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IT Professional Work Style Risk Factors for Work-Related Musculoskeletal Disorders

Ratih Andhika Akbar Rahma[1*], Aisy Rahmania[1], Dian Afif Arifah[1], Tofan Agung Eka Prasetya[2], Nurul Izzah Abdul Samad[3], Abdullah Al Mamun[4]

[1)] Department of Occupational Safety and Health, Universitas Darussalam Gontor, Ponorogo, Indonesia
[2)] Health Department, Faculty of Vocational Studies, Universitas Airlangga, Campus B, Surabaya, Indonesia
[3)] School of Health Sciences, Universiti Sains Malaysia, Malaysia
[4)] Faculty of Public Health, Universitas Airlangga, Campus C, Surabaya, Indonesia

[*)] Correspondence e-mail: ratihandhika@unida.gontor.ac.id

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Abstract

Information Technology (IT) professionals suffer musculoskeletal problems and injuries more frequently due to their type of work which makes them rely on using computers for a prolonged time. The goal of this study is to analyze the risk factors for work-related musculoskeletal disorders in IT professionals. Amount of 150 IT professionals participated in this study as respondents. The Cornell Musculoskeletal Disorders Questionnaire (CMDQ) was used as a measurement tool in determining musculoskeletal complaints among IT professionals. The independent variables (age, gender, working experience, educational level, number of hours spent at work in front of a computer per day, working hours, and exercise habits) that significantly affected the variance in the dependent variable (musculoskeletal disorders) were evaluated using multiple linear regression analysis (p-value < 0.05). IT professionals reported experiencing symptoms most frequently 3–4 times per week in the upper back (45.3%) and back (31.3%), and once or twice per week in the upper back (33.3%) and back (31.3%). Then on the discomfort level, IT professionals feel very uncomfortable in the back (71.3%), upper back (68.7%), and neck (64%). The number of hours spent at work in front of a computer per day (p-values of 0.040) and working hours (p-value of 0,032) are significant predictors of IT professional musculoskeletal disorders. IT professionals reported experiencing the greatest musculoskeletal issues in the right upper extremity, which comprises the right wrist, right forearm, right shoulder, and right upper arm (88%). Back (84%) and left lower extremities (82.7%), which include the left thigh, left knee, and left lower legs, are two other issues that most IT professionals have.

Keywords: work style, risk factor, work-related musculoskeletal disorders, IT professional

INTRODUCTION

These days, musculoskeletal disorders are regarded as one of the major global public health issues that have the worst effects on society, resulting in a low quality of life, physical injury at the workplace, disability, and loss of job (Tegenu *et al*., 2021). Worldwide, musculoskeletal disorders are a prevalent health issue. (Nag, 2018). Pain, pains, and discomfort in the muscles, tendons, ligaments, joints, nerves, and blood vessels are the hallmarks of musculoskeletal disorders (Chiwaridzo *et al*., 2018). A broad spectrum of conditions and

traumas affecting the musculoskeletal system of the body are referred to as musculoskeletal disorders, for example, bones, muscles, joints, and spinal discs (Oakman *et al*., 2019). There are various symptoms of MSDs including general symptoms such as pain, swelling, weakness, and tingling, and clinical symptoms like inflammations of tendon, nerve compression, and osteoarthritis (Beyers, 2022). Musculoskeletal problems and injuries among occupational people derived from work-related activities are commonly known as Work related Musculoskeletal Disorders (WMSDs) (Sirajudeen *et al*., 2018; Chinedu *et al*., 2020).

World Health Organization (WHO) reported that almost 317 million people suffer from WMSD-related health problems annually. Moreover, WMSDs affect the national economy with huge losses, especially in underdeveloped and developing countries (Tegenu *et al*., 2021). According to a 2017 Global Burden of Diseases study, WMSDs accounted for the second-highest number of years lost to injury in Sub-Saharan Africa (Fink *et al*., 2019). The European Agency for Safety and Health at Work is likewise troubled by this (Yizengaw *et al*., 2021). WMSDs can impact several body parts, such as the neck, hands, legs, back, and upper limbs (arms, shoulders, and elbow joints) (Russo *et al*., 2020). These health problems represent a significant burden for the workers or professionals, organizations, and as well as for society at large by decreasing the quality of life of workers and organizational productivity, and increasing absenteeism (Fernandes *et al*., 2018). Due to the work environment, WMSDs are caused by sitting or repetitive activities including different motions or physical movements (Prall and Ross, 2019). Typically, the low back, knee, foot, neck, shoulder, forearm, and hand are the body parts most impacted (Balogh *et al*., 2019; Abdelsalam *et al*., 2023).

Information technology (IT) professionals suffer musculoskeletal problems and injuries more frequently due to their type of work which makes them rely on using computers for prolonged time (Bagheri and GHaljahi, 2019). Nowadays, computer and information technology are the main driver behind innovation and has a significant role in every part of society (Van Veldhoven and Vanthienen, 2022). IT professionals such as software developers, computer programmers, computer systems analysts, website developers, IT technicians, and data analysts are hardly relied on working on computers for a prolonged time. There are many factors related to WMSDs such as poor sitting posture, unsuitable seating, and inappropriate position and use of computer parts. As a result, WMSDs from either a single instantaneous or multiple or prolonged exposure to the work environment will eventually lead to loss of work time, health problems, medical treatments, work restriction, or a switch to another job. Additionally, office workers, notably computer experts, frequently complain about their arms, necks, shoulders, and backs (Mohan *et al.*, 2019).

Several studies have been published which reported the prevalence of WMSDs among several professional background around the world. According to a cross-sectional study conducted by medical professionals who work in operating rooms, 64.2% of study participants had WRMSDs (Yizengaw *et al*., 2021) and WMSDs among Zimbabwean medical professionals, of whom 82.1% reported having had WMSDs in the previous year, with low back pain being the most prevalent issue (Chiwaridzo *et al*., 2018). In Portugal, spine was the most affected body parts among health care providers (Fernandes *et al*., 2018).

Another study was conducted in Gondar City of Northwest Ethiopia shows that the prevalence rate of WMSDs was 81.5% among the respondents who work in restaurants (Tegenu *et al*., 2021). A bank job is one of the professions with prolong sitting which may result huge WMSDs exposure. The following study also support the above statement as it reported the overall prevalence of WMSDs during the last one year is 73.1% (Etana *et al*., 2021). The most impacted bodily parts, according to them, were the upper back, lower back, neck, and shoulder. Another study among bankers reported with 65.5% prevalence rate in Ethiopia (Kasaw Kibret *et al*., 2020). An investigation including special education teachers and teacher assistants reveals that around 86% of the subjects had musculoskeletal disorders

(Cheng *et al*., 2016). In the meantime, the investigation research on Bangladeshi ready-made garment (RMG) workers reveals comparably little exposure to WMSDs, about 48% female respondents reported with back and neck pain, and 35% male respondents reported with neck and knee pain (Hossain *et al*., 2018a). The office work or desk job may cause higher prevalence of WMSDs, as reported in study with overall 71.9% prevalence rate among the office workers in higher education institutions (Chinedu *et al*., 2020).

There are several factors associated with WMSDs throughout the world including: ergonomic factors (awkward or same postures, repetitive movements, working duration), psychosocial factors (relation with others, workload, stress, professional satisfaction and success), behavioral factors (BMI, substance abuse, physical activity and other health condition) and socio-demographic factors (sex, age, income) *(*Cheng *et al., 2016;* Hossain *et al*., 2018b; Greco *et al*., 2022). Awkward or same posture, repetitive movement and sitting on same position for prolong time are the primary reason for development of WMSDs symptoms among workers (Mekonnen *et al*., 2020). Even WRMSDs mainly focus on physical issues but several studies revealed that the occupational WMSDs mostly related to psychosocial factors. The risk and progression of MSDs are statistically correlated with the psychological workplace attributes of support, collaboration, job control, and job expectations, according to a comprehensive analysis of longitudinal research (Bezzina *et al*., 2023). The modernization brought many changes in job pattern including the tremendous use of computer and information technology. IT professionals are vulnerable to developing WMSDs due to the job nature and work environment such as prolonged sitting, awkward postures, low physical activity, psychological stress, work duration, repetitive work without sufficient physical rest and mental recovery time (Aydın, 2023; Pereira and Plácido da Silva, 2023).

At present, there is a lack of studies representing the consequences and active factors related to WMSDs in Indonesian IT professionals compared to other professionals. However, the contextual differences among different professions necessitate the studies to be conducted in regions and among similar groups of workers for relevant solutions to be proffered. It's critical to comprehend the frequency of WMSDs among IT professionals as well as the key contributing elements for the employer and the employees, related organizations, health policymakers, and associated health providers to realize the risk and minimize the presence of the problem. This study aims to analyze the risk factors for work-related musculoskeletal disorders in IT professionals.

METHOD

This research is an observational study focused on exposures that are already present in a population and assesses the effects of the exposure on this cross-sectional studies (Marques *et al*., 2023). The target of data collection involved Information Technology (IT) Professionals across East Java, Indonesia as a target population. They were randomly selected using cluster random sampling which determined by city region in East Java. The respondent participated in this study should meet the required criteria, including: 1) Have a minimum age of 23; 2) Have been working for at least 1 year as a full-time worker; 3) Spend more than three hours each day on a computer or tablet; and 4) Have an information technology educational background of at least a bachelor's degree.

The minimum sample size (n) calculated by using Lemeshow's formula (Greco *et al*., 2022) for infinite population assumed, given as :

$$n = \frac{Z^2_{1-\alpha/2}\, P\,(1-P)}{d^2} \quad (1)$$

Refer to Eq. (1):

n = Minimum sample size;

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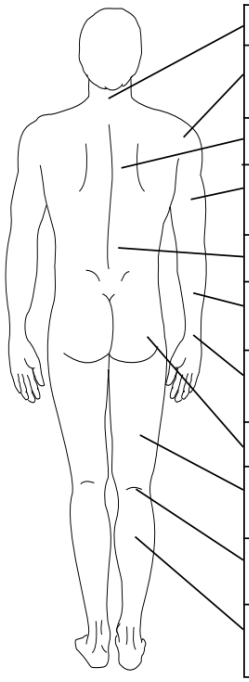
$Z^2_{1-\alpha/2}$ = $1{,}96^2$ (with $\alpha = 0{,}05$)
P = estimated proportion of companies that have implemented FSM (50% = 0,5)
d = tolerable error rate 10% = 0,1
In order for the minimum sample size to be determined as:
n = 3.84 x 0,5 (1-0,5) / 0,01
n = 96,04 ~ 97 respondents
In order to anticipated bias and data missing issue, this study gained 150 IT professionals as respondents. They were informed of the objectives and design of the study, and they voluntarily decided to participate as respondents by completing online forms for data collection.

The Hardjono Hospital Ethics Committee Review Board granted approval for this study, which agreed with the ethical standards established by that committee and was recorded under the number 00542135021212420221206000 /KEPK/XII/2022 so there is no ethical issue in this study.

The work-related musculoskeletal disorders as the main variable that consists of musculoskeletal pain, discomfort, and complaints among 12 body regions (neck, shoulders, upper back, upper arms, lower back, forearms, wrists, hip, thigh, knees, and lower leg).



The diagram below shows the approximate position of the body parts referred to in the questionnaire. Please answer by marking the appropriate box.	During the last work week how often did you experience ache, pain, discomfort in:					If you experienced ache, pain, discomfort, how uncomfortable was this?			If you experienced ache, pain, discomfort, did this interfere with your ability to work?		
	Never	1-2 times last week	3-4 times last week	Once every day	Several times every day	Slightly uncomfortable	Moderately uncomfortable	Very uncomfortable	Not at all	Slightly interfered	Substantially interfered
Neck	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shoulder (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Shoulder (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Back	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Arm (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Upper Arm (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Back	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Forearm (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Forearm (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wrist (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wrist (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Hip/Buttocks	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Thigh (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Thigh (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Knee (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Knee (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Leg (Right)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lower Leg (Left)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Figure 1. The Cornell Musculoskeletal Disorders Questionnaire (Vasanthi *et al*., 2023)

The independent variable includes demographic data such as age, gender, working experience, educational level, number of hours spent at work in front of a computer per day, working hours, and exercise habits. The demographic data were collected using questionnaire. While the Cornell Musculoskeletal Disorders Questionnaire (CMDQ) were used as a measurement tool in determining musculoskeletal complaints among IT professionals. The CMDQ contain questionnaire that used to gauge IT Professional's level of musculoskeletal pain, discomfort or any complaints during the rest periods and ergonomic adjustments. The

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instrument, which has been demonstrated to be a valid and trustworthy tool, can be used to collect data on musculoskeletal discomforts, specifically pain severity among office workers (Shariat *et al*., 2018). Standardized questions will be created using the Cornell questionnaire to look into musculoskeletal complaints or symptoms. There are four techniques to examine CMDQ scores (Aydın, 2023):

1. Easy symptom counting to determine how many symptoms each person has
2. Representing each person's rating values in summary
3. Giving ratings greater weight to make it easier to spot the most serious problems with the categories in Table 1.

Table 1
Weighting Rating Scores

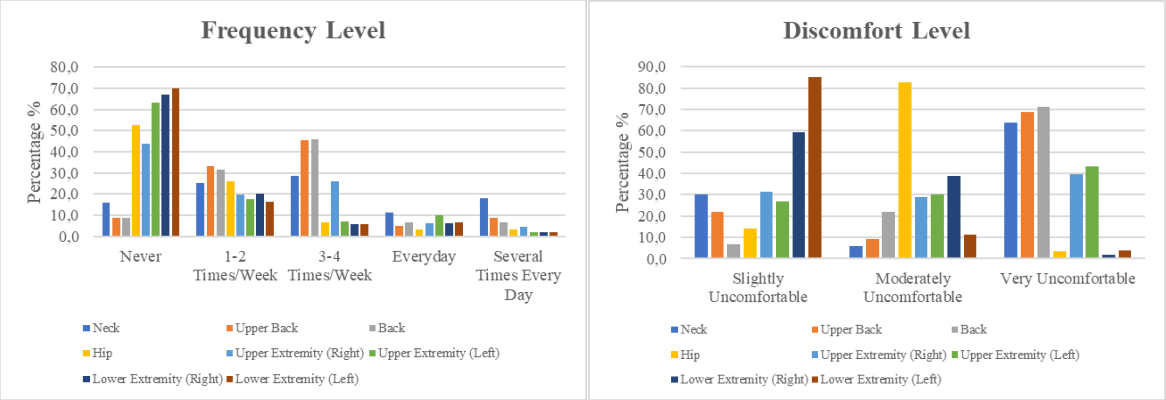
Category		Rating Score
Frequency Score	Never	0
	1-2 Times/Week	1.5
	3-4 Times/Week	3.5
	Everyday	5
	Several Times Every Day	10
Discomfort Score	Slightly Uncomfortable	1
	Moderately Uncomfortable	2
	Very Uncomfortable	3
Interference Score	Not at all	1
	Slightly Interfered	2
	Substantially Interfered	3

4. Multiplying the aforementioned frequency score, discomfort score, and interference score.

The statistical package for the social sciences (SPSS®) (Version 22.0; IBM, Armonk, NY, USA) was used to analyze the data. In addition to numbers, the category data were shown as percentages (%) of the entire population. The independent variables that significantly influenced the variance of the dependent variable (pain) were evaluated using multiple linear regression analysis. One could regard a p-value of 0.05 or less to be statistically significant.

RESULTS AND DISCUSSION

Figure 2 presents the comparative of frequency, discomfort, and interference level IT professionals experience from Cornell Musculoskeletal Disorders Questionnaire. The body parts are grouped into the neck, upper back, back, hip, upper extremity right, upper extremity left, lower extremity right, and lower extremity left.



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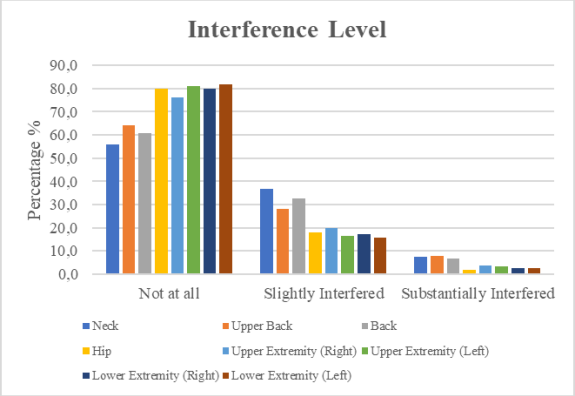

Figure 2. Level of Frequency, Discomfort, and Interference IT Professionals Experience

IT professionals reported experiencing symptoms most frequently 3–4 times per week in the upper back (45.3%) and back (31.3%), and once or twice per week in the upper back (33.3%) and back (31.3%). Then on the discomfort level, IT professionals feel very uncomfortable in the back (71.3%), upper back (68.7%), and neck (64%). However, the majority of IT professionals believed that having aches, pains, and discomfort did not affect their productivity; just a tiny minority felt that their neck (36.7%) and back (32.7%) caused some slight interference. Figure 3 shows that the right upper extremity, which comprises the right shoulder, right upper arm, right forearm, and right wrist, was where IT professionals reported experiencing the greatest percentage of musculoskeletal diseases (88%). Additionally, they experienced the most symptoms in their neck (84%) and left lower extremities (82.7%) which comprises the left thigh, left knee, and left lower leg.

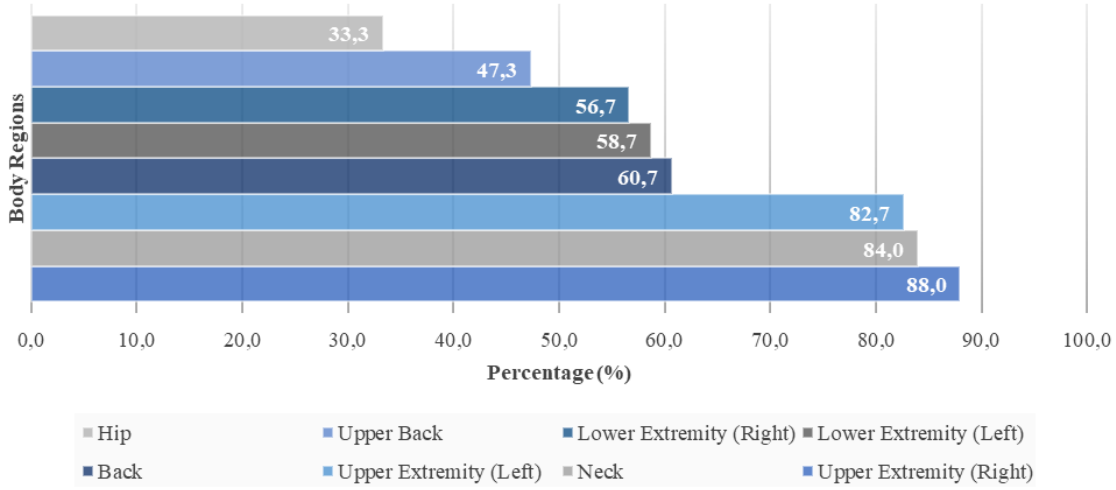

Figure 3. Body Region Comparisons of Musculoskeletal Disorders

Table 2 presents a research subject characteristic summary of 150 IT professionals including the age, gender, working experience, educational level, number of hours spent at work in front of a computer per day, working hours, and exercise habits. Table 2 also displays the statistical test outcomes of the multiple regression analysis used to examine the correlation between respondent characteristics and musculoskeletal disorders.

The musculoskeletal disorders prevalence rates were greater in younger age groups than in older ones (58.0 % for IT professionals 20 to 25 years old, 30.7% for 26 to 30 years old, and 11.3% more than 30 years old). 70% of IT professionals are female workers with 87.3% having a bachelor's degree. More than 108 IT professionals (72%) reported working more than four

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hours a day in front of a computer, and 98 IT professionals (65.3%) work longer than eight hours each day. Additionally, 81 IT professionals have a practice of exercising, while the remaining 69 do not do so frequently. Table 2 demonstrates that number of hours spent at work in front of a computer per day (p-values of 0.040) and working hours (p-value of 0,032) are significant predictors of IT professional musculoskeletal disorders.

Table 2
Demographic Analysis of IT Professionals

Variable		Frequency (n)	Prevalence Rate (%)	*p value**
Age (years)	20-25	87	58.0	
	26-30	46	30.7	0.441
	>30	17	11.3	
Gender	Male	105	70.0	0.724
	Female	45	30.0	
Working Experience (year)	< 5	126	84.0	0.242
	5-10	19	12.7	
	> 10	3	2.0	
Educational Level	High School	19	12.7	
	Bachelor's Degree	131	87.3	0.856
Number of hours spent at work in front of a computer per day	< 4	42	28.0	
	> 4	108	72.0	0.040
Working Hours (hour)	< 8	52	34.7	0.032
	> 8	98	65.3	
Exercise habits	Yes	81	54.0	0.243
	No	69	46.0	

**p-value < 0.05*

The study's findings suggest that the number of hours an IT professional spends in front of a computer each day and their working hours are risk factors for musculoskeletal disorders related to their line of work. A total of 108 IT professionals (72%) work more than four hours a day in front of a computer with an average of 7.5 working hours (7.5 ± 2.3). IT professionals are more likely to spend 65 to 80 percent of their workdays sitting still, it raises their chance of contracting musculoskeletal ailments and cardiovascular illness, among other health problems (Pereira and Plácido da Silva, 2023). They suffer musculoskeletal problems and injuries more frequently due to their type of work which makes them rely on using computers for prolonged time (Bagheri and GHaljahi, 2019). Work style with spending working hours in front of a computer per day for more than 4 hours can increase 4.2 times higher risk of experiencing pain the musculoskeletal disorders especially neck region (Aydın, 2023). A cross-sectional descriptive research of 319 Visual Display Terminal (VDT) users in office settings in Kathmandu Metropolitan City, Nepal, also found that higher amounts of time spent daily in front of a VDT screen, work-related stress, and musculoskeletal disorders were important correlates (Das *et al*., 2022). Particular effects of musculoskeletal disorders especially Low Back Pain (LBP) caused by one's posture when using a computer and their distance from the screen, spending more than six hours a day sitting in front of a computer, job happiness, and repetitious labor (Malińska *et al*., 2021).

The other IT professional's risk factor for work-related musculoskeletal disorders such as age, gender, and exercise habits also contribute to the occurrence of complaints. The musculoskeletal disorders prevalence rates were greater in younger age groups (20-25 years)

than in older ones, 70% of IT professionals are female workers with 87.3% having a bachelor's degree, and 81 IT professionals have a practice of exercising. The relationship between age-related degenerative changes and reduced functional capacity in older workers may have played a role. Additionally, as job experience increases, chronic musculoskeletal tiredness may result in accumulated tension on muscles and tendons, resulting in a decrease in blood supply to the corresponding areas (Jeong *et al*., 2018). Around 25% of the female respondents to the other study reported lower back discomfort, which was more than the prior study from Bangladesh (18%) (Hossain *et al*., 2018a). When individual and occupational variables are taken into account, physical capacity is connected with the occurrence of musculoskeletal problems in office employees. Particularly, neck and low back complaints reported in the past 12 months are related to decreased shoulder abduction strength and decreased back and leg flexibility. Additionally, the relationship between physical ability and musculoskeletal symptoms is impacted by both occupational (job control and ROSA score) and individual factors (age, sex, body mass index, amount of physical activity, and smoking). Therefore, it is important to take into account and adequately control for these factors in order to comprehend and treat musculoskeletal complaints in office employees (Cabral *et al*., 2019).

Several studies about musculoskeletal disorders among office workers or IT professionals show that the most complained about body parts are the neck, upper back, lower back, shoulder, forearm, hand, and the joints of the lower and upper limbs (Mohan *et al*., 2019), [28], [32], (Rahma *et al*., 2023). In this study, the right upper extremity, which includes the right wrist, right forearm, right shoulder, and right upper arm, was the area where IT professionals reported having the most musculoskeletal conditions (88%). Another complaint that the majority of IT professionals have are back (84%) and left lower extremities (82.7%) which comprises the left thigh, left knee, and left lower legs. The majority of IT professionals in this study work with poor sitting posture, such as a bent back, unsupported sitting, inadequate seating or a chair that cannot be adjusted, and improper positioning and use of computer components. Therefore, upper extremity body parts are most complained by IT professionals.

A risk to the musculoskeletal health of workers is prolonged sitting. Extensive lab studies have demonstrated that extended sitting increases lower back discomfort, if not pain. Additional recommendations include chronic muscle deconditioning brought on by consistently reduced levels of activation, which results in muscular tiredness, and postural adjustments such as flattening the lumbar lordotic curve with extended periods of low loading in static postures (Le and Marras, 2016). To further understand why discomfort emerges, more research is required on muscular depletion and other postural factors that contribute to the development of discomfort. This study examined the effects of two hours of prolonged sitting on low back angle, pelvic mobility, mental state, muscle exhaustion, and discomfort. All body parts saw a considerable increase in discomfort, with the low back rating the worst. Over time, there was a decline in the quality of innovative problem-solving mistakes, and extended sitting had a detrimental effect on mental health (Baker *et al*., 2018).

Several systematic reviews show that neck/shoulder strengthening exercises are more effective than ergonomic measures at reducing musculoskeletal pain in office workers (Chen *et al*., 2018), (Hwang *et al*., 2021). The combined ergonomics and neck/shoulder strengthening exercise (EET) intervention was more beneficial in the short- and possibly long-term than the combined Ergonomics and Health Promotion (EHP) intervention when office workers with baseline neck discomfort completed 70% or more of the exercise sessions (Ting *et al*., 2019). The majority of IT professionals in this study are software developers, computer programmers, computer systems analysts, website developers, IT technicians, and data analysts, who work in small enterprises, and they often spend a lot of time using computers. Most of them improperly adjusted workstations and ergonomically unsound office desks, which causes employees to adopt bad working postures (Hwang *et al*., 2021).

CONCLUSION

The amount of time IT professionals spend at work each day in front of a computer and their working hours are risk factors for work-related musculoskeletal disorders. IT professionals reported experiencing the greatest musculoskeletal issues in the right upper extremity, which comprises the right wrist, right forearm, right shoulder, and right upper arm (88%). Back (84%) and left lower extremities (82.7%), which include the left thigh, left knee, and left lower legs, are two other issues that most IT professionals have. In order to decrease musculoskeletal problems among IT professionals, particularly in small enterprise workers, further study is required.

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