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Higher Duration of Laptop Usage Associated with the Occurrence of Neck Disability in Undergraduate Physical Therapy Students During the Covid-19 Pandemic

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ABSTRACT

Introduction: To prevent the spread of the virus during the COVID-19 pandemic, all students in Indonesia were learning from home using laptops for long durations, that cause neck disabilities. This study was conducted to determine the relationship between laptop use and disability in the neck region.

Methods: This study was analyzed using multivariate logistic regression analysis with 106 students in semesters 3rd, 5th, and 7th as participants. Data was taken using a questionnaire on a google form which was distributed in August 2021. Participant data such as age, gender, semester level, height, weight, physical activity per day and per week, use of Kinesio taping, any physiotherapy action taken for neck pain, use of pain medication, use of laptops per day and per week, and ergonomic position were collected as predictors of neck pain which were interpreted if the neck disability index questionnaire (NDI) value was >60%.

Results: This study showed the results of 106 participants that have been analyzed, an increase of 1 hour of laptop use in students has a significant relation to an increase in neck pain of 3.1% after adjusting with other variables ($p = 0.034$). At the same time, other characteristics did not show a significant effect after adjusting with other variables on the occurrence of neck pain.

Conclusions: With every increase in the possibility of using a laptop in undergraduate students, there was a significant increase in the risk of developing NDI after adjusting with other variables (gender, use of painkillers, ergonomic position, physical activity, and semester).

Keywords: Covid-19, neck pain disability index, neck pain, laptop usage.

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INTRODUCTION

The COVID-19 pandemic affects various aspects of social life, especially in education in Indonesia. The Indonesian government restricts interaction by changing face-to-face learning activities from school to school from early March 2020 to December 2021, where students are required to be in front of a laptop/computer during teaching and learning activities that take a lot of time. Especially in higher education, laptops are a common thing used to access various media to support online learning.

Laptop users often do the wrong sitting posture in a prolonged static position, which causes complaints of musculoskeletal disorders (MSDs).[1] Another reason is the load due to static and repetitive actions that inhibit blood flow leading to oxygen insufficiency for aerobic metabolic processes. MSDs are disorders that occur in joints, ligaments, muscles, and other parts of the skeletal system because of prolonged static sitting behaviour.[2,3] MSDs that students often experience during the COVID-19 pandemic usually occur in the neck area with the prevalence of 22.3% for undergraduate students.[4] To find out complaints that occur in the neck area, the Neck Disability Index (NDI) is usually used as a measurement standard.[5]

The NDI is the most widely used measuring tool to measure disability due to neck pain, whether acute, chronic, or neck injury.[6] NDI was found to be reliable, valid, and responsive in a variety of patient populations, including those with acute and chronic conditions and those with neck pain caused by musculoskeletal dysfunction, whiplash-related disorders, and cervical radiculopathy.[5] Neck pain is an uncomfortable feeling that occurs in the neck area. The incidence of neck pain increases with age and significantly uses a computer/laptop over 4 hours/day.[7] Many risk factors cause neck pain, including a wrong sitting position, long work hours, and perceived neck muscle tension.[8] Some of these risk factors occur in students during online lectures during the COVID-19 pandemic.

Undergraduate physical therapy students have participated in online lectures from the beginning of March 2020 until December 2021, most of them using laptops as a medium for addresses. As the

students do school from home, they spend long hours writing, reading, and using computers, leading them to the high-risk group for neck pain. Based on research conducted by Daher (2021), they found that neck pain among college students during lockdown was higher than in the previous period, and the neck pain appearance was associated with the Visual Analogue Scale (VAS) score and the NDI questionnaire.[9] Therefore, the researchers hypothesized that the prevalence of neck pain among undergraduate physiotherapy students at Udayana University was higher during the pandemic. The present study is designed to investigate the relation between the duration of laptop usage and neck disability.

METHODS

The Udayana University's 3rd, 5th, and 7th-semester physical therapy students were given an online questionnaire using a google form containing several sociodemographic characteristics, laptop use, and neck disability using the NDI. The researchers distributed and gave the questionnaire to the students to fill out for two months, from August to September 2021. Students filled out the questionnaire on August 2, and all of them completed it on August 15, 2021. Before participants filled out related questions, the researchers provided a statement column that the sample would be a participant in the author's research and filled out informed consent. Suppose the sample is not willing to be a research participant. They will be directed to the last sheet containing an acknowledgment of gratitude. There is no need to continue the questionnaire as it should be.

The Indonesian version of the NDI Questionnaire is a valid and reliable questionnaire to measure the level of neck disability in patients with mechanical neck pain. In the content validity value, NDIs received the value of 1.0 in both the item-level validity index and scale-level validity index representing a perfect validity score. The test-retest reliability obtained an r-value of 0.86, which indicates a high-reliability value.[10]

The questionnaire comprises several subsections, namely the identity and medical history subsection (containing questions related to name, age, gender, semester level, height and weight, physical activity and its duration both per day and week, use of Kinesio taping, physiotherapy treatment for pain experienced, and the use of pain medication), the sub-section of the duration of using a laptop, both per day and per week, and the sub-section of the neck pain disability index questionnaire which contains 10 question items such as pain level, self-care, lifting weights, reading, headaches, concentration, work, driving, sleeping, and recreation.[10]

Study participants

The researchers recruited 106 students of the physiotherapy undergraduate study program at one university. This was an analytical observational study with a cross-sectional approach conducted in August 2021. Subjects were recruited by considering the inclusion and exclusion criteria. The exclusion criteria were included in the questions on the form. Furthermore, if the participant has a history of the related disease, the participant will not continue to fill out the form. The inclusion criteria used in the study were currently studying at Physiotherapy undergraduate program at a University as the researchers were examining neck disability occurrence in the University's students who obtained long duration of laptop usage, using laptop/computer during lectures as the medium, having good speaking skills both orally and in writing as the questionnaire requires both skills to complete, and being willing to become the research subject by signing the informed consent voluntarily. Exclusion criteria used in this study were visual disturbances, hearing loss, myelopathy, atlantoaxial subluxation, metastases, neoplasms, history of fractures in the neck region, systemic disease, and neurological signs.

Data analysis

The data from this study were analyzed using SPSS v.26.0 for windows with descriptive analysis covering age, gender, semester level, height, weight, physical activity per day and week, use of Kinesio taping, whether they carried physiotherapy interventions out for pain experienced, use of painkillers, use of laptops per day and per week, ergonomic position, and NDI. The neck pain that causes neck disability was assessed using the NDI questionnaire, with patients with an NDI value >60% categorized as having a neck disability.[11] Informed consent was obtained before the commencement of the survey. The hypothesis test used multivariate logistic regression to analyze the correlation of more than one independent variable on a quantitative scale (interval) on a dependent variable. The individual and behavioral issues relevant to neck pain were presented, and the preventive strategies that may be considered to control the neck pain were suggested. The correlation will be significant if the relationship between variables shows a p-value <0.05.

RESULTS

Based on Table 1, the researchers divided the subjects into 24 men and 82 women. The average age of the subjects was 19.78 years. The subjects were divided into three semesters, namely semesters 3, 5, and 7, with an average height of 162.34 cm and an average weight of 56.95 kg. The subjects' average physical activity per day was 45.09 minutes, and the average per week was 3.76 hours. The use of laptops on subjects per day is 1.58 hours, and the average per week is 26.72 hours, with the number of subjects who use laptops with ergonomic positions being 17 people, and those who do not use laptops with ergonomic positions are 89 people. Regarding non-ergonomic laptop usage, 4 subjects used Kinesio tapping, 2 people sought physiotherapy intervention because of neck pain, and 6 used painkillers.

Table 1. General Characteristics of Research Subjects (n=106)

Characteristics	mean±SD or *n* (%)
Age	19.78 ± 1.01
Sex	
Male	24 (22.6%)
Female	82 (77.4%)
Semester	
3	53 (50%)
5	15 (14.2%)
7	38 (35.8%)
Body Height	162.34 ± 7.47
Body Weight	56.95 ± 14.01
Physical activity per day (minute)	45.09 ± 64.48
Physical activity per week (hour)	3.76 ± 5.87
Kinesio tapping usage	
Yes	4 (3.8%)
No	102 (96.2%)
Physiotherapy intervention for Neck pain	
Yes	2 (1.9%)
No	104 (98.1%)
Pain medication	
Yes	6 (5.7%)
No	100 (94.3)
Laptop usage per day (hour)	1.58 ± 0.60
Laptop usage per week (hour)	26.72 ± 23.91
Ergonomic position	
Yes	17 (16%)
No	89 (84%)
Neck disability index	
With disability	64 (60.4%)
Without disability	42 (39.6%)

Table 2. Results of the multivariate logistic regression of Neck Disability Index to patients' characteristics

Characteristics	Odd Ratio (95% CI), *P*-value
Sex, *male*	2.22 (0.82-6.03), 0.117
Anti-inflammatory use, yes	0.18 (0.02-1.88), 0.151
Ergonomic position, *no*	1.80 (0.57-5.71), 0.321
Laptop usage	1.03 (1.00-1.06), 0.034
Physical activity, active	0.98 (0.92-1.05), 0.542
Semester	1.31 (0.80-2.14), 0.288

Table 3. Classification table

Observed		Predicted		
		NDI		Overall percentage
		Without disability	With disability	
NDI	Without disability	14	28	33.3
	With disability	11	53	82.8
Overall percentage				63.2

Table 2 shows that every 1-hour increase in laptop use among university students has a significant relationship with an increase in neck pain of 3.1% after adjusting with other variables (gender, use of painkillers, ergonomic position, physical activity, and semester, $p = 0.034$). At the same time, the others characteristics did not show a significant effect after adjusting with other variables on the occurrence of neck pain.

Based on Table 3, the number of samples without a disability was 42 participants. Fourteen participants didn't have a disability, and 28 participants were predicted to have a disability but didn't experience it (the participants who didn't have risk factors but felt the pain). The number of samples with disability were 64 participants. There were 53 participants who had a disability, and 11 participants predicted had no disability but experienced it. The accuracy of the multivariate logistic regression model used is quite good because it can correctly guess 63.2% of the conditions that occur.

DISCUSSION

Based on the sample size formula using the analytical observational method with a cross-sectional approach, the minimum number of samples required is 96. However, to expect the selection to drop out, the researcher added 10% of the model itself so that the necessary number of pieces was 106 samples. From the study results, the researchers found that there was a significant relationship between an increase of 1 hour of laptop use in students and an increase in neck pain of 3.1% after adjusting with other variables. This happens because other factors may influence the predictor of the duration of laptop use so that it can cause neck pain.

One previous study has been conducted to determine the relationship between the duration of using gadgets during school from home on the appearance of neck disorders. Based on research conducted by Hikmah and Puspitasari (2021) on the time of gadget use for neck pain using the NDI questionnaire, they found that the average

time of gadget use was > 3 hours average sample complained of mild neck pain.[12] However, the data were not normally distributed, and statistical tests showed no significant relationship between the long duration of using gadgets and the occurrence of neck pain.[2] Another study conducted by Sharma (2021) on the effect of online classes on students' mental and physical health during COVID-19 showed that from using laptops to take long online classes, the results of the NDI questionnaire were 4% of students with total disability, 9.3% with severe disability, 38.6% moderate disability, and 41% mild disability. However, there was no significant relationship between the duration of laptop use for online classes and neck disability.[13] Based on research conducted by Yaseen (2021) on the impact of e-learning on student aches in Palestine during COVID-19 using the NRS-11 index, it showed a significant relationship between the duration of laptop use on the time and severity of musculoskeletal pain, where neck pain is the most common musculoskeletal pain in 32.2% of the sample.[14] The researchers need further research on the relationship between the duration of laptop use and neck disorders using a multivariate logistic regression test to assess other influences that affect the independent variables.

Neck disability often appears in students with symptoms of neck pain because of the learning process using a laptop. It triggered this because the sitting position when using a laptop is less ergonomic, and contractions of the neck muscles continuously with a static state for a long time.[8,15] During prolonged muscle contractions, glutathione (GSH) is reduced, causing an increase in oxygen species. Reactive stimulates the activation of subfamily 1 transient receptor potential cation channel (TRPV1) or capsaicin receptors and finally activates analgesic receptors in the skeletal muscles of the neck, causing discomfort in the form of neck pain.[16] In simple terms, when there is continuous muscle contraction, muscle shortening occurs, which will disrupt the balance of the neck muscles in maintaining their postural position and cause hypertonus in the neck muscles, which will cause pain.[17]

The impact of COVID-19 is very influential, especially in the world of education, so the education policy implemented is to conduct distance learning or school from home, which is carried out online. This learning system requires students to use gadgets for a long duration with an average of 3.79 hours per day so that it can have several adverse effects, one of which is a musculoskeletal disorder (MSD).[4] Musculoskeletal disorders are injuries and disorders that occur in the musculoskeletal system and affect the movement of the human body, which has several causative factors, namely physical factors, biomechanical factors, and individual factors. Excessive use of gadgets such as laptops when a school from home requires students to position their heads in the same position for a long time and causes excessive contractions, causing weakness and fatigue in the neck muscles, called neck pain.[12]

Based on research conducted by Tunwattanapong (2016) on the effectiveness of neck and shoulder stretching exercises in office workers with neck pain, stretching exercises targeting the neck and shoulder area twice/day, five days/week, performed for four weeks can reduce neck pain that significantly improved neck and shoulder function.[18] Stretching increases energy bio-production in mitochondria, increases antioxidant activation and increases local calcium in muscle cells. Increased activity of energy biogenesis in mitochondria can increase glutathione (GSH), increase antioxidants, inhibit ROS increase, increase local calcium, inhibit microtubule proliferation in neck muscles, and produce ROS from NADPH oxidase so that ROS can inhibit pain receptor activation. and inhibit neck pain.[16]

Besides the duration of laptop use, several other factors need to be considered. A posture that is not ergonomic during school from home can also increase the risk of neck pain. The research conducted by Yoshimoto (2021) on pain status and its relationship with physical activity, psychological stress, and online work on workers in Japan during COVID-19 explained that poor posture, such as neck flexion, can increase neck pain. Moreover, that study found that a lack of physical activity can significantly increase the chronicity of musculoskeletal pain and that a decrease in physical activity during COVID-19 may harm the perceived pain.[19] Another study conducted by Yaseen (2021) showed that gender is also a factor that needs to be considered since the prevalence of neck pain was higher in women than in men.[14] Subsequent research by Radulović (2021) on the relationship between work from home and musculoskeletal pain in telecommunications workers during COVID-19 confirmed that gender, age, organization, disturbance by a household member, workspace conditions, poor ergonomic position, and long work duration cause musculoskeletal pain, which confirmed that working from home can cause neck pain.[20]

This study has several limitations that need to be considered. First, the researchers administered the questionnaire through an online survey, which could lead to disinterest in answering the questions carefully. Second, the questionnaire given is a self-

reported questionnaire, so that it can lead to a lower or higher assessment of one's condition. Third, this study uses a cross-sectional research design, so the results must be evaluated carefully and require further research. Fourth, the researchers did not measure the pain scale. Therefore, this study did not know the relationship between pain intensity and NDI. The study's sample size is small for this survey, which needs to be higher for future studies.

CONCLUSIONS

In conclusion, the transition to the learning system during the COVID-19 pandemic, which requires students to do online learning, can cause various adverse effects, primarily on students' physical health as musculoskeletal disorders. Using a laptop for a long time can increase the risk of neck pain. For every 1-hour increase in laptop use in the physical therapy undergraduate students, there is a significantly increased risk for NDI of 3.1% after adjusting with other variables.

CONFLICT OF INTEREST

This study does not have any conflict of interest.

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AUTHOR CONTRIBUTIONS

This research was conducted in collaboration between the three authors. NNW, TFW, and IPGSA collected the research data, analyzed it using SPSS, and drafted the manuscript and the research's result. MA did the finalization of the literature search and the manuscript's draft. All authors have read and agreed to the final manuscript.

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