

original article

# Ergonomic assessment of musculoskeletal disorders risk among the computer users by Rapid Upper Limb Assessment method

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## ABSTRACT

**Aims:** The purpose of this study was to evaluate ergonomic assessment MSDs risk in computer users with Rapid Upper Limb Assessment (RULA) method and Nordic questionnaire.

**Materials and Methods:** This cross-sectional study was conducted on 96 computer users in computer sites, Isfahan University of Medical Sciences. The data were analyzed using test SPSS 20 and descriptive statistics and ANOVA test. Data collection tool was Nordic questionnaire and checklist RULA.

**Results:** By Nordic questionnaire, the results showed that MSDs prevalence in computer users were, in the neck (54.9%), back (53.1%), and elbow (43.2%) more than in other parts of the body. Based on the level of risk, RULA was 24 individuals in an area of low risk, 41 individuals area of caution, and 31 individuals in the area hazard. MSDs prevalence was in women more than men. Furthermore, ANOVA test showed that there is direct and significant correlation between age and work experience with a final score RULA ( $P < 0.001$ ).

**Conclusion:** This study result showed that frequency of musculoskeletal problems in the neck, back, elbow, and wrist was generally high among our subjects, and ergonomic interventions such as computer workstation redesign, users educate about ergonomic principles computer with work, reduced working hours in computers with work must be carried out.

**Key words:** Computer user, musculoskeletal disorders, Nordic questionnaire, Rapid Upper Limb Assessment

## INTRODUCTION

Work-related musculoskeletal disorders (WMSDs) are considered an important source of occupational morbidity. Musculoskeletal disorders (MSDs) associated with occupational computer use are primarily linked to the upper limbs. MSD

as a disorder that affects a part of the body's musculoskeletal system, which includes bones, nerves, tendons, ligaments, joints, cartilage, and spinal discs. These are the injuries that

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result from repeated motions, no rest sufficient, and forces placed on human bodies while performing various job actions. WMSDs are a group of painful disorders of muscles. Carpal tunnel syndrome, tendonitis, thoracic outlet syndrome, and tension neck syndrome are examples.<sup>[1]</sup> Unsuitable posture and over exertion forces or over exposure time are the causes of this disorder. Almost all work requires the use of the arms and hands. Therefore, most WMSD affect the hands, wrists, elbows, neck, and shoulders. Some back problems also result from repetitive activities. MSDs have been observed and experienced widely at workplaces where the computers are frequently used.<sup>[2]</sup> MSDs are associated with high costs to employers, such as absenteeism, lost productivity, and increased health care, disability, and worker's compensation costs. MSDs cases are more severe than the average nonfatal injury or illness.<sup>[3]</sup> As a result of previous studies, 20–25% of total costs spent for medical cares, sick leaves, retirements, and pensions in the countries of Northern Europe in 1991 were related to these disorders.<sup>[4]</sup> MSDs in addition to ergonomic exposures to other factors such as work experience, and fitness depends on individual sensitivity.<sup>[5,6]</sup> In a study by Evans and Patterson who studied MSDs in computer users found that 65% of participants in the study have complained of neck and shoulder pain.<sup>[7]</sup> Yektaee *et al.* that to investigate different body areas MSDs in computer users to the concluded that individuals that 3 days or more per week working with computers increased the incidence of MSDs of the neck and upper body. Furthermore, 75% of computer users have occasionally suffered from back pain, neck, and shoulder were 20–25% had experienced musculoskeletal pain every day.<sup>[8]</sup> Occupational risk factors are high in computer users, and the purpose of this study was to evaluate ergonomic assessment MSDs risk in computer users. Posture analysis was evaluated with Rapid Upper Limb Assessment (RULA) method and the prevalence of MSDs by Nordic questionnaire.

## MATERIALS AND METHODS

This cross-sectional study was conducted on 96 computer users computer in computer sites Isfahan University of Medical Sciences. The number of individual to participate in the study was considered according to the formula below:

$$n = (z)^2 (s^2)/d^2.$$

$z$  = 95% confidence level is 1.96.

$s$  = 1 on the basis of similar studies.<sup>[4]</sup>

$d$  = 0.2.

Data collection tools were standard questionnaire Nordic musculoskeletal questionnaire (standard Nordic questionnaires) and checklist RULA method. Beginning Nordic questionnaire to determine the prevalence of MSDs during the past 12 months was completed, and then demographic variables of gender, age, and experience work were recorded and finally completed checklist RULA.

RULA method is a method observation that can identify ergonomic risk factors and has good reliability for the assessment of MSDs. Final score RULA method is between 1 and 7 that score of 1–2 is no risk rate, 3–4 score is low-risk rate, 5–6 score is median risk rate, and score more than 7 is high-risk rate.<sup>[9]</sup> Standard Nordic questionnaires used to evaluate qualitatively MSDs of the neck, arm, back, elbow, wrist, hand, thigh, knee, and foot.<sup>[10]</sup> This questionnaire is very useful for assessing musculoskeletal problems in epidemiological studies. Inclusion criteria were at least 1 year of experience working and computer use for at least 3 h a day. Furthermore, exclusion criteria were unwillingness to cooperate in completing the questionnaire.<sup>[4]</sup> Data analysis was performed with SPSS (version 20) IBM Company manufacture (American multinational technology plant, New York) descriptive statistics and ANOVA test. Furthermore, the value of  $P < 0.05$  was considered statistically significant. This study was performed after getting permission from the Ethic Committee in Isfahan University of Medical Sciences.

## RESULTS

In this study, 52 males and 44 females participated. Most and least age participant individuals in this study were between 43 and 27 years. The mean and standard deviations age and experience work are presented in Table 1.

In Table 2, the prevalence of MSDs in different organs by the Nordic questionnaire showed given in the last 12 months. According to the Table 2, most of the MSDs are in the neck, back, and elbow. Furthermore, the prevalence of MSDs in total by Nordic questionnaire in women 56.8 and men 43.2%.

Posture evaluation with RULA method showed that were 24 individual (25.5% individuals) in an area of low-risk rate with 3–4 score, 41 individual (42.7% individuals) in an area

**Table 1: Demographic characteristics age and experience work by gender**

Variable	Classification	Mean (SD)	Minimum-maximum
Age	Male	35 (9.4)	28-43
	Female	29 (3.8)	27-34
Experience work	Male	21 (6.8)	13-26
	Female	9 (3.8)	2-11

SD: Standard deviation

**Table 2: Prevalence of musculoskeletal disorders in different organs by the Nordic questionnaire in the last 12 months**

Variable	n (%)
Neck	61 (54.9)
Elbow	48 (43.2)
Hand and wrist	39 (31.5)
Back	59 (53.1)
Arm	41 (38.7)
Knee	44 (39.6)
Foot	21 (18.9)

of median risk rate with 3–4 score, and 31 individual (31.8% individuals) in an area of high-risk with 7 score.

ANOVA test showed a significant difference between the scores obtained from RULA and sex. So that MSDs prevalence was in women more than men ( $P < 0.001$ ). Furthermore, ANOVA test showed a significant relationship between obtained score from RULA with experience work and age. So that MSDs prevalence increased with increase experience work and age variables ( $P < 0.001$ ). Score obtained from RULA and score obtained from Nordic questionnaire showed that computer users are at a risk of MSDs ( $P < 0.05$ ).

## DISCUSSION

The purpose of this study was to evaluate ergonomic assessment MSDs risk in computer users by RULA and Nordic questionnaire. The present study has shown that computer users according to the type and nature of their jobs are at a risk of MSDs. According to the results of the questionnaire Nordic highest prevalence of MSDs was in the neck (54.9%), back (53.1%), and elbow (43.2%). Based on the level of risk RULA were 24 individual in an area of low risk, 41 individual area of caution, and 31 individual in the area hazard. MSDs prevalence was in women more than men. The reason for high prevalence of musculoskeletal pain and symptoms can be related to the repeated activity in each region, long-term involvement of static works, inadequate rest, and awkward postures during work with computers. Sotoyama *et al.* in a study that paid to assessment MSDs in bank computer users, observations indicated that most of MSDs was in region the neck, back, and elbow which is consistent with the findings of the present study.<sup>[11]</sup> Goodman *et al.* to concluded that MSDs prevalence in region neck, back, and elbow individuals who worked with computers was more from other staff, which is consistent with the findings of the present study<sup>[12]</sup> according to the result RULA method and the Nordic questionnaire at this study of MSDs is in women more than men. Furthermore, small size body and low muscle mass women are common causes was to more MSDs in women ratio to men<sup>[13,14]</sup> Gerr *et al.* that to the assessment prevalence of MSDs of the upper extremities of the body in the computer users to concluded that with age and work experience increases the prevalence of MSDs increased, which confirms the findings of the present study<sup>[15]</sup> Gerr *et al.* that paid to evaluate MSDs in computer users to concluded that keyboard type, mouse, table, chairs, and ergonomic work stations contributed to the reduction of MSDs and in those with the principles of nonergonomic tools used were higher prevalence of MSDs<sup>[16]</sup> Marcus *et al.* performed a prospective epidemiological investigation of 632 computer users to evaluate associations between neck or shoulder pain with computer use variables (posture and work hours). results they showed that the highest MSDs prevalence were related to the neck, back, and elbow individuals among men and

women, which confirms the findings of the present study.<sup>[17]</sup> Ming and Zaproudina showed that the repetitive computer use causes cumulative trauma on the neck, shoulder, arm, and hand muscles and joints<sup>[18]</sup> Jensen *et al.* found that the duration of computer work is associated with neck and shoulder symptoms in women and hand symptoms in men. In addition, the use of mouse was observed to have an increase in hand/wrist and shoulder region symptoms among the intensive users of computers.<sup>[19]</sup>

## CONCLUSION

This study showed that frequency of musculoskeletal problems in the neck, back, and elbow was generally high among our subjects and ergonomic interventions such as computer workstation redesign, education ergonomic principles work with computer, and reduced working hours computers with work.

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### Conflicts of interest

There are no conflicts of interest.

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