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# Musculoskeletal Disorder Symptoms Assessment among Office Workers of a Manufacturing Company

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### ABSTRACT

It is observed that high exposure of computer use in workplace resulted in problems associated with Musculoskeletal Disorder (MSD). MSD are injuries and disorders that affect the human body's movement or the musculoskeletal system. Most office workers customarily use computers as a part of their equipment in the workplace, however such equipment may create many ergonomic risk factors. Hence, MSD assessment is important to determine the risk level experienced among computer users. This research is conducted on office workers of a manufacturing company in Selangor. The objective of this research is to identify the prevalence of MSD symptoms among the employees via Nordic Musculoskeletal Questionnaire (NMQ) and to determine the ergonomic risk factors. The risk levels are assessed using Rapid Office Strain Assessment (ROSA). Results show the prevalence of MSD symptoms is high with 95.3% of total respondent had the symptoms. The highest body parts with MSD symptoms experienced are lower back with 70.9%, shoulder, 68.6% and neck with 65.1%. The lowest body parts with MSD symptoms are ankle/feet with 33.7%, followed by hips/ thigh with 25.6% and elbow with 20.9%. Majority of the office workers are at high risk level based on ROSA score. It was also found that there are significant relationship between the MSD symptoms and ROSA high score. Finding also shows that risk factor Body Mass Index (BMI) and light exercise has significant relationship with MSD. Based on the study results, an ergonomic intervention program is proposed to overcome the MSD and its ergonomic risk factors at office environment.

**Keywords:**

Office work, musculoskeletal disorders, Nordic musculoskeletal questionnaire, rapid office strain assessment

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## 1. Introduction

Office work is sedentary work, which mainly involve computer use, meetings, presentations, reading, and telephone calls. Office work may require the employees to sit down at long periods using computers, working in awkward positions, or performing repetitive manual tasks [1]. In the last two decades, the dramatic growth of computer use in working environments has resulted in some adverse effects among office workers [2]. One of the most common injuries of ergonomic

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hazard for office workers is Musculoskeletal Disorder (MSD). MSD are disorders and injuries that affect the human body's movement or musculoskeletal systems. Musculoskeletal system includes tendons, muscles, nerves, ligament, blood vessel and nerves disc and etc. MSD are major occupational health issues for workers in developed and developing countries including Malaysia [3]. According to Department of Occupational Safety and Health (DOSH), ergonomic hazard at office comprises of various form such as repetitive movement, prolong sitting, awkward posture and etc. [4]. As such, the objective of this research is to identify the MSD symptoms among office workers and to determine the risk factor of MSD. The risk level of exposure to MSD is also being assessed.

In this study, the ergonomic risk assessment is used as a tool to identify the risk factors for office workers and MSD. There are two main methods adopted for ergonomic risk assessment, which are Nordic Musculoskeletal Questionnaire (NMQ) and Rapid Office Strain Assessment (ROSA). Nordic questionnaire was developed by Kourieka et. al (1987) for the analyses of the musculoskeletal symptoms in an ergonomic or occupational health context. The musculoskeletal symptoms of interest include complaints such as pain, numbness and discomfort on nine parts of body regions from neck, shoulder, upper back, elbows, hand/wrist, lower back, hip/thigh, knees, and ankle/feet. [5]. Meanwhile, ROSA is a method which could quickly identify and quantify ergonomic risk associated with computer use. ROSA which was developed by Sonne et.al [6], is basically a picture-based postural assessment. ROSA scores more than 5 are deemed to be at high risk level and thus corrective measures should be considered.

## 2. Methodology

### 2.1 Respondents

This cross-sectional study was conducted at a manufacturing company in Shah Alam on 86 office workers from 110 total office workers. The number of respondents was determined based on the formula by Krejcie and Morgan [7]. The selection of participants is based on:

- Permanent staff only
- Staff who do routine office work and mainly engage with computers
- On voluntary basis

### 2.2 Data Collection

Data collection tools for demographic and working information are standardized Nordic Musculoskeletal Questionnaire (NMQ) and Rapid Office Strain Assessment (ROSA) checklist.

#### 2.2.1 Nordic Musculoskeletal Questionnaires (NMQ)

Section A of Nordic questionnaires comprises of demographic profile of respondents such as age, gender, BMI and physical exercise. Section B is related to respondents' working information such as computer use, working hour, time spent sitting on chair and rest break. Section C is on musculoskeletal disorder (MSD) complaints or symptoms in body region. In Section C, respondents have to choose either 'Yes' or 'No' of each question for the prevalence of MSD in the past 12 month.

#### 2.2.2 Rapid Office Strain Assessment (ROSA)

Rapid Office Strain Assessment (ROSA) checklist is an ergonomic risk assessment method to quantify exposure of risk factor related to computer workstation. ROSA is used to attain score for

each subsection of computer workstation, such as subsection A-Chair, subsection B-Monitor and Telephone, subsection C-Mouse and Keyboard, and ROSA final score. In subsection A-Chair, the total score of Chair Height and Pan Depth are combined, and matched with total score of Arm Rest and Back Support, based on ROSA scoring chart, to receive score of subsection A-Chair.

A score of -1 will be assigned if the worker spends less than 1 hour a day in the chair throughout the day. If the worker spends 1-4 hours a day the duration score is 0. If the worker spends more than 4 hours a day in the chair, the duration score will be +1. Duration score is added to score of the chair score to receive final subsection A chair score. In subsection B-Monitor and Telephone, total score of monitor is added to duration score, and then matched with total score of telephone and duration score. In subsection C-mouse and keyboard, total score of mouse is added to duration score, and then matched with total score of keyboard and duration score. Subsection B and C are matched to receive total score of peripherals and monitor.

The score ROSA range from 1 to 10 where the score was categorized into two main category. Score 1 – 4 indicate low risk level while Score 5 – 10 considered as high risk and need ergonomic intervention of computer workstation.

### 2.3 Statistical Analysis

Data are analyzed by Statistical Package for Social Science Software (SPSS). Descriptive statistics was used to exhibit the numbers and percentages of demographic information, working characteristics, MSD symptoms and ROSA risk score. Chi-square tests are also used to test for independence among variables.

## 3. Results and Discussion

The demographic and work characteristics of respondents are shown in Table 1. Results reveal 95.3% of total respondents showed symptoms of MSD while 4.7% never had experienced MSD symptoms. In Figure 1, the prevalence of MSD in different body regions of the respondents in the past 12 months are shown. Results show that the prevalence of musculoskeletal symptoms for lower back (70.9%), shoulder (68.6%), neck (65.1%), wrist/hands (50.0%), upper back (44.2%), knees (41.9%), ankles/feet (33.7%) and elbows (20.9%).

In Table 2, ROSA result by risk groups was identified. There are about 68.6% of respondents have ROSA score of 5 to 10, while 31.4% respondents with ROSA score 1 to 4.

Chi-square tests are conducted on the variables against feeling of discomfort. Results in Table 3 indicate that there is significant association between body mass index and MSD symptoms with p value 0.048. The light exercise also has significant relationship with MSD symptoms with p value 0.046. Apart from that, ROSA score has significant association with MSD symptoms with p value at 0.013. Other ergonomic risk factors was found not having significant association with MSD symptoms.

From the result gained, we can see that the prevalence of MSD symptoms for office workers is high. Such outcome is similar to previous study by Mohsen & Hamid [2]. The study found that the prevalence for MSD for office workers is high with knee 66.66%, neck 58.53% and lower back with 58.53%. (2). Another study by Rajinder [8] also found similar results with the prevalence of MSD for low back pain (40.4%) upper back (39.5%), neck (38.6%) wrist (36.8%) and shoulder (15.2%).

**Table 1**

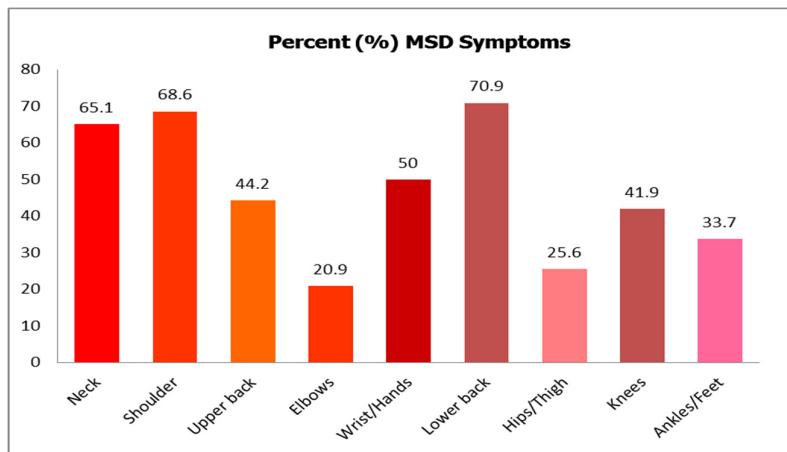
Demographic Information and Work Characteristics of the Studied Population (n = 86)

| Characteristic                                 | Group                             | No. | %    |
|--|-----------------------------------|-----|------|
| Gender   | Male                              | 44  | 51.2 |
|  | Female                            | 42  | 48.8 |
| Age  | 21 – 30 years old                 | 32  | 37.2 |
|  | 31 – 40 years old                 | 37  | 43.0 |
| Age  | 41 – 50 years old                 | 13  | 15.1 |
|  | > 50 years                        | 4   | 4.7  |
| Body Mass Index (BMI)                          | Underweight < 18.5                | 3   | 3.5  |
|  | Normal 18.5 – 24.9                | 43  | 50.0 |
|  | Overweight 25.0 – 29.9            | 34  | 39.5 |
|  | Obese > 30.0                      | 6   | 7.0  |
| Light Exercise                                 | Often (at least 2 times per week) | 17  | 19.8 |
|  | Sometimes (once a week)           | 28  | 32.6 |
|  | Rarely (1 – 2 per month)          | 31  | 36.0 |
|  | Never                             | 10  | 11.6 |
| Heavy Exercise                                 | Often (at least 2 times per week) | 1   | 1.2  |
|  | Sometimes (once a week)           | 8   | 9.3  |
|  | Rarely (1 – 2 per month)          | 11  | 12.8 |
|  | Never                             | 66  | 76.7 |
| Computer use<br>(hours per day)                | < 2 hours                         | 3   | 3.5  |
|  | 2 – 4 hours                       | 14  | 16.3 |
|  | > 4 hours                         | 66  | 80.2 |
| Rest breaks                                    | Every 30 minutes                  | 1   | 1.2  |
|  | Every 1 hour                      | 24  | 27.9 |
|  | Every 2 hours                     | 31  | 36.0 |
|  | More than 2 hours                 | 30  | 34.9 |
| Time Spent Sitting on chair<br>(hours per day) | < 2 hours                         | 1   | 1.2  |
|  | 2 – 4 hours                       | 17  | 19.8 |
|  | > 4 hours                         | 68  | 79.1 |

**Table 2**

Rapid Office Strain Assessment (ROSA) score of the respondents

| ROSA Assessment  | Frequency | Percentage (%) |
|------------------|-----------|----------------|
| High Risk (5-10) | 59        | 68.6%          |
| Low Risk (1-4)   | 27        | 31.4%          |



**Fig. 1.** The Prevalence of MSD in the past 12 months (based on body part)

**Table 3**  
Association of Ergonomic Risk Factors and MSD Symptoms

| Variables                          | Discomfort (%) |    | $\chi^2$ | p-value      |
|------------------------------------|----------------|----|----------|--------------|
|                                    | Yes            | No |          |              |
| <b>Age</b>                         |                |    |          |              |
| 21-30                              | 25             | 7  |          |              |
| 31-40                              | 25             | 12 | 5.325    | 0.149        |
| 41-50                              | 10             | 3  |          |              |
| > 50                               | 1              | 3  |          |              |
| <b>Body Mass Index</b>             |                |    |          |              |
| Underweight <18.5                  | 0              | 3  |          |              |
| Normal 18.5 – 24.9                 | 31             | 12 | 7.907    | <b>0.048</b> |
| Overweight 25.0 – 29.9             | 25             | 9  |          |              |
| Obese > 30.0                       | 5              | 1  |          |              |
| <b>Light Exercise</b>              |                |    |          |              |
| Yes                                | 56             | 19 | 3.970    | <b>0.046</b> |
| No                                 | 5              | 6  |          |              |
| <b>Heavy Exercise</b>              |                |    |          |              |
| Yes                                | 12             | 8  | 1.510    | 0.219        |
| No                                 | 49             | 17 |          |              |
| <b>Computer Use</b>                |                |    |          |              |
| < 2 hours                          | 3              | 0  | 1.294    | 0.524        |
| 2 – 4 hours                        | 10             | 4  |          |              |
| > 4 hours                          | 48             | 21 |          |              |
| <b>Working Hour</b>                |                |    |          |              |
| < 8 hours                          | 1              | 1  | 0.883    | 0.643        |
| 8 hours                            | 46             | 20 |          |              |
| > 8 hours                          | 14             | 4  |          |              |
| <b>Time Spent Sitting on Chair</b> |                |    |          |              |
| < 2 hours                          | 1              | 0  | 1.841    | 0.398        |
| 2 - 4 hours                        | 14             | 3  |          |              |
| > 4 hours                          | 46             | 22 |          |              |
| <b>ROSA Assessment</b>             |                |    |          |              |
| High Risk                          | 37             | 22 | 6.156    | <b>0.013</b> |
| Low Risk                           | 24             | 3  |          |              |

The ergonomic risk factors in this study is age, body mass index (BMI), physical exercise, computer use, working hour and time sitting on chair. From the results, BMI and light exercise had shown significant relationship with MSD symptoms. Other risk factors did not show any significant relationship. This result is identical to previous study conducted by Shamsul & Fatin [9], where there is no significant relationship between MSD discomforts with studied risk factors.

#### 4. Conclusion

This study assesses MSD among office workers using Nordic Questionnaire and ROSA checklist. While there are a various types of ergonomic risk assessments such as Rapid Entire Body Assessment (REBA), Rapid Upper Limb Assessment (RULA) and Rapid Office Strain Assessment (ROSA), REBA is suitable to assess workers with manual handling work whereby RULA on the other side can assess upper limb part only. ROSA is an ergonomic risk assessment tool that is similar to RULA. However ROSA is more specific for computer usage risk assessment rather than RULA. Therefore the researchers chose ROSA as the best tool in assessing the ergonomics risk among the office workers. In this study, it was found that the prevalence of musculoskeletal complaints is high among the office workers. According to ROSA method, respondents with scores 5 and above are at high risk level. In this study, it is observed that the computer workstation at this company is at high risk level and immediate ergonomic intervention should be taken immediately.

Based on the high level of ROSA assessment on MSD, there is a need to have ergonomic interventions such as workstation redesign and ergonomic office training for office workers. Suggested recommendations to reduce ergonomic risk include ergonomic workstation redesign by changing normal keyboard to ergonomic keyboard to reduce stress on the wrist. It is also proposed that document holder is installed at each computer to reduce strain to the neck during typing. By having document holder, there is no need for the neck bend to down. Also, installing screen protector to computer would reduce glare and would reduce eye sore. Equipment adjustments help to decrease neck and shoulder pain of seated workers [10]. Exercise program at workplace also help to reduce the MSD symptoms [11].

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