is a significant relationship between duration of PC/laptop use on weekdays and the occurrence of neck pain (OR = 1.781, P = 0.048). However, there is no significant relationship between the duration of use of PC/laptop at night and on weekends, and other types of gadget and background screen time on weekdays, at night, and on weekends and the occurrence of neck pain.

This study recruited 251 students of the Faculty of Medicine of UPH, but only 241 met the inclusion criteria and were not included in the exclusion criteria. The sample consisted of 179 females and 72 males, with an age range of 17-27 years. Out of 241 samples, 121 (50.2%) had neck pain complaints in the last 12 months, and 120 (49.8%) samples had no neck pain complaints. This result is consistent with research conducted by Jahre et al, which found that the prevalence of neck pain in young adults is around 42-67% [2].

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Results showed 75.5% of students had poor sleep quality, consistent with findings from other Indonesian medical schools [13, 14]. Chi-square analysis revealed no significant association between overall sleep quality and neck pain (P = 0.35), though poor sleepers had higher odds of experiencing neck pain (OR = 1.386). This research result is similar to a previous study conducted by Auvinen, et al, which showed that sleep quantity and quality are independent risk factors for neck pain and low back pain [15]. Additionally, research conducted on students at the International Islamic University Malaysia also found non-significant results (P = 0.101) [16]. However, research conducted by Scarabottolo, et al, showed a significant relationship between poor sleep quality and neck pain (P < 0.001). This difference in results may be due to the different number of respondents, which reached 1011 respondents. Moreover, the statistical analysis method used was also different, where the previous study used multivariate regression analysis to examine confounding variables such as age, socioeconomic status, and BMI [7].

In this study, an analysis was also conducted on the relationship between the seven components of sleep quality assessed using the Pittsburgh Sleep Quality Index (PSQI) questionnaire and the incidence of neck pain. Of the seven components, two components had significant relationships: sleep latency and sleep disturbances, showing significant results (P < 0.001 and P = 0.3, respectively). Sleep latency is the time it takes for a person to fall asleep. Sleep disturbances refer to issues such as waking up in the middle of the night, waking up to use the bathroom, difficulty breathing well, coughing or snoring, feeling cold or hot at night, having nightmares, feeling pain, and others. Poor sleep quality can contribute to the occurrence of musculoskeletal pain in an individual. Several studies have found that lack of sleep increases fatigue and pain. This can occur due to the hyperalgesic effect of poor sleep quality. Poor sleep quality is associated with decreased electroencephalogram (EEG) activity in the insula and cingulate gyrus, which may be related to increased nociceptive pathways, impaired perception of somatosensory stimuli, and disruption in dopamine pathway regulation. This mechanism can lower the pain threshold, thereby increasing sensitivity to pain. However, overall, the relationship between pain and sleep is bidirectional, where both can affect each other [17].

Based on the results of the Global Physical Activity Questionnaire (GPAQ), 87 (36.1%) students had low physical activity, 92 (38.2%) students had moderate physical activity, and 62 (25.7%)

students had high physical activity. This profile of physical activity levels among these students is consistent with research conducted on medical students at Brawijaya University, which showed that out of 90 students, 50 (60%) students had low physical activity levels, 32 (35.6%) students had moderate physical activity levels, and 4 (4.4%) students had high physical activity levels [18]. The analysis of the relationship between physical activity levels and neck pain using the chi-square method showed that low physical activity levels increased the risk of experiencing neck pain (OR = 1.182), but no significant relationship was found (P = 0.626). This result is inconsistent with research conducted on health sciences students (medicine, pharmacy, health sciences) at Taif University, which showed a significant relationship between low physical activity levels and low back pain (P = 0.002), neck pain (P = 0.004), and upper back pain (P = 0.002) [19]. Another study also showed significant results between low physical activity levels and musculoskeletal pain, including neck pain, in a study of nurses at Sundari General Hospital in Medan, with a p-value of 0.00349 [20]. This difference in results may be due to the difference in the number of respondents and the focus of previous studies encompassing disorders of the entire musculoskeletal system, not just neck pain as in this study. However, the results of this study are in line with research conducted on office employees of PT Margo Indonesia service, with non-significant results (P = 0.765) [21].

The Screen Time questionnaire provides an overview of the duration of use of various gadgets and background screen time at different times, which can be seen in table 5.5. The results of the questionnaire show that the gadgets used with the highest duration (≥ 7 hours) are PC/laptop and smartphone on workdays. In this study, statistical tests were conducted between each gadget on different days and the incidence of neck pain. Of all components, only one component was found to have a significant relationship with the incidence of neck pain, namely the use of PC/laptop on workdays, with a p-value of 0.048 and an increased risk (OR = 1.781). Meanwhile, other gadget use showed increased risk without reaching statistical significance. These include the use of TV on workdays (OR = 1.500), smartphone use (OR = 1.330) at night, TV use (OR = 2.000), devices connected to TV (OR = 1.412), PC/laptop (OR = 1.578), and smartphone (OR = 1.124) on weekends. This result is in line with research conducted by Yustianti et al, which showed a significant relationship between the intensity (duration) of gadget use and the incidence of neck pain in students at SMAN 28 Jakarta (ages 15-20 years)[22]. The duration of gadget use affects how long the neck muscles are in a flexed position. A study by Straker et al showed that men who used computers for 14-21 hours in 1 week had a 3º more flexed neck position compared to men who did not use computers. Additionally, men who used computers for more than 21 hours in 1 week had a 4.5º more flexed neck position [23]. This flexed position can increase the load on the cervical vertebrae and can cause changes in the ligaments, tendons, and muscles in the neck area, causing pain [22]. On workdays, a person may be in a stressful and pressured condition, so in this study, a significant relationship was found between gadget use, namely PC/laptop on workdays, and neck pain.

The strength of this study is that there are not many studies that examine the relationship between the independent variables in this study with neck pain specifically; the majority examine their relationship with musculoskeletal pain as a whole. In this study, data collection for the duration of gadget use used the screen time questionnaire, where with this questionnaire, the use of various types of gadgets at different times can be distinguished. In addition, this study not only analyzes the relationship between overall sleep quality and neck pain but also analyzes the relationship between each component of sleep quality from the Pittsburgh Sleep Quality Index and neck pain, so that it can be known more specifically which components have a significant relationship. Sampling in this study used a Google form so that it could be done more easily and quickly. In addition, researchers also contacted respondents directly so that if there were questions or difficulties, they could be handled immediately.

The limitations of this study are that because the questionnaire was filled out online, researchers could not monitor directly, which could lead to recall bias. In addition, this study uses a cross-sectional method so that it cannot show a high percentage of cause-effect relationships. This study also does not yet cover other factors that can increase the risk of neck pain, such as gender, age, stress levels, and BMI, and the distribution of respondents between males and females in this study is not even.

CONCLUSION

Based on the findings of this study, the following conclusions can be drawn: Specific components of sleep quality, namely sleep latency and sleep disturbances, significantly influence the occurrence of neck pain among students of the Faculty of Medicine at UPH from the 2020-2022 cohorts. Additionally, the duration of gadget use, particularly PC/laptop use on workdays, impacts the incidence of neck pain in this student population. However, no significant correlation was found between levels of physical activity and the occurrence of neck pain among these students. These findings highlight the importance of sleep quality and gadget use patterns in relation to neck pain among medical students, while suggesting that physical activity levels may not be a significant factor in this particular population.

What is already known on this topic

- Impaired sleep quality has been correlated with attenuated electroencephalographic (EEG) activity in the insular cortex and cingulate gyrus. This neurophysiological alteration may be associated with enhanced nociceptive signaling, disrupted somatosensory perception, and dysregulation of dopaminergic pathways. Such neuromodulatory changes can potentially lead to a lowered nociceptive threshold, resulting in heightened pain sensitivity.
- Adequate physical activity has been demonstrated to mitigate pain through multiple mechanisms. It enhances overall muscular strength, thereby reducing the mechanical load on vertebral structures and promoting improved postural alignment. Furthermore, regular exercise facilitates increased blood circulation, diminishes muscle tension, and maintains joint mobility, all of which contribute to pain reduction. Conversely, insufficient physical activity may lead to muscular atrophy, resulting in increased stress on the vertebral column, including the cervical region. This biomechanical alteration can potentially manifest as cervical pain.
- Prolonged duration of gadget usage is associated with sustained cervical flexion. This sustained non-neutral posture can lead to increased mechanical stress on the cervical vertebrae and surrounding soft tissues. Consequently, this may result in pathophysiological changes in the ligamentous structures, tendinous insertions, and cervical musculature, potentially manifesting as cervicalgia or related pain syndromes.

What this study adds

- Analysis of the Pittsburgh Sleep Quality Index components revealed that two of the seven domains, specifically sleep latency and sleep disturbances, demonstrated statistically significant associations with the incidence of neck pain.
- Prolonged use of electronic devices, particularly personal computers and laptops during weekdays, exhibited a significant correlation with the occurrence of neck pain.

Competing interests

The authors declare no competing interest.

Authors' contributions

Author and co-author work equally in the process of writing

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None

Tables

Table 1 : Correlation between quality of sleep and neck pain
Table 2 : Correlation between duration of gadget use and neck pain

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Include all the tables here, listed numerically

Table 1: Correlation between quality of sleep and neck pain		
Components	**Odds Ratio**	**P Value**
Sleep quality	1.386	0.350
Sleep latency	3.210	0.001
Sleep disturbance	3.106	0.030

Table 2: Correlation between duration of gadget use and neck pain		
Components	**Odds Ratio**	**P Value**
Duration of TV use on weekdays	1.500	1.000
Duration of using TV-connected devices on weekdays	0.737	0.991
Duration of PC/laptop use on weekdays	**1.781**	**0.048**
Duration of smartphone use on weekdays	0.779	0.402
Duration of tablet use on weekdays	0.778	0.584

Duration of TV use at night	0.992	1.000
Duration of using TV-connected devices at night	0.992	1.000
Duration of PC/laptop use at night	0.796	0.800
Duration of smartphone use at night	1.330	0.551
Duration of tablet use at night	0.552	0.528
Duration of TV use on weekends	2.000	1.000
Duration of using TV-connected devices on weekends	1.412	0.778
Duration of PC/laptop use on weekends	1.578	0.246
Duration of smartphone use on weekends	1.124	0.745
Duration of tablet use on weekends	0.990	1.000
Background screen time on weekdays	1.527	0.264
Background screen time at night	1.422	0.403
Background screen time on weekends	0.702	0.619