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Body Posture in Relation with Musculoskeletal Symptoms amongst Computer Operators

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Authors' contributions

This work was carried out in collaboration between all authors. Author VPS designed the study, wrote the protocol, and wrote the first draft of the manuscript. Author JJ managed the literature searches and analyses of the study and author TJ have made substantial contributions to conception and writing. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The aim of this paper is to present the prevalence of musculoskeletal symptoms among computer operators and its association with the body posture at the workplace as well as break time usage during the working hours.

Study Design: The paper represents a cross-sectional study which includes computer operators.

Place and Duration of Study: Municipality, administrative department in combine, elementary and high schools and IT in software developing company. The duration of the study was 12 months.

Methodology: The survey included 800 computer operators. For detection of musculoskeletal symptoms among computer workers Nordic standardized questionnaire was administered and Maastricht Upper Extremity Questionnaire (MUEQ) registered the body posture during the working time and the quality of the break.

Results: 28% of participants have claimed musculoskeletal symptoms. As of the total number with registered symptoms, 57% were females and the average age was 41.91±11.72 years. Positive

correlation coefficient was obtained between the neck pain and taking the setting same position during working hours, sitting with arms raised for more than 2 hours, performing repetitive tasks, holding the head in a bent position and placement of the body in asymmetric position. During the testing of cross-correlation regarding the musculoskeletal symptoms and the usage of break at work, there is a positive coefficient received between the neck and shoulder pain within the inability to use break of 10 min after 2 hours of work at the computer, not planning the break with the symptoms in the shoulder and wrist, and the insufficient break usage with the shoulder symptoms.

Conclusion: The prevalence of musculoskeletal symptoms in computer operators in Republic of Macedonia show that it is not high leveled. According to the research of muscle-skeletal system disorder at computer workers it is shown that the most frequent are the symptoms in the neck area and shoulders.

Keywords: Computer workers; body position; locomotary system; musculoskeletal disorders.

1. INTRODUCTION

WHO defines musculoskeletal system diseases as a result of many factors, but indicates that the working environment and performing of certain daily tasks are contributive factors in occurrence of musculoskeletal system disorders [1]. Work-related diseases related with the locomotor disorders cover all musculoskeletal diseases that are caused with the work at inadequate conditions of performance [2].

Nowadays it is almost impossible to find an office or institution in which the work hasn't been done on computers. The need for use of computers increases with the advancement of computer technology and software. As a result, health problems related to this kind of work are evolving constantly. Musculoskeletal disorders and pain in the neck and upper limb associated with the work on computer are commonplace in today's society and show an upward trend. Numerous studies have shown a possible cause-effect relationship between computer skills and muscle pain in the neck and arms [3-11]. Previous epidemiological studies that have dealt with the problem of computer connectivity and musculoskeletal diseases are largely based on subjective assessments of symptoms related to the upper limbs and muscles.

The findings published last few years worldwide have shown that employees suffering from the disorder of their general welfare and / or symptoms related to the upper extremities are caused by the work environment [12]. Periodic movements and activities can cause considerable disruption that Sogatz [13] described as "Neuro-plastic model of repeated effort." According to this model, frequent repetitive movements cause micro-injuries that accumulate in the affected muscle structure and

lead to pain during movement. Office jobs connected to a computer (data entry and use of the mouse) may cause upper extremity disorders. The aim of this paper is to present the prevalence of musculoskeletal symptoms among computer operators their association with the body posture at the workplace as well as break time usage during the working hours and testing the effect of body posture on musculoskeletal symptoms.

2. MATERIALS AND METHODS

The paper represents a descriptive cross sectional study which includes computer operators. Before the start of the research a permit from the competent authorities of the institution was given where the research itself was conducted and consent from every participant. With the simple random sampling the survey included 920 computer operators employed in a number of different institutions in Bitola, Republic of Macedonia: municipality, administrative department in combine, elementary and high schools and IT in software developing company. Age range of described group was 30 to 60 years. Inclusion criteria were: working at the computer operators for at least 1 hour a day during 8 working hours [14]. Exclusion criteria were pregnancy and age range. The questionnaires were distributed to 920 participants with the respondent rate of 95%. A total of 875 questionnaires were returned of which 49 were eliminated for incomplete responses and 26 eliminated due to the statements of the presence of disease (osteoarthritis, rheumatoid arthritis and other connectivity tissue disease).

As for detection of musculoskeletal symptoms among computer workers Nordic standardized questionnaire was administrated. The

questionnaire consists of structured, forced, binary or multiple choices and was used as self-administered questionnaire. It is composed of two sections. First basic part is composed of questions that refer the appearance of the musculoskeletal symptoms according the anatomic area (neck, shoulders, elbow, wrist and hand and finally the upper and the lower part of the back). An additional classification of the symptoms according the period of the appearance within last 12 months and during last 7 days was done as well. Second part of the questionnaire includes additional questions regarding the symptoms for each anatomic localization, functional influence, and durability as well as the musculoskeletal symptoms during last 7 days. It is a questionnaire with standardized methodology which enables comparison of pain that occurs in the lower back, neck and shoulders and it is used in epidemiology studies [15,16].

To evaluate the body posture during the working time and the quality of the break questions from Maastricht Upper Extremity Questionnaire (MUEQ) were used [17,18,19,20]. The questionnaire included questions about: holding same posture for a long time, asymmetric posture, sitting with raised shoulders, using a mini break after two hours working on the computer, using a qualitative break etc [16].

Statistical data processing was made by specific computer software STAT FOR WINDOWS. Results received are expressed as a percentage and arithmetic average with standard deviation, determination of Spearman correlation coefficient ($p=0.05$, 95% Confidence interval) and chi square test.

3. RESULTS

Research was conducted at 800 respondents whose daily work includes computer working for more than 1 hour throughout the working hours. As of the total number 54% were females and 46% males at the age around 42 ± 10.76 years. As of 800 operators 28% have claimed musculoskeletal symptoms. As of the total number with registered symptoms, 57% were females and the average age was 41.91 ± 11.72 years.

The prevalence of symptoms in the last 12 months shows that the majority was with symptoms in the neck (23%), shoulder (18%)

and the least of them with symptoms in the elbow (5%). The symptoms in the last 7 days was 9% in the neck, 6% in the shoulders and upper back, 3% in the region of the wrist, and 2% in the elbow (Fig. 1).

Out of 800 workers at the computer 3.1% (25) were hospitalized due to musculoskeletal symptoms, 7% tried to change jobs because of problems in the spine, neck and shoulders, and in 19.75% (158) were done medical examination for musculoskeletal symptoms.

Analysis of physical risk factors in the workplace related to working posture among 800 employees showed that 55% of operators during the work retains the same body position for a long time and 38% of operators on the computer often perform repetitive tasks during working hours (Fig. 2).

There is a statistical significance between the neck pain and taking the setting same position during working hours, sitting with arms raised for more than 2 hours, taking an incorrect position, performing repetitive tasks, holding the head in a bent position and placement of the body in asymmetric position. Also positive cross correlation was obtained between the wrist and hand pain with performance of repetitive movements during the working hours (Table 1).

24% out of the total number of 800 respondents claim that often can plan the break, 28% can never split the working hours, 22% never can make a decision about taking the break, 30% often and 24% never take 10 minutes break after two hours of computer work and 22% think that only sometimes the break is enough during working hours (Fig. 3).

During the testing of cross-correlation regarding the musculoskeletal symptoms and the usage of break at work, there is a statistical significance between the neck and shoulder pain within the inability to use break of 10 min after 2 hours of work at the computer, not planning the break with the symptoms in the shoulder and wrist, and the insufficient break usage with the shoulder symptoms (Table 2).

Results of the chi square test showed statistical significance (chi-square is 28.6537 at $p < 0.05$) for depended variables regarding the body posture and the occurrence of musculoskeletal symptoms.

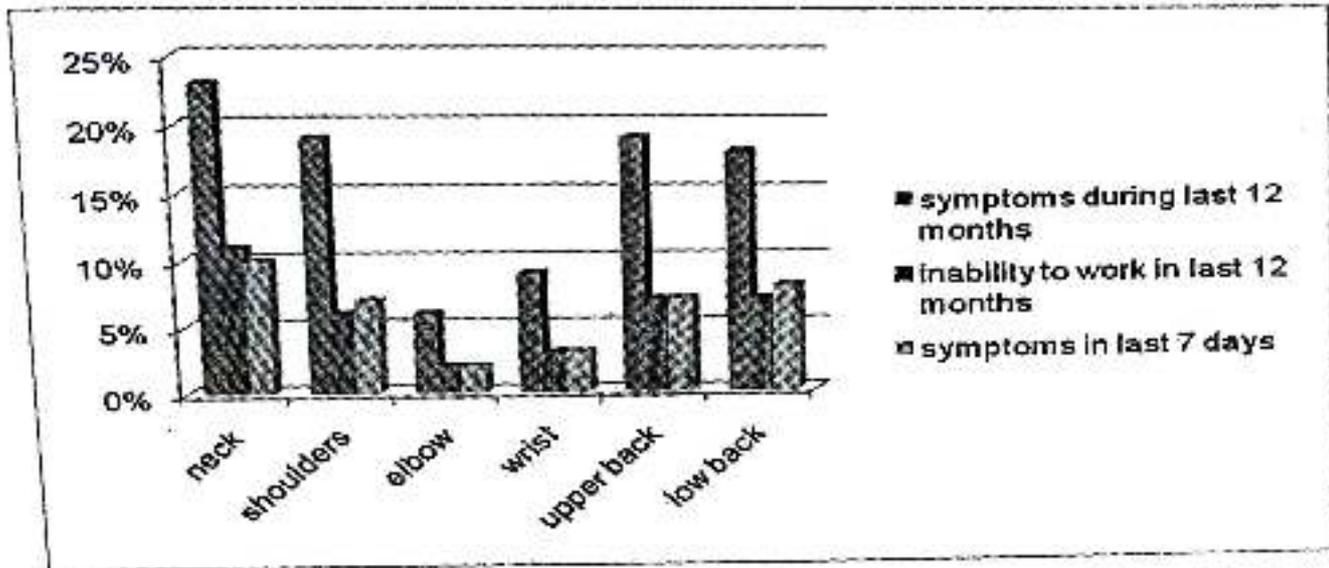


Fig. 1. Prevalence of musculoskeletal symptoms during the last 7 days and 12 months, and inability to work in the last 12 months by body region (N=800)

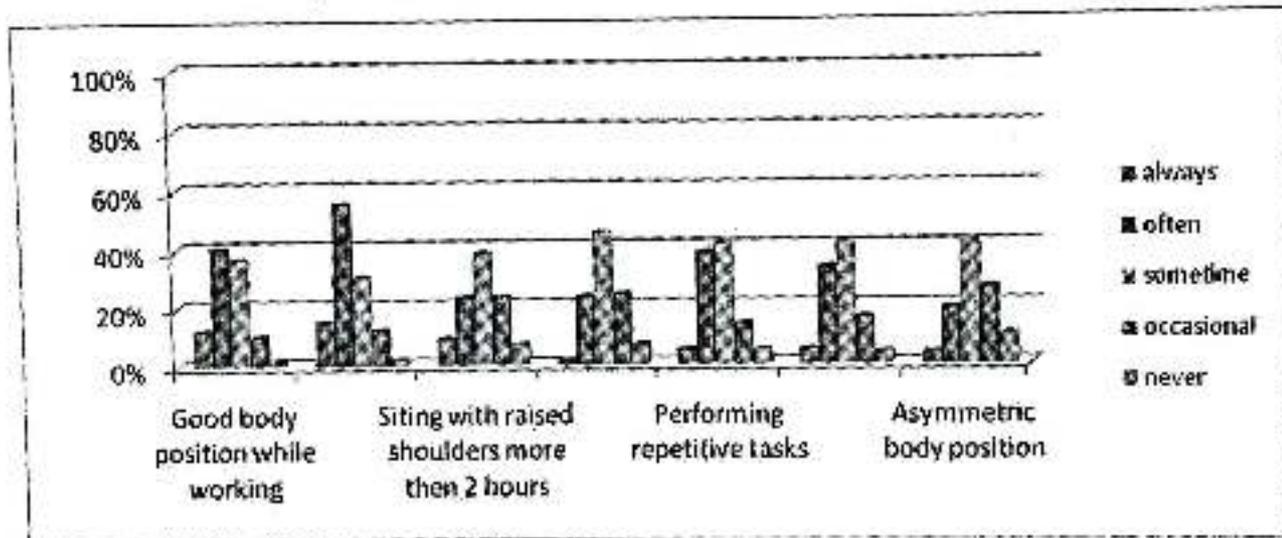


Fig. 2. Participants responses related to posture and body position (N=800)

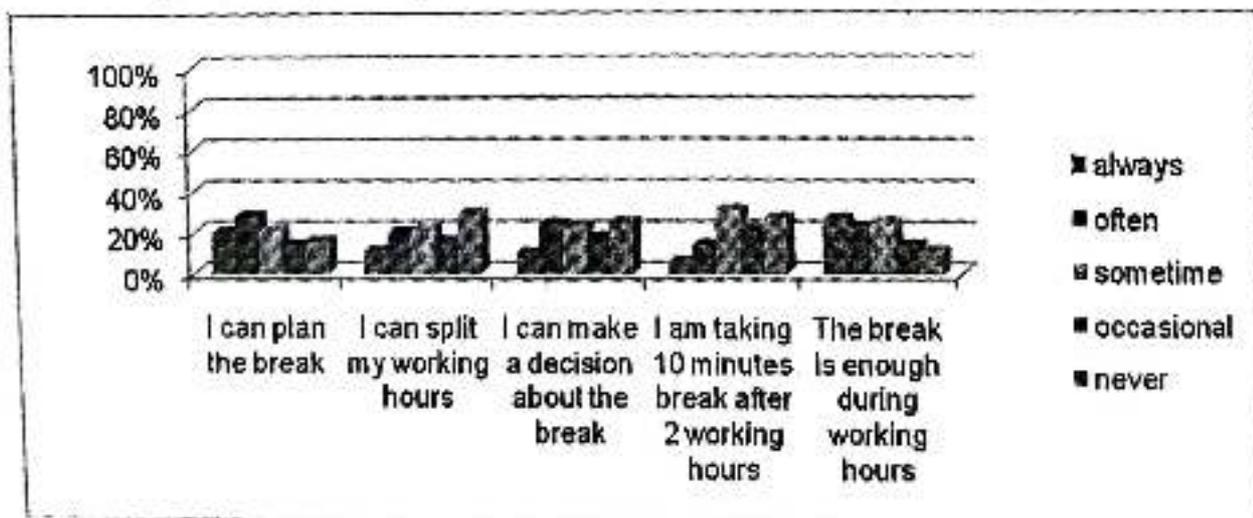


Fig. 3. Graphic presentation of the responders about using break during working hours in 800 computer operators

Table 1. Cross-correlation between body posture and musculoskeletal symptoms occurrence (p=0.05)

Body posture	Neck pain in last 12 months	Pain in the wrist in last 12 months- yes
Same posture during most of the working hours	0.0962	/
I sit more than 2 hours with my shoulders up	0.1466	/
Holding inadequate posture while working	0.1466	/
I perform repetitive tasks while working	0.0722	0.1215
My head is up while working	0.1722	/
My body is set asymmetrically	0.1016	/

Table 2. Cross-correlation between break time usage and the occurrence on musculoskeletal symptoms (p=0.05)

Break time usage	Neck pain within last 12 months	Shoulder pain within last 12 months	Wrist pain within last 12 months - yes
I can plan my break time		0.255	0.2538
I use 10 min break after 2 hours of work	0.1409	0.1054	
Claims that the break time is enough		0.142	

4. DISCUSSION

According to the analysis of the Nordic questionnaire, prevalence of musculoskeletal disorders among computer operators in the last 12 months is shown as follows: neck (23%), shoulders and upper spine (18%), lumbar region of the spine (17)%, wrist and hands (8%) and elbow (5%). The prevalence of these symptoms in all patients in the last 7 days is: most prevalent in the neck (9%), shoulder and upper spine (6%), wrist and arm (3%) and elbow (2%).

The results related to the presence of musculoskeletal symptoms are in accordance with the results of similar studies cited in the literature. Thus Shahla Eltayeb et al in their study which investigated computer operators, showed that the most prevalent musculoskeletal symptoms were in the neck and shoulder (0.33 and 0.31) that were accompanied with the symptoms in the wrist and elbow [18]. The results of this study concerning the representation of the most common musculoskeletal symptoms in the neck and shoulders of the computer operators are in accordance with results from the literature [14,19,20,21,22,23,24,25,26].

Musculoskeletal symptoms are often represented among women and the average age of the patients with symptoms was 42 years. According the results of epidemiological studies linked with

the occurrence of musculoskeletal symptoms at the workplace conducted by Punnett and Bergqvist [3] show that women often suffer from symptoms in the neck and upper extremities compared to men.

These differences based on gender can be explained by several factors, as one of them could be that women are more often exposed to physical and psychosocial risk factors than men [27].

Results related to potential risk and the relation between posture and appearance of musculoskeletal symptoms in computer operators show that most present are those to ones that hold the same posture, perform repetitive tasks during working hours and keep their head bent over while working in front of the computer. A cross-correlated analysis is conducted and the results are obtained within the group of 800 operators. A positive correlation coefficient of association between the positions of the body, performing repetitive tasks, bowed head position during working and asymmetric posture with the appearance of musculoskeletal disorders. In this group was also detected a relationship and a positive correlation between sitting with shoulders up more than two hours during the day and taking a non-physiological position of the body with the appearance of symptoms in the neck and a positive correlation and association between the execution of tasks

that are repetitive and symptoms in wrist and hand. In the scientific literature there seems to be some consensus on poor ergonomic conditions at workstations contributing to musculoskeletal symptoms or disorders [8,9]. Data and information that is given in the literature suggest an association between occurrence of musculoskeletal disorders in the upper limbs of a computer operator and adverse physical and psychosocial factors at work [28,29]. Taking asymmetrical posture of the body during computer work (the head and the whole body in a crouching position) and poor work habits (long sitting in the same position, sitting with shoulders up and perform repetitive motion) is directly associated with the appearance of musculoskeletal symptoms [30]. The results for the potential risk of misuse break during the working hours of computer operators show that the majority of respondents claim that they never used a break for 10 minutes within two hours work at the computer. The relation was established between symptoms in the shoulders, wrists and hands and the inability of planning a break; between the occurrence of symptoms in the neck and shoulders with the inability to use a break of 10 minutes after two hours at the computer. Insufficient break over the working hours and not enough time to rest was significantly associated with the appearance of musculoskeletal symptoms in computer operators, as shown by a study conducted in China [30]. Protective effect of time to pause was shown in two previous epidemiological studies [31,32]. The results of EMG studies have also confirmed the protective effect during break-time [33].

Generally, the study is limited by the cross-sectional design, which is suitable only for associations. The aim of this study was to determine the prevalence of symptoms of the upper extremities and neck and to describe possible risk factors regarding body posture during work and quality of break derived from working conditions. Information about non-occupational stress factors was not assessed, e.g. children at home, household work, ethnicity, or the history of symptoms.

The data gathered in this survey can be used as a reference for further studies with comparable outcomes and in occupational safety and health campaigns for education of the employees and employers about contribution of good posture and use of quality break during the working hours.

5. CONCLUSION

The prevalence of musculoskeletal symptoms in computer operators in Republic of Macedonia show that it is not high leveled, but since there is no quite much data on the representation of the past in the present study it can not be concluded whether there is a trend of decrease or increase in the prevalence of these symptoms. As of the influence of certain individual factors in terms of symptoms occurrence, there should be a special attention given to the female computer operators. According to the research of muscle-skeletal system disorder at computer workers it is shown that the most frequent are the symptoms in the neck area and shoulders. The medical preventive measure should be mostly focused at is exactly those body segments where the muscle-skeletal symptoms are most present and the benefit of this measure would be seen among the workers alone, employers (because of the reduced absence) and the society in general because of the financial savings during treatment.

Application of the adjusted recommendations and adequate trainings for computer operators and their supervisors, which refer to the proper body posture, sufficient breaks and their quality management are a significant preventive measures as well.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The aims, methods and procedures of the study were agreed by the management and the workers council of the company.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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