

Analyzing Musculoskeletal Discomforts of the Selected Bangladeshi University Students Using Laptops

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Abstract

Laptops have become one of the most important educational tools for students. But using laptop incessantly and adopting improper posture cause different pains in human body. This study investigates different types of musculoskeletal discomforts which significantly related to daily average use of laptops, duration of laptop use in years, and how frequently students commonly use different configurations such as laptop on a table sitting on a chair without a backrest, laptop on a table sitting on a chair with a backrest, crossed legs with a laptop on the surface, sitting with back against a surface while using laptops. This study also investigates different types of discomforts which significantly associated with commonly performed tasks (programming, gaming, social networking, and reading) in laptops. To conduct this research an online (google forms) questionnaire was developed for collecting data from selected students. Data were analyzed using SPSS 26.0 version software, frequency distribution, and Chi-square test. Findings show that duration of laptop use in years and daily average use of laptops both are significantly related to pains in fingers, elbow, shoulders, neck regions. Upper-middle back pain is significantly related to how frequently students performed reading, gaming, and social networking on laptops. All pain categories except fingers pain ($P=0.194>0.05$) are significantly associated with how frequently students adopt posture "laptop on a table sitting on a chair with a backrest". So, students must be aware of the consequences of the repetitive motions in a fixed posture for a long time while using laptops.

Keywords

Musculoskeletal Discomforts, Student, Laptop, Posture and Task

1. Introduction

Laptops have become a part and parcel in students' life. Basically university students and researchers are badly needed laptops for their academic and research purpose. But most of them aren't aware about the proper use of postures while using laptops and about the negative consequences of using improper postures. Students use common postures such as placing laptop on table and sitting on a chair with a backrest, sitting on a chair in front of a table without a backrest, lying on stomach, crossed legs with laptop on surface while using laptop. The health injury among undergraduate students is extremely high for their improper postures (Hasan et al. 2018). This study has been conducted to measure the prevalence of musculoskeletal discomforts while using laptop. The study reveals that most of the students are suffering from neck pain. Improper postures of laptop use can occur chronic neck pain to the computer users (Szeto et al. 2008). This study measures the specific discomfort levels of using laptops such as fingers pain, wrist pain, shoulder pain, neck pain, upper middle back pain and lower back pain. The students from three engineering departments are selected to conduct the study who are frequently involved with laptop use. The discomforts from using laptops can arise not only for the inconvenient postures but also excessive use of laptops. The study analyses the significant relationships between the discomforts and excessive use of laptops by taking the variables of average time of laptop use (daily) and how long the students are using their laptops (years). Generally, students use their laptops for multi-purposes in which gaming, programming, reading and social networking are also included. This study concludes that how discomforts of using laptops are associated with using laptops for gaming, programming, reading and social networking purposes. It also shows the significant relationships between the discomforts of using laptops and how frequently students commonly use different configurations such as laptop on a table sitting on a chair

without a backrest, laptop on a table sitting on a chair with a backrest, crossed legs with a laptop on the surface, sitting with back against a surface while using laptops.

1.1 Objectives

Objectives are as follows:

- i. To investigate the prevalence of musculoskeletal pains associated daily average use of laptops, duration of laptop uses in years, and how frequently students commonly use different configurations such as laptop on a table sitting on a chair without a backrest, laptop on a table sitting on a chair with a backrest, crossed legs with a laptop on the surface, sitting with back against a surface while using laptops.
- ii. To investigate different types of musculoskeletal discomforts' association with commonly performed tasks (programming, gaming, social networking, and reading) in laptops.

2. Literature review

Review of the literature means searching the existing studies relevant to the proposed study. It is essential to have the relevance of the research to gather knowledge about different research works and to conduct the research work successfully. This module aims at reviewing the literature background to develop a clear understanding of this study.

Laptop computers are little, conveniently movable devices that are low weights so easily one can use them on his/her lap (Kvavik et al., 2004). Laptops provide greater mobility, which is very important for university students because students use laptops or tablets in all aspects of their lives (Kvavik et al., 2004). Caruso and Salaway (2008) stated that 52.8% of undergraduate students used a laptop for their academic and other purposes in 2005 (Caruso & Salaway, 2008). 95.4% of university students in Dublin use a laptop. So, only 4.6% of students use a desktop computer (Dockrell et al., 2015). Chang et al. (2008) conducted a study amongst 154 college students and found that 88% of university students of the United States of America owned laptops and laptop computers were more preferable for an increasing number of students. Pew Research Centre also indicated that 88% of undergraduate college students in USA had laptops in 2010. (Smith et al., 2011). Laptop sales hold a quarter of the overall computer market from which 78.5% of sales of the laptop are going to college and graduate students (Jacobs et al., 2009). As the demand for laptop usage is an enormous increasing factor, understanding the impact of using laptops has become a very important consideration especially for university students. Data journalist Richter (2021) shows COVID 19 pandemic also revives laptops and desktop demand (Richter, 2021). Kay & Lauricella (2011) conducted a study at the University of Ontario Institute of Technology and found that compared to males, female students were more likely to use laptops for note-taking and also participating in-class lectures with laptops. But male students were more likely to use their laptops for playing games in-class (Kay & Lauricella, 4 2011). Laptop use is of particular importance for university students because academic and nonacademic laptop use can impact their educational success. According to the study of Gaudreau et al. (2014), laptop use for non-academic purposes is negatively correlated with academic results (Gaudreau et al., 2014). On the other hand, laptop use for academic purposes is positively correlated with academic results and weakly correlated with daily academic performance (Gaudreau et al., 2014).

Cornell University (2004) explained the consequences of the limitation of laptop design. They stated that due to fixed laptop design, the monitor and keyboard of a laptop can never be situated in an optimal position at a time. If a user wants to keep the right angle between the monitor and neck, he has to keep his arms higher than the normal position. On the other hand, if he wants to keep the arms properly, he has to lower himself to see the screen that causes a risk to the neck. So ergonomic requirements cannot be followed in designing a laptop. It is undoubtedly true that Laptop use is not limited to a table or chair and students are often found reading, writing, or computing on a bed, on the floor, or surfaces without having the proper ergonomic adjustments (Sommerich & Korkmaz, 2008). Since laptops or tablet computers are portable, so many factors influence the posture a student uses while using a laptop. The screen positioning, keyboard height, and use of external mice can impact the ergonomics of using a laptop. Chavda et al. (2013) stated that 20% of students reported using an external mouse while using their laptops, while 80% of students reported using the touchpad of laptops. Kanchanomai et al. (2011) conducted a study on university students from Thailand and found that students who reported using an external mouse in a low position compared to the laptop position were less likely to report neck pain than those who reported using a mouse in a suitable position. On the other hand, using a mouse at a too high position than the suitable position increased the risks of neck pain (Kanchanomai et al., 2011). Compared to desktop computers, laptops have smaller screens and this may affect the ability to view that

displayed on the laptop screen (Straker et al., 1997). Kanchanomai et al. (2011) conducted a cohort study on students and found without maintaining the laptop screen at eye level may be more likely to develop neck pain (Kanchanomai et al., 2011). This study attributed to the head position related to laptop use. According to the study of Straker et al. (1997), compared to desktop computer users, laptop users face a 6.35-degree increase in neck flexion and a 10.78-degree reduction in head forward tilt. Forrester and Harbison (1995) also stated that laptop users increase their head tilts up to 30 degrees while using a laptop. Laptop computer use is related to several risk factors for the development of musculoskeletal discomforts (Bergqvist et al., 1995; Erdinc, 2011). Because of repetitive and forceful exertions on the keyboard, frequent and static muscle contraction, and adopting improper postures are the cause of arising musculoskeletal problems (Punnett and Bergqvist, 1997). Improper postures are harmful during laptop use, particularly in the neck, where flexion and increased muscle activity are typical (Saito et al., 1997; Straker et al., 2009a). The improper postures are characterized by widespread postural deviation as they increase the chance of downward head tilt, neck flexion, and wrist extension (Bubric & Hedge, 2014). Gold et al. (2012) wanted to find the postures assumed while sitting or lying on a sofa and bed and found that these configurations are characterized by widespread postural deviation. The health injury among undergraduate students is extremely high for their improper postures (Hasan et al., 2018). Some cohort studies stated that laptop use by university students is significantly related with musculoskeletal and non-musculoskeletal effects such as carpal tunnel pressure, computer vision syndrome, and headaches (Kandri et al., 2014; Mingels et al., 2015; Obembe et al., 2013; Reddy et al., 2013; Rempel et al., 2008).

According to the study of Chakravarthy and Girish (2012), more laptop user students complained of neck pain compared to desktop users. 33.0% of students felt neck pain who use a laptop and on the other hand, 16.4% of students experience neck pain who use a desktop (Chakravarthy & Girish, 2012). The improper postures are characterized by widespread postural deviation as they increase the chance of downward head tilt, neck flexion, and wrist extension (Bubric & Hedge, 2014). The health injury among undergraduate students is extremely high for their improper postures (Hasan et al., 2018). Chavda et al. (2013) conducted a cross-sectional study on 100 students about analyzing the musculoskeletal discomfort originating from keyboard typing. They found that around 15% of students were using an external keyboard for typing (Chavda et al., 2013). Using the laptop's built-in keyboard is a vital factor in increasing musculoskeletal discomfort while using a laptop (Kanchanomai et al., 2011). The prevalence of neck pain and thoracic pain is significantly related to using a laptop's built-in keyboard (Kanchanomai et al., 2011). Students who knew about computer ergonomics could easily solve the computer workstations problems by applying the participatory approach of ergonomics while working with laptops (Robertson et al., 2002). Participatory ergonomics is, "The participation of students in planning and controlling a notable amount of their study-related work activities with the laptop, with sufficient ergonomic knowledge and power to influence both processes and outcomes to achieve desirable workstation" (Wilson and Haines, 1997, pp. 490–513). A little research has been done on using a laptop in a non-desk position while the user is sitting in an office chair. Few researchers wanted to investigate the effects of using a laptop on their knees. It was found that this particular posture creates a variety of configurations with head tilt, neck flexion, and wrist extension (Asundi et al., 2010; Moffet et al., 2002; Werth & Babski-Reeves, 2012). Different studies had identified the correlation between desktop computer use in service holders and musculoskeletal and non-musculoskeletal problems (Gerr et al., 2004; Jensen et al., 2002).

Most of the studies regarding laptop or desktop computer use are cross-sectional types and these studies cannot be used to identify whether laptop use was a risk factor for creating musculoskeletal and also non-musculoskeletal problems. Some studies have limitations related to collected data measurement techniques, including design of the questionnaires to interpret only desktop computer use rather than laptop computer use (Kandri et al., 2014; Thomée et al., 2007), using some single generic questions that lack precision and specificity (Katz et al., 2000), or questionnaires that lack validity and reliability (Gaudreau et al., 2014; Logaraj et al., 2015; Moras & Gamarra, 2007; Obembe et al., 2013). But these studies provide useful and important suggestions about laptop use. Feeling different musculoskeletal pains is a very common thing for long time laptop users. Many research works have been conducted by many authors regarding different musculoskeletal pains associated with commonly used postures and tasks while using laptop or desktop computer in different countries of the world. But very few researches have been conducted on selected undergraduate students of a university (who are mostly using laptop for a long time in a day for different purposes) in Bangladesh.

3. Methods

An action plan has been constructed so that logical and sequential progress can be made throughout the study. Action plan shown in figure.1 describes the stages involved in this study.

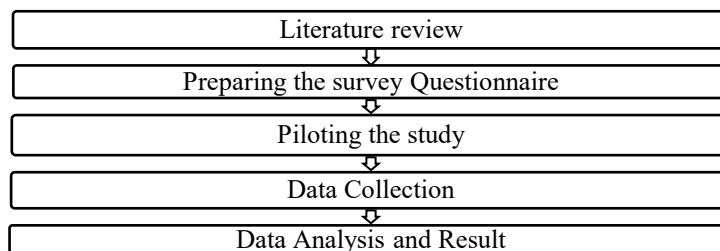


Figure 1. Action plan of this research.

To conduct this study a questionnaire was developed to collecting data. Using survey method, data were collected from three departments namely Industrial and Production Engineering (IPE), Computer Science and Engineering (CSE) and Software Engineering (SWE) (2nd, 3rd and 4th-year B.Sc. Undergraduate Engineering) students of Shahjalal University of Science and Technology (SUST), Sylhet, Bangladesh. Then that collected data were analyzed by Statistical Package for Social Science (SPSS® 26.0 version software). Different tools and techniques used in this research work are as follows:

A. SPSS® 26.0 version software

In this Study SPSS® is used to develop different charts and calculating the chi-square value and p value.

B. Frequency Distribution

Frequency distribution is counts of the number of response to a question or to the occurrence of a phenomenon of interest.

C. Chi-square Test

The Chi Square statistic is commonly used for testing relationships between categorical variables (Chi-Square Goodness of Fit Test, n.d.). In this study this technique is used to investigate the prevalence of musculoskeletal pains associated with commonly used postures while using laptop and commonly performed tasks in laptop. Chi-square test had been done with 95% confidence interval. So the relationships between the pains and different tested variables were significant when P value < 0.05.

4. Data Collection

Data were collected from select three departments of SUST. Slovin's formula is used to determine a sample size. Slovin's formula is a random sampling technique formula to estimate sample size. It is used to calculate the sample size from given population size and a margin of error. (Research Assignments - Slovin's Formula, n.d.).

$$n = \frac{N}{(1+Ne^2)}$$

Where, n = Sample size, N = Total Population, e = Error tolerance level.

Let, the confidence level of this study be 95 percent. Which gives e = 0.05. The students of three departments namely Industrial and Production Engineering (IPE), Computer Science and Engineering (CSE) and Software Engineering (SWE) (2nd, 3rd and 4th year B.Sc. Undergraduate Engineering) of SUST is approximately 538. So, by calculating and rounding to a whole number, the value of sample size found is 238. It means that 238 respondents need to be selected for data collection from survey questionnaire.

They were selected after consent if they were above 18 years old, without any serious musculoskeletal disorder and had laptops with display unit ranging between 13" and 17" and mass unit ranging from 1 kg to 3.5 kg and had owned and used the laptop for at least 6 months prior to the study.

The nature of the survey was explained to the participants and participation was voluntary. A questionnaire was developed by google forms software which was delivered to the participants via email or Facebook messenger. Questionnaire prepared included different question for finding the different pains or negative effects for using laptop more than half hour continuously. Clear instructions were given to the respondents regarding the necessary seriousness and honesty when filling out the questionnaire. The first part of the questionnaire featured questions about classification, students' departments, sex, average time using the laptop (daily) from the last three months. The second part of the questionnaire featured questions about selected pains feeling or not feeling while using laptop more than half hour continuously, how frequently adopting the four selected postures and how frequently performed selected two tasks while using laptop.

5. Results and Discussion

Applying Solvin's formula, total 238 students were selected from the selected three departments as mentioned earlier of Shahjalal University of Science and Technology (SUST) for collecting necessary data.

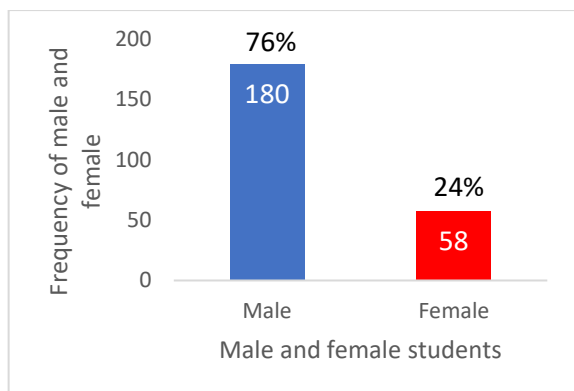


Figure 2. Number and percentages of male and female participants

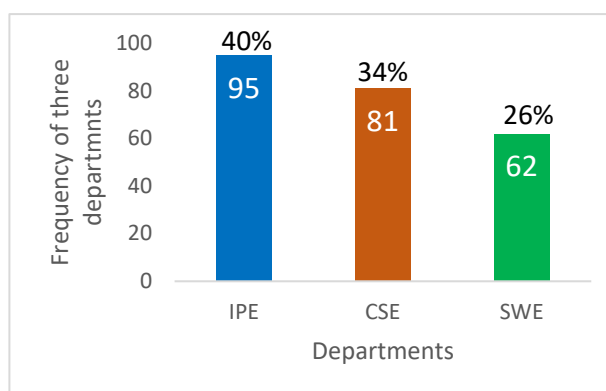


Figure 3. Number and percentages of participants from IPE, CSE and SWE departments

Figure 2 shows that 180 (76%) male students participated for this study. Female students' participation (24%) was less than male students because of less participation of female students in engineering program at SUST, Sylhet, Bangladesh.

Figure 3 shows the number of participants' in terms of percentage from three different department of Shahjalal University of Science and Technology. The highest number of students was participated from Industrial and Production Engineering dept. is 40%. Second highest number of students participated from Computer Science and Engineering dept. (CSE) is 34%. The lowest number of students participated from software Engineering Dept. (SWE) is 26%.

5.1 Chi-Square test summary of different musculoskeletal pains for using of laptop associated with daily average use of laptops, duration of laptop uses in years, selected four postures and tasks

In this study the tested variables were time span of laptop use, average time of daily laptop use, and how frequently students commonly use different configurations such as "laptop on a table sitting on a chair without a backrest", "laptop on a table sitting on a chair with a backrest", "crossed legs with a laptop on the surface", "sitting with back against a surface" while using laptops. This study also investigates different types of discomforts which significantly associated with commonly performed tasks (programming, gaming, social networking, and reading) in laptops. Chi-square test was performed for identifying the significant relationship between different tested variables and different negative effects (fingers pain, forearm pain, wrist pain, elbow pain, neck, upper middle back pain and lower back pain) for using laptop.

Table 1 shows that all pains while using laptop were significantly related with the how many years' students using their laptops. Because fingers pain ($p=0.009<0.05$), wrist pain ($p=0.001<0.05$), shoulders pain ($p=0.009<0.05$), neck pain ($p=0.000<0.05$), upper middle back pain ($p=0.042<0.05$) and lower back pain ($p=0.000<0.05$) were associated

with time span of laptop use variable. Table 1 also shows that all of the students reported at least some level of neck pain who were using laptop more than 6 hours on average (daily).

Table 1. Summary table of chi-square test for identifying the relationships between different time related variables and considered musculoskeletal pains

Variables		N = 238	Neck Pain (NP)		Upper Middle Back Pain (UMBP)		Lower Back Pain (LBP)	
		No of students	% with NP	P value	% with UMBP	P value	% with LBP	P value
Time span of laptop use	Below 1 year	29	24.1%	0.000	65.5%	0.042	48.3%	0.000
	1 yr to below 2 yrs	22	50.0%		36.4%		27.3%	
	2 yrs to below 3 yrs	31	80.6%		77.4%		74.2%	
	3 yrs to below 4 yrs	45	88.9%		66.7%		82.2%	
	More than 4 years	111	83.8%		61.3%		69.4%	
Average time of laptop use (daily)	Below 2 hours	144	67.4%	0.008	60.4%	0.859	61.8%	0.334
	2h to below 4 h	52	76.9%		65.4%		69.2%	
	4h to below 6 h	27	88.9%		66.7%		77.8%	
	More than 6 h	15	100.0%		66.7%		73.3%	
Variables		N = 238	Fingers Pain (FP)		Wrists pain (WP)		Shoulders Pain (SP)	
		No of students	% with FP	P value	% with WP	P value	% with SP	P value
Time span of laptop use	Below 1 year	29	69.0%	0.009	48.3%	0.001	51.7%	0.009
	1 yr to below 2 yrs	22	77.3%		27.3%		45.5%	
	2 yrs to below 3 yrs	31	48.4%		54.8%		48.4%	
	3 yrs to below 4 yrs	45	55.6%		75.6%		75.6%	
	More than 4 years	111	42.3%		66.7%		71.2%	
Average time on laptop use (daily)	Below 2 h	144	20.0%	0.000	51.4%	0.000	58.3%	0.028
	2h to below 4 h	52	25.9%		67.3%		67.3%	
	4h to below 6 h	27	46.2%		77.8%		74.1%	
	More than 6 h	15	62.5%		100%		93.3%	

Again all pain categories were also significantly related with the average time of laptop use (daily) except upper middle back pain ($p = 0.859 > 0.05$) and lower back pain ($p = 0.334 > 0.05$). But fingers pain ($p = 0.000 < 0.05$), wrist pain ($p = 0.000 < 0.05$), shoulders pain ($p = 0.028 < 0.05$) and neck pain ($p = 0.008 < 0.05$) were associated with the average time of laptop use (daily).

According to (Table 2), fingers pain ($p = 0.200 > 0.05$) and upper middle back pain ($p = 0.088 > 0.05$) were not significantly associated with how frequently students performed programming in their laptops. But in a programming task, programmers must strike the keyboard hard and repeatedly.

Table 2. Summuray table of chi-square test for identifying the relationships between different tasks and considered musculoskeletal pains

Variables		N = 238	Fingers Pain		Wrists pain		Shoulders Pain	
		No of students	% with FP	P value	% with WP	P value	% with SP	P value
Programming (task)	Never	25	64.0%	0.200	28.0%	0.000	36.0%	0.008
	Rarely	39	56.4%		46.2%		53.8%	
	Occasionally	59	59.3%		64.4%		71.2%	
	Frequently	42	47.6%		69.0%		69.0%	
	Very frequently	73	42.5%		72.6%		71.2%	
Gaming (task)	Never	69	49.3%	0.854	52.2%	0.151	62.3%	0.619
	Rarely	52	55.8%		67.3%		73.1%	
	Occasionally	61	54.1%		60.7%		59.0%	
	Frequently	27	55.6%		77.8%		63.0%	
	Very frequently	29	44.8%		55.2%		65.5%	
Reading (task)	Never	5	60.0%	0.489	40.0%	0.107	60.0%	0.256
	Rarely	33	42.4%		78.8%		78.8%	
	Occasionally	68	55.9%		54.4%		60.3%	
	Frequently	74	47.3%		56.8%		58.1%	
	Very frequently	58	58.6%		65.5%		69.0%	
Social Networking (task)	Never	9	33.3%	0.030	22.2%	0.006	22.2%	0.028
	Rarely	52	42.3%		63.5%		63.5%	
	Occasionally	48	58.3%		54.2%		54.2%	
	Frequently	71	45.1%		54.9%		54.9%	
	Very frequently	58	67.2%		77.6%		77.6%	
Variables		N = 238	Neck Pain		Upper Middle Back Pain		Lower Back Pain	
		No of students	% with NP	P value	% with UMBP	P value	% with LBP	% with LBP
Programming (task)	Never	25	48.0%	0.006	40.0%	0.088	36.0%	0.001
	Rarely	39	66.7%		61.5%		56.4%	
	Occasionally	59	83.1%		61.0%		66.1%	
	Frequently	42	71.4%		73.8%		69.0%	
	Very frequently	73	80.8%		65.8%		79.5%	
Gaming (task)	Never	69	65.2%	0.285	56.5%	0.014	62.3%	0.471
	Rarely	52	73.1%		61.5%		69.2%	
	Occasionally	61	77.0%		72.1%		73.8%	
	Frequently	27	81.5%		40.7%		59.3%	
	Very frequently	29	82.8%		79.3%		58.6%	
Reading (task)	Never	5	80.0%	0.136	20.0%	0.018	60.0%	0.445
	Rarely	33	87.9%		66.7%		66.7%	
	Occasionally	68	73.5%		54.4%		63.2%	
	Frequently	74	64.9%		59.5%		60.8%	
	Very frequently	58	77.6%		77.6%		75.9%	
Social Networking (task)	Never	9	55.6%	0.033	22.2%	0.002	44.4%	0.156
	Rarely	52	78.8%		50.0%		65.4%	
	Occasionally	48	62.5%		56.3%		58.3%	
	Frequently	71	70.4%		71.8%		64.8%	
	Very frequently	58	86.2%		74.1%		77.6%	

Table 3. Summurray table of chi-square test for identifying the relationships between how frequently using different postures and considered musculoskeletal pain

Variables		N = 238	Fingers Pain		Wrists pain		Shoulders Pain	
			No of students	% with FP	P value	% with WP	P value	% with SP
Laptop on a table sitting on a chair without a backrest (posture)	Never	105	49.5%	0.874	66.7%	0.025	67.6%	0.483
	Rarely	55	52.7%		45.5%		58.2%	
	Occasionally	38	52.6%		73.7%		71.1%	
	Frequently	19	63.2%		63.2%		63.2%	
	Very frequently	21	52.4%		47.6%		52.4%	
Laptop on a table sitting on a chair with a backrest (posture)	Never	14	50.0%	0.706	50.0%	0.049	50.0%	0.078
	Rarely	30	43.3%		40.0%		46.7%	
	Occasionally	33	57.6%		54.5%		57.6%	
	Frequently	63	57.1%		65.1%		69.8%	
	Very frequently	98	50.0%		68.4%		70.4%	
Crossed legs with laptop on surface (posture)	Never	121	47.9%	0.061	62.0%	0.772	62.8%	0.579
	Rarely	56	51.8%		58.9%		58.9%	
	Occasionally	35	74.3%		54.3%		74.3%	
	Frequently	15	46.7%		73.3%		73.3%	
	Very frequently	11	36.4%		63.6%		63.6%	
Sitting with Back against surface (posture)	Never	46	50.0%	0.377	58.7%	0.053	67.4%	0.382
	Rarely	58	46.6%		46.6%		53.4%	
	Occasionally	59	62.7%		72.9%		69.5%	
	Frequently	56	51.8%		66.1%		67.9%	
	Very frequently	19	42.1%		57.9%		63.2%	
Variables		N = 238	Neck Pain		Upper Middle Back Pain		Lower Back Pain	
			No of students	% with NP	P value	% with UMBP	P value	% with LBP
Laptop on a table sitting on a chair without a backrest (posture)	Never	105	79.0%	0.285	57.1%	0.081	62.9%	0.063
	Rarely	55	69.1%		69.1%		69.1%	
	Occasionally	38	65.8%		65.8%		76.3%	
	Frequently	19	84.2%		84.2%		78.9%	
	Very frequently	21	66.7%		47.6%		42.9%	
Laptop on a table sitting on a chair with a backrest (posture)	Never	14	57.1%	0.000	28.6%	0.008	28.6%	0.001
	Rarely	30	50.0%		53.3%		50.0%	
	Occasionally	33	63.6%		54.5%		66.7%	
	Frequently	63	76.2%		61.9%		63.5%	
	Very frequently	98	85.7%		73.5%		77.6%	
Crossed legs with laptop on surface (posture)	Never	121	73.6%	0.849	57.9%	0.341	58.7%	0.147
	Rarely	56	69.6%		60.7%		71.4%	
	Occasionally	35	77.1%		74.3%		77.1%	
	Frequently	15	80.0%		73.3%		66.7%	
	Very frequently	11	81.8%		72.7%		81.8%	
Sitting with Back against surface (posture)	Never	46	71.7%	0.530	45.7%	0.010	58.7%	0.036
	Rarely	58	75.9%		53.4%		53.4%	
	Occasionally	59	76.3%		71.2%		78.0%	
	Frequently	56	76.8%		73.2%		73.2%	
	Very frequently	19	57.9%		73.7%		63.2%	

According to Matt Layher (2018), some programmers suffer from RSI (repetitive strain injury) in their hands, because of excessive typing (Layher, 2018). So it is undoubtedly true the more frequently do programming on a laptop, the more frequently it occurs the fingers problem. But students are less typing and more thinking when practicing programming on a laptop compared to professional programmers. But wrist pain, shoulder pain, neck pain and lower back pain were significantly associated with how frequently students performed programming while using their laptops. On the other hand, a significant relationship was found between upper middle back pain for using laptop and how frequently students playing games in their laptops because for this case $p = 0.014 < 0.05$. But fingers pain, wrist pain, shoulder pain, neck pain and lower back pain were not significantly associated with how frequently students playing games in their laptops.

In the present study, it is seen from the results of the chi-square test (Table 2) that all of the pain categories which are considered in this study except upper-middle back pain are not significantly related to how frequently students read on laptops ($P = 0.018 < 0.05$). In this study, the results of chi-square tests reveal that fingers pain, wrists pain, shoulders pain, neck pain, and upper-middle back pain are significantly related to how frequently students perform social networking on laptops because p value < 0.05 . This finding supports the research of Ibrahim et al. (2018) regarding the use of social networking websites and the physical health profile of their users among college students. According to Ibrahim et al. (2018), postural pain like back or neck or wrist pain was associated with daily average use of social networking sites.

According to the analysis of (Table 3), a significant relationship was found between wrist pain and the posture of using laptop on table sitting on a chair without a backrest since p value (0.025) was less than 0.05. In this posture has no backrest and armrest, so most of the students apply pressure on their wrists while typing or other tasks performed on a laptop. But fingers pain ($p=0.874>0.05$), shoulder pain ($p=0.483>0.05$), neck pain ($p=0.285>0.05$), upper middle back pain ($p=0.081>0.05$) and lower back pain ($p=0.063>0.05$) were not significantly associated with how frequently students using their laptop on table sitting on a chair without a backrest.

From Table 3 it is seen that fingers pain ($p=0.874>0.05$) and shoulder pain ($p=0.483>0.05$) were not significantly associated with how frequently students using their laptop on table sitting on a chair with a backrest. Other pains such as wrist pain ($p=0.049<0.05$), neck pain ($p=0.000<0.05$), upper middle back pain ($p=0.008<0.05$) and lower back pain ($p=0.001<0.05$) were significantly associated with how frequently students using their laptop on table sitting on a chair with a backrest. According to the present study, this posture (students using their laptop on table sitting on a chair with a backrest) is mostly used posture by the students. Because of using most of the time, in this posture student cannot maintain the proper straight line posture of keyboard-wrists-forearm while using a laptop.

The present study finds from the results of the chi-square tests that no pain category is significantly related to how frequently students adopt the posture 'crossed legs with a laptop on a surface' while using their laptops (Table 3).

From Table 3 it is also seen that upper-middle back pain ($p = 0.010 < 0.05$), and lower back pain ($p = 0.036 < 0.05$) are significantly associated with how frequently students adopt the posture 'sitting with back against surface' while using their laptops. The fact is that in that posture the students mainly pressure on his/her back part while keeping the laptop on lap.

6. Conclusion

Nowadays, laptop is very important educational tools. In this modern age, laptop computer is a must for educational research work for typing the research papers and most importantly analyze the collected data by conducting different software. This device not only used for educational purposes but also used for playing games, sharing stuff, liking stuff other people share, sending emails, watching videos and staying in touch with loved ones through video calls, voice calls and of course text. According to this study it is seen that wrist pain, shoulder pain, neck pain and lower back pain were significantly associated with how frequently students performed programming in their laptops. It is also noted that among four postures considered in this study "laptop on a table sitting on a chair with a back rest" was the posture which is significantly associated with wrist, neck, lower back and upper middle back pain. For preventing musculoskeletal problems, it is suggested that different postures which are suitable for any particular device must be

adopted. Sometimes, shifting hands or legs, standing up and sitting down when working long time with laptop cause a good impact on body.

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