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Musculoskeletal symptoms related to work environment - a report based on survey conducted among computer professionals

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Summary

Introduction

Nowadays the computer has become an essential tool used at work in many vocations. Health effects resulting from sitting working are associated with taking the same position for a few hours every day. Although musculoskeletal disorders are widespread worldwide, they are typical for office jobs. Work related musculoskeletal disorders among the IT professionals are a common area of concern.

Aim

This study aimed to determine the prevalence of various musculoskeletal symptoms among computer workers.

Results and Conclusions

The survey was completed by 78 participants - 57 men (73,1%) and 21 women. Most participants (42,3%) were aged below 30 years. The musculoskeletal symptoms varied according to affected body area. Within the 7 days preceding the study, a substantial proportion of the participants reported lower back (44,9%), neck (43,6%), or shoulder (33,3%) symptoms. Almost one-quarter (23,1%) of the participants had upper back pain during the same period. Similarly, the same regions were the four most frequently affected in the 12 months preceding the study. Musculoskeletal symptoms were highly prevalent in the current sample. Prevention of the appearance and deterioration of symptoms is possible by following the rules of ergonomics at work with feedback regarding correct posture, frequently changing the position of the body with stretching exercises and taking active breaks.

Key words: musculoskeletal disorder, ergonomics, work-related illness, computer users, low back pain

Introduction

Physical inactivity at workplaces and particularly prolonged sitting has been linked to increase in cardiovascular disease, obesity and musculoskeletal disorders. Work-related musculoskeletal symptoms refer to conditions that involve the muscles, nerves, tendons, or joint-related discomforts connected with the work environment [1]. Depending on the profession, musculoskeletal symptoms occur in a variety of locations. Despite advances in ergonomics, they often persist due to prolonged computer work resulting from the overloading of some muscle groups, maintenance of incorrect postures, repeatability of the same pattern of movement, and mechanical compression of body structures. Other important risk factors include poor physical activity, advanced age, obesity, a workplace not adapted to the needs of employees, organisational and psychosocial factors, such as monotonous tasks and low job satisfaction [2]. The most common health outcome is the occurrence of pain, which is supposed to be the precursor of more severe disease or the disorder itself [1]. Considerable suffering, health problems and finally loss of motivation and productivity may cause financial loss for the company and increase public health care spending. According to an investigation performed in the United States, in 2016 low back and neck pain had the highest amount of health care spending with an estimated \$134.5 billion. Other musculoskeletal disorders accounted for the second highest amount of health care spending estimated at \$129.8 billion [3]. In Poland 2021, musculoskeletal and connective tissue diseases are the second cause of total incapacity to work [4].

Aim

This study aimed to determine the prevalence of various musculoskeletal symptoms among computer workers.

Methods

The survey designed with GoogleForms was prepared to collect data from workers of three companies dealing with informatic technologies - the questionnaire was shared on employees' general communication channels. The online survey permits to reach more participants with easy access, cost-effective and eco-friendly ways. The questionnaire was taken anonymously - no personal data was collected. It took about 5 minutes to complete.

Study

The survey assesses work-related musculoskeletal symptoms among employees of three companies including clerks usually working at the computer. A message with a link was shared with members with a reminder sent five days later. The online survey began on 8th June 2022, and was open to respondents for 7 days.

Participants

Content of the questionnaire

The questionnaire consisted of the following fields: (1) background demographic information, (2) work-related data, (3) workstation evaluation, and (4) identification of musculoskeletal symptoms. There were questions asking about the daily physical activity and most frequent way of spending a break in work (active or passive). A pilot study was conducted with a group of five to assess the clarity of the questions and the time needed to complete the survey. After the pilot study, no major changes were made to the questions. Background demographic information included data pertaining to age group (< 30 years, 30–39 years, 40–49 years, 50–59 years, and ≥ 60 years), sex, height, weight and years of practice (less than 1 year, 1–5 years, 6–10 years, and more than 10 years). Work-related characteristics included the time spent at a computer workstation (less than 4 hours, 4–6 hours, 7–9 hours and more than 9 hours) and the most frequent type of breaks taken (active or passive). The workstation was evaluated in terms of adjustability of the height of the workstation, chair and backrest (adjustable or nonadjustable). The last section asked for occurrence of musculoskeletal

symptoms in the past 7 days and 12 months. An answer of multiple choice included a list of nine body regions that have experienced harsh symptoms (neck, shoulders, upper back, lower back, elbows, wrists, hips/thighs/buttocks, knees, ankles/feet). There was an additional answer "none of the above".

Results

The survey was completed by 78 participants - 57 men (73,1%) and 21 women. Average weight of participants was $80,5\text{kg} \pm 8,3\text{kg}$ and average height was $177,6\text{cm} \pm 15,5\text{cm}$. The better part belonged to the 30–39 years and <30-year-age groups, with 31 (39,7%) and 33 (42,3%) participants (Table 1).

Table 1: Characteristics of participants and their work environment

Characteristics		Number of participants (%)
Age	<30	33 (42,3)
	30-39	31 (39,7)
	40-49	12 (15,4)
	≥ 50	2 (2,6)
Sex	Male	57 (73,1)
	Female	21 (26,9)
Years in practice	Less than 1	5 (6,4)
	1-5	25 (32,1)
	6-10	21 (26,9)
	>10	27 (34,6)
Time spent at computer workstation (hours/day)	<4	1 (1,3)
	4-6	11 (14,1)
	7-9	44 (56,4)
	>9	22 (28,2)
The most frequent type of break	passive	58 (74,4)

	active	20 (25,6)
Average daily physical activity	none	16 (20,5)
	Less than 1 hour	34 (43,6)
	1-2 hours	22 (28,2)
	More than 2 hours	6 (7,7)
Adjustable height of chair	yes	68 (87,2)
	no	10 (12,8)
Adjustable backrest	yes	55 (70,5)
	no	23 (29,5)
Adjustable height of workstation	yes	27 (34,6)
	no	51 (65,4)

Within the 7 days preceding the study, a considerable proportion of the participants reported lower back (44,9%), neck (43,6%), or shoulder (33,3%) symptoms. Almost one-quarter (23,1%) of the participants had upper back pain during the same period. Similarly, the same regions were the four most frequently affected in the 12 months preceding the study.

Table 2: Musculoskeletal symptoms occurred in different anatomical regions ($n=78$) within 7 days and 12 months preceding the study

Musculoskeletal symptoms		
Anatomical region	Symptomatology in the last 7 days	Symptomatology in the last 12 months
	n (%)	n (%)
Neck	34 (43,6)	41 (52,6)
Shoulders	26 (33,3)	36 (46,2)
Upper back	18 (23,1)	28 (35,9)
Lower back	35 (44,9)	48 (61,5)
Elbows	6 (7,7)	3 (3,8)

Wrists/hands	16 (20,5)	21 (26,9)
Hips/thighs/buttocks	9 (11,5)	12 (15,4)
Knees	15 (19,2)	25 (32,1)
Ankles/feet	3 (3,8)	5 (6,4)
None of the above	13 (16,7)	7 (9,0)

Table 3 presents the prevalence of musculoskeletal symptoms depending on sex. Higher percentage of women complained about the symptoms of neck, shoulders and hips region than men. However, male sex was associated with a higher prevalence of upper back symptoms within 7 days preceding the study.

Table 3: The prevalence of musculoskeletal symptoms depending on sex

Musculoskeletal symptoms by sex (male = 57, female = 21)

Anatomical region	Symptomatology in the last 7 days			Symptomatology in the last 12 months		
	Male	Female	Total	Male	Female	Total
	n (%)	n (%)		n (%)	n (%)	
Neck	22 (38,6)	12 (57,1)	34	28 (49,1)	13 (61,9)	41
Shoulders	16 (28,1)	10 (47,6)	26	23 (40,4)	13 (61,9)	36
Upper back	17 (29,8)	1 (4,8)	18	22 (38,6)	6 (28,6)	28
Lower back	23 (40,4)	12 (57,1)	35	35 (61,4)	13 (61,9)	48
Elbows	3 (5,3)	3 (14,3)	6	2 (3,5)	1 (4,8)	3
Wrists/hands	12 (21,1)	4 (19,0)	16	17 (29,9)	4 (19,0)	21
Hips/thighs/buttocks	4 (7,0)	5 (23,9)	9	6 (10,5)	6 (28,6)	12
Knees	8 (14,0)	7 (33,3)	15	16 (28,1)	9 (42,9)	25
Ankles/feet	3 (5,3)	0	3	3 (5,3)	2 (9,5)	5
None of the above	10 (17,5)	3 (14,3)	13	6 (10,5)	1 (4,8)	7

Factors related to long-term musculoskeletal symptoms. 71 from 78 participants declared musculoskeletal symptoms episodes that occurred in the

12 months preceding the study. “Total answers” section refers to participants belonging to the discussed variable. The occurrence of symptoms was associated with several demographic characteristics and work conditions. More women than men reported disabling symptoms in at least one body region [20 (95,2%) females vs. 51 (89,5%) males]. Out of respondents the fewest complaints about musculoskeletal symptoms were reported by participants declaring long working time (>9h - 81,8%). Data has been collected in a table.

Table 4: Factors related to long-term musculoskeletal symptoms

Variables	Total answers	Musculoskeletal symptoms in the past 12 months. <i>n</i> (%)
Age	<30	33
	30-39	31
	40-49	12
	50-59	2
Sex	Male	57
	Female	21
Years of practice	Less than 1	5
	1-5	25
	6-10	21
	>10	27
Time spent at computer (hours/day)	<4	1
	4-6	11
	7-9	44
	>9	22
Frequent type of break	passive	58
	active	20

Average daily activity (hrs)	none	16	15 (93,8)
	less than 1	34	28 (82,4)
	1-2	22	22 (100)
	2+	6	6 (100)
Adjustable height of chair	yes	68	65 (95,6)
	no	10	6 (60)
Adjustable backrest?	yes	55	52 (94,5)
	no	23	19 (82,6)
Adjustable height of workstation?	yes	27	25 (92,6)
	no	51	46 (90,2)

Discussion

This study has reported an extremely high prevalence of musculoskeletal symptoms among the examined computer professionals. Within the last 7 days only 13 interviewees (16,7%) have not experienced symptoms from mentioned regions and within the last 12 months preceding the study this percentage decreases to 7 participants (9%). The musculoskeletal symptoms by regions most affected were similar, with the lower back being the most affected, followed by the neck and shoulders. These results are in agreement with the regions that are documented as having the highest symptoms in computer workers [2].

The lower back region was the most reported area suffering from musculoskeletal symptoms in the past 12 months preceding the study. In fact, it is a very common condition, with about 90% of people suffering from it at some point in their lives [5]. The prevalence of symptoms in the lower back region reported here is higher than the global prevalence among the human population - a systematic review of over 160 studies reported a one-year mean prevalence of only 38% (61,5% in current study). The overall mean prevalence of low back pain was higher among females compared with males, which reflects the results of this study [6]. Systematic review of prospective cohort studies was performed by Janwantanakul et al. to identify risk factors for the onset of low back pain among office workers. Most factors previously investigated have no predictive value for future lower back pain, such as age, daily computer use, workstation ergonomics, social support, and job demands. Authors emphasise that there have been very few prospective cohort studies on risk factors for the onset of lower back pain in office workers, therefore further studies in this area are needed [7].

Postural musculoskeletal pain is a major public and occupational health problem, especially among information technology professionals. A prospective interventional study of 44

participants compared the effectiveness of multidisciplinary treatment approach and conventional treatment approach of back pain amongst computer users. Group I included study participants to be treated by conventional treatment approach - orthopaedics consultation and physical therapy. Group II embraced study participants treated by a multidisciplinary approach which included a combination of orthopaedic consultation, physiotherapy, ergonomics, vitamin supplementation, diet plan, massage therapy, and stress management. The study showed that multidisciplinary approach was better in reducing intensity of pain, number of sick leave availed due to low back pain, and perceived health status [8].

Majority of the participants of this study demonstrated a passive model of breaks - only one-quarter declared to spend a break in an active way. Despite this approximately 90% of respondents experienced long-term symptoms in both groups. Waongenngarm et al. evaluated the effectiveness of breaks on low back pain, discomfort, and work productivity in office workers. The review included publications of several databases from 1980 to December 2016. The demonstration for the effect of breaks on pain and discomfort was not clear. However, reviewed papers support the positive effect of active rests with postural change for musculoskeletal pain and discomfort. Authors emphasised low quality of evidence and the need for more high-quality studies before recommendations can be given [9]. The newest trials prove that active break and postural shift interventions shortened recovery time, reduced recurrence and new onset of neck and low back pain among high-risk office workers [10, 11].

Neck pain was the second most prevalent musculoskeletal symptom among participants in the 12 months preceding the survey. A systematic review by Hogg-Johnson et al. reported the one-year prevalence of neck pain to typically range from 30 to 50% in the general population [12]. Furthermore, a study investigating the extent and severity of musculoskeletal symptoms among office workers in a large telecommunication company revealed that the prevalence of neck pain or discomfort reached 77.5% [13]. This outcome emphasises the influence of the office-work environment on musculoskeletal symptoms, which was also reported in a similar study performed on computer users [14]. Another cross-sectional study of 417 office workers observed that monitors located from one side, instead of the front of the operator, was found to be an important risk factor for neck pain and lower back pain in computer-using workers [15].

Improperly designed computer stations, taking the wrong position while sitting, lack of knowledge about the correct ergonomics and other bad habits lead to excessive muscle tension and increase the incidence of musculoskeletal symptoms. It has been proved that proper workstation set-up, ergonomically designed to fit the user, is an important part of the prevention. Besides declared adjustability of workstation in most fields, the prevalence of musculoskeletal symptoms among respondents was considerable. Epstein et al. in their study noticed that good ergonomics are not always enough to solve the problem - education and feedback regarding one's correct use workstation equipment, how to sit with good posture, and the importance of stretch breaks are equally important to avoid muscle tension that leads to development of musculoskeletal disorders [16].

The results suggest that prevalence of musculoskeletal symptoms is higher in groups over 40 years. This is expected, considering the impact of age-related degenerative changes. However, the prevalence of symptoms among the youngest group (below 30 years) was reported to be 97%. This rate is high considering that 42,3% of study participants were in that age group. It is likely that these young employees who had musculoskeletal symptoms will be liable to recurrent symptoms in the future, unless effective interventions are timely taken. A set of interventions which include education, physical activity in the workplace, ergonomic interventions and promoting a positive work environment to reduce work-related stress are fundamental for

prevention.

The findings of this study have to be seen in light of some limitations. The first one is a small sample size which makes it difficult to identify significant relationships in the data. A study performed on a bigger population may show the relation between participants' age, working time or physical activity and occurrence of musculoskeletal symptoms. Identified predictors may support the need for interventions to reduce risk. There is a lack of data about the relation between the compliance of physical activity recommendations and the frequency of musculoskeletal symptoms in computer workers, but this kind of study would enable a more efficient preventive approach. Further studies should emphasise the correlation between various physical activities practised after work and occurrence of musculoskeletal symptoms, taking into account the new World Health Organization guidelines. These recommendations specify a target range of 150–300min of moderate-intensity physical activity and 75–150 min of vigorous-intensity physical activity per week, in order to obtain health benefits [17]. The anonymous questionnaire shared on company's general communication channels poses a risk of auto-selection of participants. The musculoskeletal symptoms were self-reported. Although self-reporting can be rapid and convenient, it may also introduce bias such as those who experienced musculoskeletal symptoms were more likely to respond than those who did not. Objective scales evaluating potential risk associated with computer-based office work may improve the quality of collected data.

Conclusions

Most people working at the computer experience various health problems. Musculoskeletal symptoms are common among computer workers with lower back, neck and shoulders being the most frequent areas of complaints. Therefore, it is highly recommended to prevent the appearance and deterioration of symptoms by following the rules of ergonomics at work, frequently changing the position of the body with stretching exercises and taking active breaks. The collected data of this study may be used to develop intervention strategies reducing incidence of musculoskeletal symptoms and for further evaluation of associated risk factors.

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