ORIGINAL ARTICLE

Posture Related Musculoskeletal Disorders (MSDs) among Computer Users in Higher Education Sectors of Malaysia

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ABSTRACT

Introduction: Computer usage has become an indispensable tool in the official set up of all the workplaces in the current era. Predominance of musculoskeletal disorders (MSDs) in relation to habitual posture during work is the utmost problem of modern society. Teaching staff stand out amongst a group of workers exposed to occupational MSDs. The objective of this study was to identify the prevalence and risk factors of musculoskeletal disorders in relation to posture and computer ergonomics at workplace among the college and university staff in Petaling Jaya, Malaysia. **Methods:** This cross-sectional quantitative study was conducted from August 2019-October 2019, among 419 volunteers by using a self-administered survey questionnaire. Descriptive and bivariate statistics were used for the analyses of multiple variables. The association between demographic characteristics, computer ergonomics and prevalence of musculoskeletal pains were analyzed through Chi-square test. **Results:** 55.8 % respondents (n=234) reported neck pain (NP), (n=196) 46.8% shoulder pain (SP) and (n=308) 73.5% low back pain (LBP) respectively. A significant relationship between desktop computer usage and musculoskeletal pains in LBP (P=0.036) and SP (P=0.023) was observed. Significant association of head posture was found with NP (P=0.002), SP (P=0.042) and LBP (P=0.001), correspondingly. Discussion: Habitual postures were significantly associated with musculoskeletal pains while using computer. **Conclusion:** This study proved with precession that higher prevalence rate of musculoskeletal disorders was undoubtedly influenced by prolonged sitting, awkward postures at workstation, and repetitive movements of shoulders and hands. Further synchronous studies are vital to limit the modern era of musculoskeletal disorders

Keywords: Habitual Posture, Musculoskeletal disorders, Workstation, Computer Ergonomics, Risk factors

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INTRODUCTION

Malaysian official workers have become a computer savvy in the last two decades (1-11). Workstations use has additionally been associated to MSK issue of various body regions for example, posture- related dull strain damage, with posture thought to have an etiological job (5, 7,12-25).Utilization of desktop by all age group at workplace has become mandatory (1, 6, 17,26-31). The Faculty members, academic as well as non-academic staff working in a college or university use desktop or laptop to prepare lesson plans, lecture notes, e-learning activities, presentations, managerial documentations, publications and research work (1-3,5,6,15,26,27,30-32). Body orientation for a specific quantity of time, while in an ideal posture pronounces a state of sustaining steadiness in the body by means of nominal musculoskeletal activity devoid of causing pain or discomfort (12,14,15,27,33).

Musculoskeletal disorders (MSDs) are common occupational health issues linked to inadequate work place support and subsequently affect the quality of life of those affected (9,21,23-25,31,34). Strenuous daily physical activities or external force related to improper body posture, increase risk to develop musculoskeletal disorders (12-14). Prolonged, repetitive, and awkward movements, poor posture and ergonomics, or a fast-paced workload causes musculoskeletal disorders (8, 12-14). The normal sitting lumbar angle must be more than 90 degrees. Anything that refrain from 90 degrees' lumbar angle to less or more can contribute to cause low back pain due to compression, impingement or irritation

of the lumbar nerve root (35,36). Another cause of low back pain is forward neck flexion for a prolonged period so that the chin moves towards the chest (11-13, 15, 20, 24, 32, 37). Head position is considerably important factor to contribute back pain. Forward head position with neck flexion displaces it from neutral position, hence, exerting much load on the spine (1, 6, 12, 13, 15, 16, 21, 28, 32, 33, 38). Recent epidemiological studies reported significantly greater prevalence rates of MSDs amongst teachers in different regions of the world (9, 10, 29, 31, 37, 39, 40). These studies have linked the high prevalence rates to activities that teachers often engage in while doing their jobs, for example, bending, lifting heavy books and documents, awkward habitual posture and repeated actions of fingers during typing or marking exam or test papers, and sit for longer durations at work (29, 37, 39, 40). Mainenti MR in 2014 studies revealed that among workers group that did not take a break during working hours presented a higher prevalence of MSK pains (2). Significant associations were found to be prevalent among staff sitting for extended periods and not taking frequent short breaks, Chair without back support, and poor habitual posture at work (2, 37). The negative impact of MSDs on the quality of life poses a huge economic burden with regards to compensatory costs and wages (6, 40-42). A better understanding of association of musculoskeletal disorders to habitual posture while working on the desktop workstation and computer ergonomics in relation to working hours would facilitate the higher organizations to intervene, improve workplace ergonomics, and enhance its employee's health (5, 6, 18-20, 23, 25, 30, 34).

MATERIALS AND METHODS

Study Design and Location

It was a quantitative, descriptive, cross-sectional study, conducted in 5 college and universities of Petaling Jaya, Selangor, Malaysia.

Study Target Population

The study population consisted of academic and non-academic university staff, working for minimum of 1 year. The academic staff included professors, associate professors, senior lecturers, lecturers, tutors, and librarians. The non-academic staff comprised of administrative staffs, clerical officers, and I.T operators. The target population comprised of both male and female who met the inclusion criteria having an age range from 20-55 years and currently working for more than 1 year and otherwise healthy. The exclusion criteria included the participants below 20 years of age and above 55 years old, retired or have resigned from the institution, Students, domestic workers and physically challenged or handicapped staff.

Sampling Method

A systemic random sampling method was adapted. Out of 15 higher education institutions, 3 colleges and 2 universities were selected. The survey was not limited to any race or gender. The study carried out to include voluntary participation and kept anonymous. The study involved participants who were currently working (for at least more than 1 year) as teaching, administrative and computer operating I.T. staff in the selected colleges and universities. The sampling techniques used in the study were simple randomize pattern and 419 participants were selected to determine the minimum sample size required to represent the population in Petaling Jaya, Selangor state, the sample size was calculated by using the following Kish Leslie Formula.

$n = (Z1 - \alpha)^2 \times (P(1-P) / D^2)$
where,
n = sample size
$1 - \alpha$ = 95% confidence limits
$Z1 - \alpha$ = 1.96 (for normal distribution table)
P = Estimated Prevalence = 50%
D = Desired Precision = 5%

Survey Questionnaire

A survey questionnaire was distributed to collect data from eligible participants, and 450 well-structured survey questionnaires distributed to the respondents in Petaling Jaya, Selangor state, Malaysia. The demographic characteristics, computer stressors and body postures were included as independent variables in the questionnaire; (age, gender, education, profession, number of working hours per day, working hours of using computer every day at work, computer ergonomics, head position, neck flexion, neck pain, shoulder posture, shoulder pain, low back pain and back posture). The instrument used in this study for data collection was a two-part questionnaire. Nordic Musculoskeletal questionnaire (NMQ) was adapted to determine the prevalence rate of MSDs symptoms in the past 6 months. The first part of questionnaire comprised of the demographic characteristics data and the second part contained questions regarding daily hours of computer usage, working postures, and musculoskeletal pains and disorders.

Statistics and Ethical Consideration

Statistical package SPSS version 21 was used for data analysis. Descriptive analysis was performed to present all categorical variables using frequency tables and bar charts. Associations between categorical variables like risk factors and MSDs were assessed using bivariate analyses (chi square test) with p-values less than 0.05 considered statistically significant. The ethical approval attained from Lincoln University College (LUC) to conduct this study (Ref No: LUC-RMC/MedPG-218). The Permission from the concerned authorities and the voluntary participants obtained to proceed with the survey. Verbal and written agreement made between the participants and researcher before questionnaire distribution to keep their responses anonymous and confidential.

RESULTS

In the result, execution of frequency and percentage analysis for all the categorical variables were explained, clearly. The descriptive analysis of demographic factors in Table I shows that out of total 419 participants in this study, most of the respondents were female n=241 (57.5%) compared to male n=178 (42.5%) with most n=155 (37%) of them were in 31- 40 and n=144 (34.4%) 20-30-year age group, respectively. Maximum number of the respondents were postgraduates n= 216/419 (51.1%). Mainstream of participants were from administration department n=203 (48.4%) compared to teaching faculty n=116 (27.7%) and worked daily for 8 hours n=201 (48%) and used computer workstation for 4 hours n=138 (32.9%) and 6 hours n=121 (28.9%), individually. Concerning computer ergonomics awareness, it was revealed that more than half n=227/419 (54.2%) of the respondents were aware of computer ergonomics while n=192 (45.8%) respondents lack awareness, which is of utmost importance, in the present era. (Table I). Descriptive analyses of body posture while using desktop computer at workstation were presented in Table II. The study revealed, that n=96 (22.9%) respondents are habitual of looking down at the keyboard while typing and using computer most of the time. Nevertheless, n=84 (20%) of the participants' lean head in forward position thus, exerting more force on the cervical spine. However, very few respondents n=53 (12.6%) keep their head in a balanced (neutral) position. Moreover, majority n=164 (39.1%) and n=114 (27.2%) of participants flex their neck at 15 and 30 degrees during work, respectively. Yet, others n=45 (10.7%) and n=19 (4.5%) reported 45 and 60-degree neck flexion during work. In addition, n=152/419 (36.3%) respondents keep their shoulders bent forward while using computer. It was reported that a large number of respondents n=231 (55.1%) and n=119 (28.4%) were habitual to sit with forward back bent at 70 and 80 degrees, individually. However, few respondents n=15 (3.6%) sit at 100 degrees, in backward tilt position of lower back (lumbar) at workstation (Figure 1, Table II).

Descriptive analyses of the study revealed that the most prevalent musculoskeletal pains among official workers of the PJ colleges and Universities in the last 6 months, were Low back pain n=308 (73.5%), Neck Pain n=234 (55.8%) and Shoulder Pain n=196 (46.8%). Muscle spasm and fatigue was the fourth most commonly reported MSD n=132 (31.5%). However, prevalence of other MSDs such as wrist pain n=56 (13.4%), knee pain n=37 (8.8%), elbow pain n=18 (4.3%) and ankle pain n=12 (2.9%) was also found among working staff (Table III).

Bivariate analysis of musculoskeletal pains and demographic characteristics in Table III shows that neck pain (P=0.046) and low back pain (P=0.007) was highly prevalent among respondents of all the professions in this study. However, teaching staffs were the major sufferers for both neck (63.8%) and low back pain (82.8%), among the respondents, respectively. Low back pain

Table I: Descriptive analysis related to demographic factors, daily computer usage and Ergonomics awareness

Variable	Frequency (n)	Percentage (%)
Age		
20-30 years	144	34.4
31-40 years	**155**	**37.0**
41-50 years	88	21.0
51-55 years	32	7.6
Gender		
Male	178	42.5
Female	**241**	**57.5**
Education		
PhD	**76**	**18.1**
M.Phil.	**12**	**2.9**
Masters	**128**	**30.5**
Bachelors	155	37.0
Undergraduate	48	11.5
Profession		
Teachers	116	27.7
Computer operators	100	23.9
Admin Staff	**203**	**48.4**
Working hours		
5hours	18	4.3
6hours	22	5.3
7hours	50	11.9
8hours	**201**	**48.0**
9hours	87	20.8
More than > 9 hours	41	9.8
Daily computer using hours		
1 hour	12	2.9
2 hours	70	16.7
4 hours	**138**	**32.9**
6 hours	121	28.9
More than > 6 hours	78	18.6
Awareness of ergonomics		
Yes	**227**	**54.2**
No	192	45.8
Total	**419**	**100**

Bold numbers denote highest frequency and percentage, (n) denotes the number of respondents, (%) denotes the percentage of respondents

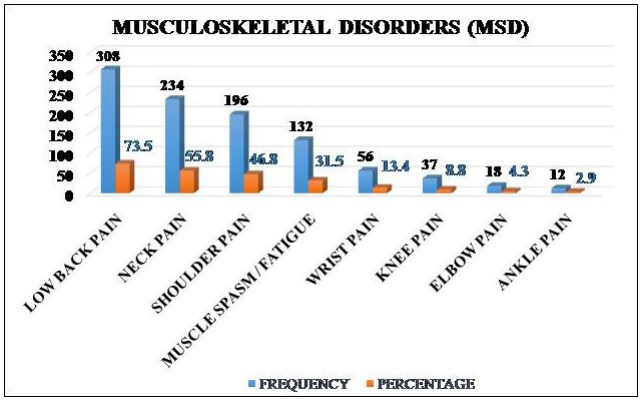

Figure 1: Musculoskletal disorders among official staff. The prevalence of musculoskeletal pain is shown by using the frequency (n) number of respondents and percentage (%) of respondent's value to demonstrate neck, shoulder and low back pain, muscle spasm and fatigue, wrist, knee, elbow and ankle joint pains.

Table II: Descriptive Analysis of Neck, shoulder and lower back Posture while using desktop computer

Postural variable	Frequency (n) n=419	Percentage (%)
Neck Posture (Flexion)		
Zero-Degrees (neutral)	77	18.4
Fifteen-Degrees	**164**	**39.1**
Thirty-Degrees	**114**	**27.2**
Forty-Five-Degrees	45	10.7
Sixty-Degrees	19	4.5
Bending of Back (Forward)		
Seventy-Degrees	**231**	**55.1**
Eighty-Degrees	**119**	**28.4**
Ninety-Degrees	54	12.9
One Hundred-Degrees	15	3.6
Shoulder posture (relaxed)		
Yes	267	63.7
No	152	36.3
Total	**419**	**100**

(n) denotes the number of respondents, (%) denotes the percentage of respondents, degrees denote the angle of forward neck flexion and bending of lower back.

(P=0.031) was significantly found in female respondents as compared to male respondents. Moreover, shoulder pain was found to be significant (P=0.031) among 20-30 years' age group, working on average, 8-9 or more than 9 hours each day at workplace.

Table IV shows significant association between daily hours of computer usage and musculoskeletal pains. There is remarkably significant association of Low back pain (P=0.036) and SP (P=0.023) with average daily computer usage between 4-6 and more than 6 hours.

Chi square test implemented to analyze relationship between head position and MSDs or pains among computer users. It revealed that 66.7% of respondents habitual of looking down while working on the computer complaint of neck pain. Hence, it was found that neck pain (P=0.002), shoulder pain (P=0.042) and low back pain (P=0.001) was significantly associated with head posture during computer usage, respectively (Table V).

DISCUSSION

This study had an explicit response rate of 99% much contented compared to other studies' response rates, which ranged between 28.5% (Chong and Chan, 2010). It is found from the study that there is a high prevalence of musculoskeletal disorders among college and university staff in Petaling Jaya, Selangor, Malaysia. However, there lies a paucity of literature on MSDs amongst Malaysian university and college teachers, admin staff and (I.T) computer operators. This prompted the current study, which aimed to determine the prevalence and identify selected risk factors for neck, shoulder and low back pains among the higher education working staff in

Table III: Bivariate analyses of Neck, Shoulder, and Low Back Pain in relation to Demographic factors

Demographic Factors	YES Frequency (Percentage) n (%)	NO Frequency (Percentage) n (%)	Total (n)	χ^2	*P*- value
		Neck Pain (NP)			
Age					
20-30 years	85(80.4)	59(63.6)	144		
31-40 years	78(86.6)	77(68.4)	155	3.196[a]	0.362
41-50 years	53(49.1)	35(38.9)	88		
51-55 years	18(56.3)	14(43.8)	32		
Gender					
Male	102(57.3)	76(42.7)	178	0.266[a]	0.339
Female	134.6(54.8)	106.4(45.2)	241		
Profession					
Teachers	74(63.8)	42(36.2)	116		
Computer/IT staff	47(47)	53(53)	100	6.147[a]	***0.046**
Admin Staff	113(55.7)	90(44.3)	203		
Working hours					
5hours	11(61.1)	7(38.9)	18		
6hours	12(54.5)	10(45.5)	22		
7hours	27(54)	23(46)	50	4.195[a]	0.522
8hours	105(52.2)	96(47.8)	201		
9hours	51(58.6)	36(41.4)	87		
> 9 hours	28(68.3)	13(31.7)	41		
		Shoulder Pain (SP)			
Age					
20-30 years	75(52.1)	69(47.9)	144	8.906[a]	***0.031**
31-40 years	77(49.7)	78(50.3)	155		
41-50 years	29(33)	59(67)	88		
51-55 years	15(46.9)	17(53.1)	32		
Gender					
Male	71(39.9)	107(60.1)	178	5.902[a]	0.10
Female	125(51.9)	116(48.1)	241		
Profession					
Teachers	63(54.3)	53(42.1)	116		
Computer/IT staff	44(44)	56(56)	100	3.656[a]	0.161
Admin Staff	89(43.8)	114(56.2)	203		
Working hours					
5hours	11(61.1)	7(38.9)	18		
6hours	11(50)	11(50)	22		
7hours	23(46)	27(54)	50	6.995[a]	0.221
8hours	84(41.8)	117(58.2)	201		
9hours	42(48.3)	45(51.7)	87		
> 9 hours	25(61)	16(39)	41		
		Low Back Pain (LBP)			
Age					
20-30 years	102(70.8)	42(29.2)	144		
31-40 years	115(74.2)	40(25.8)	155		
41-50 years	65(73.9)	23(26.1)	88	1.557[a]	0.669
51-55 years	26(81.3)	6(18.8)	32		
Gender					
Male	122(68.5)	56(31.5)	178	3.924[a]	***0.031**
Female	186(77.2)	55(22.8)	241		
Profession					
Teachers	96(82.8)	20(17.2)	116		
Computer/IT staff	76(76)	24(24)	100	9.838[a]	***0.007**
Admin Staff	136(66.9)	67(33)	203		
Working hours					
5hours	15(83.3)	3(16.7)	18		
6hours	17(77.3)	5(22.7)	22		
7hours	33(66)	17(34)	50	2.911[a]	0.714
8hours	148(73.6)	53(26.4)	201		
9hours	66(75.9)	21(24.1)	87		
> 9 hours	29(70.7)	12(29.3)	41		
Total					

***P*-value = <0.05 is significant** (*significant value in **BOLD**), **X^2 =** Pearson's chi square test (>) denotes more than and (<) denotes less than,

Petaling Jaya, Malaysia. Based on the results, highest means of work-related risk factors was body posture, working hours, daily computer using hours and computer ergonomics awareness. A study done in Australia in

Table IV: Bivariate analyses of Relationship of Neck Pain, Shoulder Pain, and Low back pain with daily Computer Usage (CU)

Computer Usage hours	YES Frequency Percentage n (%)	NO Frequency Percentage n (%)	X^2	P value
	Neck pain (NP)			
1hours	8 (66.7%)	4 (33.3%)		
2hours	36 (51.4%)	34 (48.6%)		
4hours	72 (52.2%)	66 (47.8%)	2.973[a]	0.562
6hours	73 (60.3%)	48 (39.7%)		
>6hours	45 (57.7%)	33 (42.3%)		
Total	234 (55.8%)	185 (45.2%)		
	Shoulder Pain (SP)			
1hours	6 (50.0%)	6 (50.0%)		
2hours	34(48.6%)	36 (51.4%)		
4hours	58 (42.0%)	80 (58.0%)		
6hours	49 (40.5%)	72 (59.5%)		
>6hours	49 (62.8%)	29 (37.2%)	11.372[a]	**0.023***
Total	196 (46.8%)	223(53.2)		
	Low back Pain (LBP)			
1hours	11 (91.7%)	1(8.3%)		
2hours	42 (60.0%)	28 (40.0%)		
4hours	107 (77.5%)	31 (22.5%)		**0.036***
6hours	88 (72.7%)	33 (27.3%)		
>6hours	60 (76.9%)	18 (23.1%)	10.246[a]	
Total	308 (73.5%)	111 (26.5%)		

P-Value **<0.05** is significant (*significant value), **X^2** =Pearson's chi square test, (>) denotes more than, (<) denotes less than

Table V: Head Posture in relation to Neck Pain (NP), Shoulder Pain (SP) , and Low Back Pain (LBP) during Computer use (CU)

Head Posture variable	Frequency Percentage n (%) YES	Frequency Percentage n (%) NO	X^2	*P*-value
	Neck pain (NP)			
Look Down	64 (66.7%)	32 (33.3%)	**14.714[a]**	***0.002**
Look Straight	93(50.0%)	93(50.0%)		
Lean Head Forward	55(65.5%)	29(34.5%)		
Head Balanced-Neutral	22(41.5%)	31(58.5%)		
Total	234(55.8%)	185(44.2%)		
	Shoulder Pain (SP)			
Look Down	49(51.0%)	47(49.0%)	**8.220[a]**	***0.042**
Look Straight	77(41.4%)	109(58.6%)		
Lean Head Forward	33(62.3%)	20(37.7%)		
Head Balanced-Neutral	37(44.0%)	47(56.0%)		
Total	196(46.8%)	223(53.2%)		
	Low back pain (LBP)			
Look Down	79(82.3%)	17(17.7%)	**15.872[a]**	***0.001**
Look Straight	122(65.6%)	64(34.4%)		
Lean Head Forward	71(84.5%)	13(15.5%)		
Head Balanced-Neutral	36(67.9%)	17(32.1%)		
Total	308(73.5%)	111(26.5%)		
Total Respondents	**419**			

***P*-value = > 0.05** is significant (*significant value in **BOLD**), **X^2** = Pearson's chi square test

2014 revealed, "LBP causes more global disability than any other condition and as highest in ranking (5).

Another study established causes of low back pain to be associated with standing and sitting for a prolonged time, specific sitting habits, a sudden change in posture and carrying heavy objects (13, 15, 26-29, 37, 39). This correlates with the current study, in with a highly significant relationship between sitting for a prolonged spell and low back pain normally after average of 2-3 hours of working on computers (25, 34-36, 40, 45-47). Body posture assumed as the position of an individual while doing some work using computer. Therefore, it can be alleged that majority of the official college and university staff did not discern how to practice correct body position while using a computer desktop in terms of body posture while sitting, using a keyboard and while looking at the monitor (14, 21, 25-28, 33). As for the prevalence of MSDs, almost all the participants reported experienced pain in at least one part of their body region, consequently, answering the objective of this research study (27-30, 33, 35-37, 39)

CONCLUSION

Inappropriate posture pertaining to computer usage at workplace associated with musculoskeletal disorders (MSD), such as neck, shoulder and low back pain. These findings are also linked with developing "muscle fatigue, muscle spasm, and joint pains" which findings slightly differ in male and female respondents (27, 32, 33, 48-50). Such associations may result in health concerns related to musculoskeletal system and computer work. It may cause adaptive musculoskeletal injuries, though "further case control or cohort studies desired to confirm causality". The vitality of this study is to prevent musculoskeletal disorders (MSDs) related to poor posture at workplace. It is mandatory to broaden the awareness among the teaching and admin staff and educate to avoid certain risk factors like poor habitual posture, protracted sitting for longer period, which may prove dangerous to musculoskeletal health. Hence, to inform the working staff, organization and the Government to prevent harmful work conditions, to influence positive work efficiency, to increase employer□s productivity and help public health system through reduction in cost expenditure on musculoskeletal health problems.

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