THE ASSOCIATION BETWEEN DURATION AND POSTURE IN LAPTOP USE WITH MUSCULOSKELETAL COMPLAINT IN BACHELOR OF MEDICINE STUDENTS, FACULTY OF MEDICINE UDAYANA UNIVERSITY

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ABSTRACT

The use of laptops is inseparable from people's lives. One of negative impacts from laptop usage is the musculoskeletal complaint. It is not yet known whether there is an association between duration and posture in laptop use in Bachelor of Medicine students, Faculty of Medicine, Udayana University. Therefore, this study aims to determine the association between duration and posture in laptop use with musculoskeletal complaint in Bachelor of Medicine Students.This study employed an analytic approach with cross sectional method. The research subjects were Bachelor of Medicine students in Udayana University, consisting of 84 people. Data regarding duration was obtained through a questionnaire. Data regarding posture was measured using RULA. Data related to musculoskeletal pain was measured using NBM questionnaire. Control variables were history of trauma or disease related to musculoskeletal complaints and room temperature. Bivariate analysis was performed using Spearman's Rho test.The results of this study showed 74 samples experienced low pain, while 10 other samples experienced moderate pain. The highest amount of pain was in the upper neck area. This study showed an association between the duration of laptop use with musculoskeletal complaint ($p = 0.04$; $r = 0.22$). There is also an association between body posture when using a laptop with musculoskeletal complaint ($p = 0.009$; $r = 0.28$).There is a weak relationship between duration and posture in the use of laptops with musculoskeletal complaint in students of the Bachelor of Medicine students, Faculty of Medicine, Udayana University.

Keywords : laptop., duration., posture., musculoskeletal complaint

INTRODUCTION

In the age of information and technology, laptops have become an indispensable part of life. Apart from technological advancements, the increase in laptop usage is also supported by the ongoing pandemic situation. The work from home policy that has been implemented previously has caused activities to be increasingly restricted and carried out from home online. As a result of this policy, many people use hybrid methods in both work and learning. Hybrid method is a combination of offline and online activities which can increase the duration of laptop usage in daily life.The use of laptops provides many benefits, especially in the field of communication. However, excessive use of laptops can also have a negative impact. Based on several previous studies, it was concluded that laptop use can cause complaints in the musculoskeletal system due to excessive duration of use and unergonomic posture. However, there is no clear data regarding the relationship between duration and posture in laptop use to musculoskeletal complaints in Bachelor of Medicine student, Faculty of Medicine, Udayana University.Therefore, researchers have conducted preliminary interviews with 20 Bachelor of Medicine students class of 2020, before conducting further research. The results of the interviews showed that students often

use laptops with an average duration of use up to 5 hours a day. Almost all of the students interviewed stated that the use of laptops aims to record lecture material and carry out Small Group Discussion (SGD) activities which are still carried out online. In addition, the interview results also showed the presence of musculoskeletal complaints thet were expressed in the form of pain in the neck area (25%), shoulders (20%), back (25%), hands (15%), and fingers (30%).The occurrence of musculoskeletal complaints in Bachelor of Medicine students who use laptops is one of the urgencies to carry out this research. Musculoskeletal complaints that occur continuously and not treated properly can have an impact on the movement of the musculoskeletal system. Until now, it is not certain whether the musculoskeletal complaints that occur in Bachelor of Medicine students class of 2020 are influenced by the duration and posture when using a laptop or not. Therefore, researchers want to conduct further research to clearly determine whether or not there is a association between duration and posture when using a laptop with musculoskeletal complaints experienced by Bachelor of Medicine students class of 2020.

Laptop

Laptop comes from two words, lap and top. In general, a laptop is a small computer that is used on an individual's lap.[1] There are two factors that support the use of laptops, namely internal factors and external factors. Internal factors include high sensation seeking, high extraversion personality, and low self-control. External factors include economic, situational, and social.[2,3,4,5,6,7]

Musculoskeletal System

The musculoskeletal system is a group of muscles attached to bones where the nature of movement can be regulated (volunteer). The musculoskeletal system is often referred to as the skeletal muscle system.[8] The musculoskeletal system is composed of muscles and bones. Muscles act as active locomation because they can contract, while bones act as passive locomotion because they only follow muscle control.[9]

Musculoskeletal Complaint

Musculoskeletal complaints are a condition of pain or aches that appear in the skeletal muscles, which can be mild to severe complaints.[10] Musculoskeletal complaints are generally caused by excessive strain or stress on the musculoskeletal system.[11] Repeated static loading over a long period of time on muscles can cause damage to muscles, tendons, joints, cartilage, nerves, and intervetebral discs which leads to pain in the muscles.[12] There are two factors that can lead to musculoskeletal complaints, including: internal and external factors. Internal factors including age, gender, anthopometry, and lifestyle. External factors including activity and posture.[13,14,15,16,17,18]

Those who use laptops excessively will generally be in a monotonous position for a long time, leading to an unergonomic posture. This leads to weight centering at one point which causes pain and trauma to the muscles. In addition, unergonomic postures can cause tendon irritation, nerve compression, and muscle and ligament strains that lead to musculoskeletal complaints.[19]

In addition to unergonomic posture, repetitive movements can also affect the occurrence of musculoskeletal complaints. Repetitive typing or bending the neck can cause a decrease in blood flow to the muscle tissue so that nutrients to the muscles will be reduced. This can lead to pain and fatigue in the muscles. If the muscles experience fatigue for more than 30 minutes, muscle contraction will decrease. The decrease in muscle contraction will have an impact on the movement of the musculoskeletal system.[20]
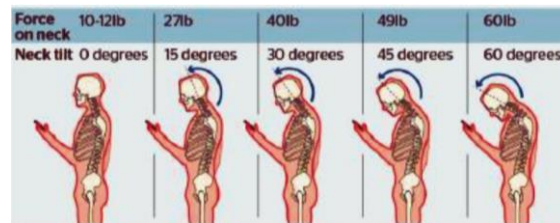

Figure 1. Neck posture when using smartphone[21]

Based on Figure 1 related to neck posture when using a smartphone, it can be seen that the angle formed by the neck is directly proportional to the pressure received by the neck muscles.[22] The greater the angle formed, the greater the pressure received. This theory also applies when using a laptop. When bending the neck, there is an additional pressure load on the spine. The pressure load received can reach 60 pounds where 1 pound is equivalent to 0.45 kg.[23]

MATERIAL AND METHOD

This research used an analytic approach with a cross sectional method (measurements were taken at one time). Sample selection using consecutive method. This research was conducted online (distributing questionnaires via google form) and offline (requesting documentation of research subjects) at the Faculty of Medicine, Udayana University. This study was conducted for 5 months starting from January 2023 to June 2023. This research has received ethical clearance from the Research Ethics Commission of the Faculty of Medicine, Udayana University. The ethical clearance number was 01/UN14.2.2.VII.14/LT/2023.The research sample in this study amounted to 88 people, where Bachelor of Medicine students class of 2020, Faculty of Medicine Udayana University students totaled 240 people, with a division of class A totaling 119 people and class B totaling 121 people. The number of men in the population is 88 people, while the number of women in the population is 152 people. Students who are included as research samples are Bachelor of Medicine students class of 2020, Faculty of Medicine, Udayana University who are willing to become research respondents by filling out the informed consent provided on the google form. Students who have history of fracture or diseases related to musculoskeletal complaints, such as rheumatoid arthritis (RA), herniated nucleus pulposus (HNP), and others; did not use laptops; and did not complete the questionnaire data are excluded.

The questions for research subject were distributed by using google form and divided into personal data, duration in laptop usage, and level of pain that caused by laptop usage. Question about duration were divided into 3 time ranges consist of short (< 2 hours/day), medium (2-4 hours/day), excessive (> 4 hours/day). The duration variabel was a categorical data.
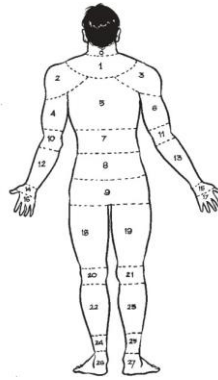
Figure 2. Nordic Body Map [24]

Musculoskeletal complaints when using a laptop was measured using the Nordic Body Map (NBM) questionnaire. Nordic Body Map is a questionnaire used to determine the level of pain in 28 musculoskeletal areas, where the first area marked with the number 0 is located on the upper neck and the last area marked with the number 27 is located on the soles of the feet as shown in Figure 2. No validity and reliability test were conducted on the NBM .

questionnaire used in this study because the questionnaire was standardized. Determination of pain levels on the NBM uses a Likert scale consisting of 4 levels of pain, including scale 1 (no pain), scale 2 (slight pain), scale 3 (pain), scale 4 (very painful). The variable level of musculoskeletal complaints was a categorical data where each score from the 28 existing areas will be summed and classified according to the scores listed in Table 1

Table 1. Classification of NBM scales [25]

Likert scale	Total score	Level of pain	Corrective actions
1	28 – 49	Low	Does not require corrective action yet
2	50 – 70	Medium	May require corrective action
3	71 – 91	High	Requires corrective action
4	92 - 112	Very high	Requires immediate corrective action

Measurement of body posture variables while using a laptop will be measured through direct documentation. Students who have answered the questionnaire will be contacted by researchers to be collected in one place. Then the respondents will be asked to perform the posture when using a laptop. The angle formed from the results of the documentation will be assessed by using "GeoGebra" website and classified according to the RULA category. The posture variabel was a categorical data.Rapid Upper Limb

Assessment is a method that assesses a person's posture in performing activities to estimate the risk of musculoskeletal complaints, especially in the upper limbs. The body parts assessed in the RULA method are divided into two groups: group A (upper arm, forearm, wrist, and wrist rotation) and group B (neck, torso, and legs). The total of the scores that obtained from group A and group B will be classified according to Table 2.

Table 2. RULA action level [26]

Score	Category	Action
1-2	1 (safe)	Posture is acceptable
3-4	2 (small)	Further examination is required in the near future and changes may be required
5-6	3 (medium)	Examination and changes are required in the near future
7	4 (high)	Immediate (urgent) action required

Measurement of the variables of trauma history and diseases related to musculoskeletal complaints was done through a google form that distributed online, in the form of "yes" or "no" questions. Respondents who had such a history were excluded from the study sample. The room

temperature variable is controlled by measuring the respondent's posture while using a laptop in the same room.
RESULT
 Characteristics of the Research Subject

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The characteristics of the entire sample can be seen in Table 3. Respondents obtained during the study were 99 people, which 15 people were excluded because they had a history of trauma and diseases related to musculoskeletal complaints. The total sample that met the inclusion criteria in this study totaled 84 samples.

Table 3. Characteristic of research subject

Variable	N	%
Gender		
Female	51	60.7
Male	33	39.3
Age		
≤ 20 years	67	79.8
> 20 years	17	20.2
Laptop usage duration		
Short	10	11.9
Medium	31	36.9
Excessive	43	51.2
Body posture (RULA)		
Safe	-	-
Small	62	73.8
Medium	22	26.2
High	-	-
Overall pain level		
Low	74	88.1
Medium	10	11.9
High	-	-
Very high	-	-
Level of upper neck pain		
Low	31	36.9
Medium	43	51.2
High	10	11.9
Very high	-	-
Level of lower neck pain		
Low	34	40.5
Medium	35	41.7
High	14	16.7
Very high	1	1.2
Level of left shoulder pain		
Low	61	72.6
Medium	16	19.0
High	6	7.1
Very high	1	1.2
Level of right shoulder pain		
Low	54	64.3
Medium	22	26.2
High	8	9.5
Very high	-	-
Level of upper left arm pain		
Low	78	92.9
Medium	6	7.1
High	-	-
Very high	-	-
Level of back pain		
Low	35	41.7
Medium	32	38.1
High	16	19
Very high	1	1.2
Level of upper right arm pain		
Low	75	89.3

Medium	8	9.5
High	1	1.2
Very high	-	-
Level of waist pain		
Low	38	45.2
Medium	33	39.3
High	13	15.5
Very high	-	-
Level of lower waist pain		
Low	40	47.6
Medium	24	28.6
High	17	20.2
Very high	3	3.6
Level of bottom pain		
Low	42	50
Medium	29	34.5
High	11	13.1
Very high	2	2.4
Level of left elbow pain		
Low	78	92.9
Medium	5	6
High	1	1.2
Very high	-	-
Level of right elbow pain		
Low	77	91.7
Medium	7	8.3
High	-	-
Very high	-	-
Level of lower left arm pain		
Low	80	95.2
Medium	3	3.6
High	1	1.2
Very high	-	-
Level of lower right hand pain		
Low	77	91.7
Medium	5	6
High	2	2.4
Very high	-	-
Level of left wrist pain		
Low	70	83.3
Medium	7	8.3
High	7	8.3
Very high	-	-
Level of right wrist pain		
Low	59	70.2
Medium	18	21.4
High	6	7.1
Very high	1	1.2
Level of left hand pain		
Low	75	89.3
Medium	5	6
High	4	4.8
Very high	-	-
Level of right hand pain		
Low	71	84.5
Medium	9	10.7
High	4	4.8

Very high	-	-
Level of left thigh pain		
Low	80	95.2
Medium	3	3.6
High	1	1.2
Very high	-	-
Level of right thigh pain		
Low	80	95.2
Medium	4	4.8
High	-	-
Very high	-	-
Level of left knee pain		
Low	80	95.2
Medium	2	2.4
High	2	2.4
Very high	-	-
Level of right knee pain		
Low	81	96.4
Medium	3	3.6
High	-	-
Very high	-	-
Level of left calf pain		
Low	81	96.4
Medium	2	2.4
High	1	1.2
Very high	-	-
Level of right calf pain		
Low	81	96.4
Medium	2	2.4
High	1	1.2
Very high	-	-
Level of left ankle pain		
Low	82	97.6
Medium	1	1.2
High	1	1.2
Very high	-	-
Level of right ankle pain		
Low	82	97.6
Medium	1	1.2
High	1	1.2
Very high	-	-
Level of left foot pain		
Low	81	96.4
Medium	2	2.4
High	1	1.2
Very high	-	-
Level of right foot pain		
Low	80	95.2
Medium	2	2.4
High	2	2.4
Very high	-	-
	N = 84	

Based on Table 3, the majority of samples in this study were female (60.7%). This is in accordance with the representation of gender in the population where there are more women (152 people) than men (88 people). The age range in the sample was between 19-22 years, with age grouping divided into 2, namely ≤ 20 years and > 20 years. The majority of the sample was ≤ 20 years old (79.8%). The duration of laptop use in this study was divided into 3 categories, namely: short, medium, excessive. The majority of samples used laptops with excessive duration, with a duration of > 4 hours / day (51.2%). Based on posture assessment using RULA, there are four categories used, which are: safe, small risk, medium risk, and high risk. The majority of the samples had a small risk (73.8%) and none of the samples fell into the safe or high risk posture categories.

In this study, the overall pain level was divided into four categories, consisting of low, moderate, high, and very high. Almost all samples had mild pain levels (88.1%) and no samples experienced high or very high pain levels. The level of pain in 28 limbs was divided into four categories, consisting of no pain, mild pain, pain, and severe pain. Based on Table 3, it can be concluded that the highest amount of pain was in the upper neck area (53 samples), followed by the lower neck area (50 samples), and back (49 samples).

The Association Analysis between Gender with Musculoskeletal Complaints

The association analysis of gender with musculoskeletal complaints in this study using Fisher's Exact Test and described in Table 4.

Table 4. Fisher's Exact Test results of gender with musculoskeletal complaints

Gender	Musculoskeletal complaint	
	p	1.0
	N	84

Based on the results, the p value = 1.0. The analysis in this study shows there is no relationship between gender and musculoskeletal complaints.

The Association Analysis between Duration in Laptop Use with Musculoskeletal Complaints

The association analysis between the duration of laptop use and musculoskeletal complaints in this study using Spearman's Rho and described in Table 5.

Table 5. Spearman's Rho Test results duration of laptop use with musculoskeletal complaints

Duration of laptop use	Musculoskeletal complaint	
	r	0.22
	p	0.04
	N	84

Based on the results, the p value = 0.04. The correlation coefficient test results shows r = 0.22 which indicates a weak relationship. It can be concluded that there is a weak relationship between the duration of laptop use and musculoskeletal complaints.

The Association Analysis between Posture in Laptop Use with Musculoskeletal Complaints

The association analysis between posture in laptop use with musculoskeletal complaints in this study using Spearman's Rho and described in Table 6.

Table 6. Spearman's Rho Test results posture in laptop use with musculoskeletal complaints

Posture in laptop use	Musculoskeletal complaint	
	r	0.28
	p	0.009
	N	84

Based on the results the p value = 0.009. The correlation coefficient test results shows r = 0.28 which indicates a weak relationship. It can be concluded that there is a weak relationship between posture in laptop use and musculoskeletal complaints.

DISCUSSION

The Association between Gender with Musculoskeletal Complaints

Gender is one of the risk factors that contribute to the occurrence of musculoskeletal complaints. Female muscle strength is generally only two-thirds of male muscle strength. In addition, the size of women's muscles is also smaller than men's.[14] Hormonal changes and menopause are also associated with decreased bone density and osteoporosis in women.[27] There are no studies that specifically state the association between gender and musculoskeletal complaints caused by laptop use. However, the research on tea picking workers at PT X Kayu Aro showed a similar thing where there was no relationship between gender and general musculoskeletal complaints (p = 0.649).[28] This is based on the theory that men and women have the same risk of experiencing musculoskeletal complaints until the age of 60 years. In addition, the absence of an association between gender

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and general musculoskeletal complaints may also be due to other factors, such as: duration of work, non-ergonomic posture, and physical fitness of an individual.

The Association between Duration in Laptop Use with Musculoskeletal Complaints

Excessive duration of laptop use can cause increased loading, resulting in changes in posture.[29] Unergonomic posture and static for a long time can cause muscles to contract continuously which causes a decrease in blood flow. This leads to an increase in lactic acid levels, resulting in musculoskeletal complaints in the form of fatigue and pain.[30] According to another study, the frequency of laptop use is not associated with musculoskeletal complaints.[31] Low or high frequency of laptop use can still lead to musculoskeletal complaints, which are closely related to the duration and posture of laptop use.[32] In addition, a similar thing was also shown by research conducted by Tarawifa on 190 students of the Faculty of Medicine and Health Sciences, Jambi University (p = 0.01).[33] Variable assessment of duration and level of low back pain complaints was measured through a questionnaire with categorical data results. The results of this study concluded that there is a relationship between the duration and behavior of laptop use with complaints of low back pain.

However, there are different results in research conducted by Tanzila to 416 students of the Medical Study Program at Muhammadiyah University of Palembang. Variable assessment of duration and level of musculoskeletal complaints was measured through a questionnaire with categorical data results. The absence of a relationship between the duration of laptop use with musculoskeletal complaints can be due to individuals who use laptops have done a 10-15 minute stretch and rest after two hours of use, thus leading to a decreased risk of musculoskeletal complaints.[29]

The Association between Posture in Laptop Use with Musculoskeletal Complaints

The association between posture and musculoskeletal complaints is related to increased static and torsional loads on bones and joints as a result of unergonomic and static postures. This leads to increased energy use which leads to muscle fatigue.[34] Muscle conditions that receive static loads continuously and repeatedly can cause musculoskeletal complaints that affect muscles, joints, tendons, intervertebral discs, peripheral nerves or peripheral nerves, to the vascularization system, where this can begin from acute to chronic conditions. Complaints that are often felt by an individual are mild to severe pain, where swelling, redness, tingling, heat, soreness, stiffness, and numbness occur.[35,36] The existence of a relationship between posture in laptop use and musculoskeletal complaints was also conveyed by research conducted by Wicaksono on 60 students of the Department of Architecture, Faculty of Engineering, Diponegoro University (p = 0.03).[30] The research method used was analytic-cross sectional. Assessment of body posture variables in laptop use and the level of musculoskeletal complaints was measured through a questionnaire with categorical data results. The results of this study concluded that there is a relationship between body posture in laptop use and musculoskeletal complaints. This is likely due to the non-ergonomic design of the laptop resulting in a posture that bends to see the monitor more clearly.

CONCLUSION AND SUGGESTION

Based on the results of this study, it can be concluded that there is a weak relationship between the duration of laptop use and musculoskeletal complaints in Bachelor of Medicine students class of 2020, Faculty of Medicine, Udayana University. In addition, there is also a weak relationship between body posture in laptop use with musculoskeletal complaints in Bachelor of Medicine students class of 2020, Faculty of Medicine, Udayana University.Reflecting on the results of this research, research subjects are advised to use a laptop for a reasonable duration or use a laptop with an ergonomic posture. If this is not possible, research subjects can do some stretching in between laptop use to prevent excessive muscle contraction.

This research has not looked the association of laptop use with acute pain. Therefore, researchers are advised to conduct further research to examine acute pain caused as a result of laptop use. In addition, researchers are also advised to apply other research methods such as experimental.

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