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Gadgets and Sleep Problems are Causes of Neck Pain in Young Adults

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KEYWORDS
neck pain, sleep quality, latency of tifur, duration of gadget use

ABSTRACT
Neck pain affects two-thirds of the population, disrupting daily activities. In young adults, it can reduce quality of life and productivity. While risk factors for neck pain are known, the impact of sleep quality and gadget use on its incidence in Generation Z is less studied. This study aimed to determine the effect of sleep quality and gadget use on neck pain in young adults. A cross-sectional, unpaired categorical comparative analysis was conducted on preclinical students of the Faculty of Medicine, Universitas Pelita Harapan (class of 2020-2022). Neck pain incidence was assessed using the Nordic Musculoskeletal Questionnaire; sleep quality was measured with the Pittsburgh Sleep Quality Index; and gadget use duration was evaluated with the Screen Time Questionnaire. Data were analyzed using SPSS 26 and Chi-Square analysis. A significant relationship was found between sleep latency and neck pain ($P < 0.001$; OR = 3.210), sleep disturbances and neck pain ($P = 0.030$; OR = 3.106), and gadget use duration on weekdays and neck pain ($P = 0.048$; OR = 1.781). Sleep latency, sleep disturbances, and the duration of gadget use are significantly associated with neck pain in young adults.

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INTRODUCTION

Two-thirds of the population has experienced neck pain, so neck pain has been a common complaint (Elbinoune et al., 2016). On a global level, the prevalence of neck pain in 2019 was 2,696 per 100,000 population. Meanwhile, in Indonesia, the prevalence of neck pain is around 965 per 100,000 population1. The prevalence of neck pain increases with age, but in young adults between 18-29 years old, the prevalence of neck pain is quite high, around 42-67%2. Neck pain ranks fourth in the global burden of musculoskeletal 3,4 and can cause disturbances in daily activities. In adolescents and young adults, neck pain can lead to decreased quality of life and productivity levels. Some of the risk factors for neck pain are sleep quality, duration of gadget use and lack of physical activity.

Pain is a protective mechanism to prevent further tissue injury. Neck pain is pain that occurs in the region bounded by the superior linea nuchalis from the posterior side, the lateral border of the neck from the lateral side, and by the transverse imaginary line passing through the spinous process from the inferior side (Toumanidou, 2018). Neck pain can stem from a variety of anatomical structures, including paraspinal soft tissues, intervertebral joints and discus, spinal medulla compression or peripheral nerves, and diverted pain. Causes of neck pain consist of neoplastic causes, such as metastatic tumours, multiple myelomas, spinal cord tumours and chordomas; inflammatory causes, such as rheumatoid arthritis and seronegative spondyloarthropathies; infectious causes, such as osteomyelitis, epidural abscesses,

discitis, shingles, and meningitis; vascular causes such as atriovenous malformation, endocrine causes, such as Paget's disease and osteoporotic fractures; and neurologic lesions, such as peripheral neuropathy, amyotrophic lateral sclerosis, transverse myelitis, Guillaine-Barre syndrome, and Brachial plexus lesions. The pathophysiology of neck pain has not been clearly identified, but there is evidence that there is an oxidative metabolic disorder and increased levels of pain-causing substances that indicate that disturbances in local muscle circulation or metabolism may be part of the pathophysiology of neck pain. In addition, neck pain is also associated with disturbances in the coordination of the cervical muscles and disturbances in proprioception in the neck and shoulders (Fatima, Veqar, Zaidi, & Tanwar, 2022). Although this phenomenon is caused by pain, it can also worsen the pain condition. In trauma-induced neck pain conditions, soft tissue injuries can interfere with information from mechanoreceptors, causing sensory and motor dysfunction15. Cheever, et al (2017) stated that neck pain could occur due to various basic pathological mechanisms, so the term non-specific neck pain is often used. Such pathologies include whiplash, poor posture, and injuries due to high-speed exercise16. In addition, other factors that were found to increase the risk of developing neck pain were psychopathology, genetics, sleep disorders, smoking, obesity, lifestyle, history of neck pain, trauma, back pain, and poor overall health. Sports and occupational injuries are also associated with neck pain, with the highest incidence found in auto racers, wrestlers, and ice hockey athletes.

Sleep is defined as the stage of unconsciousness produced by the body in which the brain is in a phase of rest relative to internal stimuli and reactive to internal stimuli (Siclari & Tononi, 2016). Sleep is not only a period of resting conditions of the body and nervous system but can also restore the formation and synthesis of proteins. Sleep serves as a time for restoration, memory consolidation, and preparation for the next waking period. In addition, the function of sleep is to maintain heart function by decreasing heart rate in the NREM phase, repairing and renewing epithelial cells and other cells in the brain that occur in the REM phase, tissue renewal that occurs through protein synthesis and cell division; maintaining energy supply with a decrease in the basal metabolic rate; brain development, cognition, and memory are associated with changes in the brain such as increased blood flow to the brain and cortical activity that occurs in the REM21 phase. Sleep is one of the basic human needs because it has several crucial functions. With so many assignments and a student's busy schedule, the need for adequate and quality sleep is often not met. The Centers for Disease Control and Prevention (CDC) recommends that adults between the ages of 18 and 60 get more than 7 hours of sleep per night5. A person's sleep quality includes not only sleep duration but also sleep latency as well as subjective aspects such as deep sleep and rest6. Based on research conducted by Scarabottolo, et al (2020) shows that a person's lack of sleep quality will increase the risk of neck pain. Sleep deprivation can cause disturbances in immune system function, metabolism, nitrogen levels and protein catabolism. Sleep deprivation in the REM phase can lead to confusion and suspicion. Sleeping too long can also cause disturbances in body functions, such as mood, motor performance, memory and balance. Sleep disorders can increase the risk of developing chronic diseases such as hypertension, diabetes and obesity (Van Ryswyk, Mukherjee, Chai-Coetzer, Vakulin, & McEvoy, 2018). In addition, sleep disorders can decrease a person's quality of life and productivity. Sleep duration is one of the components that affect sleep quality. Lack of sleep duration can increase musculoskeletal pain with activation of the sympathetic nervous system and inhibition of muscle relaxation, thereby increasing muscle tone, which increases the risk of pain (Navarro-Ledesma, Hamed-Hamed, Gonzalez-Muñoz, & Pruimboom, 2024).

In addition, sleep disorders can also increase the risk of injury because poor sleep quality can decrease cognitive function.

The frequency of gadget use has increased significantly after the COVID-19 pandemic forced the implementation of physical distancing. In Indonesia, the duration of online meetings after the COVID-19 pandemic increased by 52% compared to before the pandemic. Since then, most people have done all their activities, such as social activities, studying and working online using gadgets. Among young adults, especially students, gadgets are used as a source of information, communication, recreation, to learning and doing assignments. In some studies, it was found that the increase in the duration of gadget use was associated with the incidence of neck pain in college students or young adults.

Gadgets or gadgets, according to the Oxford Learner's Dictionary, are tools that can do something useful (B R & G, 2023). The use of technology is getting higher day by day and human life now depends on the use of gadgets such as smartphones, laptops, PCs and tablets. With gadgets, humans can do daily activities, not only to communicate but also to transact, play games, watch, and source information to work and study. However, the use of gadgets can also have a negative impact on human life, such as decreased concentration when studying, decreased social skills, addiction, and health problems. The use of gadgets has a positive and negative impact on many fields, such as business, education, health, and social life (Dwivedi et al., 2020). The convenience that gadgets provide for daily life is huge; just pressing a button can provide access to health services and various other services anytime and anywhere. Even so, the convenience offered can be dangerous for gadget users. With online health services, gadget users are reluctant to go to the doctor directly, which can be dangerous in an emergency. In addition, the use of gadgets can decrease direct social interaction, increasing the risk of eye health problems, musculoskeletal disorders, and psychological problems such as addiction and anxiety (Nakshine, Thute, Khatib, & Sarkar, 2022). The relationship between the duration of gadget use and neck pain complaints can be caused by the flexion of the head position when using the gadget. Neck pain complaints will increase if a person is in a flexion position of at least 200 for 70% of the time using the gadget. With this flexion position, the bone load of the cervical vertebrae is greatly increased. In addition, flexion positions can cause changes in the cervical bones, curvature, ligaments, tendons, and muscles in the neck area which ultimately leads to changes in posture and can cause neck pain.

Previous studies have found that there is a relationship between sleep quality, duration of gadget use, and physical activity levels to the incidence of neck pain7,9,11. However, there has been no research on this in young adults, especially among students in Generation Z. The research aims to investigate the relationship between sleep quality, gadget use, and the incidence of neck pain among young adults, specifically focusing on Generation Z students.

METHOD

The study design uses unpaired categorical comparative analytical research with a cross-sectional method conducted through the distribution of online questionnaires from January to March 2023. Informed consent questionnaire, Nordic Musculoskeletal Questionnaire (NMQ), Pittsburgh Sleep Quality Index (PSQI), and screen time visit by 241 respondents of preclinical students of the Faculty of Medicine, Universitas Pelita Harapan class of 2020-2022. The inclusion criteria are students who are willing to be a research sample and fill out the questionnaire completely. The exclusion criteria in this study are students who have a history of cervical trauma, surgery in the neck area and/or pathological abnormalities that can cause neck pain (Cohen & Hooten, 2017). The data results were processed using

the Microsoft Excel application and the Statistical Program for Social Science (SPSS) version 26 with a statistical test of Chi-Square analysis. Some of the questionnaires used in this study are as follows:

Nordic Musculoskeletal Questionnaire (NMQ)

The Nordic Musculoskeletal Questionnaire (NMQ) is a questionnaire instrument commonly used to assess musculoskeletal disorders. This questionnaire can detect and analyze musculoskeletal symptoms in several different parts of the body, namely in the neck, shoulders, elbows, wrists, upper back, lower back, pelvis, knees, and ankles (Arora & Khatri, 2022). In this questionnaire, there are three questions, namely about the presence or absence of disorders such as pain and discomfort in the parts that have been mentioned for the past 12 months, whether or not there is a disturbance in doing daily work due to pain felt in the last 12 months; and whether or not the pain has been in the last 7 days. This questionnaire has several advantages, namely standardized questions, which are globally recognized, can be self-evaluated and relatively quick to identify symptoms. In this study, an Indonesian version was used that had been tested for validity and realism18. In the Nordic Musculoskeletal Questionnaire (NMQ), neck pain complaints (+) if respondents answered "Yes" to the question "In the last 12 months, have you felt pain, pain or discomfort in the neck (0 and 1) below?". Neck pain complaints (-) if the respondent answered "No" to the same question.

Pittsburgh Sleep Quality Index (PSQI)

A person's sleep quality can be measured using a questionnaire called the Pittsburgh Sleep Quality Index (PSQI). This questionnaire consists of 24 questions divided into 7 components, namely subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disorders, use of sleeping pills and Daytime Dysfunction. Each component produces a value in the range of 0-3. The scores of the seven components were summed up, ranging from 0-21, with higher scores indicating poorer sleep quality. The results of this questionnaire are categorized into poor sleep quality, namely, with a score above 5 and good sleep quality, with a score below 56.

Screen Time Questionnaire

The screen time questionnaire was created to measure the use of screen-based devices. In this questionnaire, the devices are categorized into 5 categories, namely TVs, TV-connected devices, laptops/computers, smartphones, and tablets. This questionnaire consists of 18 points to measure the duration of use of the device. Respondents were asked to estimate the total time spent in minutes. Because the duration of layer-based device use varies per day, the average duration on weekdays, weeknights and weekends (Saturday and Sunday) is assessed separately27. The results of this questionnaire were interpreted into 2 categories, namely moderate intensity (< 56 hours/week) and high intensity (≥56 hours/week). In this screen time questionnaire, gadget usage of 1-6 hours/day is categorized as low. The use of gadgets 7-11 hours/day is categorized as high.

RESULT AND DISCUSSION

Of the total 251 students who received the questionnaire, 241 respondents were included in the inclusion criteria and showed an overview of the characteristics according to Table 1.

Table 1.
Characteristics of Respondents

Characteristic	Frequency (n)	Percentage (%)
Gender		
Woman	179	71,3

Man	72	28,7
Age (years)		
17-20	219	87,3
21-27	32	12,7
History of trauma to the neck		
Exist	6	2,4
None	245	97,6
History of surgery in the neck		
Exist	1	0,4
None	250	99,6
History of pathological disorders that may cause neck pain		
Exist	4	1,6
None	247	98,4

There were 179 (71.3%) female and 72 (28.7%) male. The respondents were aged 17-27 years. The most were 20 years old, namely 85 (33.9%) respondents, followed by 18 years old 72 (28.7%) and 19 years old 57 (22.7%). The respondents of the class of 2020 were 95 (38.8%) students, the class of 2021 was 55 (21.9%) students and in 2022, there were 101 (40.2%) students. 11 respondents with exclusion criteria consisting of 6 (2.4%) respondents because they have a history of trauma to the neck, 1 (0.4%) respondents have a history of surgery on the neck and 4 (1.6%) respondents have a history of pathological disorders that can cause neck pain.

The results of the Nordic Musculoskeletal Questionnaire showed that 121 (50.2%) respondents felt pain, pain or discomfort in the neck, and as many as 120 (49.8%) respondents did not have these complaints. In the conclusion of the PSQI questionnaire, in general, most respondents had good subjective sleep quality (component 1), which was 139 (57.7%) respondents. In sleep latency (component 2), most respondents had a low score, which was 101 (41.9%) respondents. A total of 104 (43.2%) respondents had a lack of sleep duration (component 3). The majority of respondents, namely 182 (75.5%), had good sleep efficiency (component 4). Component 5 shows the score of sleep disturbances experienced by respondents. Component 6 shows the use of sleeping pills where the majority of respondents, namely 232 (96.3%) have not used sleeping pills in the past month. Component 7 shows the score for daytime dysfunction experienced by respondents. The PSQI global score shows the overall questionnaire results, which are cumulative of the seven components. A total of 182 (75.5%) respondents had poor sleep quality, and 59 (24.5%) respondents had good sleep quality.

Table 2.
Results of the Statistical Test of the Relationship between Sleep Latency and Neck Pain

Sleep Latency	No Neck Pain		Neck pain		Total		OR (95%CI)	P Value
	n	%	n	%	n	%		
Low	104	**56,2**	**81**	43,8	185	100	3,210 (1,678 - 6,139)	<0.001
Tall	16	28,6	40	71,4	56	100		
Total	120	49,8	121	50,2	241	100		

Table 2 illustrates the results of the statistical test of the relationship between sleep latency and the incidence of neck pain using the chi-square method. The results of chi-square analysis showed that there was a significant relationship between sleep latency and the incidence of neck pain with a P value of < 0.001. The Odds Ratio value of 3.210 indicates that a person with poor sleep latency has a 3.210 chance of experiencing neck pain.

Table 3.
Results of the Statistical Test of the Relationship between Sleep Disorders and Neck Pain

Sleep Disorders	No Pain		Neck pain		Total		OR (95%CI)	P Value
	n	%	n	%	n	%		
Not	**114**	52,3	104	47,7	218	100	3,106 (1,180 - 8,176)	0,030
Yes	16	26,1	17	73,9	182	100		
Total	**120**	49,8	121	50,2	241	100		

Table 3 illustrates the results of the statistical test of the relationship between sleep disturbances and the incidence of chi-square neck pain. The results of chi-square analysis showed that there was a significant relationship between sleep disorders and the incidence of neck pain with a P value = 0.030. The Odds Ratio value is 3.106, indicating that a person with sleep disorders has a probability of 3.106 to experience neck pain.

Table 4.
Results of the Statistical Test on the Relationship between the Duration of PC/Laptop Use on Weekdays and Neck Pain

Duration of PC Usage	No Neck Pain		Neck pain		Total		OR (95%CI)	P Value
	n	%	n	%	n	%		
Low	86	54,8	71	45,2	157	100	1,781 (1,041 - 3,048)	0,048
Tall	34	40,5	50	59,5	84	100		
Total	120	49,8	121	50,2	241	100		

The results of the Screen Time questionnaire show that the use of gadgets with the highest duration is the use of smartphones on weekdays, as many as 121 (50.2%) respondents; at night, as many as 41 (17.0%) respondents; and on weekends as many as 116 (48.1%) respondents, followed by the use of computers/laptops on weekdays as many as 84 (34.9%) respondents. The majority of respondents had low background screen time, which was 185 (80.9%) on weekdays, 222 (92.1%) at night, and as many as 201 (83.4%) on weekends. Table 4 shows the results of the statistical test of the relationship between the duration of PC/laptop use on weekdays and the incidence of neck pain using the chi-square method. The results of the chi-square analysis showed that there was a significant relationship between the duration of PC/laptop use on weekdays and the incidence of neck pain with a P value = 0.048. An Odds Ratio value of 1.781 indicates that a person with a high duration of PC/laptop use on weekdays has a 1.781 chance of experiencing neck pain.

This study included 251 students, but only 241 met the inclusion criteria and were not included in the exclusion criteria. The respondents consisted of 179 women and 72 men with an age range of 17-

27 years. Of the 241 samples, 121 (50.2%) had neck pain complaints in the past 12 months, and 120 (49.8%) samples had no neck pain complaints. This result is in accordance with research conducted by Jahre, et al (2020), namely, the prevalence of neck pain in young adults is around 42-67%2. Based on the results of the Pittsburg Sleep Quality Index (PSQI) questionnaire, 182 (75.5%) students had poor sleep quality and 59 (24.5%) students had good sleep quality. The description of sleep quality in students is in line with research conducted on students of the Faculty of Medicine, Udayana University, where it was found that from 206 samples, 137 (66.5%) students had poor sleep quality and 69 (33.5%) students had poor sleep quality28. This picture is also in line with research conducted on students of the Faculty of Medicine, Padjajaran University, where out of 97 students, 82 (84.5%) students had poor sleep quality and 15 (15.5%) students had good sleep quality29.

The results of the analysis of the relationship between sleep quality and neck pain conducted using the chi-square method showed that there was no significant relationship (P = 0.35) between poor sleep quality and the incidence of neck pain, but a person with poor sleep quality was more likely to experience neck pain (OR = 1.386). The results of this study are similar to the previous study conducted by Auvinen, et al (2015), which showed that the quantity and quality of sleep are independent risk factors for neck pain and low back pain30. In addition, research conducted on students of the International Islamic University Malaysia also obtained insignificant results (P = 0.101)31. However, research conducted by Scarabottolo, et al (2020) showed a significant relationship between poor sleep quality and neck pain (P < 0.001). This difference in results can occur due to the different number of respondents, which reaches 1011 respondents. In addition, the statistical analysis method used is different, whereas previous research used multivariate regression analysis to research confounding variables. Meanwhile, this study uses the chi-square method. This study also included several confounding variables such as age, socioeconomic status, and Body Mass Index.

In this study, an analysis was carried out of the relationship between seven components of sleep quality assessed using the Pittsburg Sleep Quality Index (PSQI) questionnaire and the incidence of neck pain. Of the seven components, there are two components that have a significant relationship, namely sleep latency and sleep disorders, by showing significant results (P < 0.001 and P = 0.3, respectively). Sleep latency is the time it takes for a person to fall asleep. Meanwhile, the sleep disorders in question are disturbances such as waking up in the middle of the night, waking up to go to the bathroom, difficulty breathing properly, coughing or snoring, cold or overheating at night, nightmares, pain, and others. Poor sleep quality can contribute to the occurrence of musculoskeletal pain in a person. Some studies have found that poor sleep increases tiredness and pain (Afolalu, Ramlee, & Tang, 2018). This can occur due to the hyperalgesic effects of poor sleep quality. Poor sleep quality is associated with decreased electroencephalogram (EEG) activity in the insula and cingulate gyrus, which can be associated with increased nociceptive jars, impaired perception of somatosensory stimuli and disturbances in dopamine jarin regulation. This mechanism can lower the pain threshold, thereby increasing sensitivity to pain. Overall, however, the relationship between pain and sleep is bidirectional, where the two can affect each other.

The Screen Time questionnaire provides an overview of the duration of use of various gadgets and background screen time at different times (Lanca & Saw, 2020). The results of the questionnaire show that the gadgets used with the most high duration (≥ 7 hours) are PCs/laptops and smartphones on weekdays. In this study, a static test was carried out between each gadget on a different day with the incidence of neck pain. Of all components, only 1 component was found to have a significant

relationship with the incidence of neck pain, namely the use of a PC/laptop on weekdays with a p-value of 0.048, and there was an increased risk (OR = 1.781). Meanwhile, the use of several other gadgets also showed an increased risk but without a significant relationship. Among them are TV usage on weekdays (OR = 1,500), smartphone use (OR = 1,330) at night, TV usage (OR = 2,000), TV-connected devices (OR = 1,412), PCs/laptops (OR = 1,578), and smartphones (OR = 1,124) on weekends. These results are in line with research conducted by Yustianti et al (2019), which showed a significant relationship between the intensity of use (duration) of gadget use and the incidence of neck pain in SMAN 28 Jakarta students (aged 15-20 years).

The duration of use of the gadget affects how long the muscles in the neck are in a flexion position. A study by Straker, et al (2017) showed that men who used a computer for 14-21 hours in 1 week had a neck position that was 30 times more flexible than men who did not use a computer. In addition, men who used a computer for more than 21 hours in a week had a neck position that was 4.50 more flexible. This flexion position can increase the load on the cervical vertebrae and can cause changes in ligaments, tendons, and muscles in the neck, causing pain. On weekdays, a person may be in a stressful condition, so in this study, a meaningful relationship was found between the use of gadgets in the form of PCs/laptops and neck pain.

The advantage of this study is that there have not been many studies that have examined the relationship between independent variables in studies similar to those on neck pain specifically; the majority have examined the relationship with musculoskeletal pain as a whole. In this study, data collection for the duration of gadget use used a screen time questionnaire, where the use of various types of gadgets at different times can be distinguished (Rashid et al., 2021). In addition, this study not only analyzed the relationship between overall sleep quality and neck pain but also analyzed the relationship between each component of sleep quality from the Pittsburg Sleep Quality Index and neck pain so that it can be known more specifically which components have a significant relationship. Sampling in this study uses Google Forms so that it can be done more easily and quickly. In addition, the researcher also contacted respondents directly so that if there were questions or difficulties, they could be handled immediately. The disadvantage of this study is that because filling out the questionnaire is done online, the researcher cannot monitor it directly, which can cause recall bias (Story & Tait, 2019). In addition, this study uses a cross-sectional method so that it cannot show a high percentage of cause-and-effect relationships. This study also does not include other factors that can increase the risk of neck pain, such as gender, age, stress level, and body mass index, as well as the uneven distribution of respondents between men and women in this study.

CONCLUSION

It was found that sleep quality was influenced by latency and sleep disturbances on the incidence of neck pain. There was an influence of the duration of use factor Gadgets in the form of PCs/laptops on weekdays to the incidence of neck pain in young adults of generation Z. Acknowledgement: Awards and thanks were given to Mirela Emmanuela for her assistance in data collection and processing; to Jeremiah Hilkiah Wijaya for the help of reviewing and editing the manuscript until this article can be completed.

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