Impact of Training Program on Awareness and Practice of Computer Ergonomics among Academic Staff

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ABSTRACT

In this advanced era, the education curriculum has a significant dependence on the use of modern technological devices such as computers. Improper use of such devices may, however, accompany a number of occupational health hazards like repetitive strain injuries. This in turn can affect the productivity of academic staff. The purpose of the study was to assess the knowledge and practice of computer ergonomics and its associated health-related disorders and also to evaluate the effectiveness of training in the given matter.

Quasi-experimental research design; one group pretest-posttest of 103 academic staff of two private and two public universities in Dhaka was employed to observe the effectiveness of computer ergonomics training. The study participants were subjected to self-report inventory and observation of computer workstation. Moreover, in-depth interviews were conducted on six participants. After the baseline survey, participants were given training in computer ergonomics and a three month window period was allotted before post-training evaluation.

Findings reveal that the major reported pain was in the back, shoulders and neck region. Multivariate analysis shows back pain (p=0.048) and overall MSE pain (p=0.043) to be significantly higher among public university academic staff. The reported complaints among males to some extent was more for shoulders as compared to females (p=0.005). Back pain was lower among those who knew proper distance, height and location of the monitor (p=0.026) and practiced appropriate position of the keyboard and mouse (p=0.026). Neck pain was more among participants below 40 years of age (p=0.048). Then again, it was less for those who knew height adjustments of the workstation chair (p=0.008) and practiced proper monitor angling (p=0.002). Overall MSE pain was lower among participants who knew proper seat tilt, depth and width pan of the chair (p=0.002) and practiced proper monitor angling (0.001). Furthermore, Mcnemar test results show that the awareness and practice related to computer ergonomics significantly increased after training (p=0.000).

As analysis reflects, MSDs are less among academic staff who have better knowledge and practice computer ergonomics. Also, the given training is seen to be effective to enhance the knowledge and practice related aspects. Nonetheless, to reduce and prevent the overall risk of MSDs, a multi prolonged approach is required.

Keywords: Computer ergonomics, Academic staff, MSDs, Training, Bangladesh

ABBREVIATIONS

BRACU	Brac University
CTS	Carpal Tunnel Syndrome
CVS	Computer Vision Syndrome
DU	Dhaka University
FIU	Fareast International
ICT	Information and Communication Technologies
JnU	Jagannath University
MSD	Musculoskeletal Disorder
MSE	Musculoskeletal Extremity
MUEQ	The Maastricht Upper Extremity Questionnaire
NIOSH	The National Institute for Occupational Safety and Health
RSI	Repetitive Strain Injuries
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organization
WMSD	Work-related Musculoskeletal Disorder

Chapter 1: Introduction

1.1 Background

In every sphere of life, the dependence on computers is rising. The technological revolution is taking place in almost every work sector. This is happening more so rapidly because of it's enormous benefits in extending human capacity (Bairagi et al., 2011). Since the requirement to use such tools becomes necessary, it is often used by academic staff for several purposes like facilitating or disseminating communication. Though this sort of convenience has led to the rising usage of such resources; on the contrary, it has created a risk for related occupational health hazards (Jensen et al., 2002). As for the teaching profession, very little has been studied from the perspectives of computer ergonomics (Bennett et al., 2006).

The higher academic institutions of Bangladesh are pioneers in adopting and using Information and Communication Technologies (ICTs) and among 35 public and 79 government approved private universities, most of them have internet-based facilities (UGC Bangladesh, 2014; Roknuzzaman, 2006). A study in the Khulna division of Bangladesh observed 55.87% of the university teachers to have ICT knowledge as compared to the supporting staff with 39.37% knowledge on the given matter (Bairagi et al., 2011).

As with the concept of ergonomics, the word is derived from the Greek word ergon meaning work and nomos meaning law (Rwamamara & Smallwood, 2009). According to International Ergonomics Association (IEA, 2014) "Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance."

In simpler terms, Ergonomics is the scientific study of people and their work (Stranks, 2007). The factors that contribute to the aspect of ergonomics include body posture and movement (sitting, standing, lifting, pulling and pushing), environmental factors (noise, vibration, lighting, temperature), and work itself (appropriate tasks, interesting jobs) (Dul et al., 2008).

Studies have increasingly shown that extended periods of work in an inappropriate workstation for a long time can adversely lead to work-related musculoskeletal disorders (WMSDs) (Sirajudeen et al., 2013). Musculoskeletal disorders (MSDs) is an umbrella term used to describe a variety of conditions that affect the muscles, bones, joints, ligaments and nerves (Luttmann et al., 2003). It can be caused due to a number of reasons. While MSDs severity may vary with age, the daily activities could be affected by pain and discomfort (Jensen et al., 2002). The term "work-related" disorders is distinguished from "occupational" disorders where a single factor is both necessary and sufficient to cause the disease (WHO, 1985).

MSDs can cause discomfort in the neck, shoulders, arms, elbows, wrists, hands, back, legs and feet areas (Sharan et al., 2011). The symptoms may include tenderness, aches, tingling, stiffness as well as swelling. (Moom et al., 2015). Moreover, aspects such as job satisfaction, demanding workload, monotonous work, job control, and social support are five identified psycho-social factors found to be related to MSDs (NIOSH, 1997). Repetitive works and awkward motion of the fingers, hands and wrists, have been proposed to have a possible cause of injury because of prolonged use of the keyboard and mouse (Village et al., 2005). These disorders range from discomforts, minor aches to more severe and even medical circumstances that may require time off the job and seek medical attention (Sharan et al., 2011).

Without treatment, the symptoms of WMSDs can become constant and cause permanent disability or body malfunction (Canadian Centre for Occupational Safety and Health, 2014). Additionally, musculoskeletal conditions make up the largest proportion of workplace productivity loss (WHO, 2019). Nonetheless, early diagnosis is the key to alleviating pain while reducing further harm to the body (Jensen et al., 2002).

Global estimates show 20%–33% of people live everyday with painful musculoskeletal conditions (Vos et al., 2016). Furthermore, between 1990 and 2016, musculoskeletal conditions are estimated to have increased by 61.6 percent worldwide. (Briggs et al., 2018). The Global Burden of Disease (GBD) study provides evidence of the impact of musculoskeletal conditions as the second highest contributor to global disability (Voset al., 2016).

In one of the studies, the prevalence of self-reported MSDs among teacher's ranged from 39% to 95% and another study found that the prevalence of WMSDs among faculty members was 55% (Erick & Smith, 2011; Sirajudeen et al., 2018). Despite the fact that the prevalence of musculoskeletal conditions rises with age, often young individuals are seen to be affected during their highly productive years (WHO, 2019).

In a diverse work setting, ergonomics training is seen as the best initial strategy to educate computer users about office ergonomics (Westgaard & Winkel, 1997). Disseminating effective educational intervention not only improves its awareness and practice but is also assumed to reduce the associated health risk factors (Hultman et al., 1995).

1.2 Justification for the study

The study has been conducted for several vital reasons. The specific reasons were:

- Almost all academic staff use computer/laptop regularly for a significant period.
- Improper use invariably gives rise to MSDs which decreases the efficiency of work.

- Training in appropriate computer use can reduce MSDs and improve the working capacity.
- Limited number of studies have been carried out in our country on this issue and no study particularly focuses on academic staff at universities.

1.3 Research questions

- Research questions 1 – What percentage of academic staff are aware of computer ergonomics and how much of it do they practice?
- Research question 2 – What percentage of academic staff have MSDs?
- Research question 3 – Does training in computer ergonomics increase awareness and practice and reduce WMSDs?

1.4 Objectives

- The aim of this study was to assess the knowledge and practice of computer ergonomics among the academic staff of public and private universities in Dhaka. It tried to explore the implications of training in increasing the awareness and practice related to computer ergonomics for reducing associated health risk factors.

Chapter 2: Literature Review

In several studies, musculoskeletal pain has been associated with teaching profession as a major health issue. To provide more insights about the matter, the literature is organized according to different themes which are, the prevalence of MSDs, causes of MSDs and training in relation to computer ergonomics and academic staff.

2.1 Prevalence of MSDs

A study by Sirajudeen et al. (2018) determined the prevalence of WMSDs in any body region as 55%. This was measured by a self-administered questionnaire of 60 faculty members via a cross-sectional study among the college of Applied Medical Sciences of Majmaah University. The major reported complaint was seen to be in the neck region (53.5%), followed by lower back (43.3%) and then hand region (31.6%). The cause of these complaints was associated with the lack of computer ergonomic training.

In Vaghela and Parekh's (2017) investigation, the prevalence of the MSDs among 314 school teachers aged between 22 - 59 years assessed with the modified Nordic questionnaire was found to be 71.95%. Moreover, female teachers were seen to be more affected (72%) than male teachers (28%). Overall, musculoskeletal pain was most often seen in the region of the shoulders, knees, and back.

Iti, Nigudgi, and Reddy (2017) interviewed 79 teaching-staff and 319 third-year students of the computer science department in Gulbarga city using the Nordic questionnaire. Statistical significance shows that the most disabling MSDs were reported in the upper back, lower back, neck and wrists/hand regions.

The literature reviewed by Mesaria and Jaiswal (2015) on the prevalence of MSDs among school teachers depicts Turkey, China, Australia, Brazil, Sweden, Germany, Estonia, Japan, Malaysia, Philippines, France, Greece and the United States as having shown a high prevalence rate as compared to other occupational groups. The teachers also reported musculoskeletal pain in neck, shoulders, lower back, hands, wrists and knees.

A study by Erick and Smith (2014) investigated the prevalence, risk factors and impacts of MSDs among school teachers in Botswana via a self-administered questionnaire. It showed that over 50% of the teachers reported upper back, shoulders and neck as common discomfort areas followed by the feet, knees and wrists/hands. Also, the prevalence of MSDs was 83.3%. Among individual factors, sex and age were associated with MSDs. Moreover, awkward arm position and high psychological job demands were positively associated and physical exercise and supervisor support were negatively associated.

Additionally, a survey carried out by Li, Yue, and Liu (2012) using the Nordic musculoskeletal questionnaire showed 59.5% of the school teachers reported of having at least one WMSD. The 1-year prevalence of WMSDs shows neck, shoulders and low back regions to have the highest complaints. However, the senior middle school teachers showed higher prevalence as compared to the primary and junior middle school teachers.

2.2 Causes of MSDs

Ng, Ibrahim, and Maakip (2017) reviewed literature from 2006 to 2016 on the the risk factors of musculoskeletal disorders among primary and secondary school teachers in Malaysia. The analysis depicts secondary school teachers having a greater risk of MSDs compared to primary school teachers. Moreover, prolonged sitting and standing, long hours of work with computers, and correcting test papers were seen to be contributary factors to the development of MSDs. However, studies show a lack of high-quality researches in both the developed and particularly in developing countries.

Another study by Erick and Smith (2013) reviewed a number of research work that seems to show risk factors of MSDs among teachers varies by sex, age and teaching experience. In fact, poor posture, inappropriate furniture, lifting and carrying things inappropriately is viewed as high prevalence factors. Additionally, psychosocial matters such as poor colleague relations, low support from supervisor, high job stress and low job satisfaction and are seen to be associated with MSDs.

Besides, Ellahi, Khalil and Akram (2011) studied the prolonged use of computers and their effects on employee health. Their findings reveal health disorders such as MSDs, carpal tunnel syndrome (CTS), computer vision syndrome (CVS) and stress occur simultaneously among prolonged computer users. The study also suggests employees who use computers daily for more than four hours are more likely subjected to the risks of all these four health-related disorders.

Futhermore, Canadian Centre for Occupational Safety and Health (2014) stated that WMSDs progresses in many stages. During work, the initial stages of Repetitive Strain Injuries (RSI) involve aching and tiredness of the affected area. However, these symptoms do not last long and are rarely noticed. Soon it is followed by pains appearing at night or during working hours.

In the findings of the study of Li et al. (2012), uncomfortable back support, prolonged static and sitting posture is associated with WMSDs. Similarly, in Mesaria and Jaiswal's (2015) analysis, factors such as long work hours, work environment, high stress, low family and community support are seen to be related to MSDs.

2.3 Training in computer ergonomics

Shuai et al. (2014) performed a self-controlled longitudinal study with pre/post design to evaluate the effects of intervention among 350 school teachers. Participants received eight weeks of intervention that included participatory ergonomic training and occupational health education. Two post-tests were administered to the participants one after six months and another after twelve months. The self-reported prevalence of WMSDs for neck, shoulder, upper and lower back regions were lower than before. Interventions based on occupational health education lectures, on-site ergonomics training, brochures and posters showed a positive effect on the prevention and control of WMSDs in teachers.

Additionally, an investigation carried by Devesh and Bimani (2012) reported that the teaching program on ergonomics for computer use is associated with improved knowledge and quality of work environment. The mean score of the experiment showed the knowledge of the staff on computer ergonomics before the training was 9.36 and after training it increased to 15.99.

Chapter 3: Research Methodology

For the purpose of the study, a mixed research methodology was applied. Both qualitative and quantitative approaches complemented each other in order to enhance the completeness of the study. As far as the quantitative part is concerned, a quasi-experimental design, one group pretest-posttest method was applied. And, for the qualitative part, in-depth interviews were carried out. The selected population were the academic staff of public and private universities of Dhaka city, Bangladesh. By considering the nature of this research, it can thus be called an exploratory research.

3.1 Variables

Based on the research questions and objective of the study, the identified variables were categorised in two segments. One was to assess the awareness and practice related to computer ergonomics. For this, the selected variables were:

Independent Variable: Duration of computer use, ergonomics training, sex, and age.

Dependent Variable: Knowledge and practice of computer ergonomics

And for the other, i.e. to assess MSDs among academic staff, the selected variables were:

Independent Variable: Duration of computer use, ergonomics training, sex, age and knowledge and practice of computer ergonomics.

Dependent Variable: MSDs (RSI, neck pain, back pain, etc).

These variables were selected because of the accessed literature. Numerous research findings depict these independent variables as associative factors for MSDs. Thus, these variables were considered.

3.2 The sampling technique

The data was collected using a multi-stage sampling process. In the first stage, private and public universities were considered as strata and inside this strata, universities were considered as cluster. Then in the second stage, two universities from private sector (stratum) and two universities from public sector (stratum) were randomly selected by equal allocation method. This was done by preparing separate lists for public universities and private universities in Dhaka city by alotting serial numbers. From each list, two universities were chosen by picking out random numbers from it. The selected universities were Jagannath University (JnU), Brac University (BRACU), Fareast International University (FIU), and Dhaka University (DU).

In the subsequent stage, teachers from different departments of the selected universities were approached. 103 sample units were possible to collect for the initial baseline survey. After that, based on the participants current knowledge, attitude and practice of computer ergonomics, the participants who fulfilled the selection criteria were selected for the training program. Out of these 103 participants, all of them provided their consent to participate in the training. Fig 3.1 shows the sample frame of the study. Subsequent to the training, a three month window period was allotted before completing the post evaluation.

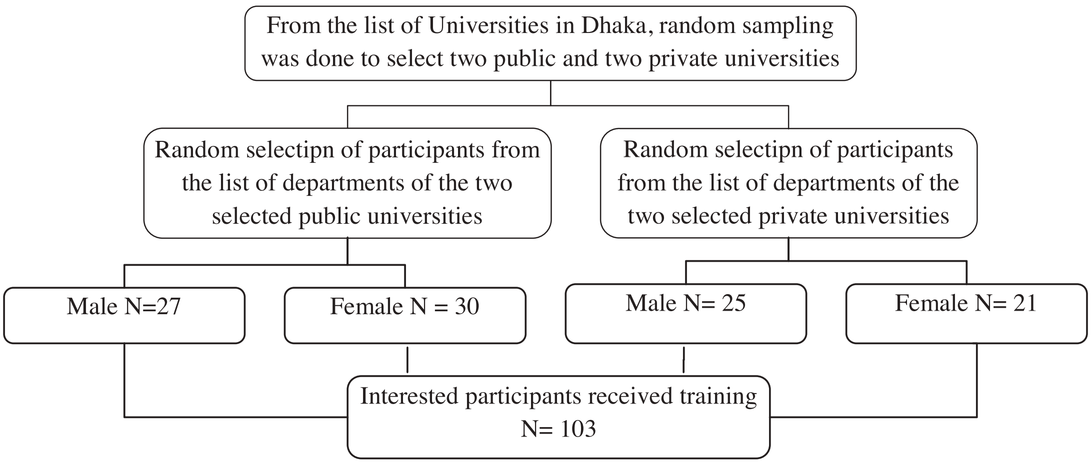

Figure 3.1 : Graphical representation of the sample frame

The inclusion criteria for the study participants were; age less than 50 years, use computers for more than 10 hours per week, lack of awareness and practice related to computer/laptop ergonomic factors and willingness to take part in the training program. Therefore, anyone who did not meet these criteria was automatically excluded from the study. Even though our inclusion criteria for age was 50 years and below, there were three participants who showed interest in being a part of the study. These three participants were in between the age of 55 years. In addition, academic staff who were disabled for having other medical causes of MSD's was also excluded from the study. These requirements were mainly set after going through related literature. Providentially, the numbers of male and female participants in this study are almost equal i.e. 51 female participants 52 male participants with equal proportion to size.

When we initiated the data collection for the baseline survey, about 400 teachers were approached from various departments who fulfilled one of our inclusion criteria, i.e. age less than 50 years. Among them, 115 participants provided their consent and were willing to participate in the study. However, the final data was received from 103 participants out of the 366 targeted sample units. Initially, this was calculated by taking the prevalence of MSDs 39% from the study of Erick & Smith (2011) as our P and using the calculation, sample size (n)= pqz2 / d2, we found our sample size 366 (z= 95% confidence interval= 1.96, d= error permitted in the study= 5%, q= p-1). From the 366 sample, 140 participants who fulfilled the inclusion criterias were supposed to be targeted for training. However, as the final data is received from 103 participants, therefore 263 sample units are considered as missing in this case.

The number of respondents who did not participate in the study is much higher than what we had expected prior to data collection. As the participants were approached on a random basis, therefore based on our observation, the characteristics (age, sex, job experience, education background) of the participants who took part in the research study are similar in nature as compared to those who did not participate.

3.3 Ethical consideration

The following ethical considerations were upheld:

- Participant's privacy were supported.
- Informed consent was taken prior to data collection.
- Individual data is kept confidential, and group data is used for the presentation of results.

3.4 Data collection

The data has been collected from March 2018 to November 2018; however, the pre-training data was gathered until August 2018. For the quantitative data collection, self-report inventory and observation methods were mainly used.

For qualitative data, in-depth interviews were conducted. The semi-structured interviews were taken for the participants who showed a keen interest in the topic and provided detailed information. The information gathered from the participants was later transcribed.

3.4.1 Questionnaire

- This research consisted of six questionnaires in total. Among the six questionnaires, the Computer Use Checklist and the Complaint section was adopted and modified from The Maastricht Upper Extremity Questionnaire (MUEQ).[1] The MUEQ is a tool to examine the physical, psychological and environmental risk factors in the workplace that may contribute to the prevalence of MSDs (Mohammadipour et al., 2018). Factor analysis and Cronbach's alpha coefficient of a study indicate the results are generalizable to the population and the total scale has high internal consistency (Bekiari et al., 2011). The Computer Use Checklist consisted of eight sections and the statements are responded in a likert scale from always to never. Originally in MUEQ, there are seven sections in total. The Complaint section consisted of six segments that assess upper extremity body pain risk factors and its causes if any.

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[1] The Maastricht Upper Extremity Questionnaire (MUEQ)

- Ergonomic Assessment Checklist (Computer Workstation Observation) has been adopted from Computer Workstation Ergonomic Self Assessment Checklist by the University of Melbourne[2] and Ergonomics Checklist - Computer and General Workstations[3] (Enos, 2012.) This checklist consisted of five sections. It tried to assesses the set up of computer workstation in the workplace.

- Computer Ergonomics Pre-Training Survey contained 9 items and the Post-Training Evaluation Form contained the same 9 items like the pre-training survey with an addition of 7 more items. This survey tried to assess an individual's knowledge about computer ergonomics and how much one practices it's principles before and after training.

- Post-training feedback was another segment of 9 items which was to rate the participant's feedback regarding the given training.

The questionnaire was drafted and pretested on academic staff from different universities. The feedback gained during the pilot testing was incorporated in the questionnaire and finalized for data collection.

3.5 Training program

- After the initial baseline survey on awareness and practice of computer ergonomics, the trainers emphasized on the proper computer use postures that, if maintained, can reduce the risk of MSDs. The training included graphical presentation on appropriate computer use postures and some associated precautionary measures, simultaneously involving practical demonstration.

- The materials included in the training were a training booklet, two A2 size posters (both hard and soft copy) that includes appropriate personal computer workstation setup and stretches to be performed while/ after using computers. The posters include graphical representation with instructions. For the trainer's reference, a training checklist was maintained regarding the points to be emphasized during the training. These materials have been developed with reference to Office Ergonomics Guidelines for preventing Musculoskeletal Injuries.[4]

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[2] Computer Workstation Ergonomic Self Assessment Checklist. University of Melbourne. Available at:https://safety.unimelb.edu.au

[3] Ergonomics Checklist - Computer and General Workstations, Avilable at: https://www.wsha.org/wp-content/uploads/Worker-Safety_Computer-Ergo-checklist-LONG-HumanFit.pdf

[4] Work Safe, Travail Securitaire, January 2010. Office Ergonomics. Guidelines for preventing Musculoskeletal Injuries.

3.6 Data management and analysis

Collected data were entered into the Statistical Package for the Social Sciences (SPSS) 17 version. After checking and cleaning data, descriptive analysis is done using frequency distribution, cross-tabulation and chi-square. Pearson's Chi-square Test is used because we wanted to measure how well our observed distribution of data fits with the distribution of independent variables (such as age, sex and hours worked per day behind computers).

Besides, the effectiveness of training is compared using McNemar's test to assess the differences between the pretest and posttest results. This statistical test is applicable here as our study used pretest-posttest data analysis of related dichotomous variables (e.g., yes or no response). Also logistic regression is used for analyzing the multiple explanatory variables associated with the dependent variable (such as MSDs).

Chapter 4: Results

Academic staff of two private and public universities from Dhaka, Bangladesh, were chosen to observe the impact of training program on awareness and practice of computer ergonomics. A detailed analysis of the variables was performed to get the socio-demographic profiles of 103 study participants. The findings are thus described below.

4.1 Demographic profile

Table 4.1 a: Workplace of participants

Organization name	Frequency	Percent
BRACU	36	35.0
DU	24	23.2
FIU	21	20.4
JnU	22	21.4
Total	103	100.0

Table 4.1 b: Job titles of participants

Job titles	Frequency	Percent
Assistant Professor	24	23.3
Associate Professor	7	6.8
Grad Teaching Assistant	2	1.9
Lecturer	62	60.1
Professor	2	1.9
Senior Lecturer	6	5.8
Total	103	100.0

Table 4.1 c: Sex distribution of participants

Sex	Frequency	Percent
Female	51	49.5
Male	52	50.5
Total	103	100.0

Table 4.1 d: Job shift of the participants

Job shift	Frequency	Percent
Fulltime	102	99.0
Part time	1	1.0
Total	103	100.0

Table 4.1 e: Participants work in more than one place

Work in more than 1 place	Frequency	Percent
No	91	88.3
Yes	12	11.7
Total	103	100.0

Table 4.1 (a, b, c, d, e) shows the demographic information of study participants. Most of the participants, i.e. 35% were from BRACU and the rest 65% were from DU, JnU and FIU respectively. The majority of the participants (60.1%) were lecturers followed by (23.3%) assistant professors and of them, 99% worked as full-time faculty and among them, 88.3% did not work at any other institution. On average, the work experience of the study participant's in the same job was for 5.5 years. However, the time of job for the new lecturers was as low as 1 year and for the professors it was as high as 25 years. The participants worked in different academic departments such as English, Business Studies, Computer Science and Engineering, Mass Communication, Chemistry, Political Science, Social Work, Botany, etc. Of all the participants, 50.5% were males and 49.5% were females.

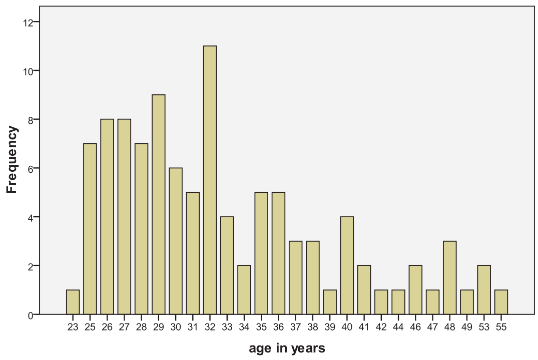


Figure 4.1 a: Age of participants

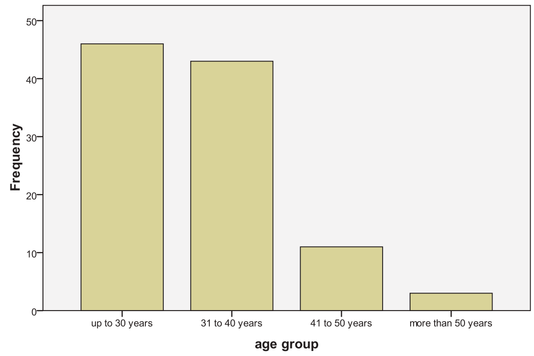


Figure 4.1 b: Age group of participants

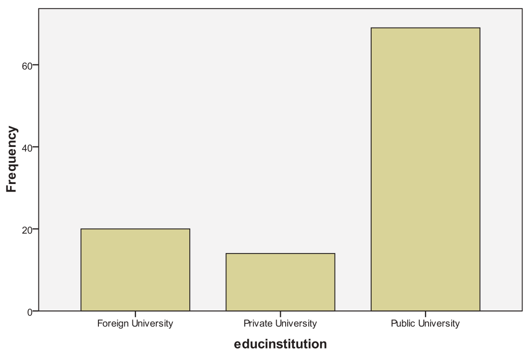


Figure 4.1 c: Education institutions

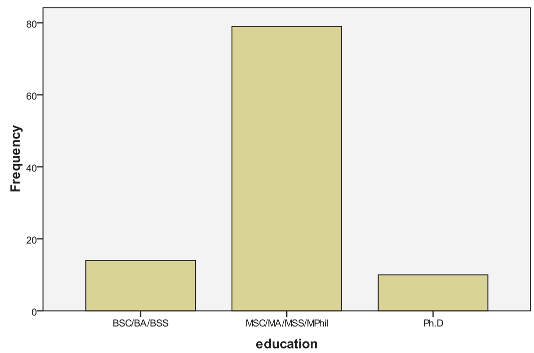


Figure 4.1 d: Education level of participants

Figure 4.1 (a, b, c, d) presents information of the participant's age and education. The average age of the participants was 33.0 years ± 7 years; with maximum age being 55 years and minimum age 23 years. Of them, 44.7% were in the age group of 30 years and 41.7% belonged to 31-40 years age group. Most of the participants (67%) completed their highest education from a public university, 13.6% from a private university and 19.4% from a foreign university. Nevertheless, the majority of the participants (76.7%) were master's degree holders.

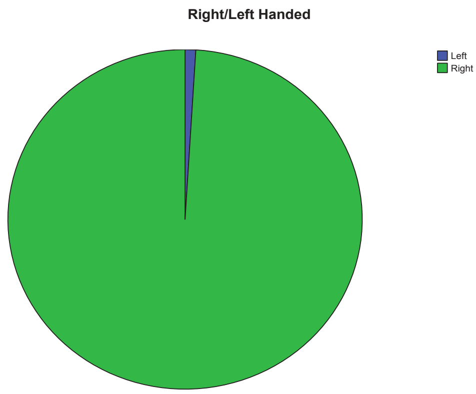


Figure 4.2 a: Right/left handed participants

Figure 4.2 b: Participants with bi/trifocal

Figure 4.2 (a, b) shows that of all the participants, 99% were right-handed, 12.6% used bi/trifocal glasses and the rest 87.4% did not require to use any glasses.

Table 4.2 and Figure 4.3 (a, b, c) illustrates the work pattern of the study participants. The participants reported to work for 35.17 hours ± 5.9 hours per week with a minimum of 8 hours and a maximum of 45 hours. Among them, 77.7% said to work for 31 to 40 hours per week. However, on a computer, the participants worked for 4.69 hours ± 3.5 hours a day. Among them, 77.7% reported to work less than 5 hours and 16.5% worked for 6 to 10 hours per day behind the computers.

Table 4. 2: Group of work hours per week

	Frequency	Percent
up to 30 hours	20	19.4
31 to 40 hours	80	77.7
more than 40 hours	3	2.9
Total	103	100.0

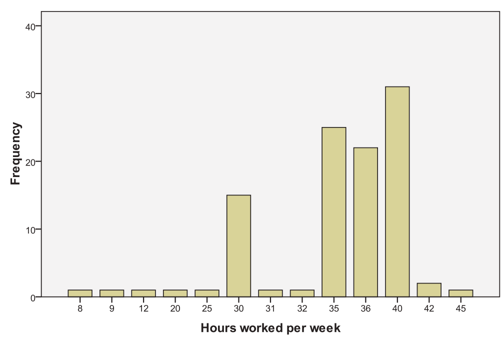
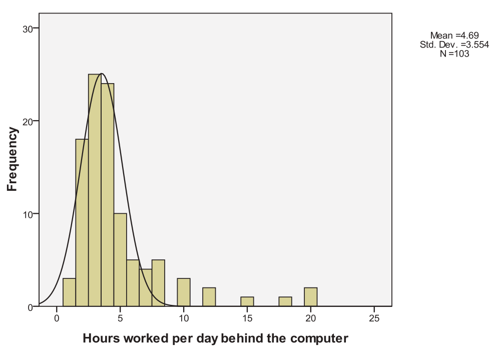


Figure 4.3 a: Work hours per week



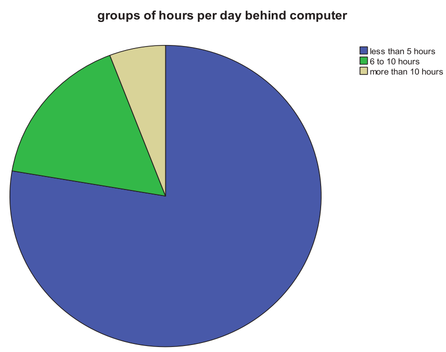


Figure 4.3 b: Histrogram of hours worked per day behind computers

Figure 4.3 c: Group of hours worked per day behind computers

4.2 General work environment

Table 4.3: Characteristics of work station

Work Station	Always %	Often %	Sometimes %	Seldom %	Never %
I like working with computers.	51.5	39.8	8.7	0.0	0.0
My desk (table) at work has a suitable height being comfortable.	52.4	24.3	13.6	3.9	5.8
When I use the mouse device, my arm is supported by the table.	52.4	11.7	14.6	10.7	10.7
The chair I use during work supports my lower back.	35.9	22.3	16.5	9.7	15.5
My keyboard is placed directly in front of me.	57.3	26.2	8.7	5.8	1.9
The screen is placed directly in front of me.	64.1	21.4	6.8	1.0	6.8
I have enough space to work at my office.	34.3	23.5	18.6	8.8	14.7
Changes In Work Station				**Yes %**	**NO %**
There are some changes required in my workstation or activities to perform my work.				50.5	49.5
There have been changes made to my job, workstation or activities to perform my work.				22.3	77.7

Table 4.3 reveals the characteristics of a computer work station used by participants. The majority (51.5%) stated they mostly like working with computers, 52.4% of them felt the height of the computer table is of comfort, a good many are able to support their arms by the table while using a mouse (52.4%) and a keyboard (57.3%). Also, 64.1% said their computer screen is placed comfortably in front of them. Although about half of the participants felt they have a good workstation, the rest were not fully satisfied. Only 35.9% used a chair with lower back support and 34.3% have enough working space. So, the rest (65%) have problems with their chairs and office space. The majority (50.5%) indicated they need some workstation changes. Though few (22.3%) office spaces went through some improvements, they were mostly related to office design and not related to making a more ergonomic workstation.

An example of an improper setup of office space:

> *"I mostly have to work with my computers for long hours and usually feel discomfort in the right region of my shoulder and also the left leg. My workspace cubicle may be one of the reasons for this, as it provides very limited space. Because of this, my hand and leg movements become very constricted. This causes my shoulders to stay strained at the same stance and legs cramp up while working on the table. I feel a spacious table may provide better comfort"*
>
> (Female, Lecturer, Institute of Languages, April 04, 2018)

Table 4.4: Information regarding body posture

Body Posture	Always %	Often %	Sometimes %	Seldom %	Never %
At work I sit for long hours in one position.	15.5	36.9	35.0	9.7	2.9
For more than two hours per day I sit with lifted shoulders.	8.7	30.1	35.9	14.6	10.7
During my work I sit in awkward posture.	2.9	20.4	29.1	20.4	27.2
In work I perform repetitive tasks.	14.6	41.7	35.0	8.7	0.0
I find my job physically exhausting.	1.9	13.6	36.9	24.3	23.3
When I key my hand is placed in a straight line with my lower arm.	9.7	32.0	37.9	14.6	5.8
When I work my head is bent.	13.6	27.2	35.0	14.6	9.7
Head is twisted towards the left or right.	8.7	14.6	40.8	21.4	14.6
Trunk is twisted towards the left or right.	5.8	10.7	48.5	23.3	11.7

Table 4.4 shows information regarding body posture of participants while working with computers. A few of the participants always had some incorrect body postures; for example, 15.5% tend to sit for long hours in one position, 14.6% performs repetitive task and 13.6% works with a bent head. But a substantial proportion of participants often had these postures; i.e. 30.1% said they sit with lifted shoulders while working with computers, however, 32.0% have their hands and lower arms positioned in a straight line while using a keyboard and a mouse.

Table 4.5: Information regarding job control

Job Control	Always %	Often %	Sometimes %	Seldom %	Never %
I decide how to perform my job task.	41.7	42.7	9.7	3.9	1.9
I participate with others in decision taking.	20.4	48.5	20.4	8.7	1.9
I decide my own task changes.	26.2	27.2	38.8	4.9	2.9
I determine the time & speed of the job tasks.	30.1	43.7	17.5	5.8	2.9
I solve work problems by myself.	24.3	55.3	19.4	1.0	0.0
My work develops my abilities.	49.5	41.7	4.9	2.9	1.0
In my work I learn new things.	45.6	38.8	11.7	3.9	0.0
I have to be creative in my work.	46.6	30.1	20.4	1.9	1.0
I under take different tasks in my work.	38.8	31.1	26.2	3.9	0.0

Table 4.5 presents information related to job control. We found participants' to have greater

job control in most of the categories. For example; they can decide how to carry out the job (always 41.7%, often 42.7%), participates in decision making (always 20.4%, often 48.5%), can determine the time and speed of tasks (always 30.1%, often 43.7%), solve problems themselves (always 24.3%, often 55.3%), feel their work developes their abilities (always 49.5%, often 41.7%), learns new things from work (always 45.6%, often 38.8%), requires creativity to work (always 46.6%, often 30.1%) and undertake different tasks (always 38.8%, often 31.1%). However, they felt less control over deciding their own task change (always 26.2%, often 27.2%).

Table 4.6: Information regarding job demand

Job Demand	Always %	Often %	Sometimes %	Seldom %	Never %
I work under extensive work pressure.	4.9	35.9	35.9	20.4	2.9
I find it difficult to finish my tasks on time.	1.0	21.6	38.2	27.5	12.7
I take extra hours to finish my job tasks.	6.8	19.4	41.7	18.4	13.6
I don’t have enough time to finish my job task.	1.0	6.8	39.8	25.2	27.2
At work I speed to finish my tasks on time.	24.3	33.0	35.9	3.9	2.9
I find my work tasks difficult.	2.9	4.9	22.3	40.8	29.1
I have too many job tasks.	2.9	29.1	32.0	27.2	8.7

Table 4.6 illustrates the participants’ job demand patterns. In the study, the participants’ job demand seems to be on a moderate level, neither too high nor too low. For example; about 35.9% of participants felt they sometimes work under extensive pressure, 38.2% sometimes find it difficult to finish their tasks on time, 41.7% sometimes takes extra time to finish their tasks, 39.8% sometimes do not have enough time to finish their tasks, 35.9% sometimes speed up to finish their tasks at hand, 22.3% sometimes find work tasks difficult and 32.0% sometimes had too many tasks.

Table 4.7: Information regarding break time

Break Time	Always %	Often %	Sometimes %	Seldom %	Never %
I can plan my work breaks.	19.4	45.6	23.3	10.7	1.0
I can divide my work time.	31.1	44.7	18.4	5.8	0.0
I can decide when to take a break.	23.3	39.8	31.1	5.8	0.0
I alternate my body posture in between tasks.	19.4	35.9	29.1	11.7	3.9
I alternate in between my job tasks.	9.7	33.0	36.9	18.4	1.9
I perform job tasks without computer.	1.9	12.6	51.5	25.2	8.7
After two hours I take a break for 10 minutes.	18.4	21.4	32.0	26.2	1.9
I find my work breaks sufficient.	17.5	35.9	36.9	8.7	1.0

Table 4.7 shows information regarding the management of break time during the work hours. In this study, the participants' data appear to portray some sort of autonomy over their rest breaks. Many of the participants' often believed they were able to plan (45.6%) and divide (44.7%) their work breaks. Also, 39.8% often could decide when to take a rest breaks and 35.9% were able to alternate their body posture in between tasks. Moreover, the participants' sometimes felt they are able to; perform their task without a computer (51.5%), take a break after two hours of work for about ten minutes (32.0%) and have enough work breaks (36.9%).

Table 4.8: Information regarding work environment

Work Environment	Always %	Often %	Sometimes %	Seldom %	Never %
I find my work environment good.	37.9	46.6	13.6	1.9	0.0
The air inside the office is too hot.	1.9	12.6	31.1	33.0	21.4
The air inside the office is too cold.	3.9	4.9	31.1	27.2	33.0
There is available fresh air in my work.	11.7	33.0	22.3	13.6	19.4
My work environment is noisy.	7.8	28.2	36.9	17.5	9.7
My work place is too bright.	9.7	16.5	22.3	19.4	32.0
I gaze at the computer screen.	6.8	29.1	43.7	19.4	1.0
The computer screen reflects the office lights.	1.0	9.7	21.4	18.4	49.5

Table 4.8 presents information regarding the views of participants on their physical working environment. Sufficient lighting, ventilation, airflow, control of heat and cold is necessarily a part of a suitable work environment that influnces overall human health. In this study, participants' views on their work environment were somewhat mixed. They often found their work environment to be good (46.6%) and have availability of fresh air (33.0%). On the other hand, they sometimes found their office air to have a moderate temperature; i.e. neither too hot nor too cold (31.1%), noisy (36.9%), too bright (22.3%). They also mentioned to gaze at their computers (43.7%) and their office lights to reflect on their computer screens (21.4%).

Table 4.9: Information regarding social support

Social Support	Always %	Often %	Sometimes %	Seldom %	Never %
My work flow goes smoothly.	17.5	60.2	18.4	3.9	0.0
I can ask and enquire in my work.	29.1	48.5	21.4	0.0	1.0
My work tasks depend on other colleagues.	1.0	19.4	46.6	25.2	7.8
My work atmosphere is comfortable.	29.1	53.4	12.6	4.9	0.0
My colleagues are friendly.	56.3	35.9	7.8	0.0	0.0
If I made a mistake in my work task I find support from my Supervisors/ Seniors.	45.6	37.9	15.5	1.0	0.0
If I made a mistake in my work task I find support from my colleagues.	58.3	29.1	10.7	1.9	0.0

Information regarding participants social support received at their workplace is shown in table 4.9. Social support is needed to reduce job-related stress and increase employee effectiveness. Participants in this study have had somewhat good social support. For example; majority (60.2%) reported to often find their workflow going smoothly, 48.5% of them could often ask and enquire in their work and 53.4% often find their work environment comfortable. Remarkably, 56.3% participants mentioned to always have had friendly colleagues. Besides, a large number of participants also always found support from their seniors (45.6%) and colleagues (58.3%) in case they made any mistake. However, only 46.6% of participants sometimes had to depend on other colleagues in order to complete their tasks.

Table 4.10: Information regarding carrying laptop

Laptop Carrying	**Always %**	**Often %**
I carry my laptop to the workplace.	22.3	77.7
	One-sided bag %	**Two-sided bag %**
I use a laptop bag to carry my laptop.	57.2	42.8
	One-sided way %	**Two-sided way %**
I hold/carry my laptop bag.	61.2	38.8

Table 4.10 shows information about participants carrying their laptops to the workplace. Of all the participants, only 22.3% carried their laptops to their office and of them, 57.2% used a one-sided laptop bag and among them, 61.2% carried the laptop bag in a one-sided way. Carrying a laptop, especially in a one-sided bag or in a one-sided manner, in particular, can cause shoulder painand increase the risk of MSDs.

This example shows a participant using her laptop in office:

> *"I feel comfortable working with my laptop. I usually tend to spend about one to two hours on it. Most of the days I carry it to the university with an usual one-sided bag. And many of the times I happen to sit in awkward positions while using it both at home and in office. Although I adjusted some of the settings according to my comfort, I have not heard about computer ergonomics before."*

(Female, Lecturer, Department of Botany, May 08, 2018)

4.3 MSDs among academic staff

Table 4.11: Information regarding pain/ complaints/ disability in MSE (Musculoskeletal Extremety) in the past one year

During the past year I had pain/complaints for at least one week in one or more of the following body regions						
Specific areas of pain/ complaints/ disability	**Yes %**	**No %**		**Left %**	**Right %**	**Both %**
Neck	37.9	62.1				
Shoulder(s)	39.8	60.2	If Yes,	7.3	22.0	70.7
Upper Arm	16.5	83.5	If Yes,	17.6	41.2	41.2
Elbow(s)	12.6	87.4	If Yes,	16.7	58.3	25.0
Lower Arm	11.7	88.3	If Yes,	8.3	50.0	41.7
Wrists	23.3	76.7	If Yes,	17.4	69.6	13.0
Hand	17.5	82.5	If Yes,	5.6	55.6	38.9
Back	41.7	58.3				
Knee	14.6	85.4	If Yes,	21.4	28.6	50.0
Legs	18.4	81.6	If Yes,	21.1	15.8	63.2

Table 4.11 displays information regarding pain/complaints/disability in MSE. Overall, 30.1% of participants suffered from pain/ complaints/ disability for at least one week during the last one year. Among them, 37.9% had pain in the neck, 39.8% suffered from shoulder pain (both shoulders), 41.7% had back pain and 23.3% had pain in their wrists (mainly right wrist). They also mentioned having pain in other parts of the body but in a lesser percentage as compared to the above-mentioned body regions.

Table 4.12: Information regarding work loss and treatment of pain/complaints/disability in MSE

Work loss and treatment of pain/ complaints/ disability in MSE				
	Yes %		**No %**	
During the past year I had pain/complaint/disability in my musculoskeletal extremity	30.1		69.9	
Because of my extremity complaints (during the past year) I was absent from work	10.8		89.2	
Due to musculoskeletal extremity complaints in the past year my activities were hindered in my work	21.2		78.8	
Due to musculoskeletal extremity complaints in the past year my activities were hindered in my leisure time	37.3		62.7	
My complaints are due to a previous accident.	7.8		92.2	
During the past year I was referred to the physician due to my musculoskeletal extremity pain?	29.1		70.9	
	Physio-therapy %	**Medica-tion %**	**Opera-tion %**	**Other %**
What kind of treatment did you receive (during the past year)	10	40	3.3	46.7

Table 4.12 shows information on work loss and treatment of pain/complaints/disability in

MSE. MSE in this case represents neck, shoulders, hands, wrists, arms, elbows and back. Because of their extremity complaints in the past one year, 10.8% of them had been absent from work. Moreover, activities at the workplace were hindered for 21.2% of the participants and for 37.3% of them, leisure time activities were affected. Furthermore, 29.1% of the participants were referred to a physician. The longest duration of complaints of MSE was for about 9 days on an average, maximum being 120 days and the minimum being 1 day for past one year. For these complaints, 40% was on medication, 10% took physiotherapy, 3.3% went through a surgery.

A participant's experience with MSD is stated below:

"I suffer from the initial stages of carpal tunnel syndrome; a medical condition that causes numbness and pain in the hands and arms region. This condition has developed as a result of continuous writing (checking papers) and working on a computer by using the same hand posture for hours. It even caused a slight inflammation in my right hands wrist bone. Although I took medication, the condition seems to have worsened over time due to the nature of my work."

(Male, Lecturer, Bachelor of Business Studies, March 29, 2018)

Table 4.13: Information regarding different category of complaints in MSE in the past one year

Complaints related to complaints in the neck, shoulder, hand, wrist, elbow and back in the past year					
	Yes %	**No %**		**Yes %**	**No %**
I feel pain in my musculoskeletal extremity as soon as I finish work	28.2	71.8	This pain disappears after a short rest	93.1	6.9
I feel fatigue and exhaustion in my musculoskeletal extremity	33.0	67.0	This complaint disappears after a short rest	91.2	8.8
I feel stiffness in my finger	18.4	81.6	This stiffness disappears after a short rest	100.0	0.0
I feel numbness in my fingers	14.6	85.4	This numbness continues after a short rest	64.3	35.7
I feel tingling in my fingers	14.6	85.4	This tingling continue after work	60.0	40.0
I feel weakness in my musculoskeletal extremity	28.2	71.8	This weakness continue after work	48.3	51.7
I suffer from swelling in my hands	13.6	86.4	This swelling continue after work	42.9	57.1
I feel swelling/ stiffness in my musculoskeletal extremity				6.9	93.1
I feel continuous pain in my musculoskeletal extremity				7.0	93.0
I feel a change in the colour, temperature, sweating in musculoskeletal extremity				4.9	95.1
I use mouse pad, file holder, foot supporter to reduce musculoskeletal extremity pain				17.5	82.5
I use neck collar or belts or others to reduce musculoskeletal extremity pain				3.9	96.1

Table 4.13 reveals details about various types of MSE complaints for the last one year. There are different categories of complaints in MSDs like pain, stiffness, numbness, tingling sensation, etc. In this study, participants after finishing their work, reported to feel pain (28.2%) and fatigue or exhausted (33%) in their MSE. They also reported feeling stiffness in their fingers (18.4%). However, these complaints seemed to disappear after taking short rests. Additionally, participants reported experiencing numbness (14.6%), tingling (14.6%) and weakness (28.2%) in their fingers after finishing work. Likewise, 13.6% mentioned having swelling in their hands and even after work these complaints mostly persisted. In order to reduce these discomforts, some of them started to use a mouse pad, foot support, neck collar, or belts for ease.

This example below shows one's duration of computer use and its associated body discomforts.

> *"As a faculty member of the Computer Science and Engineering Department, it is a necessity to work with computers. Majority of my office hour goes behind the computers. Sometimes, when I have other official work or meetings and seminars, this is less. But most of the time I work on my computers for about 4 hours on an average. Working at a stretch has taken a toll on my musculoskeletal extremity and I often experience discomfort in the region of the shoulders and knees. This shoulder discomfort also often triggers referred pain in the wrist as well.'*
>
> (Female, Lecturer, Computer Science and Engineering, March 29, 2018)

Table 4.14: Information regarding medical condition and support related to MSDs

Medical condition and support	Yes %	No %
I have previous medical condition for related pain.	3.9	96.1
I have been diagnosed by a medical doctor with work-related musculoskeletal disorders (herniated disk, carpal tunnel syndrome, tendonitis, etc…)	7.8	92.2
If no, a medical doctor has told me that I am in risk of work-related musculoskeletal disorders?	8.7	91.3

Table 4.14 reveals the medical condition and support the study participants required for their MSDs. Of all the participants, 3.9% had some previous medical conditions for related pain. Notably, 7.8% of the participants were previously diagnosed with WMSDs and 8.7% were warned about developing it in the future.

Table 4.15: Information regarding previous computer ergonomic training

Training	Yes %	No %
I am aware of the term computer ergonomics.	64.1	35.9
I am interested to receive training related to proper posture of computer use.	100.0	0.0
Previously, I have received training related to proper posture of computer use.	8.7	91.3
If yes, the training program has benefitted me.	100.0	0.0
I think a training program related to proper computer use could be beneficial.	87.4	12.6

Table 4.15 indicates that of all the study participants, i.e. 64.1%, were aware of the term computer ergonomics and all the participants showed interest to receive computer ergonomic training. Merely 8.7% had previously undergone such training and 87.4% felt they would benefit from this form of training.

Table 4.16: Information regarding exercise and sports activities

Exercise		**Always %**	**Often %**	**Sometimes %**	**Seldom %**	**Never %**
I perform exercise regularly.		7.8	18.4	34.0	33.0	6.8
I perform short exercise in between my work.		1.9	11.7	13.6	35.0	37.9
		Yes %	No %			
I am involved with sport activities.		48.5	51.5			
Type of sports involved.	**Walking %**	**Football %**	**Basketball %**	**Swimming %**	**Jogging %**	**Others %**
	62.0	14.0	4.0	6.0	2.0	12.0

Table 4.16 presents information about exercise and sports related activities. The majority of participants hardly performed any sort of exercise on a regular basis. 34.0% of them reported exercising daily at times and just 13.6% sometimes performed some sort of exercise in between work. Compared with other sporting activities, most of the participants preferred to walk (62%).

A statement portraying doctors advice related to exercise:

"My Doctor i.e.my family physician, has advised me to do routine exercise that may help to relieve my discomfort. However, due to my busy schedule, I don't get the time to perform such exercises."

(Male, Lecturer, Bachelor of Business Studies, July 04, 2018)

4.4 Computer and general workstation ergonomic assessment

Table 4.17: Information regarding workstation height and surface

Workstation Height and Surface	**Yes %**	**No %**	**Comments**
Is it a multi user work station?	8.7	91.3	
Is the task performed at the correct type of work station? (Sitting, standing or both).	73.8	26.2	
Is the work surface big enough to accommodate a monitor, keyboard and equipment necessary to perform all tasks.	77.7	22.3	
Is the work surface height can be adjusted according to the user.	2.9	97.1	
Is the work surface can be adapted for right or left-hand use.	60.2	23.3	N/A 16.5%
Are contact points from work surface corners and edges padded or minimized?	49.5	50.5	
Is leg clearance adequate for adopting different postures?	58.3	41.7	
Is there any frame, cable holder or other fixture encroaching on leg room?	19.4	80.6	

Table 4.17 displays details about the height and surface of the workstations. About 73.8% of the participants' workstation was somewhat suitable, 77.7% of them were observed to have big enough work surface, can be adapted for right or left-hand users (60.2%), have padded corners (49.5%) and adequate leg clearance (58.3%) for adopting different postures. But 97.1% of the work surface height cannot be adjusted according to the users comfort.

Table 4.18: Information regarding workplace chair

Chair	Yes %	No %
Is the chair easily adjustable even from a seated position?	74.8	25.2
Is the chair suited for the tasks?	85.4	14.6
Is the range of height adjustment adequate?	71.8	1.9
Are other controls conveniently located and easy to use?	96.1	1.9
When seated at the workstation with hands on the keyboard can the following posture be achieved?		
• Shoulders relaxed and symmetrical, head in midline.	74.8	25.2
• Elbows in vertical alignment with shoulders, slightly away from the body and slightly higher than wrists.	64.1	35.9
• Wrists in functional position (slightly extended - 10-20 degrees).	92.2	7.8
• Hips slightly higher than knees.	67.0	33.0
• Thighs not making contact with under-surface of desk.	92.2	7.8
• Feet flat on the floor or footrest (not dangling).	99.0	1.0
Does the chair have armrests?	100.0	0.0
Are the armrests sufficiently padded?	59.2	40.8
Can the arm rests move up and down?	53.4	46.6
Can the arm rests move from side to side?	1.9	98.1
Does seat pan width and depth accommodate the user?	98.1	1.9
Does seat pan width and depth adjust horizontally and lock?	55.3	44.7
Does seat pan width and depth can tilt?	43.7	56.3
Is the tension of the backrest adjustable?	17.5	82.5
Does the chair have a padded seat with rounded front edge?	95.1	4.9
Is the chair in good repair?	100.0	0.0

Table 4.18 shows information concerning the chairs used at the workplace. As seen, many of the chairs except for a few have correct ergonomic features; for example, 98.1% of the armrests cannot be adjusted from side to side and also it is insufficiently padded (40.8%). About 82.5% of the backrest tensions are not adjustable and 56.3% of the seat pan width and depth cannot be tilted at a comfort level. However, most of the participants when at a seated position are able to achieve relaxed shoulders (74.8%), elbows in vertical alignment with shoulders (64.1%), wrists (92.2%) and hips (67%) in functional positions, thighs not making contact with under-surface of the desk (92.2%) and feet not dangling above the ground surface (99%).

An example showing office setup changes to an ergonomically suited chair:

> *"Currently, I think I have developed frozen shoulders because of the improper postures during sleep. This is primarily a condition that causes stiffness in the joints of the shoulders. But this problem is not new as it began earlier due to the lifting of heavy weights during exercise. Because of this underlying medical condition, it also causes discomfort in other regions of the upper musculoskeletal extremity when I work. So, I have made certain changes in my office room that are suitable for my comfort and health. These changes include a spacious working table and an ergonomically suitable chair."*
>
> (Male, Associate Professor, Economics and Social Sciences, March 28, 2018)

Table 4.19: Information regarding workplace keyboard and mouse

Keyboard and Mouse	Yes %	No %
Is the keyboard, mouse and input device located in front and close to the user?	100.0	0.0
Is the height and tilt of the keyboard work surface adjustable?	13.6	82.5
Do the wrists rest in a neutral position when keying and when using the mouse?	71.8	28.2
Is the wrist support (if used) kept in neutral posture?	1.9	0.0
Is the wrist support (if used) firm but cushioned?	1.9	0.0
Is the mouse kept on the same surface, height and distance as the keyboard?	60.2	39.8
When using mouse can the following posture be achieved?		
• Shoulder relaxed.	42.7	57.3
• Elbow close to side of body.	39.8	60.2
• Forearm supported on desktop.	89.3	10.7
• Wrist still-not moving from side to side.	92.2	7.8
• Middle finger maintained in straight line with forearm.	93.2	6.8
• Circular, smooth, whole arm movements.	79.6	20.4
Does keying require minimal force?	74.8	25.2

Table 4.19 presents information regarding keyboard and mouse used at the workstation. Most of the keyboards and mouses have correct ergonomic characteristics except for a few, for example, height and tilt of the keyboard work surface was of the not adjustable type (82.5%), shoulders were not relaxed while using a mouse (57.3%) and elbows were usually not close to the side of body for 60.2% of the participants. Moreover, it was observed that most of the participants (98.1%) do not use any wrist support while using a mouse. Thus, the wrist assistance queries were not applicable for some.

Below is an idea of workstation (keyboard and mouse) modification to achieve better posture:

"I have made a few modifications to my workstation. Previously in my computer table, the mouse was placed right next to the monitor and the keyboard was underneath it. One of the simple changes I made was, I put my mouse and keyboard next to each other. Now every time I have to work on the computer, I need to relocate the mouse and position it next to the keyboard. Although the mouse positioning has helped me, the keyboard has slightly moved to one side. When I type on the keyboard; my hands shift left instead of being at the centre. I know that's not ideal but that's the best I can do for now."

(Male, Assistant Professor, Department of Botany, August 13, 2018)

Table 4.20: Information regarding workplace computer monitor

Monitor	Yes %	No %
Is the monitor placed directly in front and approximately arms reach away?	73.8	26.2
Is the top line of the screen kept slightly below eye level with head and neck upright?	59.2	40.8
Can the monitor be adjusted in angling backwards/forwards?	92.2	7.8
Can the monitor be adjusted in viewing distance?	72.8	27.2
Can the monitor be adjusted in brightness and contrast controls?	100.0	0.0
Is the screen clean and free of flickering?	100.0	0.0
Is the screen free from glare or reflections from light sources?	87.4	12.6
Is laptop stand and external keyboard/ mouse used when using a laptop computer for prolonged period of time?	1.0	22.3
Can a user who wears bifocal or trifocal (progressive) lenses read thescreen without bending the neck more than 20 degrees forward?	8.7	1.0
Is the monitor large enough to read text easily?	88.3	11.7

Table 4.20 shows information about the workplace computer monitors in use. Most computer monitors have acceptable ergonomic characteristics, such as keeping the screen at arms distance (73.8%), can be adjusted in angling (92.2%), brightness and adjustment controls (100%). However, the top line of the screen is trypically not kept slightly below the eye level (40.8%) and few (27.2%) of the monitors couldnot be adjusted at a viewing distance. Nevertheless, some of the queries related to laptop stand and using bifocal or trifocal (progressive) lenses were not applicable in this case as most of the participants did not use it.

Table 4.21: Information regarding workplace physical environment

Physical Environment	Yes %	No %
Is there sufficient lighting without causing glare?	88.3	11.7
Does the user have control over lighting at workstation?	38.8	61.2
Are noise levels conducive to concentration?	48.5	51.5
Is there visible dust/dirt on work surfaces, keyboards and monitor?	34.0	66.0
Is the user comfortable with the room temperature and air flow?	88.3	11.7
Is there any trip hazards e.g. cabling, mats, poor housekeeping?	18.4	81.6
Is the electrical cabling loomed neatly around work area to avoid unwanted contact?	59.2	23.3
Is laptop stand and external keyboard/ mouse used when using a laptop computer for prolonged period of time?	1.0	22.3

Table 4.21 outlines information concerning the workplace's physical environment. Few of the physical environment aspects were seen to be appropriate, such as the participants were typically comfortable with room their temperature (88.3%) and lighting (88.3%). Nonetheless, certain aspects appeared to be inappropriate, for example, 61.2% of participants had no control over lighting. Moreover, in 51.5% of cases, noise levels were not conducive to concentration and in 34.0% of cases, visible dust/dirt was accumulated on work surfaces, keyboards and computer screens.

4.5 Awareness and practice related to training in computer ergonomics

Table 4.22: Pre and post-training comparison of computer ergonomics awareness

Computer Ergonomics Awareness	Pre-training		Post-training		
	I Know		I Know		
	Yes %	No %	Previously knew %	Knew from training %	No %
I am aware of the proper height adjustment of a computer workstation chair.	44.7	55.3	45.6	52.4	1.9
I am aware of the proper back support of a computer workstation chair.	59.2	40.8	56.3	42.7	1.0
I am aware of the proper seat tilt, depth and with pan of a computer workstation chair.	38.8	61.2	36.9	60.2	2.9
I am aware of the proper arm rest position of a computer workstation chair.	49.5	50.5	49.5	48.5	1.9
I am aware of the proper position in which keyboard and mouse should be kept.	48.5	51.5	47.6	51.5	1.0
I am aware of the proper distance, height and location at which the monitor should be kept.	46.6	53.4	45.6	51.5	2.9
I am aware of the proper angle at which a monitor should be.	43.7	56.3	40.8	58.3	1.0
Others					
I am aware of when to take rest breaks while using computer.	57.3	42.7	55.3	44.7	0.0
I am aware of the stretches to perform while using computer.	45.6	54.4	42.7	56.3	1.0

Comparison of computer ergonomics awareness before and after training is shown in table 4.22. As for pre-training and post-training, the analysis reveals participants' responses to be consistent. In fact, analysis shows there is a significant increase in computer ergonomics awareness across all the tested nine categories. Even though we know what is good for us most of the times, yet we do not follow it. So there's a distinctive difference between our awareness of certain things and compliance with them.

Here is a statement about knowing but not practicing the principles of computer ergonomics:

"In this computer ergonomics training program, I think I have learned the right manners to use a computer. After the training, while I recall maximum of the points and I know it's going to be good for me but I haven't practiced them much. However, when I work continuously, I now try to take short breaks more often ."

(Female, Lecturer, Institute of Languages, July 15, 2018)

Table 4.23: Pre and post-training comparison of computer ergonomics practice

Computer Ergonomic Practice	Pre-training		Post-training	
	I Practice		I Practice	
	Yes %	No %	Yes %	No %
I am aware of the proper height adjustment of a computer workstation chair.	25.2	74.8	51.5	48.5
I am aware of the proper back support of a computer workstation chair.	28.2	71.8	49.5	50.5
I am aware of the proper seat tilt, depth and with pan of a computer workstation chair.	15.5	84.5	22.3	77.7
I am aware of the proper arm rest position of a computer workstation chair.	30.1	69.9	38.6	61.4
I am aware of the proper position in which keyboard and mouse should be kept.	31.1	68.9	49.5	50.5
I am aware of the proper distance, height and location at which the monitor should be kept.	29.1	70.9	46.1	53.9
I am aware of the proper angle at which a monitor should be.	26.2	73.8	48.5	51.5
Others				
I am aware of when to take rest breaks while using computer.	35.0	65.0	64.1	35.9
I am aware of the stretches to perform while using computer.	22.3	77.7	39.2	60.8

Table 4.23 shows a comparison of computer ergonomics practice before and after training. While most categories confirm a substantial improvement in computer ergonomics practice, with the exception of some workstation chair features such as seat tilt, depth, pan width (15.5% to 22.3%) and arm rest position (30.1% to 38.6%). Furthermore, the practice also seems low in the area of performing stretches while using a computer (22.3% to 39.2%).

Here is a situation depicting workstation changes made after receiving computer ergonomics training.

"After I took computer ergonomics training, I felt some changes are required with the placement of my computer and other devices. In fact, I made some changes in it's placement thereafter. Besides, I have also started to utilize my short breaks to perform little stretches demonstrated during the training. This has, to an extent, helped to releive my discomforts."

(Male, Associate Professor, Economics and Social Sciences, July 02, 2018)

Another example of how taking appropriate rest breaks and performing stretches have been helpful.

"The changes have been apparent after the training. The stretches have been of great help in relieving discomforts in my shoulders and wrists. I have also started practicing a few correct postures while sitting and working on my computer. The training has helped me provide myself with the necessary short breaks required between work."

(Female, Lecturer, Computer Science and Engineering, June 30, 2018)

Table 4.24: Information regarding computer ergonomics training

Computer ergonomic training	**Excellent %**	**Good %**	**Average %**	**Fair %**	**Poor %**
How was the training program?	39.8	48.5	6.8	4.9	0.0
How did the trainers explain the proper body postures?	39.8	45.6	10.7	3.9	0.0
How did the trainers demonstrate the proper body postures?	35.9	47.6	15.5	1.0	0.0
Did the trainers demonstrate and explained the stretches properly?	41.7	49.5	6.8	1.9	0.0
How would you rate the whole training process?	32.0	56.3	10.7	1.0	0.0
How would you rate the training materials given to you?	36.9	50.5	5.8	6.8	0.0
How would you rate the trainer?	44.7	48.5	6.8	0.0	0.0
How would you rate the whole research?	35.9	54.4	8.7	1.0	0.0

Training materials	**Yes %**		**No %**	
Training material given	**97.1**		**2.9**	
	Pasted %	In hand %	Emailed%	On desktop%
Mode of distributing training material	10.7	79.6	6.8	0.0

Recommendation for training	**Yes %**	**No %**
Would you like to recommend others for the training program?	92.2	7.8
The training materials (eg. Poster) have assisted me in maintaining proper posture while using computer.	98.1	1.9
The training method was well suited to meet the training objectives and content.	98.1	1.9
The training context was well suited to the learning process.	98.1	1.9
I feel this kind of training program is useful.	98.1	1.9

Details on computer ergonomic training is shown in Table 4.24. Considerably, most participants, around 80-90% said that the training program was either good or excellent in all categories. For example, the explanations and demonstrations of proper body postures, performing stretches and the training materials along with the training instructers seemed to be helpful. Nearly all participants (97.1%) received the training materials in hand. Most participants (98.1%) felt this sort of training program to be beneficial and thus (92.2%) wanted to recommend it to others.

An example showing the thoughts on the importance of training in computer ergonomics:

"On average, I work on computers every day for 3 hours. I often like working with it, but I believe I don't know the exact right working postures. Even though I don't have severe body pain / discomfort, I think a lot of us do. Many faculty members who extensively use computer/laptop face these kinds of problems. Not only faculty members, even students and other professionals such as computer engineers who have to work extensively with computers may face this problem. I think many of us are not aware of this highly important issue. I feel we tend to neglect it or not be careful about it."

(Male, Assistant Professor, Department of Botany, May 12, 2018)

Table 4.25: Information regarding post-training reduction of MSD related discomforts

Discomfort	No %	Yes, The training/practice have helped to reduce it %	The training/ practice did not reduce it %
I experience body discomfort(s) while using computers.	36.9	47.6	15.5
The following body related discomforts are reduced as a result of training.	Neck – 6.8%		
	Shoulder(s) – 19.4 %		
	Upper Arm – 5.8%		
	Wrists – 8.7 %		
	Hand – 1.9%		
	Back – 3.9 %		
After the training, I have fewer complaints of body pain related to computer use.	98.1 (Yes)		1.9 (No)

Table 4.25 shows information on reduction of MSD related discomforts after training. Nearly half (47.6%) of the participants reported that the training and it's related practice have helped in the reduction of their body discomforts. Moreover, 98.1 % mentioned to have fewer complaints of body pain prior to receiving computer ergonomics training. Also, the following body-related discomforts seem to have reduced as a result of training; pain in the neck, shoulders, upper arms, back, wrists, etc.

To provide more details on it, the following example shows the effectiveness of performing stretches in between work:

> *"After receiving the training and learning about the exercises, the wrist movement in particular, was of great help as it reduced my wrist pain. Since these exercises require a very short amount of time, I can perform them during my rest breaks in office. It has also assisted me in managing my time."*
>
> (Male, Lecturer, Bachelor of Business Studies, July 04, 2018)

Table 4.26: Pre-training and post-training differences in awareness and practice of computer ergonomics, McNemar test

Pre and post-training differences in computer ergonomics practices		
Cross-tabulation	McNemar test, p-value	
	Awareness	Practice
Proper height adjustment of workstation chair	0.00	0.00
Proper back support of workstation chair	0.00	0.00
Proper seat tilt, depth and pan width of workstation chair	0.00	0.06
Proper armrest position of workstation chair	0.00	0.02
Proper position of keyboard and mouse	0.00	0.00
Proper distance, height and location of monitor	0.00	0.00
Proper angle of monitor	0.00	0.00
When to take rest breaks while using computer	0.00	0.00

Stretches to perform while using computer	0.00	0.00

Table 4.26 demonstrates the comparison of pre-training and post-training differences in awareness and practice of computer ergonomics by using the McNemar statistical test. The table indicates a highly significant increase in awareness of computer ergonomics and it's practice. For most items, the p-value (p=0.000) is significant except for the element that is connected to practicing proper workstation chair seat tilt, depth and pan width showing an insignificant value (p=0.06).

4.6 MSDs association with demographic variables and computer ergonomics awareness and practice

To find out the statistically significant association between MSDs and socio-demographic variables of the study participants, we carried out bivariate and multivariate analysis. Only the significant results of cross-tabulation and Pearson's chi-square test are presented here. Additionally, the results presented here for the binary logistic regression are statistically significant and shows considerable difference in odds ratio.

Table 4.27: Cross-tabulation of pain/complaint/disability in MSE and group of work hours per day behind computers

			Group of work hour per day behind computer		**Total**
			up to 3 hrs	**more than 3 hrs**	
Pain/ Complaint/ Disabilty in MSE	yes	Count	10	23	33
		% within group of work hour per day behind computer	21.7%	40.4%	32.0%
	no	Count	36	34	70
		% within group of work hour per day behind computer	78.3%	59.6%	68.0%
Total		Count	46	57	103
		% within group of work hour per day behind computer	100.0%	100.0%	100.0%

Table 4.27 shows the results of cross-tabulation which found a significant association between pain/complaints/disability in MSE and group of hours worked per day behind computers. Pain/Complaints/Disability in MSE was more frequently reported by participants who worked more than 3 hours per day (40.4%) and less frequently by those who worked upto 3 hours per day behind the computer (21.7%). And, this analysis is seen to be statistically significant

(p<0.04).

Table 4.28: Cross-tabulation of pain or discomfort in back for 1 week in the past year and group of work hours per day behind computers

			Group of work hour per day behind computer		Total
			up to 3 hrs	more than 3 hrs	
Pain or discomfort in the back for 1 week in past year	yes	Count	12	31	43
		% within group of work hour per day behind computer	26.1%	54.4%	41.7%
	no	Count	34	26	60
		% within group of work hour per day behind computer	73.9%	45.6%	58.3%
Total		Count	46	57	103
		% within group of work hour per day behind computer	100.0%	100.0%	100.0%

Table 4.28 illustrates the result of cross-tabulation that found a significant association between pain or discomfort in the back for one week in the past one year and the group of work hours worked per day behind computers. Analysis reveals back pain to be more frequently reported by participants who worked more than 3 hours per day (54.4%) and less frequently by those who worked less than 3 hours per day (26.1%) behind the computer. These numbers seem to show statistical significance (p<0.004).

Table 4.29: Cross-tabulation of pain or discomfort in shoulder(s) for 1 week in the past year and work hours per week

			Work hour per week		Total
			up to 30 hrs	more than 30 hrs	
Pain or discomfort in shoulder (s) for 1 week in the past year	Yes	Count	13	28	41
		% within work hour per week	65.0%	33.7%	39.8%
	no	Count	7	55	62
		% within work hour per week	35.0%	66.3%	60.2%
Total		Count	20	83	103
		% within work hour per week	100.0%	100.0%	100.0%

Table 4.29 shows the result of cross-tabulation which found a significant association between pain or discomfort in the shoulder(s) for 1 week in the past one year and work hours per week. As analysis indicate, shoulder pain was more frequently mentioned by those who worked up

to 30 hours per week (65.0%) and less among those who worked for more than 30 hours per week (33.7%). And, this is taken to be statistically significant (p<0.01).

Table 4.30: Cross-tabulation of pain or discomfort in neck for 1 week in the past year and age group

			Age group		Total
			up to 40 years	more than 40 years	
Pain or discomfort in neck for 1 week in the past year	Yes	Count	37	2	39
		% within age group	41.6%	14.3%	37.9%
	no	Count	52	12	64
		% within age group	58.4%	85.7%	62.1%
Total		Count	89	14	103
		% within age group	100.0%	100.0%	100.0%

Table 4.30 shows cross-tabulation result which found a significant association between pain or discomfort in the neck for one week in the past one year and participants age group. Neck pain is seen to be higher among those who were in between 40 years of age (41.6%) and less frequent among those over 40 years of age (14.3%). These numbers also seem to show statistical significance (p<0.05).

Table 4.31: Summary statistics from logistic regression model for pain by categories vs. different independent variables

Dependent variable	Independent variable	Categories	Odds ratio	95% C.I	p-value
Back Pain	Organization	Private (Ref.) Public	3.07	1.00- 9.39	.048
	Know distance, height and location of monitor	No(Ref.) Yes	.01	.00 - .55	.026
	Practice proper position keyboard and mouse	Yes	.027	.00- .64	.026
Shoulder Pain	Sex	Male (Ref.) Female	.17	.05- .59	.005
Neck Pain	Age group	>40 years(Ref.) <40 years	.083	.00 - .98	.048
	Know height adjustment of workstation chair	Yes	.020	.00 - .35	.008
	Practice proper angle of monitor	Yes	.004	.00 - .12	.002

Overall MSE Pain	Organization	Public	4.54	1.04 - 19.73	.043
	Know propoerseat tilt depth and width pan of chair	Yes	.004	.00 - .14	.002
	Practice proper angle of monitor	Yes	.003	.00 - .086	.001

Table 4.31 presents the summary statistics from logistic regression model for pain (back, shoulder, neck, overall MSE) by categories vs. different independent variables. In this table, odds ratio 95% class interval (CI) of the parameters and p-values are reported. From the odds ratio, it can be seen that back pain is 3.07 times higher among public university participants (p=0.048); however, it is lower among those who knew proper distance, height and location of monitor placement (p=0.026) and practiced proper position of keyboard and mouse (p=0.026).

In the case of shoulder pain, female participants reported fewer complaints as compared to male participants (p=0.005). Neck pain is seen to be more for participants who are below the age of 40 (p=.048) and less among those who were familiar with height adjustments of workstation chair (p=0.008) and practiced proper angling of monitor (p=0.002). Overall, MSE pain is 4.54 times higher in teachers of public university as compared with teachers of private university (p=0.043), and lower among those who knew proper seat tilt depth and width pan of chair (p=0.002) and practiced proper monitor angle (0.001) than those who do not practice it.

Chapter 5: Discussion

5.1 Discussion

This chapter presents an analysis of the study's findings and their discussion. The present study was designed to assess the knowledge and practice related to computer ergonomics and to explore the percentage of MSDs among academic staff of Dhaka's public and private universities. Beyond this, the other goal of the study was to see the implications of the training program for enhancing computer ergonomics awareness and practice in order to minimize WMSDs.

For this, the descriptive analysis carried out on one hundred and three data reveals that a little over half of the sample was from private universities (BRACU and FIU) and the rest from public universities (DU and JnU). These participants have been drawn from various faculties of arts, science, social science and business studies. Taking all of the faculties into consideration has helped to get various viewpoints from the participants and thus make the study more representative.

As for age, the participants spanned from different age groups with the youngest being 23 years old and the oldest 55 years old. The majority of them, i.e. more than eighty percent belonged to two age groups; below the age group of 30 years and the other from 31 to 40 years. In a way, this signifies that young staff members were not only interested to participate in the research study, but they were able and willing to provide time from their demanding schedule. Nearly all respondents worked full-time and only few of them reported to work with other institutions. As eighty percent of our respondents were primarily lectures and assistant professors, therefore the number of affiliations with other institutions was low.

Besides this, almost all of the participants use right hand as their preferred hand and a little more than ten percent of them reported to use bi/tri focal glasses. For our country context, this information is vital as the workstations are mainly designed for right-handed users and those who do not wear bi/tri focal spectacles. Examples of workstations particularly designed for those who are left-handed or use bi/tri focal lenses are very rare. Although the number of such users is low, without these personalized modifications, there may be a greater risk of CVS and MSDs.

Now, to explore further on the given topic, we need to note that the literature relates MSDs directly to the duration of computer use on a daily or weekly basis (Chang et al., 2007; Ellahi et al., 2011). In this study, about seventy eight percent of the participants reported to work on a computer for less than 5 hours and the rest of them worked for 6-10 hours daily. This shows that a few participants appear to be working on their computers for a fairly long duration. It has been seen that, longer duration of computer use, particularly using it in an inappropriate posture or in a wrong type of workstation can have positive association with MSDs (Ng et al., 2017; Erick & Smith, 2014). Besides this, other factors such as physical, psychological and environmental risk factors that perhaps have contributed to the prevalence of MSDs in the workplace will be addressed in the following few paragraphs.

Notably, a computer workstation is a significant determinant of computer ergonomics and it's related health risk factors (Erick & Smith, 2013). The overall response of the participants reveals a somewhat positive outlook. Almost half of the participants have said they always like working with computers. They mentioned some of the computer aspects with which they are able to function comfortably, such as, the computer screen is positioned directly in front of the user, the workstation table has a suitable and comfortable height and their arms are supported while using a mouse and keyboard.

Contrary to this, the participants have some grievances regarding the chair they use and the workspace in which they function. Only one-third of the participants use a chair that supports their lower back and has ample office room to function. While half of the participants believe some improvements are nedded in their workspace, some modifications have already been made in certain office spaces. The mentioned modifications concern mostly the office room decoration but not much about ergonomic friendly furniture or equipment. However, one of the participants mentioned having made few personalized changes including an ergonomic chair after developing frozen shoulders.

To further discuss this, it is necessary to note that besides using the right type of workstation, it is equally important to maintain correct body posture during computer use (Dul et al., 2008; Erick & Smith, 2014). Although low, but a varying percent of participants ranging from five to fifteen percent mentioned that when using their computers they always have awkward or incorrect body postures. They either tend to sit long hours in one position with lifted shoulders or perform repetitive tasks and work with bent hand twisted on either side. For academics, the sort of repetitive tasks includes correcting/checking scripts, typing on a keyboard, writing on a whiteboard/blackboard, etc (Ng et al., 2017). And, in the case of having incorrect body postures, the reasons might be a lack of awareness of appropriate computer use postures and improper workstation setup. If a person continues to have such unhealthy postures, the risk of injury could arise in the long run (Village et al., 2005; Li et al, 2012).

Furthermore, studies suggests that there is an association between job control and MSDs (NIOSH, 1997; Erick & Smith, 2014). The concept of job control can be understood as having an authority to make decisions on the job and the degree to which a job involves variety of tasks (Mohammadipour et al., 2018). The analysis portrays a condiferable proportion of the participants having considerable job control. This is obvious because to some degree, the essence of the tasks academics perform has autonomy. Approximately twenty five to forty five percent participants mentioned that they are able to decide on how to perform a job, participate with others in decision making, decide their own task change, solve work problem by themselves, undertake different tasks and determine the time and speed required to complete it.

As mentioned, job control is negatively associated with MSDs; on the contrary, increased job demand has a positive association (NIOSH, 1997; Erick & Smith, 2014). The findings show a number of participants often work under extensive pressure. In few cases, it becomes difficult to finish a task on time because of work overload. At such times these participants often take extra hours or speed up to finish the tasks at hand. This sort of demanding workload is seen to be one of the identified psychosocial factors related to MSDs (NIOSH, 1997).

Addtionally, ergonomic aspects such as taking rest breaks at regular intervals and simple muscle stretches in between work are crucial factors for increasing job efficiency and decreasing fatigue and exhaustion (Das, 2012). Thirty five to fifty percent of the study participants said they are able to decide and plan on their work breaks, alternate tasks and change their body postures in between tasks and sometimes can perform tasks even without a computer. However, similar percentage of participants also sometimes found their work breaks insufficient. This could be due to their demanding work schedule.

Besides, for an employee, the influence of one's working conditions has some sort of significance. A suitable work environment with enough light, low noise, sufficient space, proper ventilation and appropriate temperature is linked to better occupational health (Dul et al., 2008). In this study, the majority of participants mentioned having a good working environment with available fresh air inside the office. Sometimes, however, the temperature was found to be too hot and the environment quite noisy. During the summer time, as the overall temperature of the country is quite high, therefore the temperature inside the office too gets affected. And moreover, the environment sometimes gets noisy because of student gatherings. But the noise isn't like the continuous sound of heavy industrial machinery.

In the earlier discussion, MSDs has been seen to be negatively correlated with job demand and positively correlated with job control (NIOSH, 1997). In fact, the stress caused by high job demand and low job control can often be reduced with social support (Mesaria & Jaiswal, 2015). On a positive note, maximum of the study participants mentioned having healthy social support in their workplace. For instance; most of them often find their workflow going smoothly, can ask and inquire in their work if necessary and the overall work environment was found to be comfortable surrounded by friendly colleagues.

Moreover, in addition to the seven segments of MUEQ related to the physical, psychological and environmental risk factors, another component has been seen in this study, i.e., ways to carry a laptop to one's office. Inapproriate laptop carrying in a one-sided bag or one-sided way, might increase the risk of pain in the shoulders. In this study, even though majority of the participants used desktop in office, yet, when sometimes required to carry a laptop, most of the participants used a one-sided laptop bag in a one-sided way. Nevertheless, their association with MSDs is not seen to be statistically significant.

As we further reflect on participants' body-related complaints, the percentage of MSDs is found to be thirty percent. These participants particularly mentioned having some pain/complaints/disability for at least one week during the past year. The highest complaint was for the back, followed by shoulders (mainly right shoulder) and the neck. Because of their extremity complaints, few were even absent from work. Moreover, participants' workplace as well as leisure time activities were hindered because of this. Of all these pains and concerns, only very few seem to be involved with regular exercise such as walking or running.

As seen in researches, WMSDs are seen to progress in many stages. The initial stages of RSI involve aching in the affected area followed by pains at night or during working hours (Canadian Centre for Occupational Safety and Health, 2014). In this study, less than one third of the participants reported to feel pain and fatigue in their MSE. Additionally, only few participants reported to feel numbness, stiffness, tingling and weakness in their fingers and also swelling in their hands even after work. Detailed information on this can be found in Table 4.13. Though the numbers are bleak, evidences of WMSDs is noticeable for these few participants which is a major concern.

Furthermore, one of the essential components of this study was the observation of individual participant's workstation. This was mainly to determine if participants' have ergonomically suited workstations. Based on observations, the majority of workstations were considered to be adequate. A good number of chairs had overall correct ergonomic characteristics except for a few features such as armrests did not move from side to side, backrest tension was not of the adjustable type. Moreover, the seat pan, width and depth couldn't be tilted and armrests were not sufficiently padded.

Likewise, most keyboards and mouses were found to have acceptable ergonomic characteristics except for a few features; for instance, the majority of the mouses had no wrist support, the keyboard's height and tilt couldn't be adjusted and the shoulders were typically not relaxed

while using a mouse. Apart from this, with regard to the physical environment, most users had no control over lighting at the workstation, noise levels were not conducive to concentration and there was visible dust/dirt on work surfaces. It is important to note these aspects as ergonomically suited workstations can play a significant role to reduce the risk of WMSDs (Village et al., 2005).
A number of research work shows that the risk factors for MSDs differ among teachers based on sex, age, teaching experience and number of hours worked on a computer (Erick & Smith., 2013; Ellahi et al., 2011). In this study, results of the chi-square test shows a significant association with age, sex and the number of hours worked on a computer but not with teaching experience. Both chi-square test and logistic regression show a significant associations between neck pain and age. Neck pain is seen to be higher among participants below 40 years of age and less among those familiar with height adjustments of workstation chair and practice proper monitor angling.
A significant association was found between MSE pain and those who work for more than three hours a day behind computers. The pain was, however, lower among participants who knew the proper seat tilt, depth and width pan of the chair and practiced proper monitor angle. Moreover, a significant association was found between back pain and those who work more than three hours a day behind computers. In literature, long hours of work are seen to be associated with MSDs (Mesaria & Jaiswal., 2015). Nevertheless, the pain was lower among those who know proper distance, height and location of monitor placement and practiced proper position of keyboard and mouse.

Furthermore, back pain among public university teachers is three times higher and MSE pain about five times higher. The furniture in use could be one of the reasons for public university academic staff displaying more back and overall MSE pain than private university teachers. There is also a significant associations found between shoulder pain and those who work up to thirty hours a week. In addition to this, male participants appear to have higher shoulder pain as compared to female participants. But overall, though negligible, the percentage of complaint is higher for females.

One of the key aspects of this research is to determine the effect of training on awareness and practice of computer ergonomics. For this purpose, the McNemar test was to determine the significant difference before and after the training. The participants were asked nine questions to measure the changes in knowledge and practice related to computer ergonomics. Some of the aspects were related to computer monitor, keyboard, chair, restbreaks, stretches, etc. To see the substantial difference between pre/post training process, all the nine items were checked out of which eight of the items were found to be statistically significant.

Of all the items, the chair seat tilt, depth and pan width showed statistically insignificant results. One of the reasons is that the modification required to practice the proper ergonomic posture for this element is to fully alter the chair. But, in this case, it is not possible to alter or purchase a new chair, as the university office administration offers these types of equipment. Other factors, such as monitor angle, mouse and keyboard placement, etc., are however easy to modify. Overall, this study certainly indicates the effectiveness of computer ergonomics training in improving the awareness and practice related to computer ergonomics.

5.2 Limitations

- The data has been collected only from Dhaka city because of its feasibility; hence the findings can not be generalized to the general population. Furthermore, only academic staff from four universities have been chosen for the study.
- The achieved sample size has its limitations. The number of respondents is merely 103 which is not representative of the population. Nevertheless, these participants were randomly selected; thus, the characteristics such as age, sex, work experience and education are similar in nature as compared to those who did not participate in the study.
- One section of the assessment is the discomfort survey, which is a self-reported questionnaire. Therefore, the pain-related information were provided by the participants rather than a physician. This may be subjected to biases in recall. The participants may under or overestimate the stated pain. Likewise, this might also be true for estimating the duration of computer use.
- Also, the effects of training in computer ergonomics have been evaluated only once after a three month window period. This may not depict long term behavioural change.
- Although the study assesses the general working environment, it fails to analyze the psycho-social factors in depth. Nor does it touch upon other ergonomic factors such as cognitive ergonomics etc.
- The study only considers the observation of computer workstations in the workplace. It does not involve observing any personal workstation; e.g. computer workstation setup at home.

5.3 Recommendations

- Further research can be done to determine the risk factors not only among university teachers but also other staff members working in educational establishments. Nevertheless, using the result of this study, an extensive study can be designed for other employees. Additionally, a large sample size and more choices of private and public institutions could help to generalize the results.
- Academic institutions can accommodate ergonomically designed equipment by switching to adjustable furniture for a multiuser workstation.

- Besides, accomodating a place for physical activities and relaxation sessions can give long term health benefits, as following proper posture can prevent having MSDs.
- The university website can have a separate section on the guidelines to be followed for an ergonomic friendly computer workstation. And, short trainings can be arranged for both new and old staff members.
- Periodical trainings could be provided to further observe long-term effects and benefits of training.
- It may be necessary for educational authorities, policymakers and other stakeholders to take proactive steps to recognize and mimimize MSDs for academic professionals.
- Being technologically advanced, many academicians work in flexible work arrangements away from the traditional workplace such as a home; therefore, the workstations outside the office may also be included in future research studies to obtain a more comprehensive understanding.

5.4 Conclusion

In conclusion, the back, shoulder and neck complaints were more frequently reported by the participants than complaints in any other regions of the body. Adding to this, ergonomic knowledge shortfalls are evident to some extent in factors like the kind of chair, placement of keyboard and monitor, taking proper rest breaks, etc. Stated otherwise, poor workstation facilities are seen to be linked to health issues. On the positive side, it seems that the academic staff have more control/autonomy over their working environment with a decent social support. To a certain extent, the training has not only assisted the participants to effectively enhance their computer ergonomics knowledge and practice, but also minimized body-related discomforts. Moreover, participants feel that having training on such a topic is beneficial.

In fact, the role of an educator is not limited to teaching in class, but also additional work duties such as performing research, counseling students and also carry out certain clerical tasks. Seemingly, because of different roles, academicians are subjected to many occupational health hazards. For this reason, their performance should be evaluated and retained through multiple interventions. Notably, as seen in this research, the academic staff seldom received training in computer ergonomics, even though nowadays, the ergonomics guidelines and recommendations for computer workstations are easily available online.

The findings of the study would be beneficial for the authorities to recognize the impact of poor computer workstation design both in office rooms and in classrooms and take measures accordingly. Basically, effective human resource strategies with positive support towards the safety and well being of the employees may help to achieve better employee performance.

References

Bairagi, A. K., Rajon, S. A. A., & Roy, T. (2011). Status and Role of ICT in Educational Institution to build Digital Society in Bangladesh: Perspective of a Divisional City, Khulna. *International Journal of Advances in Engineering & Technology, 1*(4), 374-383.

Bekiari, E. I., Lyrakos, G. N., Damigos, D., Mavreas, V., Chanopoulos, K., &Dimoliatis, I. D. (2011). A validation study and psychometrical evaluation of the Maastricht Upper Extremity Questionnaire (MUEQ) for the Greek-speaking population. *Journal of musculoskelet neuronal interactions, 11*(1), 52-76.

Bennett, C., Woodcock, A., & Tien, D. (2006). Ergonomics for students and staffs. In Frumkin, H., Geller, R. J., & Rubin, I. L (Eds.), Safe and Healthy School Environments. *National Center for Environmental Health/Agency for Toxic Substances and Disease Registry U. S. Centers*. NY, USA: Oxford University Press.

Briggs, A. M., Woolf, A. D., Dreinhöfer, K., Homb, N., Hoy, D. G., Kopansky-Giles, D., ... & March, L. (2018). Reducing the global burden of musculoskeletal conditions. *Bulletin of the World Health Organization*, 96(5), 366.

Canadian Centre for Occupational Health and Safety (2014). *Work-related Musculoskeletal Disorders (WMSDs) 2014*. Retrieved: September 2, 2015, from http://www.ccohs.ca.

Chang, C. H., Amick III, B. C., Menendez, C. C., Katz, J. N., Johnson, P. W., Robertson, M., & Dennerlein, J. T. (2007). Daily computer usage correlated with undergraduate students' musculoskeletal symptoms. *American journal of industrial medicine, 50*(6), 481-488.

Das, R. (2012). Occupational Health Concerns of Software Professionals and Their Coping Strategies. *International Journal of Research Business Strategy, 1*(1) 81-86.

Devesh, S., & Bimani, N. A. (2012). A Study on The Effectiveness of a Planned Teaching Programme to Improve The Knowledge Regarding "Ergonomics For Computer Use" among selected staff of Majan College – Muscat – Sultanate of Oman. *Asian Transactions on Science & Technology, 1*(6), 21-28.

Dul, J., & Weerdmeester, B. (2008). *Ergonomics for Beginners: A Quick Reference Guide*. (3rd ed.). NW, USA: CRC Press.

Ellahi, A., Khalil, M, S., & Akram, F. (2011). Computer users at risk: Health disorders associated with prolonged computer use. *Journal of Business Management and Economics, 2*(4), 171-182.

Enos, L (2012). *HumanFit*, LLC. Retreived: December 10, 2015, from: https://safetyresourcesblog.files.wordpress.com/2014/11/ergonomics-checklist.pdf.

Erick, P., & Smith, D. (2011). A systematic review of musculoskeletal disorders among school teachers. *BMC MusculoskeletDisord. 12*(260), 1-11.

Erick, P., & Smith, D. (2013). Musculoskeletal disorder risk factors in the teaching profession: a critical review. *OA Musculoskeletal Medicine, 1*(3), 1-10.

Erick, P., & Smith, D. (2014). The prevalence and risk factors for musculoskeletal disorders among school teachers in Botswana. *Occupational Medicine & Health Affairs*, 1-13.

Hultman, G., Nordin, M., & Saraste, H. (1995). Physical and psychological workload in men with and without low back pain. *PubMed, 27*(1), 11-17.

International Ergonomics Association. (2014). *Definition and Domains of ergonomics 2014*. Retrieved: April 20, 2015, from http://www.iea.cc/whats.

Iti, J. L., Nigudgi, S. R., & Reddy, S. (2017). Assessment of musculoskeletal disorders by standardized nordic questionnaire among computer engineering students and teaching staff of Gulbarga city. *International Journal of Community Medicine and Public Health, 3*(3), 668-674.

Jensen, C., Ryholt, C. U., Burr, H., Villadsen, E., & Christensen, H. (2002). Work-related psychosocial, physical and individual factors associated with musculoskeletal symptoms in computer users. *Work & Stress, 16*(2), 107-120.

Li, L., Yue, P., & Liu, F. (2012). Work-related Musculoskeletal disorders among school teachers in China, prevalence and occupational factors. *Injury Prevention, 18*(Suppl 1), 162.

Luttmann, A., Jäger, M., Griefahn, B., Caffier, G., Liebers, F., & World Health Organization. (2003). Preventing musculoskeletal disorders in the workplace. Protecting Workers' Health Series, (5), 1-32.

Mesaria, S., & Jaiswal, N. (2015). Musculoskeletal disorders among teachers residing in various Nations: a review. *Research Journal of Recent Sciences*, 4, 23-27.

Mohammadipour, F., Pourranjbar, M., Naderi, S., & Rafie, F. (2018). Work-related musculoskeletal disorders in Iranian office workers: prevalence and risk factors. *Journal of Medicine and Life, 11*(4), 328-333.

Moom, R. K., Sing, L. P., & Moom, N. (2015). Prevalence of musculoskeletal disorder among computer bank office employees in Punjab (India): a case study. *Procedia Manufacturing, 3*, 6624-6631.

NIOSH (National Institute for Occupational Safety and Health). (1997). Musculoskeletal disorders and workplace factors: a critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back. NIOSH Publication. 97-141.

Ng, YM., Ibrahim, N., & Maakip, I. (2017). Prevalence and Risk Factors of Musculoskeletal Disorders (MSDs) among Primary and Secondary School Teachers: A Narrative Review. *Austin Journal ofMusculoskelet Disorders*. *4*(2), 1-6.

Roknuzzaman, M. (2006). A survey of Internet access in a large public university in Bangladesh. *International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2*(3), 86-105.

Rwamamara, R. A., & Smallwood, J.J. (2009). Ergonomic in Construction, Specifically in Industrially Developing Countries. In Scott, P. A (Eds.), *Ergonomics in Developing Regions: Needs and Applications* (pp. 314-321). NW, USA: CRC Press.

Sirajudeen, M. S., Alaidarous, M., Waly, M., & Alqahtani, M. (2018). Work-related musculoskeletal disorders among faculty members of college of Applied Medical Sciences, Majmaah University, Saudi Arabia: A cross-sectional study. *International journal of health sciences, 12*(4), 18-25.

Sirajudeen, M. S., Pillai, P. S., & Vali, G. M. Y. (2013). Assessment of Knowledge of Ergonomics among Information Technology Professionals in India. *International Journal of Health and Rehabilitation Sciences, 2*(4), 192-197.

Sharan, D., Parijat, P., Sasidharan, A. P., Ranganathan, R., Mohandoss, M., & Jose, J. (2011). Workstyle risk factors for work related musculoskeletal symptoms among computer professionals in India. *Journal of occupational rehabilitation, 21*(4), 520-525.

Shuai, J., Yue, P., Li, L., Liu, F., & Wang, S. (2014). Assessing the effects of an educational program for the prevention of work-related musculoskeletal disorders among school teachers. *BMC Public Health, 14*(1), 1211.

Stranks, J. (2007). *Human Factors and Behavioural Safety*. NY, USA: Routledge.

Tsou, I. Y. Y., & Chng, H.H. (2002). The Bone and Joint Decade 2000-2010: For Prevention and Treatment of Musculoskeletal Disease. *Annals Academy of Medicine, 31*(1), 69-70.

UGC (University Grants Commission of Bangladesh). (2014). *List of Private Universities 2014*. Retrieved: March 20, 2017, from http://www.ugc.gov.bd/university/?action=private.

Vaghela, N. P., & Parekh, S. K. (2018). Prevalence of the musculoskeletal disorder among school teachers. *National Journal of Physiology, Pharmacy and Pharmacology, 8*(2), 197-201.

Village, J., Rempel. D., & Teschke, K. (2005). Musculoskeletal disorders of the upper extremity associated with computer work: a systematic review. *Occupational Ergonomics, 5*(4), 205-218.

Vos, T., Allen, C., Arora, M., Barber, R. M., Bhutta, Z. A., Brown, A., ... & Coggeshall, M. (2016). Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet, 388(10053), 1545-1602.

WHO (World Health Organization) Expert Committee on Identification and Control of Work-Related Diseases & WHO. (1985). *Identification and control of work-related diseases: report of a WHO expert committee [meeting held in Geneva from 28 November to 2 December 1983].*

WHO. (2019). Musculoskeletal conditions [Fact sheet]. Retrieved: January 22, 2020, from *https://www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions*.

Westgaard, R. H., & Winkel, J. (1997). Ergonomic intervention research for improved musculoskeletal health: A critical review. *International Journal of Industrial Ergonomics, 20*(6), 463-500.

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