Research Article

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Assessment of musculoskeletal disorders by standardized nordic questionnaire among computer engineering students and teaching staff of Gulbarga city

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ABSTRACT

Background: Computer work has generated a new genre of occupational health problems like Repetitive Strain Injuries (RSI). Computer overuse have resulted in an epidemic of injuries of the hands, arms and shoulders causing pain and stiffness in various regions of the body like neck, lower back and wrist etc. The objective of the study was to find the prevalence of Musculoskeletal disorders (MSDs) among computer engineering students and teaching-staff in Gulbarga city.

Methods: A cross-sectional study was done among the 319 third-year students and 79 teaching-staffs of computer science department of all 4 engineering colleges in Gulbarga from January2011 to December2011. The study-subjects were interviewed using pre-designed and pretested proforma including Standardized Nordic Questionnaire. Appropriate statistical tests are applied.

Results: Out of 398 study subjects majority (75.37%) were 20-22 years age studying B.E Computer science. The most disabling MSDs affecting study subjects were upper back 67 (16.83%), lower back 64 (16.08%), neck 51 (12.81%) and wrists/hand 34 (8.54%) which was statistically significant ($\chi^2 = 53.14$, 64.514, 9.452, p<0.001).

Conclusions: Majority of study subjects (31.16%) suffered at least 1 disabling episode of MSDs causing poor classroom performance which can be prevented by multidisciplinary approach. Implications by multidisciplinary approach RSI symptoms could be reduced by 40%.

Keywords: Musculoskeletal disorders, Computer usage, Repetitive Strain Injuries

INTRODUCTION

In the twenty–first century computers have become a household need, used from calculating grocery bills, telecommunications to banking operation. Many universities or job require a computer literate for enrolment. The application of computer technology and the accompanying use of VDT's are revolutionizing the work places in India.

Computer work has generated a new genre of occupational health problems like RSI, CTD (Repetitive Strain Injuries and Cumulative Trauma Disorder) and occupational overuse syndrome. Computer use causes general malaise, eyestrain and musculoskeletal problems etc. The common musculoskeletal complaints include pain and stiffness in various regions of the body like neck, shoulder, lower back, and wrist etc. The rise in computer use and flat light touch keyboard that permit

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high speed typing have resulted in an epidemic of injuries of the hands, arms and shoulders. The risk factors associated with computer work include the integration of biomechanical factors such as static muscular overload, repetitive motions and conditions related to work environment.² The common musculoskeletal complaints include pain and stiffness in various regions of the body like neck, shoulder, lower back, wrist, hand and fingers. The above problems are more commonly associated with old age but due to many factors such as poor component design, proximity of the user to the screen and an excess of consecutive working hours mean that the above problems can feature in both young and old computer users.³

Since more students use computers for their assignments, internet use and for playing games, more students describe similar symptoms as reported by employees using computers which accumulate over a period of time resulting in debilitating injuries. The high prevalence of computer related MSDs reported by graduate students suggests a public health need to identify interventions that will reduce symptom severity and prevent impairment.

The bulk of literature available on computer related MSDs among students is more in the developed countries with few studies in an Indian setup. Hence a need was felt to carry out the present study to determine the Musculoskeletal disorders by Standardized Nordic Questionnaire among computer science staff and also students, who are budding engineers of our society.

Aims and objective

- 1. To find the prevalence of Musculoskeletal disorders (MSDs) among computer engineering students and teaching staff in Gulbarga city.
- To suggest remedial measures for prevention of Musculoskeletal disorders (MSDs) among study subjects.

METHODS

A cross sectional study was conducted among computer engineering students and teaching staff in all 4 Engineering colleges of Gulbarga city for 1 year from January 2011 to December 2011.

Inclusion criteria

Students and teaching staff working on computers for minimum of 3 hours continuously per day for 3 times in a week for 6 months are included in the study.² After consulting with the head of department of computer science department of Engineering colleges; teaching staff and third year computer engineering students are included in the study.

Exclusion criteria

- 1. Computer engineering students belonging to first, second and final year.
- 2. Students belonging to other departments of engineering colleges.

Sample size

In Gulbarga city, there are four engineering colleges. All the third year (319) students and 79 teaching staff of computer science department belonging to these four engineering colleges are included in the study.

Study tool

The study subjects were interviewed using pre-designed and pretested proforma including Standardized Nordic questionnaire.⁴ Data was analysed by using proportions and chi square test. The statistical software SPSS 12 is used for the analysis of the data and Microsoft word and Microsoft Excel have been used to generate graph, tables etc.

Source of data

Teaching staff and third year students of the Computer science department of all 4 Engineering colleges in Gulbarga city namely Appa Institute of Engineering and Technology, Kalleveravan Charitable Trust, Khaja Bande Nawaz and Poojya Doddappa Appa colleges.

RESULTS

The Study (Table 1) showed that the majority of study population belonged to 20-22 years (75.37%), followed by age group of more than 24 years (15.07%). The least are the age group 22-24 years (9.54%). Amongst the males the majority has been in the age group of 20-22 years (71.77%), followed by that of 22-24 years (16.12%). Amongst the females the majority has been in the age group of 20-22 years (77%), followed by more than 24 years (16.42%).

The majority of the study subjects were studying B.E 319 (80.15%), followed by 41 (10.3%) graduates, 35 (8.7%) postgraduates and 3 (0.75%) doctorates. In the study majority of the study subjects were students 319 (88%) [males-104(83.9%), females-215 (78.5%)] and staff 79 (19.89%) [males-20 (16%), females-59 (21.5%)].

The majority of the study subjects belonged to class III 215 (54%), followed by class II 89 (22.36%), class IV 83 (20.89%) and least were the class I 11 (2.76%). Among the males majority of them belonged to class III 76 (61.3%), followed by class IV 25 (20.16%) and class II 23 (18.54%). Among the females majority were in the class III 139 (50.72%), followed by class II 66 (24.08%) and least were in the class I 11 (4.01%).

In the study (Table 2) majority of the study subjects 164 (41.2%) used computers for 3-6 hour followed by 117 (29.4%) less than 3 hour, 75 (18.84%) for 6-9 hour and 42 (10.55%) for more than 9 hr. Among the males majority of subjects used computers 48 (38.8%) for 3-6 hr followed by 41(33.1%) for less than 3 hr, 31 (25%) for 6-9 hr and 4 (3.23%) for more than 9 hr. Among the females majority of subjects used computers 116 (42.33%) for 3-6 hr followed by 76 (27.73%) for less than 3 hr, 44 (16.05%) for 6-9 hr and 38 (13.86%) for more than 9 hr.

Table 1: Distribution of study population according to socio-demographic factors.

Socio-	Male		Fema	ale	Tota	Total		
demogra- phic factors	No.	%	No.	%	No.	%		
Age in years								
20-22	89	71.77	211	77	300	75.37		
22-23	20	16.12	18	6.56	38	9.54		
≥24	15	12.09	45	16.42	60	15.07		
Total	124	100	274	100	398	100		
Education								
Student	104	83.87	215	78.46	319	80.15		
Graduate	13	10.48	28	10.21	41	10.3		
Postgraduate	7	5.6	28	10.21	35	8.7		
Doctorate	0	0	3	1.09	3	0.75		
Total	124	100	274	100	398	100		
Occupation								
Student	104	83.9	215	78.5	319	80.15		
Staff	20	16	59	21.5	79	19.85		
Total	124	100	274	100	398	100		
Socio-econom	ic stat	us						
Ι	0	0	11	4.01	11	2.76		
II	23	18.54	66	24.08	89	22.36		
III	76	61.3	139	50.72	215	54		
IV	25	20.16	58	21.16	83	20.88		
V	0	0	0	0	0	0		
Total	124	100	274	100	398	100		

Table 2: Distribution of the study subjects according to the duration of working on computers in a typical day.

Duration	Male		Fema	ale	Tota	Total		
Duration	No.	%	No.	%	No.	%		
<3hr	41	33.1	76	27.73	117	29.4		
3-6hr	48	38.8	116	42.33	164	41.2		
6-9hr	31	25	44	16.05	75	18.84		
>9hr	4	3.23	38	13.86	42	10.55		
Total	124	100	274	100	398	100		

The majority (Table 3) of the study subjects 195 (48.99%) used computers for 3-6 yr followed by 101 (25.37%) less than 3 yr, 56 (14.1%) for more than 9 yr and 46 (11.6%) for 6-9 yr. Among the males majority of subjects used computers 58 (46.8%) for 3-6 yr followed

by 38 (30.6%) for less than 3 yr, 18 (14.5%) for more than 9 yr and 10 (8.06%) for 6-9 yr. Among the females majority of subjects used computers 137 (50%) for 3-6 yr followed by 63 (22.99%) for less than 3yr, 38 (13.9%) for more than 9 yr and 36 (13.1%) for 6-9 yr.

Table 3: Distribution of the study subjects according to the duration of using computers (in years).

Duration	Male		Fema	ile	Total	Total		
Duration	No.	%	No.	%	No.	%		
<3yr	38	30.6	63	22.99	101	25.37		
3-6yr	58	46.8	137	50.0	195	48.99		
6-9yr	10	8.06	36	13.1	46	11.6		
>9yr	18	14.5	38	13.9	56	14.1		
Total	124	100	274	100	398	100		

The Table 4 showed that lower back 114 (28.74%), upper back 100 (25.12%), neck 86 (21.6%), shoulders 85 (21.35%) were the most affected parts during the previous week. MSDs occurring during the previous year, the affected body parts showed a slightly different priority as lower back 153 (38.44%), neck 137 (34.42%), upper back 132 (33.16%), shoulders 128 (32.16%) and wrists/hand 124 (31.15%) were most commonly affected. The most disabling MSDs affecting study subjects were upper back 67 (16.83%), lower back 64 (16.08%), neck 51 (12.81%), shoulders 36 (9.04%), knees 35 (8.79%) and wrists/hand 34 (8.54%).

The Table 5 shows that MSDs in previous 7days were more common among 20-22 yr age group 150 (37.68%), females 133 (33.41%), S-E class III 92 (23.11%) and students 166 (41.45%). MSDs in previous 1year follows same pattern as MSDs in previous 7 days. Among study subjects disabling attack were more common among 20-22yr age group 92 (23.11%), females 82 (20.6%), S-E class III 54 (13.77%) and students 100 (25.12%).

The Table 6 showed that 10 (2.51%) had positive Phalen's and Tinel's tests and 388 (97.48%) negative Phalen's and Tinel's tests.

DISCUSSION

Socio-demographic factors

In our study majority (75.37%) of study subjects belonged to 20-22 years age studying B.E Computer science and 274 (68.84%) were females and 124 (31.15%) were males (Table 1) and in study done by Eric B. Schlossberg, et al in 206 Electrical Engineering and computer science graduate students of the University of California at Berkeley in whom majority (85%) belongs to 21-25 yr age group and (85%) were males and study done by Sen A and Stanley Richardson in Malaysia among 136 under graduate students (studying computing or medicine) revealed that 71% of the respondents were less than 30 years old and 65% of them were females. ^{5,6}

Table 4: Distribution of the study subjects according to the Standardized Nordic Questionnaire.

Body parts affected	Previo	revious 7 day		ıs 12 month	Disabli	ing attack	2 1	Danilos	
by MSD	No.	%	No.	%	No.	%	χ² value	P-value	
Neck									
Yes	86	21.6	137	34.42	51	12.81	53.154	P<0.001	
No	312	78.39	261	65.57	347	87.18			
Shoulders									
Yes	85	21.35	128	32.16	36	9.04	CA 514	D <0.001	
No	313	78.64	270	67.83	362	90.95	64.514	P<0.001	
Elbows									
Yes	34	8.54	45	11.3	21	5.27	0.452	D <0.001	
No	364	91.9	353	88.73	377	94.72	9.452	P<0.001	
Wrists/hand									
Yes	63	15.82	124	31.15	34	8.54	70.307	P<0.001	
No	335	84.17	274	68.84	364	91.45	70.307	P<0.001	
Upper back									
Yes	100	25.12	132	33.16	67	16.83	28.279	P<0.001	
No	298	74.87	266	66.83	331	83.16	28.219	P<0.001	
Lower back									
Yes	114	28.64	153	38.44	64	16.08	49.916	P<0.001	
No	284	71.35	245	61.55	334	83.91	49.910	r<0.001	
Hip									
Yes	30	7.53	35	8.79	16	4.02	7.708	P<0.05	
No	368	92.46	363	91.2	382	95.97	7.708	r<0.03	
Knees									
Yes	59	14.82	75	18.84	35	8.79	16.763	P<0.001	
NO	339	85.17	323	81.15	363	91.2	10.703	r<0.001	
Foot/ankle									
Yes	50	12.56	65	16.33	31	7.78	13.594	P<0.005	
No	348	87.43	333	83.66	367	92.21	13.374	1<0.003	

The study revealed that 319 (80.15%) of the study subjects were studying B.E, followed by 41 (10.3%) graduates, 35 (8.7%) postgraduates and 3 (0.75%) doctorate (Table 1). This study was done among students and teaching staff in contrast to study done by Husnun Amalia, et al in 2010 among 99 (100%) are computer science students of university of Indonesia and Cammie Chaumont Menéndez et al in their study done in 2009 in USA revealed that 160 (100%) are engineering graduate students.^{7,8}

Duration of using computers

Our study reported that majority of the study subjects 164 (41.2%) used computers for 3-6 hour followed by 117 (29.4%) less than 3hour, 75 (18.84%) for 6-9 hour and 42 (10.55%) for more than 9 hr (Table 2). Since in this study the study subjects have got practical classes for 3hr in a day hence majority (41.2%) of them work on computers for 3-6hr.

Richa Talwar et al in their study on computer professionals in Delhi reported that 88 (44%) individuals worked in front of computers for 6-9 hours followed by 60 (30%) for 3-6 hours and 52 (26%) for more than 9hours per day.²

A study done by Che-hsu (Joe) Chang PT et al in USA among undergraduate students, reported that daily computer usage longer than 3 hr was significantly associated with an odds ratio 1.50 (1.01–2.25) of reporting symptoms.⁹

A K Sharma, et al in their study on IT professionals with varied job profiles in New Delhi revealed that average working hours per day on computer in call center and software development were higher i.e. 9 ± 0.67 hours and 8.3 ± 0.81 hours respectively as compared to 5 ± 0.41 hours in data entry/ processing group. ¹⁰

Table 5: Association between Standardized Nordic Questionnaire and Demographic and Socio-economic factors.

Mo	Demographic	Standa	rdized Nor	rdic Ou	estionna	ire								
Part									Disabling attack					
Part														
Age wise					%				%				%	
\$\sum_{\char*{2}} \begin{array}{c c c c c c c c c c c c c c c c c c c		110	, 0	210	, 0	1100	, ,	1101	, 0	1100	, ,	1100	, 0	
22-24		150	37.68	150	37.68	84	21.1	216	54 27	208	52.26	92	23 11	
224														
χ²-Value 2.890 S 0.475 2.721 S P														
Policy Services			0.55	34	0.54			71	10.5		11.05	10	7.02	
Sex wise Male 50 12.56 74 18.59 34 8.54 90 22.6 83 20.85 41 10.3 Female 140 35.18 134 33.66 81 20.35 193 48.49 191 47.99 83 20.85 χ²-Value 9.20.5 9.00.5										5				
Male		1 > 0.03				1 > 0.0	33			1 > 0.0.	<i></i>			
Female		50	12.56	7/	18 50	3/1	8 5/1	90	22.6	83	20.85	41	10.3	
χ²-Value 3.97 0.191 0.306 P>0.05 P<0.05 P<0.05<														
P-value P<0.05			33.10	134	33.00			173	70.77		71.77	0.5	20.03	
Married 25 6.28 20 5.025 13 3.26 32 8.04 35 8.79 10 2.51 Lomnarried 165 41.45 188 47.23 102 25.62 251 63.06 239 60.05 114 28.64 χ²-Value 1.0243 1 79 19.52 25.02 50.25 195 48.99 84 21.1 Religion Hindu 144 36.18 135 33.91 79 19.85 200 50.25 195 48.99 84 21.1 Muslim 46 11.56 66 16.58 35 8.8 77 19.34 75 18.84 37 9.20 Christian 0 0 2 0.5 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5											<u> </u>			
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Religion Hindu 144 36.18 135 33.91 79 19.85 200 50.25 195 48.99 84 21.1 Muslim 46 11.56 66 16.58 35 8.8 77 19.34 75 18.84 37 9.29 Christian 0 0 5 1.25 1 0.25 4 1.01 4 1.01 1 0.25 Others 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 2 0.5 0 0 0 0 0 2.0 0 0											-			
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Education Student 154 38.69 165 41.45 95 23.86 224 56.38 219 55.02 100 25.12 Graduate 23 5.77 18 4.77 12 3.01 29 7.54 34 8.54 7 1.75 Postgraduate 12 3.26 23 5.77 8 2.01 27 6.78 20 5.02 15 3.7 Doctorate 1 0.25 2 0.5 0 0 3 0.75 1 0.25 2 0.5 χ^2 -Value 3.973 1.262 P>0.05 P<0.05	<td></td>													
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$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Class II	47	11.8	42	10.55	28	7	61	15.32	59	14.82	30	7.5	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Class III	101	25.37	114	28.64	54	13.56	161	40.4	148	37.19	67	16.83	
χ^2 -Value 1198.93 1204.30 1198.66	Class IV	38	9.5	45	11.3	30	7.5	53	13.31	58	14.57	25	6.28	
~	Class V	0	0	0	0	0	0	0	0	0	0	0	0	
P-value P<0.001 P<0.001	χ²-Value	1198.93	3			1204	.30			1198.6	56			
	P-value	P<0.00	1			P<0.0	001			P<0.00	01			

Table 6: Distribution of the study subjects according to the Phalens and Tinels tests.

Toot	Posit	ive	Nega	itive	Total	
Test	No.	%	No.	%	No.	%
Phalens test	10	2.51	388	97.48	398	100
Tinels test	10	2.51	388	97.48	398	100

Our study subjects were third year computer science students and teaching staff therefore majority (48.99%) have 3-6yr computer exposure followed by 101 (25.37%) less than 3yr, 56 (14.1%) for more than 9yr and 46 (11.6%) for 6-9yr (Table 3) which is similar to study done by A K Sharma, et al on IT professionals with varied job profiles in New Delhi where in majority 72 (36%) worked on computers for 3-6years followed by 35 (17.5%) for 6-9yers, 31 (15.5%) for <3years, 28 (14%) for 12-15years, 27 (13.5%) for 9-12 years and 7 (3.5%) for >15years. 10

Study subjects according to the Standardized Nordic Questionnaire

The study shows that lower back 114 (28.64%), upper back 100 (25.12%), neck 86 (21.6%), shoulders 85 (21.35%) (Table 4) were the most affected parts during the previous week which was statistically highly significant.

MSDs occurring during the previous year, the affected body parts showed a slightly different priority as lower back 153 (38.44%), neck 137 (34.42%), upper back 132 (33.16%), shoulders 128 (32.16%) and wrists/hand 124 (31.15%) were most commonly affected which was statistically significant.

The most disabling MSDs affecting study subjects were upper back 67 (16.83%), lower back 64 (16.08%), neck 51 (12.81%), shoulders 36 (9.04%), knees 35 (8.79%) and wrists/hand 34 (8.54%) which was statistically significant.

The present study reveals that 208 (52.26%) suffered at least 1 episode of Musculoskeletal disorders (MSDs) during the previous week, 283 (71.10%) during the previous year and 124 (31.16%) suffered at least 1 disabling episode in 1 year in contrast to study done by Q.A.S. Akrouf et al in 750 bank office workers in Kuwait were 57% reported suffering from MSDs during the previous week while 80% during the previous year and 42% suffered at least 1 disabling episode. The most affected body parts were the neck (53.5%), lower back (51.1%), shoulders (49.2%) and upper back (38.4%).

Association between Standardized Nordic Questionnaire and Demographic and Socio-economic factors

The study reveals that MSDs in previous 7days were more common among 20-22 yr age group 150 (37.68%), unmarried study population 188 (47.23%), students 165

(41.45%) and nuclear family 156 (39.19%) which was not statistically significant whereas MSDs in previous 7 days among females 133 (33.41%), belonging to Hindu religion 135 (33.91%), S-E class III 114 (28.64%) (Table-5) was statistically significant (χ^2 =3.97, 10.07, 1198.93, p<0.05, p<0.001, p<0.001).

MSDs in previous 1 year follows same pattern as MSDs in previous 7 days.

Among study subjects disabling attack were more common among 20-22yr age group 92 (23.11%), females 83 (20.85%), unmarried study population 114 (28.64%), belonging to Hindu religion 84 (20.10%), nuclear family 90 (22.6%), S-E class III 67 (16.83%) and students 100 (25.12%) (Table 5).

Our study reveals that disabling attack and MSDs in previous year are more common in socio-economic class III which is statistically significant.

A study done by Q.A.S. Akrouf, et al in 750 bank office workers in Kuwait with mean age of 33.2 (SD 9.1) years were 52.5% respondents were females, 62.9% were married, 90.2% had higher than secondary education, 25.7% were smokers while 9.7% were alcohol drinkers and the predominant nationality was Kuwaiti (53.9%). The mean duration in their job was 7.6 (SD 7.5) years. Nationality, GHQ12 score, smoking and sex were significant predictors of MSDs during the previous year, while alcohol drinking, marital status, GHQ12 scores, years in Kuwait and sex were significant predictors of disabling MSDs during the previous year.

Study subjects according to Phalen's and Tinel's tests

This study shows that 10 (2.51%) had positive Phalen's and Tinel's tests and 388 (97.48%) negative Phalen's and Tinel's tests (Table 6) in contrast to study done by K. Mohamed Ali, et al in Chennai in 2006 among 648 persons having more than 6 months of experience revealed that the prevalence of carpal tunnel syndrome was found to be 13.1% (95% CI 10.5–15.7%).

A study done by A K Sharma, et al on IT professionals with varied job profiles in New Delhi reported that Phalen's test for carpal tunnel syndrome was positive in 11.5% while Tinel's test was positive in only 5%. 10

CONCLUSION

In our study majority of the subjects used computers daily for 3-6 hours continuously for 3-6 years. Most of the students are affected with MSDs and disabling attack causing absenteeism and poor classroom performance. It is crucially important that these problems are identified and resolved sooner rather than later in an effort to reduce if not eradicate these problems and if ignored can causes debilitating and crippling injuries. By multidisciplinary approach RSI symptoms could be reduced by 40%.³

Recommendations

- 1. Computer related MSDs problems among students warrants a place on the Health Education agenda since students are country's future.
- 2. Universities have to provide ergonomic training designed for college students to: conduct workstation assessments; identify computer related problems (risk factors); and propose ergonomic solutions so that students reflexively adjust their workstations, not necessarily with expensive equipment to fit them well but to ensure they can use healthy postures and sound work habits.
- 3. Students need to consider relaxation measures like exercise, meditation, proper rest, good sleep and timely food intake.

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