Original Research Article

Musculoskeletal symptoms among computer officers: a cross-sectional evaluation of prevalence and risk factors in a developing country along with validation of Maastricht Upper Extremity Questionnaire

ABSTRACT

Background: Due to an increase in the use of a computer at work musculoskeletal symptoms are becoming very common and are well known for sickness absenteeism. Musculoskeletal symptoms usually occur in the upper parts of the body because of their continuous involvement in completing any computer-related task. The prevalence of musculoskeletal complaints and validation of a modified Maastricht Upper Extremity Questionnaire (MUEQ) questionnaire were not previously done in Asian countries like Pakistan before.

Aims: To find out the prevalence of musculoskeletal symptoms and to ascertain the factors affecting work-related musculoskeletal symptoms among computer workers along with the MUEQ questionnaire validation.

Methods: A cross-sectional study was conducted using a validated questionnaire (MUEQ) along with some changes, from July 2017 to February 2018 in Lahore. 326 computer workers between 18 to 49 years of age and having at least one year of work experience were evaluated for computer-associated musculoskeletal problems.

Results: The lifetime prevalence of musculoskeletal symptoms was 62.6% while prevalence within the last week was 30.7% in the study population. MUEQ total scoring ($p<0.001$), years of the job ($p=0.038$), working days ($p<0.001$), and working hours per day ($p=0.038$) were related to the frequency of musculoskeletal complaints.

Conclusion: The musculoskeletal complaints were more related to the workstation control, body posture, job demand, and the number of days and hours spend using computer. Adequate steps for the prevention of these symptoms should be taken to increase the economic productivity of employees.

Keywords: Work-related musculoskeletal symptoms, computer workers, computer-related diseases, musculoskeletal pain

INTRODUCTION:

More than 50% working class in European Union [1] uses the computers for routine work, increasing the prevalence of Work-related musculoskeletal disorders (WMSDs) of the neck, shoulder, and arms [2]. Recently, in developing countries computer usage has been massively increased in different professions [3]. The computer has also been increasingly used in Pakistan in every field, especially in the banking sector [4].

This data corresponds with the figures from earlier research performed in developed countries [5, 6]. Furthermore, some similar studies also showed that the prevalence rate MSDs in computer users is much higher than in general population (36.8%) [7].

Pain in the upper extremity and inability to main proper erect posture are frequently reported by employees who worked on computers [8]. Especially neck pain which develops due to the working with a lifted shoulder and neck tilted towards one side constantly for a long time causes changes in cervical vertebrae [9].

Lack of workstation orientation, multiple years spend in the same kind of job, and monotonous work like data entry or office software processing [10], decrease in the implementation of workplace ergonomics are the multiple risk factors for musculoskeletal symptoms among computer officers[11]. Mental health is also an important determinant of WMSDs. Psychosocial stress can stimulate muscle spasms during computer-based work [12]. Job demand, [13]. Job control, job pressure, difficulty to cope up with the job, and stressful decision making, are some psychosocial risk factors to Musculoskeletal disorders (MSDs) [14].

Some studies showed that computer-based work and issues of arm and neck are linked [15]. This association between using computers for a prolonged period and the development of discomforts due to musculoskeletal symptoms has been proved by many researchers [16, 17] especially by doing computer work for more than 2 hours per day [18]. In Europe, 100 million people had chronic musculoskeletal disorders (MSDs) and distress [19], counting 40 million officers who reported that their symptoms develop directly due to their job [20]

WMSDS puts a heavy burden on the employer as well as employees and also on the whole community with a decrease in work efficiency. In the United States, approximately $45 to $54 billion are spent annually on medical insurance and loss of work productivity due to ailments mainly caused by complaints of arms, neck, and /or shoulder (CANS) [10, 21].

United States' Occupational Safety and Health Administration (OSHA) documented that majority of occupational ailments related to computer workstations are due to poor ergonomic practices [10]. By decreasing the complaints, the efficiency of workers can be increased [22]. Changes at the workstation under the ergonomics is a new field seeking a lot of popularity [23]. To prevent these musculoskeletal complaints, appropriate body posture should be maintained [24]. Workers can have an optimal posture during work, if they are aware of such things and thus can decrease related problems [25].

The conceptual framework of this study is shown in Figure 1. The purpose of this study was to determine the prevalence of musculoskeletal symptoms among office workers with high computer use. Since in Pakistan, no study explored the work-related risk factors among computer professionals in a detailed manner, hence in this study, an effort is made to find out the link between work-related risk factors and work-related musculoskeletal symptoms among computer users by recording their responses on a pre-validated Maastricht upper extremity questionnaire (MUEQ) English version.

Objectives:

1. To determine the prevalence of MSDs
2. To determine the association between workplace physical and psychosocial factors the duration of computer use and MSDs
3. Validation of the Modified Maastricht Upper Extremity Questionnaire (MUEQ).

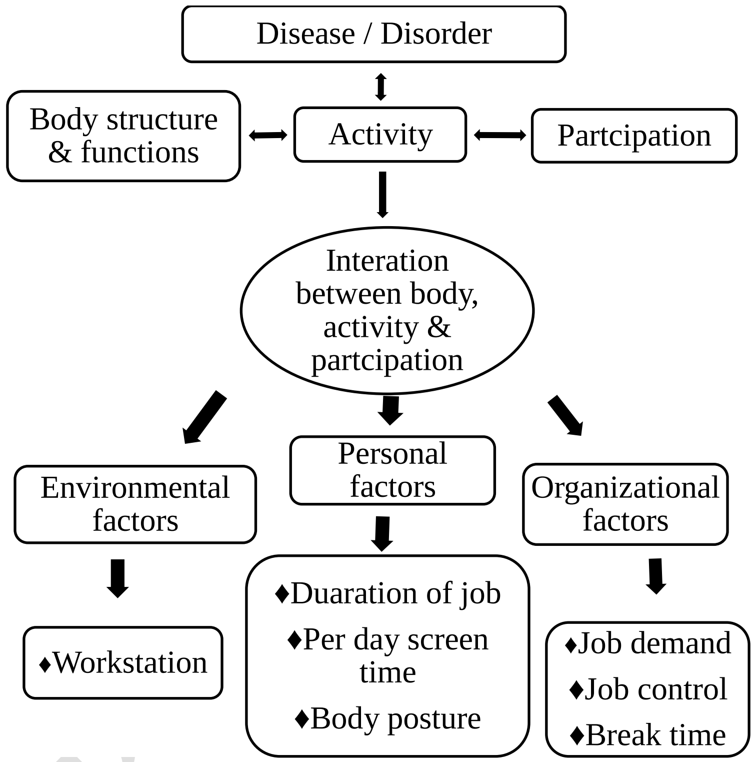

Figure 1: **Multiples factors relating to musculoskeletal disorders**

MATERIAL & METHODS:

A descriptive cross-sectional study was conducted from July 2017 to June 2018 and questionnaires were filled out based on the interviews with the 396 employees working on the computers from February 2018. The duration of data collection was 2 months. Purposive non-probability sampling was done on all those workers who fulfilled the inclusion criteria. One hundred and thirty-two computer officers, from each of the three sectors, were selected namely banks, telecommunication firms, and educational institutes.

Inclusion criteria: Employees that worked on the computer for at least 2 hours per day, falling in the age bracket of 18 to 50 years, and consented to their participation in the study. Exclusion criteria: Employees who had any musculoskeletal surgery or congenital malformation of the musculoskeletal system.

Work-related upper extremity musculoskeletal disorder (WMSDs): Any type of upper body musculoskeletal disorders/pains, including neck, shoulder, arms and elbow, wrists, and hands that were experienced after joining a computer-related profession. [26].

Most of the items included in the questionnaire used in this study were taken from the Maastricht Upper Extremity Questionnaire (MUEQ) [27] which is a screening tool that helps in the estimation of the frequency of WMSDs and their associated factors.

Domains included from MUEQ were workstation (6 questions, 0 to 6 points); body posture at the workplace (6 questions, 0 to 18 points); job control (9 questions, 0 to 27 points); job demands (5 questions, 0 to 15 points) and break time (3 questions, 0 to 9 points).

A revised version of the questionnaire consists of 42 items, with the dichotomous type of answers (yes 0 points &no 1 point) for the workstation domain and the other domains, a five-point Likert scale (always-never) was used in which “always” and “often” are scored 0 points each as both the options showed a high frequency of an event, “sometimes” 1, “seldom” 2, and “never” 3 making a total score ranging from 0 to 75 for all domains. Greater the sum score, the greater the perception of the worker about the intrusion of physical and psychosocial aspects at work.

Model from two studies also eliminated the environmental domain considering it a more physical factor [5, 27]. For the sake of simplicity, some questions are removed along with the work environment domain from the original questionnaire.

The total completion time was 10 minutes maximally. All the components of the questionnaire were kept confidential and ethical aspects of the whole research were reviewed twice. After getting consent, data were collected, double entered, and analyzed in statistical package for social sciences (SPSS) version 21 and cross-checked for consistency. Quantitative variables were summarized in tabulated form and confounders like age, and gender was minimized by stratification of data.

The reliability of data was tested after data cleaning. The normal distribution of data was checked by Shapiro–Wilk test. Independent T-test was applied for getting the relationship between the scoring of the domains and comparison between with MSDs and without reported MSDs and the Chi-square test for categorical data with p values ≤ 0.05 was considered significant. Intra and inter-rater reliability were checked by Intraclass Correlation Coefficient [28]. Weak reliability was considered when ICC<0.40 and strong reliability when ICC >0.75 [29]. Factor analysis by the principal component method (extraction method) and varimax rotation with Kaiser Normalization (rotation method) was done on parts of MUEQ.

RESULTS:

Out of 396 participants, only 82% of participants completely responded to the questionnaire. The study population consisted of 64% (210) men and 36% (116) women with a mean age was 24.60±6.12 years. Almost half (47.24%) of participants had a temporary job while 19.6 % (64) worked for more than 4 years. Most of them worked for more than 5 days a week (64.7%, 211) and half of the respondents worked on the computer for more than 6 hours a day (50%, 163). Mean hours spend using a computer in the workplace were 5.80± 2.76 hrs. Only 16.3% (53) worked overtime, out of which 84.9% (45) worked at the office. The lifetime prevalence of musculoskeletal symptoms was 62.6% (204) and last week from the time of the survey was 30.7% (100) (Table 1).

Table 2 showed that by applying t-test, total MUEQ scoring, workstation, posture at the workplace, and job demand ($p<0.001$, $p<0.001$, $p<0.001$, $p=0.005$ respectively) were significantly related to musculoskeletal symptoms. Among the workstation domain, only 2 items (adjustable chair and the chair supports lower back) had significant p values ($p<0.001$, $p<0.001$). However, job control and break time ($p=0.337$, 0.587 respectively) had no association with MSDs.

Cross tabulation showed that complaints of the musculoskeletal system were statistically related to the duration of the job ($p=0.038$), increasing days working per week ($p<0.001$) but no relation was shown with job contract ($p=0.628$) (Table 3). Increasing hours spent on the computer at the workplace was significantly related to WMSDs after joining the profession ($p=0.035$) (Figure 2).

Table 4 showed factor loadings through the varimax rotation with Kaiser Normalization. The domain "workstation" consisted of six items, out of which the first four items had factor loadings more in factor 1 and the last two items loaded high in factor 2. Both these factors showed a variance of 28.83 and 22.96 respectively and Cronbach alpha was not acceptable i.e. 0.57 and internal consistency ranged from 0.24 to 0.46 (Table 5).

The domain "body posture" consisted of eight items. Two factors were retained and one factor was deleted as it had less than three subscales. Two articles (Neck is twisted towards the left or right and Trunk is twisted towards the left or right) had a factor loading less than 0.5 in the remaining two factors so they are deleted. "Bad work practices" was a crucial scale that constituted three items (When I work my head is bent; At work, I sit for long hours in one position; For 2 hrs./day I work with lifted shoulders) with variance was 16.52% (Table 4), Cronbach alpha 0.48 and total correlation 0.29 to 0.33. The remaining three items went into "Asymmetric work posture" accounting for a variance of 13.87%, Cronbach alpha 0.40, and a total correlation of 0.18 to 0.29 (Table 5).

The third domain addressed the "Job control" which included nine items. By Principal component analysis, two items were extracted and examination of rotated factors loading, four items related to decision power belongs to the first factor and this factor accounted for 35.99% of the total variance. The scale Cronbach's alpha of 0.67 near the acceptable level and item-total correlation ranged from 0.26 t 0.58. Furthermore, the remaining five items loaded heavily in the second factor, constituted 12.35% total variance with very less Cronbach's alpha to be 0.28 and item-total correlation ranged 0.15 to 0.28 (Table 4&5).

Analysis of the "Job demand" domain showed that two factors were meaningful enough to be retained. The first three items loaded high for the first factor "Effective time planning" and this accounted for 36.94% of the total variance (Table 4). The Cronbach's alpha to be 0.62 and the item-total correlation ranged from 0.31 to 0.52. The other two items (At work I speed up to finish my tasks on time and I find my work tasks difficult.) were labeled as "Work burden"; the second factor and accounted for 23.91% of the total variance. The Cronbach's alpha and item-total correlation were 0.46 and 0.30 respectively (Table 5).

In "Break time", although, each of the two factors extracted contained only two items nevertheless each covered significant assumptions of scale, so both were considered. "Work without a screen" (containing items I perform job task without a computer, and I alternate with my job task) and “Work recess” contained the remaining two items. The First and the second factor accounted for 47.15% and 35.9% of the variance respectively (Table 4). Table 6 shows the percentages of different responses of study participants for five main domains.

Table 1: Frequency distribution of study subjects according to different personal characteristics and upper extremity musculoskeletal complaints related to computer use

Characteristics (n=326)	Frequency	Percent
Employment Contract		
Temporary	154	47.24
Permanent	172	52.76
Duration of Job		
up to 1 year	139	42.6
1.1 to 2 years	71	21.8
2.1 to 3 years	19	5.8
3.1 to 4 years	33	10.1
more than 4 years	64	19.6
Working days per week		
≤ 3 days	12	3.7
> 3 but ≤ 5 days	103	31.6
> 5 but ≤ 7 days	211	64.7
Hours spend in front of the computer at the workplace		
≤ 3 hours	81	24.8
≤ 6 hours	82	25.2
> 6 hours	163	50
Place of overtime work		
Office	45	13.8
Home	8	2.5
Not Applicable	273	83.7
Any pain/complaints after joining this profession		
Male (210)	108	51.4%
Female (116)	96	82.8%
Total (326)	204	62.6%
Any Pain/Discomfort in your upper extremity during the last 7 days		
Male (210)	47	22.4%
Female (116)	53	45.7%
Total (326)	100	30.7%

Table 2: Relationship of scoring of MUEQ domains with musculoskeletal complaints

MUEQ domains (n=326)	With Musculoskeletal pains (N=204)	Without Musculoskeletal pains (N=122)	t (Degree of freedom)	p-value	Mean Difference (95% Confidence Interval)
	Mean±S.D.	Mean±S.D.			
MUEQ – Total score (0–81)	24.33±7.28	20.43±6.63	4.844 (324)	**0.001**	3.91(2.32-5.49)
MUEQ – Workstation (0–6)	1.25±1.23	0.66±0.97	4.608 (324)	**0.001**	0.60(0.34-0.85)
i. Suitable desk height	0.12±0.33	0.09±0.29	0.901 (324)	0.368	0.03(-0.04-0.10)
ii. Enough space at workplace	0.25±0.43	0.18±0.39	1.461 (324)	0.145	0.07(-0.02-0.16)
iii. Adjustable chair	0.25±0.43	0.08±0.28	3.745 (324)	**0.001**	0.16(0.08-0.25)
iv. Chair supports lower back	0.43±0.50	0.18±0.39	4.697 (324)	**0.001**	0.25(0.14-0.35)
v. Keyboard placed in front	0.13±0.33	0.07±0.25	1.772 (324)	0.077	0.06(-0.01-0.13)
vi. Screen placed in front	0.08±0.28	0.06±0.23	0.867 (324)	0.387	0.03(-0.03-0.08)
MUEQ – Body posture during work (0–24)	9.11±3.21	7.12±3.30	5.342 (324)	**0.001**	1.98(1.25-2.72)
MUEQ – Job control (0–27)	3.35±3.72	2.95±3.55	0.962 (324)	0.337	0.40(-0.42-1.22)
MUEQ – Job demands (0–15)	6.91±3.24	5.84±3.33	2.838 (324)	**0.005**	1.06(0.33-1.80)
MUEQ – Break time (0–9)	3.71±2.36	3.85±2.13	-0.543 (324)	0.587	-0.14(-0.65-0.37)

Table 3: Relationship of different work factors with musculoskeletal complaints among computer users.

Work-related factors (n=326)		Any complaints of pain or Discomfort in muscles after joining the profession				Any Pain/Discomfort in your upper extremity during the last 7 days			
		Yes	No	p-value	Chi-square	Yes	No	p-value	Chi-square
Job contract	Temporary	48	36	0.232	1.427	24	60	0.628	0.235
		23.5%	29.5%			24.0%	26.5%		
	Permanent	156	86			76	166		
		76.5%	70.5%			76.0%	73.5%		
Job duration	≤ 2 yrs.	131	79	0.125	4.153	65	145	**0.038**	6.548
		64.2%	64.8%			65.0%	64.2%		
	> 2 to ≤ 4 yrs.	38	14			22	30		
		18.6%	11.5%			22.0%	13.3%		
	> 4 yrs.	35	29			13	51		

		17.2%	23.8%			13.0%	22.6%		
Working days per week	≤ 3 days	11	1	**0.001**	20.912	7	5	**0.001**	13.477
		5.4%	0.8%			7.0%	2.2%		
	> 3 to ≤ 5 days	47	56			19	84		
		23.0%	45.9%			19.0%	37.2%		
	> 5 to ≤ 7 days	146	65			74	137		
		71.6%	53.3%			74.0%	60.6%		
Hours spent in front of computer at workplace	≤ 3 hrs.	49	32	**0.035**	6.713	19	62	0.139	3.945
		24.0%	26.2%			19.0%	27.4%		
	≤ 6 hrs.	61	21			31	51		
		29.9%	17.2%			31.0%	22.6%		
	> 6 hrs.	94	69			50	113		
		46.1%	56.6%			50.0%	50.0%		

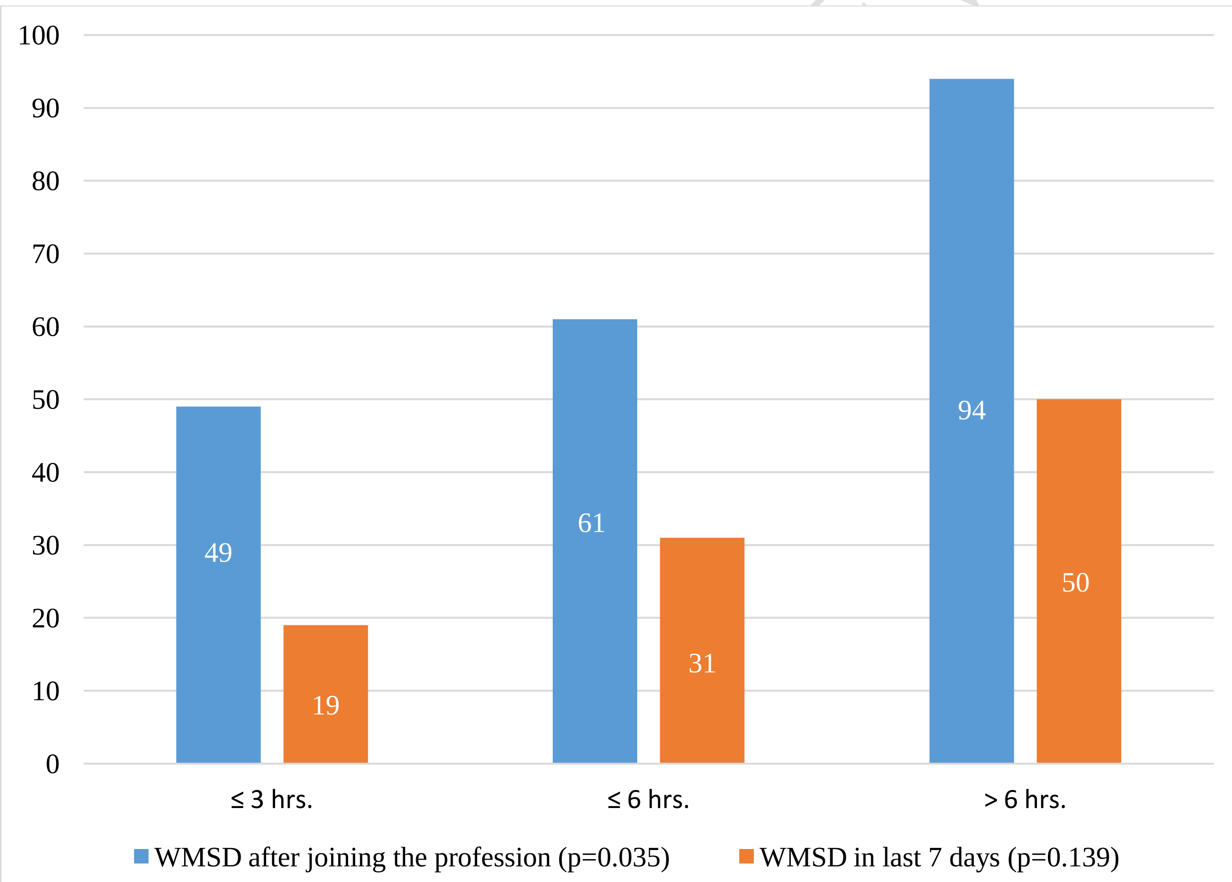

Figure 2: Relationship of WMSD and hours spend in front of computer at workplace among study subjects

Table 4: Factor loadings and orthogonal VARIMAX rotation (Rotated Component Matrix)

Domain Abbreviated Item description	**Factor 1** (n=326)	**Factor 2** (n=326)
Workstation	**Workstation**	**Computer equipment position**
My desk (table) at work has a suitable height	0.581	0.172
I have enough space to work at my office	0.607	0.143
I can adjust my chair height	0.795	-0.147
My chair supports my lower back	0.572	-0.029
My keyboard is placed directly in front of me	0.096	0.829
The Screen is placed directly in front of me	-0.005	0.821
Eigen value	1.730	1.380
Percentage of Variance	28.83	22.96
Domain Abbreviated Item description	**Factor 2** (n=326)	**Factor 3** (n=326)
Body posture	**Bad work practices**	**Asymmetric work posture**
When I use the keyboard, my hand is not in a straight line with my arm	-0.2	0.546
When I work my head is bend.	0.514	0.095
During my work, I keep an asymmetric work posture	0.043	0.781
At work, I sit for long hours in one position	0.72	-0.091
For 2 hrs./day I work with lifted shoulders	0.753	-0.045
I do not alternate in my body posture	-0.006	0.659
Eigen value	1.32	1.11
Percentage of Variance	16.52	13.87
Domain Abbreviated Item description	**Factor 1** (n=326)	**Factor 2** (n=326)
Job Control	**Decision power**	**Skill & proficiency**
I participate with other colleagues in decision taking	0.511	-0.051
My work develops my abilities.	0.189	0.578
I decide on how to perform my job task.	0.602	0.406
In my work, I have the chance to learn new things.	-0.424	0.680
I have to be creative in my work.	0.486	0.553
I determine the time & speed of job tasks.	0.721	0.287
I solve work problems by myself	0.687	0.295
I undertake different types of tasks in my work	0.405	0.580
I can divide my work time	0.194	0.553
Eigen value	3.24	1.11
Percentage of Variance	35.99	12.35
Domain Abbreviated Item description	**Factor 1** (n=326)	**Factor 2** (n=326)
Job Demand	**Effective time planning**	**Work burden**
I work under extensive work pressure	0.60	0.068

I find it difficult to finish my tasks on time	0.802	0.067
I do not have enough time to finish my job task	0.839	0.046
At work, I speed up to finish my tasks on time	-0.039	0.834
I find my work tasks difficult.	0.182	0.771
Eigen value	1.85	1.20
Percentage of Variance	36.94	23.91
Domain Abbreviated Item description	**Factor 1** (n=326)	**Factor 2** (n=326)
Break time	**Work without screen**	**Work recess**
I can plan my work breaks	0.05	0.847
I perform job tasks without a computer.	0.97	-0.021
After 2 hrs. I take a break for at least 10 minutes.	-0.049	0.847
I alternate with my job task	0.97	0.023
Eigen value	1.89	1.44
Percentage of Variance	47.15	35.9

Table 5: Internal consistency (reliability) and Item-total correlation of the Factors / Subscales

Domain	Subscales (n=326)	Internal Consistency (Cronbach's alpha)	Item total correlation	Item numbers
Workstation	Subscale 1: Work Area Subscale 2: Computer position	0.51 0.57	0.24-0.46 0.40, 0.40	12, 13, 14, 15 16, 17
Body posture	Subscale 1: Bad work practices Subscale 2: Asymmetric work posture	0.48 0.40	0.29-0.33 0.18-0.29	19, 23, 24 18, 22, 25
Job Control	Subscale 1: Decision power Subscale 2: Skill & proficiency	0.67 0.28	0.26-0.58 0.15-0.28	26,28, 31, 32 27, 29, 30, 33,34
Job Demand	Subscale 1: Effective time planning Subscale 2: Work burden	0.62 0.46	0.31-0.52 0.30, 0.30	35, 36, 37 38, 39
Break time	Subscale 1: Work without screen. Subscale 2: Work recess	0.61 0.94	0.44, 0.44 0.88, 0.88	40, 42 41, 43

Table 6: Percentage of response option for each item listed in the main domains

Domains	**Percentage of response**	
Workstation	**Yes**	**No**
Suitable height of desk	89.0	11.0
Enough space at office	77.6	22.4
Adjustable chair height	81.6	18.4
Chair supports lower back	66.6	33.4
Keyboard is placed in front	89.6	10.4
Screen is placed in front	92.6	7.4

Body posture	Always	Often	Some-times	Seldom	Never
While using keyboard, hand is not in a straight line with arm	4.0	3.1	32.8	36.5	23.6
While working on computer:					
Head is bended.	16.9	23.3	39.6	6.1	14.1
Neck is twisted	15.0	25.5	32.5	11.3	15.6
The trunk is twisted	10.7	24.8	32.8	12.3	19.3
Keep an asymmetric posture	6.7	8.3	23.9	27.3	33.7
Sit for long hours in one position	25.5	26.4	23.0	8.3	16.9
For 2 hrs./day, work with lifted shoulders	12.9	22.1	34.4	13.2	17.5
Do not alternate in body posture	5.8	10.7	36.5	29.4	17.5
Job Control					
Involve in decision taking	42.9	24.2	24.5	3.4	4.9
Work develops abilities.	62.3	21.2	13.5	1.5	1.5
Liberty in deciding ways of doing job task.	56.7	26.1	12.6	2.5	2.1
Get chance to learn new things.	57.4	21.5	14.7	4.9	1.5
Need creativity in work	58.3	16.9	17.5	3.7	3.7
Liberty of determining the time & speed of job tasks.	54.0	23.6	14.7	4.3	3.4
Independently solving work problems	45.1	31.6	17.5	4.6	1.2
Different types of tasks at work	36.8	33.1	21.8	7.1	1.2
Liberty in dividing work time	40.8	23.9	19.6	5.8	9.8
Job Demand					
Working under extensive work pressure	21.8	26.7	27.6	8.9	15.0
Difficult in finish job tasks	16.3	17.2	30.1	18.7	17.8
Insufficient time to finish job task	8.9	18.4	26.1	18.4	28.2
Have to speed up to finish tasks on time	44.2	24.5	19.3	8.6	3.4
Work tasks seem difficult.	18.4	14.7	36.8	15.6	14.4
Break time					
Freedom in planning work breaks	31.9	20.2	27.6	6.1	14.1
Perform job tasks without a computer.	9.5	9.2	20.2	10.7	50.3
Take a break (at least 10 min.) after every 2 hrs	21.2	24.5	26.4	13.5	14.4
Alternate with job tasks	9.2	11.7	21.2	18.1	39.9

DISCUSSION:

In this study, the frequency of lifetime and immediate upper extremity complaints was 62.6% and 30.7% respectively, similar to the study conducted by Fatemah et.al. [30]. Another study conducted in Pakistan by Arsalan et.al. on 300 office workers showed that 29.2% of computer users were experiencing low backache at the time of the survey and 69.2% experienced it at least once in their lifetime [31].

Considering the risk factors, adjustable chair, placement of VDT display, sitting in one position for long hours, and work-psychosocial factors are associated with MSDs [31]. This study showed a statistically significant relationship between MSDs and workstation factors ($p<0.001$) in which an adjustable chair and proper back support were important for determining the symptoms (Table 2). Moreover, body posture practices ($p<0.001$), including keeping the same posture for many hours and job demand domain like extensive work pressure are also related to WMSDs ($P=0.005$ for both). One of the studies done by Larsen showed that job control is significantly related to MSDS [13] while Baek reported that job control had a role in it [32]. Our study gave the same results as the later study ($p=0.337$). Robertson reported that on day three of work, the WMSDs were less common in ergonomic trainees relative to less trained participants. He also projected that facilitating computer users with a comfortable workstation with adjustable chairs gave them control over their workstation [33].

The current study showed that job demand was related to MSDs ($p=0.005$). So, It can be concluded that psychosocial stressor directly affects MSDs. Griffith et al reviewed the impact of an increasingly using computers at the workplace on the physical and psychological well-being of professional occupations. The survey concluded that in response to workload, deadline, and performance monitoring pressures, many professional workers are often encouraged to perform long hours of computer work with high mental demands resulting in extreme muscle tension and forces [34].

Moreover, bad work posture was also associated with MSDs ($p<0.001$). Some of the studies stated that the musculoskeletal symptoms are due to uninterrupted computer work, bad sitting posture, and substandard ergonomics [35, 36]. Moreover, the decreased rate of rest breaks of changing posture during computer work, and a long period of continuously maintaining the same posture during computer work were seemed to be directly related to musculoskeletal symptoms [37-39].

Furthermore, upper extremity pain seemed to be directly related to the duration of exposure to the computer like duration of the computer-related job ($P=0.038$), the number of days per week ($p<0.001$), and per daytime of using a computer ($P=0.035$). These results are reinforced by other studies [2, 30, 31].

The results of factor analysis in this study showed that each domain constituted the two scales that were collectively responsible for 50% variance. The scales identified were based on the factor loading of all items in each domain. The interpretation of factor loading was easier as all those items that are loaded towards one factor contributed to that scale. For example, in the job control domain, two scales were extracted. One was "Decision power" which showed the authority of employees to do work with ease and the others was "Skill & proficiency" which showed their ability and creativity during their jobs at the best possible way. The items included in each factor are very much similar to another study done by Eltayeb [5].

Moreover, the reliability coefficient should be 0.7 or more to get into an acceptable range [5]. In this study, Cronbach's alpha of most of the scales was less than 0.7 mainly due to the limitation in sample size, and almost in all domains items are reduced in number than the original standardized MUEQ to make the questionnaire a bit smaller and to increase the response rate. So all subscales cannot be evaluated which might be a reason for such a low value of Cronbach's alpha. The domain break time had the subscale such a good value of Cronbach's alpha (0.94), this is because the questions related to that domain were easy to understand by the workers

Many studies revealed that both physical and psychosocial factors are involved in causing MSDs, but conclusive results were not found in any study [5, 40] (S. M. Eltayeb et al., 2008; Ranasinghe et al., 2011).

In this study, 82% and 67% of participants reported that they have an adjustable chair and their chair supports their lower back respectively to prevent these MSDs (Table 5) while most (92.6%) of the respondents stated that they maintain an appropriate distance with their computer screen and 86.6% of computer workers had keyboard just in front of them. Inappropriate distance between computer screen and eyes [15] and inappropriate keyboard placement are two of the principal factors causing neck pain [41].

Only 15% of participants always/often and 24% sometimes (Table 5) maintain asymmetric posture during working on a computer which may worsen their symptoms. Continuous sitting in one position without break was found in 75% of the participants. Khalil and Rosemoff (Khalil, 1993) stated that bad work posture leads to tiredness and discomfort in back muscles. Other studies also showed the same results, so taking gaps between work [42], proper back support, and stretching exercises could be beneficial in preventing low back pain [43].

In one study, Louise B. et al wrote that 73% of subjects reported low job control [13] while in this study only 8% reported that they cannot determine the time and speed of their work

Stress due to work is a multifaceted problem with the complex interaction of a person and his work environment involving multiple gestures and actions [44]. 48.8% felt extensive work pressure. In the current study, 85% of participants felt somewhat work pressure, and job demand was linked with MSDs (p=0.005). Twenty-four percent of participants took no break while 19.6% takes regular breaks of more than 15 minutes after every 2 hours while the duration of break is not significant (p=0.587). In a study by Henning et al. [45], small gaps while using a computer decreased the frequency of distress due to musculoskeletal symptoms and problems caused by a sedentary work routine.

MSDs had a strong relationship with workstation factors and specifically lack of adjustable chair and chair supporting back, body posture and job demand. Moreover, MSDs after joining the computer related profession was associated with increasing working days and hours spend in front of computer.

Musculoskeletal complaints can be prevented by erect posture if a computer worker has to do work on the computer for long hours without break [24]. This can be achieved by giving awareness to workers about proper work position [25] and avoiding monotonous work [10], while, Shoulders and trunk can be adequately supported by the proper adjustable chair that helps in preventing these complaints [46].

One limitation of this study was, this study was a cross-sectional study so the temporal relationship cannot be done. In the future, a prospective study should be required to do that. Secondly, Cronbach's alpha was not up to the mark mainly because of the relatively small sample size of the previous studies and the current questionnaire cannot evaluate the psychosocial factors in detail.

CONCLUSION:

The lifetime frequency of musculoskeletal complaints was 0.63, which was more related to the workstation control, body posture, job demand, number of days, and hours spend using the computer. The questionnaire to be tested has a diverse range of reliability and consistency with some domains having satisfactory values when we reported MSDs in Pakistani educated population. We explored the physical and psychosocial aspects of computer-related jobs, further exploration of these domains is needed among different occupations and subscales recognized during factor analyses should be further examined in a follow-up study.

CONSENT:

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this research study.

ETHICAL APPROVAL:

This research study has been approved by the appropriate ethics committee of Fatima Memorial System.

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