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Knowledge and Practice of Laptop Ergonomics and Prevalence of Musculoskeletal Symptoms among University Students

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ABSTRACT

Objective: This study aimed to assess the knowledge and practice of laptop ergonomics and prevalence of musculoskeletal symptoms among university students.

Method: This cross-sectional study was conducted on 197 volunteers from a public university student in Selangor. Volunteers were 101 health science and 96 non-science students who completed a self-administered questionnaires consisting of general information, knowledge and practice of laptop ergonomics and self-reported musculoskeletal symptoms.

Result: Overall, the students had knowledge scores of 74.1% and practice scores of 70% on laptop ergonomics. However, the knowledge among health science students was significantly higher than the non-science students ($p<0.01$). Meanwhile, there was no significant difference observed in the practice between health science and non-science students. There were 67% of the students who experienced musculoskeletal symptoms (MSS) in at least one part of their body and the most common musculoskeletal symptom were shoulder pain (46.2%), neck pain (41.1%), upper back pain (39.1%) and lower back pain (34.5%). There was no significant association between knowledge and practice of laptop ergonomics with the prevalence of MSS. No association was found between age, gender, BMI category, physical activity and duration of laptop use with prevalence of MSS.

Conclusion: Although there was no association found between knowledge, practice and other contributing factors with MSS, the prevalence of musculoskeletal symptoms among UPM students was 67%. Hence, this study emphasized the need to promote ergonomics awareness program on musculoskeletal pain and healthy postures while using laptop in order to minimize the prevalence of musculoskeletal symptoms among the students.

Keywords: *Knowledge, practice, laptop ergonomics, musculoskeletal symptoms*

1. Introduction

International Ergonomic Association (2000) defined physical ergonomic as concerned with human anatomical, anthropometric, physiological and biomechanical characteristics as they relate to physical activity which include working postures, materials handling, repetitive movements, work related musculoskeletal disorders, workplace layout, safety and health. Ergonomic seeks to adapt task, working conditions, work methods, tools and machines to maximize their suitability for people (Loo & Richardson, 2012). As related to computer equipment, ergonomics is concerned with such factors as the physical design of the keyboard, screens, and related hardware, and the manner in which people interact with these hardware devices (Howe,

2010). Ergonomics play an important role to ensure capacity and capability well-performed. When a person understands and learn about ergonomics, its help to improve working environment so that people can work comfortably and use minimum amount of energy efficiently (Muin & Sapri, 2013).

Laptop Personal Computer (PC) has been synonym with university student life. Laptop is a necessity for them to carry out daily activities such as completing assignments, seeking information, surfing internet, communication as well as for leisure activity such as gaming and watching movies. Besides being portable and lightweight, laptop enables them to access information technology at the tips of their hand. Prior to this, it is not surprisingly to see most of student spend longer period of time using laptop. Students also reported to spend more hours of work per day on computer than professionals (Noack-Cooper et al, 2009). Meanwhile, Jacobs et al (2009) reported that laptop sales comprise at least a quarter of the overall computer market, with these numbers jumping to 75.8% among college and graduate students. According to Caruso and Salaway (2008), laptop ownership by university students has increased from 65.9% in 2006 to 82.2% in 2008. In Malaysia, government have encourage the use of computer and multimedia in order to attain a develop nation status by 2020. In line with this, the dwindling prices have increased the popularity of laptop PC especially among college and office users (Sen & Richardson, 2007).

Despite of negative impact to health related to prolong used of laptop without proper ergonomic measure, mostly university student are still unaware of this outcome. Study conducted by Khan et al (2012) revealed that only 52.33% of their respondent have heard and have the knowledge about ergonomic. This showed that awareness level about ergonomic and safe computer practise need to be improved. Knowledge of ergonomics is required to discipline computer users to avoid certain risk factors that can contribute to the development of musculoskeletal symptoms and musculoskeletal disorders (Khan et al., 2012). The knowledge and application of ergonomics can serve to prevent the onset and progress of musculoskeletal injuries and improve one's health status (Wahlstro et al, 2000).

In the absence of a good ergonomic design, extended work for prolong periods can adversely affect not only vision, but also the muscles of neck, upper back, shoulders and arms, leading to visual and muscular fatigue and discomfort (musculoskeletal condition). Symptoms like pain, numbness, tingling in various body parts like wrists, shoulders, back and legs and eye strains occur due to improper seating, lack of short breaks during work and improper viewing distance (Khan et al., 2012). Several studies had stated that computing related neck and upper extremity pain has been reported among college and graduate students during the last ten years (Katz et al, 2000; Schlossberg et al, 2004; Jenkins et al, 2007; Menendez et al, 2009).

Computer use creates a risk of musculoskeletal system discomfort especially for the upper extremities (Weston & Barker, 2002). Working on a computer in awkward postures for prolong periods may result in a variety of computer related health problems (Sen & Richardson, 2007; Wahlström, 2005). Prolong used of laptop without proper ergonomic practice can expose student with the risk of getting musculoskeletal symptoms such as neck pain, shoulder pain, and back pain. Current practice of students for computing laptop was ergonomically improper and prevalence of health problems among laptop users was high and it is reported that up to 20% of the students suffered from at least one of the musculoskeletal problems every time when they worked with laptop computer (Chavda et al., 2014).

Musculoskeletal symptoms refer to any aches or pain of musculoskeletal. Few studies have assessed the use of laptop computers and its association with musculoskeletal symptoms among college student (Hamilton et al., 2005; Jacobs et al., 2009; Raps & Nanthavanij, 2008; Shin, 2010; Rajagopal et al., 2012). Hamilton et al (2005) suggested that further research need to be conducted to investigate the association between laptop used with musculoskeletal discomfort. Meanwhile, Chavda et al (2014) suggested that more research is needed to evaluate the relationship between practice of laptop computer and musculoskeletal health problems. Therefore, for this reason that the researcher conducted study to assess the knowledge and practice of laptop ergonomic and prevalence of musculoskeletal symptoms experienced by the students.

2. Materials and Method

2.1 Study background

A cross-sectional survey was conducted from February to March 2015 at the main campus of a public university in Selangor. The Faculty of Medicine and Health Sciences and Faculty of Economics and Management were selected purposively to represent the health science and non-science respectively. The study samples were undergraduate laptop users from 1st years to 4th year who volunteered to participate in the study from each of the faculty. Self-administered pre-tested questionnaires were distributed to the students from both faculties when attending lectures. Overall, 197 students (101 from health sciences and 96 from non-science) completed the questionnaires.

2.2 Data collection

Questionnaire was the main tool for data collection. The questionnaire used was adapted from a survey instrument called Laptop Computer User Screening Survey (LCUSS) by Shin (2010) which was developed to study laptop computer-use patterns and to examine the relationships between laptop computer use and physical discomfort. Meanwhile, questionnaire was constructed to assess the knowledge and practice of laptop ergonomics, the based on comprehensive literature reviews and other related health and safety website concerning computer ergonomics (California Department of Industrial Relations, 2005; Mahmud et al., 2014). A standardized Nordic Questionnaire by Kuorinka et al (1987) was used to assess seven days prevalence rate of musculoskeletal symptoms. Overall, the questionnaires consisted of 11 sections. Section 1 to section 8 included questions about socio demographic data and laptop usage patterns. Meanwhile, section 9 and 10 involved questions regarding knowledge and practice of laptop ergonomic. Section 11 consisted of questions regarding the prevalence of musculoskeletal symptoms which consists of neck, shoulders, upper back, lower back, wrists/hands, hips/thighs, knees and ankles/feet. Reliability of the questionnaire was assessed through a pilot study among 40 respondents from other universities. The result obtained for Cronbach alpha was 0.823 which indicates a good reliability. At the end of the pilot test, the respondents were asked to give feedback about the questions that they had answered. Alteration of the questionnaire was made according to the feedbacks.

3. Results

3.1. Demographic

Respondents for both science and non-science categories consisted of 1st year (34.5%), 2nd Year (13.7%), 3rd (38.1%) and 4th year (13.7%) students. There were 39 (19.8%) male and 158 (80.2%) female and majority of the students were Malays (75.6%). Many of health science students (18.3%) were not in normal body weight (underweight, overweight and obese) compared to non-science students (13.2%). Body Mass Index (BMI) was measured as the previous study has found a positive association between BMI and musculoskeletal pain in the shoulder and in the wrist/hand. Regarding their involvement in physical activities, health science students (38.1%) were more active compared to non-science students (36.1%). Generally, 94.4% of the students were in good health condition.

3.2. Information laptop use

The task that students usually involved while laptop computing was internet surfing to search for work-related sources, checking emails and reading news (87.8%). The respondents had been using computers from 1 to 14 years. For daily usage, 51.8% used their laptop computer for about 1 to 4 hours per day and 88% were involved in continuous laptop computing without rest break for about 1 to 4 hours. Thirty five percent of respondent took rest breaks for 5 to 10 minutes throughout their computing.

The most favourable laptop computing location was in the dormitory room (82.7%) followed by in the library (19.8%). The reason for the selection of the location was based on the accessibility of wireless internet (72.6%), presence of electrical socket (56.9%) and convenient location (52.3%). Majority of the respondent practiced sitting with laptop on desk during computing (72.6%), lying prone (17.3%) and lying supine (8.6%). Meanwhile, laptop backpack was the most popular (57.9%) method used to carry laptop from one place to another, 43.1% of the respondents were carrying laptop weighted from 2.3kg to 3kg and 37.1% used computer monitor size of 14 to 14.9 inch.

3.3 Knowledge of laptop ergonomics

Figure 1 shows the percentage of knowledge score between health science and non-science students. Knowledge was measured by noting respondent's agreement with a set of 24 dichotomous questions (yes/no). The mean and standard deviation of the raw score was used to categorize it into poor, fair and good knowledge (Srisaard, 1992; Suchat, 1997). A total of 74.1% students had fair knowledge on laptop ergonomic while only 15.8% had poor knowledge. However, health science students were more knowledgeable about laptop ergonomic compared to non-science students.

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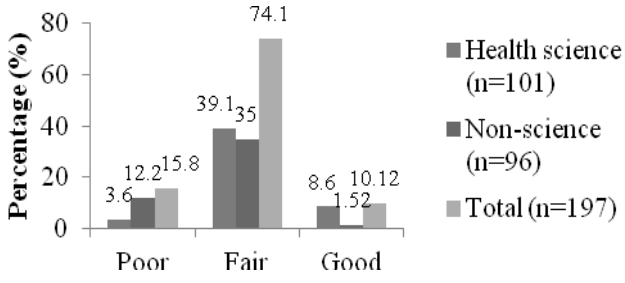

Figure 1: Knowledge score between the two groups

3.4 Practice of laptop ergonomics between the two groups

Figure 2 shows the percentage of practice score between health science and non-science based student. Practice was

measured by noting respondent's agreement with a set of 40 Likert-scale type questions. The mean and standard deviation of the raw score was used to categorize it into poor, fair and good practice (Srisaard, 1992; Suchat, 1997). Seventy percent of the students have fair practice in laptop ergonomic while 16.8% have good practice. Meanwhile, only 13.2% have poor practice in laptop ergonomics.

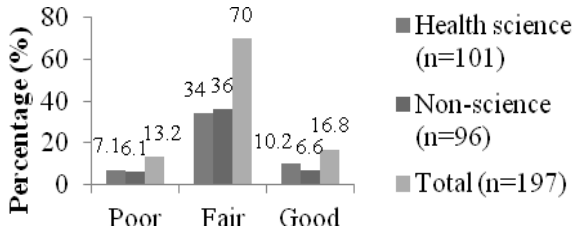

Figure 2: Practice score between the two groups

3.5 Prevalence of musculoskeletal symptoms among respondents

Figure 3 shows the prevalence of musculoskeletal symptoms on various parts of the body of the respondents for seven days period. Shoulder pain was the most common symptoms experienced by the respondent (46.2%), followed by neck pain (41.1%), upper back pain (39.1%) and lower back pain (34.5%). Overall, non-science students reported more prevalence of musculoskeletal symptoms as compared to health science students.

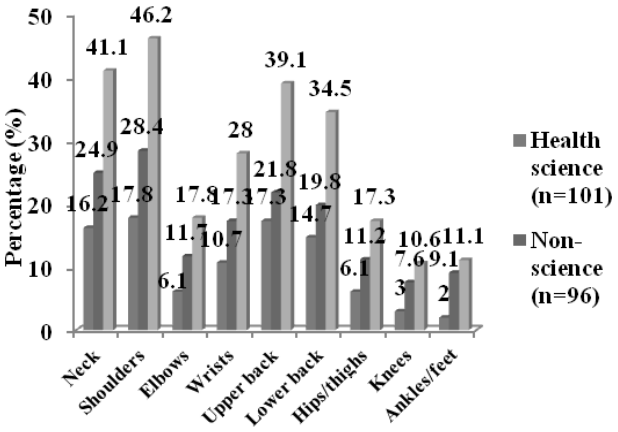

Figure 3: Prevalence of MSS among students for seven days period

Table 1 shows the total prevalence of musculoskeletal symptoms among respondents for seven days prevalence. There were 67% of them experienced musculoskeletal symptoms in at least one part of their body. Meanwhile, the result from Chi-square test shows that there was a significant association of musculoskeletal symptoms between health science and non-science students ($p < 0.05$). Overall, non-science student show higher prevalence (76.0%) compared to health science students (58.4%).

Table 1: Comparison of total prevalence of MSS for the past seven day period between groups

MSS	Health science (n=101)	Non-science (n=96)	Total	χ^2 /p
	Freq (%)	Freq (%)	Freq (%)	
No	42 (41.6)	23 (24.0)	65 (33)	6.916
Yes	59 (58.4)	73 (76.0)	132 (67)	/0.009*

* Significant at $p < 0.05$

3.6 Comparison on knowledge and practice of laptop ergonomics between the two groups

The result of Independent Sample T-test in Table 2 shows that the mean knowledge level score among health science students (18.5±2.98) was significantly higher ($p<0.001$) than among non-science students (16.06±3.42). Based on the result of independent sample t-test as shown in Table 3, the mean ergonomic practice score among health science and non-science students was 81.42±16.11 and 80.32±14.58 respectively. There was no significant difference found ($p>0.05$) in practice level between health science and non-science students.

Table 2: Comparison on knowledge of laptop ergonomics between the two groups

	Knowledge (Mean±SD)	t/p	Mean diff.	95% CI
Health science (n=101)	18.5±2.98	5.33 / <0.001*	2.43	1.53; 3.33
Non-science (n=96)	16.06±3.42			

* Significant at $p<0.05$

Table 3: Comparison on practice of laptop ergonomics between the groups

	Practice (Mean±SD)	t/p	Mean diff	95% CI
Health science (n=101)	81.42±16.11	0.498 / 0.619	1.09	-3.23; - 5.42
Non-science (n=96)	80.32±14.58			

3.7 Comparison of prevalence of musculoskeletal symptoms between the groups

As shown in Table 4, the difference of musculoskeletal symptoms between health science and non-science students was significant ($p<0.05$) in all part of their bodies except for upper back and lower back.

Table 4: Association between groups and musculoskeletal symptoms (N=197)

MSS	Health science (n=101)	Non-science (n=96)	χ^2 / p
	Freq (%)	Freq (%)	
Neck			
No	69 (68.3)	47 (49.0)	7.618 /
Yes	32 (31.7)	49 (51.0)	0.006*
Shoulder			
No	66 (65.3)	40 (41.7)	11.100 /
Yes	35 (34.7)	56 (58.3)	<0.001*
Elbow			
No	89 (88.1)	73 (76.0)	4.914 /
Yes	12 (11.9)	23 (24.0)	0.027*
Wrists			
No	80 (79.2)	62 (64.6)	5.231 /
Yes	21 (20.8)	34 (35.4)	0.022*
Upper back			
No	67 (66.3)	53 (55.2)	2.560 /
Yes	34 (33.7)	43 (44.8)	0.110
Lower back			
No	72 (71.3)	57 (59.4)	3.090 /
Yes	29 (28.7)	39 (40.6)	0.079
Hips/thighs			
No	89 (88.1)	74 (77.1)	4.197 /
Yes	12 (11.9)	22 (22.9)	0.040*
Knees			
No	95 (94.1)	81 (84.4)	4.847 /
Yes	6 (5.9)	15 (15.6)	0.028
Ankles/feet			
No	97 (96.0)	78 (81.2)	10.85 /
Yes	4 (4.0)	18 (18.8)	<0.001*

* Significant at $p < 0.05$

3.8 Association between knowledge, practice and other factors with musculoskeletal symptoms.

Table 5 and 6 shows the association between knowledge and practice of laptop ergonomics with prevalence of musculoskeletal symptoms. The results showed that there was no significant associations between knowledge and practice with prevalence of musculoskeletal symptoms ($p>0.05$). Other factors such as age, gender, BMI category, physical exercise, years of using laptop and continuous duration of laptop usage per day were also tested for their association with prevalence of musculoskeletal symptoms (results were not shown). However, no significant association was found as well.

Table 5: The association between knowledge on laptop ergonomic with musculoskeletal symptom.

Knowledge (Freq)	Musculoskeletal symptoms Freq (%)		χ^2 / p
	No (n=65)	Yes (n=132)	
Poor (31)	8 (25.8)	23 (74.2)	1.190 / 0.552
Fair (146)	49 (33.6)	97 (66.4)	
Good (20)	8 (40.0)	12 (60.0)	

Table 6: The association between practice of laptop ergonomics with the prevalence of musculoskeletal symptoms.

Practice (Freq)	Musculoskeletal symptoms Freq (%)		χ^2 / p
	No (n=65)	Yes (n=132)	
Poor (26)	9 (34.6)	17 (65.4)	0.852 / 0.653
Fair (138)	43 (31.2)	95 (68.8)	
Good (33)	13 (39.4)	20 (60.6)	

4. Discussion

4.1 Socio-demographic factors and laptop use information

Majority of the respondents were female (80%). Female student outnumber the population of male in the university because they have better academic performance during high school which qualify them to enter universities. According to new statistics from the Australian Education Department, the number of female students in higher education jumped by 33.5% between 2002 and 2012 compared with a 22 per cent rise for males (Maslen, 2013). Malay students made up the highest racial composition among the students in the university (75.6%). According to the Department of Statistic Malaysia (2011), Malaysian citizens consists of the ethnics groups Bumiputera (67.4%), Chinese (24.6%), Indians (7.3%) and others (0.7%). Among the Malaysian citizens, the Malays (63.1%) were the predominant ethnic groups in Peninsular Malaysia.

In term of laptop usage, most (87.8%) students were engaging in internet surfing to search for work related sources, checking emails and news. Students used their laptop not only for studying but also for entertainments, communication and others activities (Moras & Gamarra, 2007). These findings were similar with a study conducted by Raps and Nanthavanij (2008) which found that majority of students use their notebook computer primarily for internet purpose which include information searching and chatting. In fact studying is the least popular purpose of laptop usage among students.

Reddy et al (2013), found that the mean total duration of computer use was 8.9 years ranging from 10 months to 15 years. In the present study, at least 50% of the respondents have used their laptop computer for approximately 5 years. Meanwhile, for daily usage, 51.8% used their laptop computers for about 1 to 4 hours per day and 88.3% were involved in continuous laptop computing without rest break for about 1 to 4 hours. There was 35.0% of respondent took rest breaks for 5 to 10 minutes during laptop computing. This findings was similar to Jacobs et.al (2009) which reported that the daily amount of laptop computer used among university student was 2.5 hours per day over a 5 day week. Meanwhile, Khan et al (2012) reported that more than half of computer users from different professions (54%) were using computer for over 10 years and 55% were using it for 4 to 5 hours per day. Sen and Richardson (2007) in their study revealed that 42.9% of their respondents used computers of more than 2 hours without taking rest breaks and 20% were using computers for 4 to 6 hours per day by which this study reported lesser duration than the findings of these previous studies.

Jensen et al (2002) conducted a study to report associations between duration of computer and mouse use and musculoskeletal symptoms among computer users. The findings showed that the duration of computer work was positively associated with symptoms in the neck and shoulder among women, but for hand/wrist symptoms there was an association among men only. The duration of computer use appears critical for the reporting of musculoskeletal symptoms, but a further increase in hand/wrist and shoulder symptom prevalence may be due to intensive mouse use.

Due to the portability of laptop computer, it can be used in various workstations. The wireless network allowed student to used their laptop computers anywhere in the campus (Moras & Gamarra, 2007). When ask about the selection of places for laptop computing, majority of student prefers dormitory room due to the accessibility of wireless internet, presence of electrical socket and convenient location. The present study confirmed the findings by Raps and Nanthavanij (2008) which reported that students used their laptop computers at home, followed by university, dormitory and other places. The present findings is also consistent with that of Shin (2010) which reported that the primary reason for selection of location among 20% of college students was due to accessibility to wireless internet, followed by the presence of electrical outlets and convenient location.

Majority of the respondents were practicing sitting with laptop on desk during computing (72.6%). The most popular method to carry laptop from one place to another was laptop backpack (57.9%). Majority of the respondents were carrying laptop weighted from 2.3kg to 3kg and with monitor size of 14 to 14.9 inches. This finding agree with that found by Moras and Gamarra (2007) as such university students used laptop computer weighed approximately 2 kg and featured 14-inch screen. This findings also indicated that laptop computer users usually engaged themselves in awkward posture such as lying on the floor, using desk that are not appropriately designed for laptop computers and placing laptop on the lap.

4.2 Comparisons between knowledge and practice of laptop ergonomic between groups

Study conducted by Shantakumari et al (2012) found that only 44% of university students were aware of laptop ergonomics. A similar study conducted by Khan et al., (2012) found that computer users from different professional backgrounds shows 52% awareness in computer ergonomics. However, disproportion was observed between knowledge and practice of certain components that was being study. This shows that university students still lack of knowledge regarding laptop ergonomics. This present study demonstrated that university students have fair knowledge (74.1%) and fair practice (70%) regarding laptop ergonomic. However, there is significant difference in knowledge level between health science and non-science students ($p<0.001$) where the mean knowledge among health science student was higher compared to non-science students. Health science student might encounter with or ever heard about ergonomic principles during their science-related courses. Meanwhile, no significant difference was observed in the practice of laptop ergonomics between health science and non-science students. However, students who had read documents on ergonomics or knowledgeable about ergonomic were seen to put most the principles surveyed into practice (Shantakumari et al., 2012).

A similar study conducted by Sirajudeen et al (2013) to assess the knowledge of ergonomics among information technology professionals, showed that majority of the

subjects were unaware of ergonomics such as cumulative trauma disorders, sign and symptoms and the risk factors of musculoskeletal disorder.

4.3 Prevalence of musculoskeletal symptoms

Many studies have reported an association between the use of computer and musculoskeletal symptoms. Several cross sectional studies have shown that the most frequently reported musculoskeletal symptoms among computer users were neck and shoulder pain (Eltayab et al, 2007; Johnston et al, 2008; Korhonen et al, 2003 and Hanse, 2002 as cited in Mahmud et al, 2011). Overall, 67% of the respondents in this study experienced musculoskeletal symptoms in at least one part of their body. The findings for seven days and 12 months prevalence of musculoskeletal symptoms showed that most common musculoskeletal symptoms experienced by the respondent were shoulder pain, neck pain, upper back pain and lower back pain. This study confirmed the earlier report that neck and shoulder complaints were significantly more than the complaint on other parts of the upper extremities among computer office workers (Eltayeb et al., 2009).

This findings from Rap and Nanthavanij (2008) reported that over 50% of students experienced discomfort in the neck, back and shoulder areas of their bodies. The discomfort at the body regions were believed to be the result of mismatch between the body size, laptop size and workstation dimensions and could also be due to the flexion of neck, shoulder and back parts while computing. It is reported that nearly all students had their neck bent forward excessively during computing due to the laptop screens that were positioned at lower level of the students' eye height. They also reported that placing the laptop computer too far in front of the body caused the shoulder to flex extensively in order to reach the keyboard. These resulted in them leaning against the backrest which could affect both shoulder and neck parts.

Obembe et al (2013) have conducted a study to determine the prevalence of musculoskeletal pain among undergraduate laptop users in Nigerian university. Theirs study confirmed with this present study findings that the most commonly reported musculoskeletal complaint was shoulder pain (75.5%). A survey of ergonomic issues by Moras and Gamarra (2007) was also found that the most common problems included neck pain (0.85±1.12), upper back pain (0.79±1.15) and lower back pain (0.81±1.12).

4.4 Comparison of prevalence of musculoskeletal symptoms between groups

This study reported that shoulder pain, neck pain, upper back pain and lower back pain were the most common symptoms experience by students, and it was found that there was a significant association between health science and non-science with prevalence of shoulder and neck pain. However, there is no significant association was found between health science and non-science with prevalence of upper back and lower back pain. When compared with health science students, non-science students reported more prevalence of musculoskeletal symptoms in every parts of the body. The significant association of shoulder and neck pain between these two disciplines might because as health science has better knowledge in laptop ergonomics, they were able to put the ergonomic principles into practice. Similar to this finding, Joshi et al (2015) conducted a study to assess the knowledge of computer workstation ergonomics among agricultural students and found out that majority of the computer users does not have adequate information about positioning of computer workstation in term of the angle and the distance of monitor, and most of the students complained about upper body extremities problems.

Non science students reported to have 51% and 58.3% of neck pain and shoulder pain respectively as compared with 31.7% neck pain and 34.7% shoulder pain of health sciences. A total of 51% of health sciences surveyed reported that they ever heard about laptop ergonomics and know the correct position of laptop screen to be at one's arm length away and to be set at eye level. The correct position that they practice may prevent them to involved in awkward posture while computing, hence they were likely reported less neck pain and shoulder pain as compared with non-science students. Similarly, Safraz et al (2013) conducted a study to assess the awareness of ergonomics among physiotherapy and medical students found that only 28.67% were aware of the word ergonomics however 82% of them admitted to have knowledge of body posture and productivity and 85.33% considered that maintaining body posture can prevent musculoskeletal disorders.

Meanwhile, both of health science and non science students surveyed knew the importance of chair back rest to provide lumbar support and understand that the improper seating, lack of short breaks, improper viewing distance, awkward posture, repetitive motion and sustained posture were the risk factor for ergonomic problems among laptop user. Both disciplines were also reported that they always take postural breaks from laptop every 30 minutes of laptop usage, used a chair with a back rest and adjusted the height, seat and back of their chair to achieve comfortable posture.

Hence, non significant association between health science and non-science with prevalence of upper back and lower back pain might be due to the proper ergonomic practice of chair and good postures during computing.

4.5 Association between knowledge, practice and other contributing factors with musculoskeletal symptoms

This study found that there was no significant association between knowledge and practice of laptop ergonomics and prevalence of musculoskeletal symptoms among students. This finding was in contrast with previous study by Jacobs et.al (2009) who investigated the use of laptop computer among university students and determined the effective ergonomic strategy in reducing musculoskeletal discomfort among this population. The study found that students who improved their ergonomic quiz score had significantly less computer-related musculoskeletal discomfort. According to Abarqhouei and Nasab (2011), application of knowledge on ergonomics in total showed an increase in productivity, improved work life quality and reduction of musculoskeletal disorders. Without ergonomic awareness, efforts to incorporate ergonomics in practice could be tough and led to injuries and illness which directly affected workers' productivity, performances and cost (Muin & Sapri, 2013). Meanwhile, Mahmud et al (2011) conducted a study to explore whether musculoskeletal complaints can be reduced by providing of ergonomic awareness programme. They concluded that office ergonomic training can be beneficial in reducing musculoskeletal risks and stress among workers.

There was no significant association between gender and age with musculoskeletal symptoms, contrary to the findings from previous studies. Calik et al (2014) found that a higher level of discomfort musculoskeletal was felt by female students where the difference was statistically significant ($p<0.05$). Meanwhile, Rajagopal et al (2012) reported musculoskeletal pains occurred more among females (96%) than males (76%). In a prospective study by Gerr et al (2002), he found that participants aged 30 years and older had an increased risk of developing neck and shoulder pain. Small sample size and less variability of age among the respondents could be a limiting factor in this study contrary to previous studies.

Previous study has found a positive association between BMI and musculoskeletal pain in the shoulder and in the wrist/hand in last 12 months period. The result suggests that overweight/obese participants were most likely to have MSS. However, the association was not confounded by age, gender and job positions (Moreira-Silva et al., 2013). This was in contrast with this study where we found that there was no association between body mass index (BMI) with prevalence of MSS since majority of the respondents had normal weight.

In regards with physical activity, it is found that there was no association between physical activities with prevalence of MSS as majority of respondents in this study were involved in physical activity. The finding was in lined with Hilderbrandt et al (2000) which found that physical activities in leisure time were not associated with prevalence rate of low back and neck-shoulder morbidity. Their study also suggested that worker with sedentary task and with no participation in physical activity had greater prevalence of MSS. This findings was also in line with Rajagopal, et al (2012) where they did not find any association between physical activity and musculoskeletal pains. In addition, Shan et al (2013) found that students who were engaged in physical activities has lower prevalence of neck/should pain and lower back pain compared to those who lacked in physical activities ($p < 0.05$).

This study found that there was no significant association between the duration of laptop usage with prevalence of musculoskeletal symptoms among the respondents. This finding was similar to Noack-Cooper et.al (2009) where they found no relationship between hours/week of computer usage and musculoskeletal symptoms. Contrary to this findings, Blatter and Bongers (2002) reported that there are hardly differences were observed between the effect of duration of computer used on proximally or distally located symptoms of neck or upper limb. They conclude that four hours or more of self-reported computer use per day is associated with work related upper limb disorder in women and that six hours or more of computer use is associated with symptoms in men.

Similar to this findings, Rajagopal et al (2012) also reported no association between computer use and musculoskeletal symptoms. They concluded that the possible cause might be that the students spent less time on computers than they did before experiencing the pain and they knew that excessive computer used was harmful.

The limitation of this study, other than the small sample size, was that it only involved health science and non-science students from two faculties. Hence, the result of this study cannot be generalized to all student population.

5. Conclusion

The knowledge and practice scores for both science and non-science student were fair, the prevalence of musculoskeletal symptoms was 67% where shoulder and neck pain

were the most common symptoms experienced by them. However, the increased in the prevalence of musculoskeletal symptoms were not significantly associated with any contributing factors such as age, gender, BMI category, physical exercise, years of laptop use and continuous laptop use. This study emphasized on the need to promote ergonomic awareness program on musculoskeletal disorder and healthy postures when using laptop.

In order to minimize the prevalence of musculoskeletal symptoms, campaign of safe laptop computing can be introduced to increase the knowledge, promote and raise awareness on the safe and proper ergonomics practice of using laptop computer. The campaign can be promoted massively through university's website and bulletin boards.

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CONFLICT OF INTEREST

None declared.

ETHICAL ISSUES

This study was approved by the Ethics Committee for Research Involving Human Subjects Universiti Putra Malaysia (UPM/TNCPI/RMC/1.4.18.1 (JKEUPM)/F2). Respondents informed and written consent were obtained before data collection.

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