
THE CORRELATION BETWEEN POSTURE, DURATION OF GADGET USAGE AND PHYSICAL ACTIVITY DURING COVID-19 PANDEMIC TO THE OCCURRENCE OF NECK PAIN AMONG MEDICAL STUDENTS IN UDAYANA UNIVERSITY

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ABSTRACT

Increased duration of gadget usage since COVID-19 pandemics can cause various negative impacts if implemented without considering ergonomic factors, especially body and neck posture. One of those impacts that often found is musculoskeletal disorders like neck pain due to excessive cervical flexion load. However, incidence of neck pain also affected by many other factors, such as physical activity and exercise habit. This study aims to determine the correlation between posture, duration of gadget usage, and physical activity during COVID-19 pandemic to the occurrence of neck pain among Medical Students in Udayana University. An analytical observational study was conducted with cross-sectional approach using questionnaire adapted from Nordic Musculoskeletal Questionnaire to measure quantity and quality of neck pain of 106 medical students in Udayana University. The correlation between variables was then analyzed by Chi-square test. Results of this study showed that 77.4% of medical students in Udayana University usually use gadget ≥ 56 hours a week and 61.3% of medical students have experienced neck pain in last 12 months during COVID-19 pandemic. Analytical study showed that correlation between posture and neck pain has p -value = 0.016 (<0.05), physical activity and neck pain has p -value = 0.012 (<0.05), while duration of gadget usage and neck pain has p -value = 0.733 (>0.05). It can be concluded that there are significant correlations between posture while using gadget and physical activity to neck pain, but there is no significant correlation between duration of gadget usage and neck pain during COVID-19 pandemic among medical students in Udayana University.

Keywords : *posture; duration; gadget; physical activity; neck pain*

INTRODUCTION

The rapid development of technology presently forces people to adapt to sophistication of digital media. Gadgets such as smartphones, tablets, laptops, and computers are commonly used by almost all people, whether for work, social, or entertainment purposes.¹ However, gadget usage must be done ergonomically to optimize performance and productivity of users in terms of many factors such as health conditions, safety, security, and job satisfaction.² The use of gadgets without consideration of ergonomic factors can cause excessive load accumulation in neck area which will alter spinal physiologic curvature and increase risk of spinal cord compression, leading to musculoskeletal complaints such as aches, pain, numbness, even headaches.³

Posture that is considered non-ergonomic when using gadgets for a considerable period can cause various negative impacts, such as forward head posture, rounded shoulders, and slouched posture.⁴ Forward Head Posture (FHP) is a condition when head position points more anteriorly to a vertical plane parallel to shoulder. Besides, Rounded Shoulder Posture (RSP) occurs as a result of body compensation to FHP,

indicated by acromion that is positioned more anterior than normal, shoulders rotation to inferior, and shoulders that sloped towards anterior.⁵

Duration is the length of time that a person allocates to carry out an activity, such as to access media on gadgets. Previous study stated that increased cervical flexion with significant degree will occur after duration 5 minutes using smartphone in non-ergonomic positions so that the neck receives excessive load. Furthermore, in the usage of laptop and computer, cervical flexion with significant degree will also occur after 10 minutes duration of use, especially in non-ergonomic position such as typing while sitting cross-legged.⁶

Physical activity that can reflect physical fitness also affects the incidence of musculoskeletal complaints due to gadget usage issues in non-ergonomic positions. The NIOSH (National Institute for Occupational Safety and Health) stated that the risk of musculoskeletal complaints is 7.1% for people with low body fitness, 3.2% for people with moderate body fitness, and 0.8% for people with high body fitness. Therefore, people with a higher level of physical fitness have a lower risk of muscle injury and other musculoskeletal disorders.⁷ Physical exercise that is done regularly can maintain body flexibility and strength of skeletal muscle, strength of heart muscle and respiratory muscle, thus improving blood flow into body cells.⁸

Ergonomics study also considers work environment that may affect the user's work performance, such as circulation, lighting, humidity, color, and temperature.⁹ Furthermore, user's medical histories such as bone dislocation, arthritis, and other musculoskeletal conditions, if followed by non-ergonomic body position and posture while using gadgets can increase the risk of Cumulative Trauma Disorders (CTD), which can cause chronic pain to many others physiological disorders.¹⁰

COVID-19 lockdown policies in Indonesia such as *Pembatasan Sosial Berskala Besar* (PSBB), *Pemberlakuan Pembatasan Kegiatan Masyarakat* (PPKM), and work from home in order to handle the pandemic cause sharp increase of gadget usage duration by most society.¹¹ Most students use gadgets for a minimum of 8 – 12 hours a day to attend online classes or do other work.¹² In fact, before the COVID-19 pandemic occurred, using gadgets more than 7 hours a day has been categorized to be in an addictive state.¹³

One of negative impacts of prolonged gadget usage in non-ergonomic postures is musculoskeletal disorders, including neck pain, back pain, even wrist pain.¹⁴ Recent study conducted on 164 high school students in Jakarta stated that 66.5% of respondents aged 15-20 years use smartphone for 56 hours per week and 84.1% of them complain of neck pain.¹⁵ This correlation is also supported by findings of a study conducted in Saudi Arabia which stated that 71.2% of students as a research subject experienced neck pain and 63.3% experienced headaches due to excessive use of gadgets.¹⁶

Neck pain related with considerable duration of gadget usage can be correlated with incidence of FHP which is characterized by increased degree of lower cervical vertebrae anterior curvature and increased degree of upper thoracic vertebrae posterior curvature.¹⁷ Flexion position in cervical vertebrae cause increased weight in neck, where under normal conditions, weight of head supported by neck is only in the range of 4.54-5.44 kg, while in flexion position with angle of 15° the load on neck becomes 12.25 kg, 30° becomes 18.14 kg, 45° becomes 22.23 kg, and 60° becomes 27.22 kg.¹⁵ The body feedback mechanism to encounter with excessive load that burdens the neck muscle can lead to muscle tension, disc herniation, arthritis, instability of the ligaments in the neck joints, to pinched spinal nerves causing symptoms such as discomfort feelings in neck, shoulders, and back areas.¹⁸ However, complaints of neck pain due to non-ergonomically gadget usage both in terms of posture and duration is also affected by various individual factors, such as gender, age, Body Mass Index (BMI), and occupation.¹⁵

From many previous studies, there has been no research about negative impacts of gadget usage that increased significantly during COVID-19 pandemic. Based on that background, this study aims to find out more about correlation between posture, duration of gadget usage and physical activity during the COVID-19 pandemics. This study is important to facilitate further research so that the result can be used for increasing work effectiveness and preventing complications due to body posture alterations.

METHODS

a. Methodology

Study design

This study is a analytic observational quantitative study with cross-sectional design. This study is conducted on May 2021 until July 2021 in Faculty of Medicine Udayana University. The research subject is students of Bachelor of Medicine and Doctoral Profession Study Program, Medical Faculty of Udayana University. Before research subjects were involved, this study was approved by Research Ethics Committee Medical Faculty of Udayana University/Sanglah Hospital Denpasar with ethical clearance number 178/UN14.2.2.VII.14/LT/2021.

Subjects recruitment

Respondents of this study must fulfill all the inclusion criteria including subjects who were active as medical students in Bachelor of Medicine and Doctoral Profession Study Program of Udayana University batch 2018-2020, age 18-21 years, and have normal BMI ranged 18.5-24.9 kg/m². Subjects who are refuse to participate, non-cooperative, and have medical history of musculoskeletal and joint disorders, neck injuries, arthritis, and other spinal disorders were excluded from this study.

Sampling technique

Sampling technique used in this study is stratified random sampling so that the data can be collected randomly but also with consideration of characterization in each stratum. This technique is chosen so each member in each stratum has the same opportunity to be selected and represent the population. Stratified random sampling technique can show a representative population in each batch randomly with minimal bias. Students who are chosen by lottery were then explained about the study. This study involves 106 medical students who have met the inclusion and exclusion criteria.

b. Material and procedure

Material

The instrument used in this study was a questionnaire which includes gadget usage questionnaire, physical activity and exercise habit during COVID-19 pandemic questionnaire adapted from Physical Activity Questionnaire (PAQ), and neck pain quantity and quality questionnaire adapted from Nordic Musculoskeletal Questionnaire (NMQ). This questionnaire has been modified to specifically assess neck pain associated with gadget usage and has been tested for validity and reliability before being used as study instrument.

Procedures

The research procedure started with a literature study that is relevant to the topic, arrangement of questionnaire, calculation of sample size, and submitting ethic permission process. An explanation of study purpose, procedures, benefit and disadvantage have been told to all respondents before the study began. Subject who are willing to participate will then provide informed consent of their willingness to become research subjects.

c. Assessment

Duration of gadget usage in this study is measured by questionnaire that assesses how many hours a day and how many days a week the respondents spend to access their gadgets on any behalf. Posture of gadget usage is measured by questionnaire and classified as neck position perpendicular or not perpendicular to the body. Physical activity is measured by questionnaire about respondents' exercise habits include exercise frequency, intensity and duration during each session. Physical activities

counted in this measurement are include aerobic exercises (such as cycling, jogging, swimming, basketball, etc.), flexibility exercises (such as yoga or pilates), and resistance exercises (such as lifting weights, push up, planks, etc.). Furthermore, the quantity and quality of neck pain are measured using questionnaire adapted from Nordic Musculoskeletal Questionnaire that has a high level of validity and reliability as the standardized methods for assessing musculoskeletal pain and discomfort. Neck pain in this study is every sensation of pain, ache, discomfort, or even numbness in neck area, with or without pain radiation to the head, shoulder, upper arm, or any other areas.

d. Data analysis

Analysis of the data was conducted in univariate analysis for each variable and bivariate analysis to prove the hypothesis of correlation between independent and dependent variables. The correlation between neck posture when using gadget, duration of gadget usage, and physical activities to the occurrence of neck pain was tested using Chi-square method by SPSS software version 25. The correlation between variables is said to be meaningful if the results of Chi-square p-value is <0.05 .

RESULTS

A. Characteristics of The Study Subjects

Respondents characteristics can be seen in Table 1.

Table 1. Respondents characteristics

Variable	Frequency (n)	Percentage (%)
Age (years)		
18	14	13.2
19	33	31.1
20	44	41.5
21	15	14.2
Gender		
Female	67	63.2
Male	39	36.8
Gadget Usage Duration (weekly)		
≥ 56 hours	82	77.4
< 56 hours	24	22.6
Neck Posture to Body while Using Gadget		
Perpendicular	13	12.3
Not perpendicular	93	87.7
Exercise Frequency		
Almost everyday	6	5.7
4 – 5 days / week	5	4.7
3 days / week	22	20.8
1 – 2 days / week	33	30.2
Rare	41	38.7
Exercise Intensity		
Very hard	1	0.9
Hard	4	3.8
Moderate	50	47.2
Mild	31	29.2
Very mild	20	18.9
Exercise Duration (per session)		
≥ 120 minutes	0	0
90 – 120 minutes	8	7.5

60 – 90 minutes	11	10.4
30 – 60 minutes	39	36.8
<30 minutes	48	45.3
Neck Pain (in past 12 months)		
Yes	65	61.3
No	41	38.7
Neck Pain Interfere Daily Functions		
Yes	13	12.3
No	93	87.7

Based on Table 1 above, research subjects' characteristics can be seen and classified based on age, gender, duration of gadget usage weekly, neck posture against the body when using gadgets, exercise frequency, exercise intensity, exercise duration per session, complaints and occurrence of neck pain in the last 12 months, and neck pain quality whether it limits daily functions or not. Based on the age category, 14 respondents (13.2%) were 18 years old, 33 respondents (31.1%) were 19 years old, 44 respondents (41.5%) were 20 years old, and 15 respondents (14.2%) were 21 years old. Based on gender, 67 respondents (63.2%) were female and 39 others (36.8%) were male. Based on the duration of gadget usage, 82 respondents (77.4%) use gadgets ≥ 56 hours in one week and 24 respondents (22.6%) use gadgets < 56 hours in one week. Majority of the respondents, that is 93 from 106 respondents (87.7%) use gadgets in a position where neck is not perpendicular to the body, and only 13 respondents (12.3%) use gadgets in a position where neck is perpendicular to the body. Furthermore, based on physical activity, respondents is categorized into active physical activity habit if total score of exercise frequency, intensity, and duration is > 5 and inactive physical activity habit if total score of exercise questionnaire is ≤ 5 . It was found that 67 out of 106 respondents (63.2%) were in active category and 39 respondents (36.8%) were in inactive categories of physical activity. Based on complaints of neck pain in the last 12 months (during the COVID-19 pandemic), 65 respondents (61.3%) stated that they had experienced neck pain and 41 respondents (38.7%) said they did not feel any pain or discomfort in neck area during that duration of time. Furthermore, 13 respondents (12.3%) stated that their neck pain limited their daily functions or works, while 93 respondents (87.7%) stated that their neck pain did not limit their daily function or they did not feel any neck pain.

B. Bivariate Analysis of Posture while Using Gadget and Neck Pain

Cross tabulation between the posture while using gadget and neck pain can be seen in Table 2.

Tabel 2. Cross Tabulation of Posture and Neck Pain

Neck Posture Against Body	Neck Pain (in last 12 months) (n=65)	No Neck Pain (in last 12 months) (n=41)	Total (n=106)	P value
Not perpendicular	61 (57.0%)	32 (36.0%)	93 (87.7%)	0.016
Perpendicular	4 (30.8%)	9 (62.9%)	13 (12.3%)	

Based on Table 2 above about correlation between neck posture while using gadgets and complaints of neck pain within last 12 months while in COVID-19 pandemic, p-value of 0.016 (p-value < 0.05) is obtained from Chi-square test. P-value lower than 0.05 indicates that hypothesis of a significant correlation between posture while using gadgets and occurrence of neck pain is accepted.

C. Bivariate Analysis of Gadget Usage Duration and Neck Pain

Cross tabulation between the duration of gadget usage and neck pain can be seen in Table 3.

Tabel 3. Cross Tabulation of Gadget Usage Duration and Neck Pain

Gadget Usage Duration (weekly)	Neck Pain (in last 12 months) (n=65)	No Neck Pain (in last 12 months) (n=41)	Total (n=106)	P value
≥56 hours	51 (62.2%)	31 (37.8%)	82 (77.4%)	0.733
<56 hours	14 (58.3%)	10 (41.7%)	24 (22.6%)	

Based on Table 3 above about correlation between duration of gadget usage and complaints of neck pain within last 12 months while in COVID-19 pandemic, p-value of 0.733 (p-value >0.05) is obtained from Chi-square test. P-value higher than 0.05 indicates that hypothesis of a significant correlation between duration of gadget usage and occurrence of neck pain is rejected.

D. Bivariate Analysis of Physical Activity and Neck Pain

Cross tabulation between the physical activity habit and neck pain can be seen in Table 4.

Table 4. Cross Tabulation of Physical Activity and Neck Pain

Physical Activity	Neck Pain (in last 12 months) (n=65)	No Neck Pain (in last 12 months) (n=41)	Total (n=106)	P value
Active	35 (52.2%)	32 (47.8%)	67 (63.2%)	0.012
Inactive	30 (76.9%)	9 (23.1%)	39 (36.8%)	

Based on Table 4 above about correlation between physical activity and neck pain within last 12 months while in COVID-19 pandemic, p-value of 0.012 (p-value <0.05) is obtained from Chi-square test. P-value lower than 0.05 indicates that hypothesis of a significant correlation between physical activity and occurrence of neck pain is accepted.

DISCUSSION

Based on univariate analysis from data about duration of gadget usage, the average duration of gadget usage by medical students of Bachelor of Medicine and Doctoral Profession Study Program Udayana University is 7 – 9 hours a day and 7 days a week, thus classified as ≥56 hours a week. Moreover, 65 out of 106 respondents (61.3%) also experienced neck pain in last 12 month from when the data were obtained, where that overall 12 months period had entered the COVID-19 pandemic era. From 82 medical students who are using gadget ≥56 hours in one week, 51 of them (62.2%) experienced neck pain, and from 24 medical students who are using gadget <56 hours in one week, 14 of them (58.3%) experienced neck pain in the last 12 month of COVID-19 pandemic era.

Correlation between Posture while Using Gadget and Neck Pain

Based on bivariate analysis of data about neck posture while using gadgets and complaints of neck pain, there was a significant correlation between posture and neck pain. This finding is suitable with a previous study conducted at a high school in Jakarta, which stated that a person would be more prone to complain a neck pain if 70% of the time spent for accessing gadgets is done with position of neck flexion with minimum angle of 20°. ¹⁵ This neck flexion posture that is not following body's physiological condition causes a significant increase in the load of cervical vertebrae, so that can be burdensome to neck muscle and cause many negative impacts. The head and neck muscles must resist a load of more than 20 kg while users on neck flexion with angle more than 30°, compared to their normal ability to support only 5 kg of load when the neck position is ergonomically perpendicular to the body. This excessive load can cause alteration in cervical spine, curvature, ligaments, muscle and tendons in cervical spine and cause further neck pain.

Furthermore, another studies stated that there is a significant correlation with p-value lower than 0.05 between craniovertebral angle (CVA) and high thoracic angle (HTA) to the occurrence of neck pain in working position. Respondents with low CVA and high HTA value which indicates incidence of FHP and thoracic kyphosis are more prone to experience neck pain compared to those who have normal CVA and HTA.¹⁹

Correlation between Duration of Gadget Usage and Neck Pain

Based on bivariate analysis of data about gadget usage duration and complaints of neck pain, there was no significant correlation between duration of gadget usage and neck pain. This rejection of the hypothesis of a significant correlation between duration of gadget usage and neck pain is similar to result of previous study conducted on 47 education staff where there was no significant correlation between duration of using computer and complaints of neck pain.²⁰ On the other hand, another previous study conducted to 164 high school adolescents stated that there was a significant correlation between intensity of smartphone usage and neck pain. These differences in research results about correlation of gadget usage duration and the occurrence of neck pain are considered to be influenced by any other factors, such as body posture when using gadgets, working environment conditions, rest and stretch habits between duration of using gadgets, and so on.¹⁵ Furthermore, the risk of neck pain will decrease in a person who uses the gadgets ergonomically even with a long duration of usage.²⁰

Correlation between Physical Activity and Neck Pain

Based on bivariate analysis of data about physical activity and complaints of neck pain, there was a significant correlation between physical activity and neck pain. This finding is suitable with a previous study which stated that there was a significant correlation between body fitness levels and musculoskeletal complaints, where respondents with low body fitness level will have a higher risk of experiencing musculoskeletal discomfort or disorders.²¹ Another study conducted on 97 nurses also showed a significant correlation with p-value < 0.05 between exercise habits and musculoskeletal complaints, so can be concluded that regular exercise habits can provide strength and efficiency of muscle activity, including skeletal muscle, so that can reduce the risk of musculoskeletal disorders.⁸

In addition to posture, duration of gadget usage, and physical activity, there are many confounding factors that can influence the results of this study, such as stretching habits before and during work time, breakfast before work, amount of mineral water consumption in a day, environmental conditions while using gadgets, personal medical history, psychological stress, and many more.^{19,21}

CONCLUSION

Based on the results, analysis and discussion that have been described in this study, it can be concluded that there are a significant correlation between the posture while using gadgets and physical activity to the occurrence of neck pain during the COVID-19 pandemic, but there is no significant correlation between the duration of gadget usage and the occurrence of neck pain during the COVID-19 pandemic. Using gadgets in non-ergonomic postures, like neck position that is not perpendicular to the body, will increase the risk of neck pain. Moreover, a good body fitness that can be seen from exercise and physical activity habits will reduce the risk of neck pain complaints. Besides, extensive study about correlation of Forward Head Posture by measure the angle of cervical flexion while using gadgets and neck pain requires further research so that the optimal suggestion to cure and prevent neck pain caused by non-ergonomic gadget usage can be appropriately carried out.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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