

Consequences of risk factors related to prolonged computer use on musculoskeletal pain in public university students: A case study

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ABSTRACT – The Malaysian government formally enforces study, worship, and online learning rules during the movement control order period. Learning activities that used to be carried out face-to-face have now been changed mainly into virtual meetings. These conditions affect the effectiveness of the student's well-being and learning process in higher education. This study aims to determine the problems and risk factors of continuous computer use on a person's musculoskeletal system. This cross-sectional study was conducted on 60 volunteers from a public university student body in Pahang. Data were collected using a structured socio-demographic, work-related factors questionnaire and the Nordic Musculoskeletal Questionnaire (NMQ) for MSD assessment. Each student's severity of MSD symptoms was assessed by a visual analogue scale (VAS). Robust Poisson regression was used to investigate the association of MSDs with socio-demographic and other study-related factors. More than 60% of students experienced symptoms of musculoskeletal problems in the neck, shoulder, upper back, and lower back. This study found that gender and not taking a break from electronic devices lead to musculoskeletal discomfort among students. In addition, this result shows that revision activity leads to musculoskeletal discomfort in the neck and low back among students. Moreover, class attendance led to musculoskeletal discomfort in the lower back. These findings provide awareness regarding musculoskeletal discomfort risk factors among students in university institutions.

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INTRODUCTION

Most Work-related Musculoskeletal Disorders (WMSD) develop over time, either caused by work or by the environment in which the work is performed [1]. Internal and external conditions of humans affect WMSD onset and can increase the trend of enduring them [2]. In a study by Sirajudeen et al.[3], more than half of the students reported that computer usage was related to (WMSD). There is a high prevalence of WMSD among university students who use computers and other electronic devices daily over long periods[4].

Moreover, individuals with characteristics, work ergonomics such as wrong posture and movements, and WMSD were found to have significant interactions [5]. In Hong Kong office employees spend long hours with computers, especially with the new norm of working from home [6]. A study found that there is a high prevalence of neck pain among medical and health sciences undergraduate students, which are prolonged reading, using computers, and prolonged sitting [7]. Studies focus on healthcare students and to our knowledge, there is no study that has looked at the prevalence of and risk factors associated of university students [8].

There are many body pains issue among people that have prolonged sitting and computer use. Prolonged sitting and maintaining the neck in forwarding flexion are the risk predictors for the neck [9]. People can experience physical and psychological problems if they use computers too much [10]. Students sit in front of their computers for hours without time to stroll between classes. Sitting involves less muscular effort than standing, but it nonetheless results in physical exhaustion and the necessity to maintain body parts for extended periods [11]. Therefore, this study investigates the ergonomics risk factors caused by prolonged computer use among students.

This study aims to determine the problems and risk factors in an individual's musculoskeletal system using computer devices. The objectives of this study are:

- i. To determine the risk factors that may occur in a student's musculoskeletal system
- ii. To explore the relationship between pain, discomfort and student's activities
- iii. To identify the body part that has severe pain

LITERATURE REVIEW

Work-related Musculoskeletal Disorder (WMSD)

The Italian physician Bernardino Ramazzini, the father of occupational medicine, discovered the link between employment and certain musculoskeletal disorders caused by rapid and irregular movements and the adoption of uncomfortable postures [12]. Repetitive motion injuries, repetitive strain injuries and occupational cervicobrachial disorders are the other names [13]. WMSD is described as muscular pain or damage to the human support system that can result from a single event or cumulative stress, limiting daily activities [14].

WMSDs have a significant impact on the workplace. WMSD has become more of a problem in our society [15]. The lower back was the most commonly reported anatomical area for WMSD, and obese people reported higher WMSD than non-obese people [16]. Body pain in the knee area is the most common type of pain, followed by discomfort in the wrists and pain in the neck among people [17].

Neck and lower back were more prone to pain and had a higher likelihood of having musculoskeletal problems [18]. A previous study mentioned that studying for extended periods led to stress and back discomfort [19]. Moreover, students ignore their working posture and position, resulting in postural imbalance [20]. Also have pain and discomfort in the upper and lower back, neck, arms, and legs.

According to a local study by Syed Abudaheer, [21] students are at high risk of developing work-related musculoskeletal disorders, especially in the shoulder, neck and lower back regions. The neck, lower back, and shoulders were the most commonly affected areas among students like years of work experience; the neck and lower back revealed an elevated pattern of pain frequency [14]. Studying WMSD is essential to prevent and reduce the risk and the high prevalence and long-term symptoms of WMSD among students [22].

Consequences of Prolonged Using Personal Computer

A study conducted by Kanchanomai et al, [23] revealed neck pain that persisted, including some aspects related to computer use. Computer use suffered musculoskeletal disorders such as neck, shoulder, and waist pain [24]. Moreover, computer use impacts healthy older people's daily functioning, well-being, and happiness, as well as their social network [25].

According to Browning et al,[26], prolonged using personal computers could have long-term consequences on their health and education. Moreover, inappropriate online contacts between students and teachers and the influence of an informal relationship with a teacher disrupting formal instruction during class are potential negative consequences [27]. Thus, neck pain persisted, including some aspects related to computer use. Computer use impacts people's daily functioning, well-being, happiness, and social networks.

METHODOLOGY

This study's respondents comprised students from a local university in Pahang. These students were selected for their willingness to provide research access. Their study style tends to have prolonged computer use and sitting, which might cause WMSD. However, the subjects were randomly chosen. The information gathered was kept private and handled confidentially. The data collection was analyzed using Statistical Package for the Social Science (SPSS).

Nordic Musculoskeletal Questionnaire (NMQ)

Nordic Musculoskeletal Questionnaire (NMQ) is a well-validated tool created to investigate the prevalence and impact of WMSD [28]. NMQ has been widely used to identify pain in nine-body parts: neck, shoulder, upper back, elbow, lower back, wrist, thigh, knees, and ankle (refer to Figure 1) [29]. NMQ was suitable for large-scale studies and many participants [30]. NMQ was developed and tested to standardize the questionnaire methodology used in WMSD studies that allows comparison between nine-body parts[31]. This survey required students to answer all sections, which took around three to five minutes.

The first section was respondent demographic data. It required students to fill in their private information, such as email and phone numbers. In the second section, students must fill in the information regarding their gender, weight, faculty, and campus. The third section was NMQ. NMQ was a crucial part where students should answer whether they had trouble with the nine body parts for the past twelve and four months and today. Moreover, some other questions, such as taking medication and being hospitalized also been asked in NMQ.

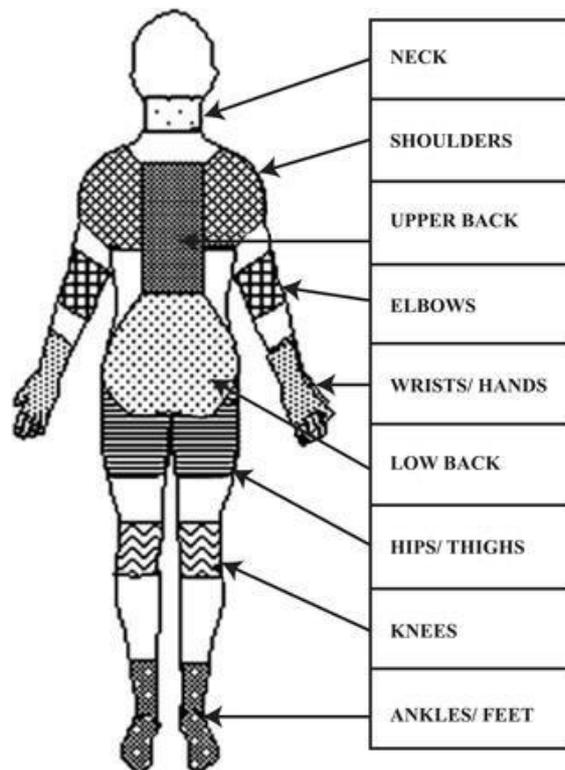


Figure 1 Nine body part of NMQ

Visual analog scale (VAS)

VAS is a rating scale on which the subject assigns a numerical value to the health outcomes [32]. It has been widely used in various adult populations [33]. VAS was used to understand a participant’s different levels of pain. This study will assess pain severity using VAS for respondents with a high body pain rate. The scale was categorized as shown in Table 1.

Table 1 Visual analog scale

Scale	Rate of Pain
0	No Pain
1-3	Mild Pain
4-6	Moderate Pain
7-9	Severe Pain
10	Worst Pain

RESULTS AND DISCUSSIONS

In this study, 60 students (55% female, 45% male; age: 18–27 years) were included. Participants are diploma, undergraduate, and postgraduate students. Most of the students (55%) are from the Faculty of manufacturing and mechatronics engineering technology (FTKPM), and fewer (1.7%) are from the Faculty of chemical and process engineering technology (FTKPP), with 1.7%. Table 2 displays the personal characteristics of students.

Figure 2 shows the pain of body parts for the past 12 months among students: neck, shoulder, upper back, elbow, low back, wrists and hands, hips, thighs, knees, and ankles/feet. Four parts of the body have had the most discomfort for the past 12 months which is the neck (78.3%), shoulder (61.6%), upper back (61.6%), and low back (73.3%) number of students. However, two parts of the body have had no body part discomfort for the past 12 months, which are the elbow and ankles/feet (86.6%).

Figure 3 shows students' pain experienced during everyday activities. The study results show that the upper and lower backs have the worst pain among the two students (3.33%). Two body parts have no pain rate among the students, which are the knees and ankles/feet, with 42 students. Four students (6.66%) experienced severe pain in the neck, while 16 students (9.6%) experienced mild pain in the upper back and low back, respectively.

Table 2 Respondent background

No	Personal Characteristics	No of Respondent	Percentage %
1.	Gender		
	Male	27	45
	Female	33	55
2.	Age		
	18-22	13	21.7
	23-27	47	78.3
	28-32	0	0
	32 and above	0	0
3.	Body Weight (kg)		
	<60	27	45
	60 -80	28	46.7
	80 – 100	3	5
	100 kg and above	2	3.3
4.	Campus		
	Pekan	58	96.7
	Gambang	2	3.3
5.	Faculties		
	FTKPM	33	55
	FTKA	2	3.3
	FTKMA	5	8.3
	FTKEE	5	8.3
	FTKKP	1	1.7
	FK	14	23.3
	FIM	0	0
	PBM	0	0
	FIST	0	0
6.	Level of Education		
	Diploma	7	11.7
	Bachelor Degree	53	88.3
	Master Degree	0	0
	PHD	0	0

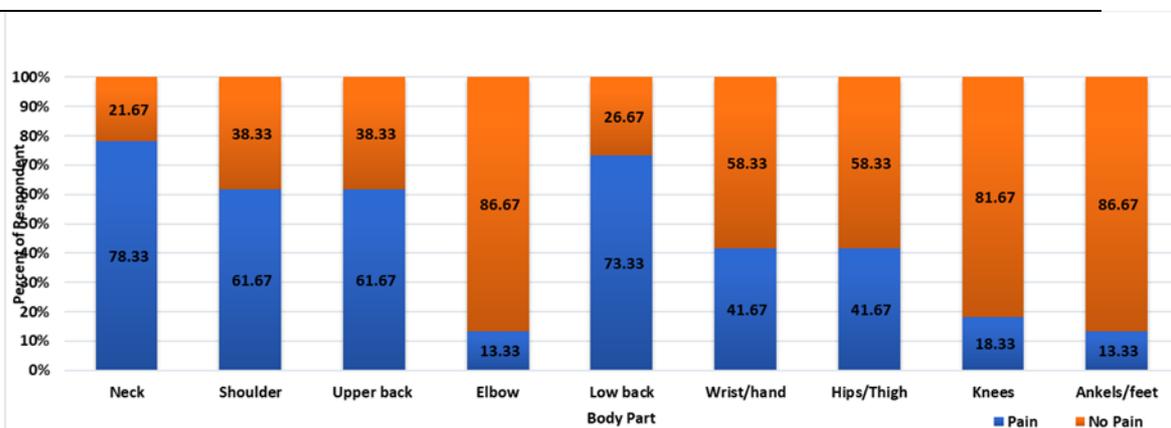


Figure 2 Pain of body parts for the past 12 months

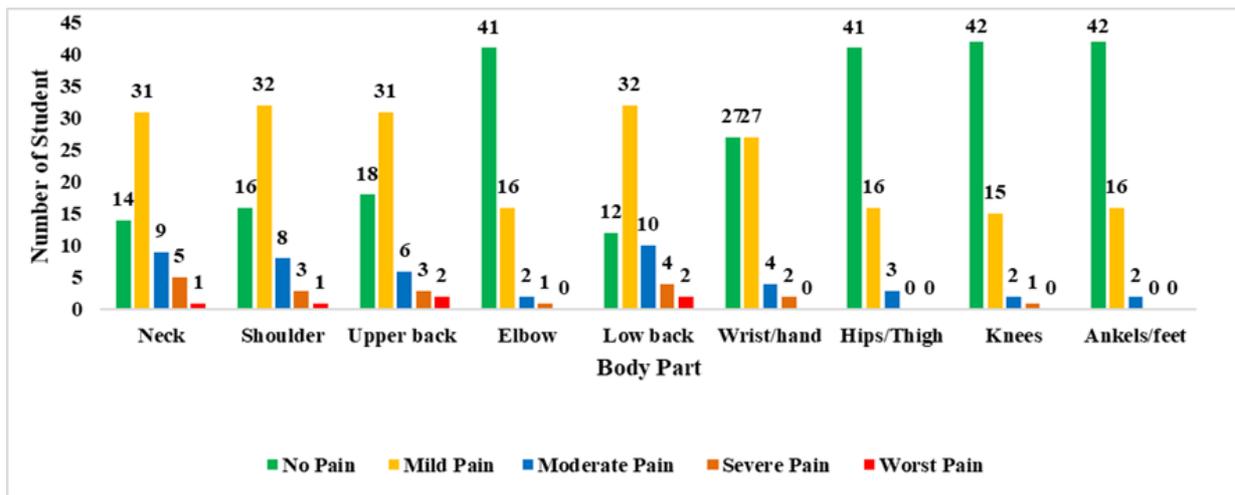


Figure 3 Pain experienced during everyday activities

Table 3 shows the relationship between risk factors and pain or discomfort in the neck, shoulder, upper back, and low back. This relationship was investigated using Bivariate Correlation. There is a small positive correlation between gender and pain in the upper back ($r=0.183$) and lower back ($r = 0.136$). There is also a positive medium and large correlation between gender and pain in the neck ($r = 0.337$) and shoulder ($r = 0.527$), respectively. In this study, gender is statistically significant between pain in the neck ($p = 0.008$) while shoulder ($p = 0.000$), upper back ($p = 0.163$), and low back ($p = 0.299$) are statistically not significant. This result proves in Ataei et al. [34] research that gender did not show a significant relationship with the prevalence of pain in the shoulder, upper back, and lower back. On the other hand, study by Ali Bhutto et al, [32] showed that gender is related to neck pain and has the most discomfort in the neck compared to the other parts of the body.

Table 3. The risk factors and body part discomfort

Risk Factor	Neck Discomfort		Shoulder Discomfort		Upper back Discomfort		Low back Discomfort	
	r	p	r	p	r	p	r	p
Gender	0.337	0.008*	0.527	0.000	0.183	0.163	0.136	0.299
Age	0.018	0.891	0.001	0.992	0.168	0.200	-0.43	0.746
Weight	-0.243	0.062	-0.126	0.335	-0.221	0.089	-0.070	0.598
Level of education	0.061	0.644	-0.073	0.580	0.247	0.057	0.016	0.906
Time spends on an electronic device	-0.114	0.387	0.096	0.464	-0.234	0.072	-0.061	0.646
Time spends in class	0.109	0.409	0.116	0.379	0.021	0.872	0.021	0.875
Time spends on doing the assignment	0.007	0.956	0.006	0.963	-0.055	0.674	0.014	0.918
Take a break from the electronic device	0.190	0.146	0.044	0.738	0.044	0.738	0.305	0.018*

There is a relationship between weight and body discomfort in the neck, shoulder, upper back, and low back (Table 3). There is a small negative correlation between weight and pain in the neck ($r = -0.243$), shoulder ($r = -0.126$) and upper back ($r = -0.221$). However, there is no correlation between age and low back pain ($r = -0.070$). There is a statistically significant difference between weight and all the body parts, which are the neck ($p = 0.062$), shoulder ($p = 0.335$), upper back ($p = 0.089$) and lower back ($p = 0.598$). However, in a previous study by Nauzeer & Jaunky, [35] the higher weight is significantly associated with low back pain in male and female students.

There is a relationship between the level of education and pain or discomfort in the neck, shoulder, upper back, and low back (Table 3). Study results show a small correlation between education level and pain in the upper back ($r = 0.247$). There is no correlation between level of education and pain in the neck ($r = 0.061$), shoulder ($r = -0.073$) and low back ($r = 0.016$). However, according to Alexandrov & Alexandrov, [36] university student most often reported neck pain.

Last but not least is the relationship between taking a break from electronic devices and pain or discomfort in the neck, shoulder, upper back, and lower back. It shows a small positive correlation between taking a break from an electronic device and neck pain ($r = 0.190$) for the past 12 months. There is a positive medium correlation between taking a break from an electronic device and having pain in the lower back ($r = 0.305$). There is a statistically significant difference between age and pain in the neck ($p = 0.146$), shoulder ($p = 0.738$) and upper back ($p = 0.738$). However, there was a statistically significant difference between taking a break from an electronic device and experiencing pain in the lower back ($p=0.018$).

Table 4. Relationship between body part discomfort with student's activities

Student's Activities	Neck Discomfort		Shoulder Discomfort		Upper back Discomfort		Low back Discomfort	
	r	p	r	p	r	p	r	p
Class Attendance	0.099	0.452	0.030	0.822	0.030	0.822	-0.024	0.062
Completing assessment task	0.232	0.075	0.162	0.216	0.093	0.480	0.242	0.047*
Revision activity	0.347	0.007*	0.145	0.268	0.145	0.268	0.282	0.029*
Sport activity	0.104	0.430	0.008	0.952	-0.198	0.130	0.131	0.319
Social activity on campus	0.117	0.374	0.059	0.652	-0.199	0.452	0.174	0.183

Table 4 shows the relationship between neck, shoulder, upper back, and lower back discomfort with student activities such as class attendance, assessment tasks, revision activities, sports activities, and social activities on campus. There are three groups that determine the correlation: small correlation ($r = 0.1-0.29$), medium correlation ($r = 0.3-0.49$) and large correlation ($r = 0.5-1.0$). There was a medium-positive correlation between neck pain and revision activity ($r = 0.347$). Table 4 shows that other students' activities indicated a small positive correlation with body part discomfort ($r < 0.29$). However, sports activities and social activities on campus have a small negative correlation with upper back discomfort.

The Pearson correlation application is that when $p < 0.05$, it is statistically significant, while if $p > 0.05$, it is statistically not significant. This study showed a statistically significant difference between pain in the neck ($p = 0.007$) and the lower back ($p = 0.029$) with revision activity, respectively. This finding was supported by Rabab et al, [37] among medical students showed that it is significant that students suffer from lower back pain because of revision activity. Moreover, pain in the lower back is also statistically significant with completing the assessment task ($p = 0.047$). According to Anggiat et al, [38] some lower back pain students reported an inability to perform academic activities.

Last but not least, there is no statistically significant difference between neck with class attendance ($p=0.452$), completing assessment tasks ($p=0.075$), sports activity ($p=0.430$) and social activity on campus ($p=0.374$). Furthermore, all student activities have no significant differences between the shoulder and upper back. On the low back, three activities are not statistically significant, including class attendance ($p = 0.062$), sports activity ($p = 0.319$) and social activity on campus ($p = 0.183$). However, according to the study by Ge et al, [39] exercise time a day for college students significantly affects the body.

CONCLUSION

The main finding of this study is more than 60% of students experienced symptoms of musculoskeletal discomfort in the neck, shoulder, upper back, and lower back. The first objective was achieved by finding that the significant risk factors influencing musculoskeletal discomfort are gender and taking a break from the electronic device. While the other risk factors such as age, weight, level of education, time spent on electronic devices, class, and doing assignments are not significant.

The second objective was determined by the correlation between body parts and students' activities. This result shows that revision activity led to musculoskeletal discomfort in students' necks and lower backs. Moreover, class attendance led to musculoskeletal discomfort in the lower back. The third objective was achieved by considering the severity level among students. Most students have moderate pain experienced in their necks, shoulders, upper back, and lower back. However, most students have no experience of the pain in their elbows.

This study may increase awareness regarding the musculoskeletal discomfort risk factor among students in university institutions. For future studies, it is recommended to implement a considerable number of respondents to achieve a more precise result. Next, it is also recommended to do studies regarding seating posture and device position. Recommend to university management to provide a reasonable online class schedule that is not tight for students. Last but not least, the student can change the mode of study from online notes to physical notes.

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