Factors Related to the Complaints of Musculoskeletal Disorders of Shelving Staff

Faktor yang Berhubungan dengan Keluhan Musculoskeletal Disorders pada Petugas Shelving Book

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ABSTRACT

Introduction: Every worker is exposed to the risk of occupational accidents or occupational diseases when working. Awkward working postures are the postures that cause body parts to detach from its natural postures that can result in the complaints of musculoskeletal disorders (MSDs). This research intends to analyze the factors related to the complaints of MSDs suffered by the shelving staff in the library and reading room in Universitas Airlangga Surabaya. Methods: This research is observational research that applies a cross-sectional design. The sample of this research consists of 27 people chosen by the total population method. The data regarding the individual characteristics and the complaints of MSDs are obtained through interview and filling out a questionnaire that has been standardized. The data on working postures are analyzed by referring to the Rapid Entire Body Assessment (REBA) method, while the data on the complaints of MSDs are scrutinized by implementing the Nordic Body Map (NBM) method. Results: Reveal that most of the shelving staff experience very high-risk level of MSDs (40.7%). Other than that, it is noticed that the working postures consist of squatting (high-risk level), bowing (high-risk level), standing (moderate-risk level), standing with arms stretching (very high-risk level), and standing with arms stretching while tiptoeing (very high-risk level). The collected data is analyzed by using the Spearman correlation test. Conclusion: It can be stated that the strongest factor causing the occurrence of MSDs is the years of service (r=0.803) with a positive relationship, which means that the longer the years of service is, the higher the risk to experience MSDs is.

Keywords: complaints of musculoskeletal disorders, individual factors, shelving staff

ABSTRAK


Kata kunci: faktor individu, keluhan musculoskeletal disorders, petugas shelving

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©2019 IJOSH. Open access under CC BY NC–SA license doi: 10.20473/ijosh.v8i3.2019.352-360. Received July 10, 2018, revised in revised form January 23, 2019, Accepted November 04, 2019, Published: December 2019
INTRODUCTION

Working ergonomically will provide a sense of comfort, a state where fatigue and unnecessary movements can be avoided, as well as a condition of giving minimum effort to acquire maximum results of work. Moreover, it is common for workers to be at risk of experiencing occupational accidents or diseases when working, especially caused by awkward working postures. Awkward working postures can be defined as postures where body parts are detached from its natural postures, for example, over-reached arms, bending, and other non-ergonomic postures (Tarwaka, H.A and Sudiajeng, 2004).

There are various types of ergonomic problems discovered in a workplace, particularly those that are related to muscle strength and endurance, for instance, musculoskeletal disorders (MSDs). MSDs is a disorder on the soft tissues and nervous systems. The working activities performed by operational workers are noticed problematic, for example, the working activities carried out by the shelving staff in the libraries and reading rooms in Universitas Airlangga that comprise placement and rearrangement of library materials based on each book call number, alphabet, et cetera.

The works performed by the shelving staff require non-ergonomic postures, such as book alignment on a 5-level shelf that forces squatting with unstable leg postures. The other postures discovered made by shelving staff comprise bending with arms reach above the head when putting books on the shelf, tiptoeing while reaching arms, and carrying heavy books at the same time.

If those postures are continuously made in a long period of time, it is not impossible that the shelving staff will suffer from awkward body postures. Moreover, those postures can also trigger the occurrence of disorders in several limbs, such as disorders in soft tissues, as in muscles, tendons, ligaments, joints, and nervous systems, which also known as MSDs. Hence, it has been confirmed that shelving staff has a high risk of experiencing complaints of MSDs.

METHODS

This research is observational research completed by observation and not giving any special treatment to the respondents or the research objects. Other than that, this research was carried out by implementing a cross-sectional approach due to the fact that the observation of the variables was completed in a certain period of time. The sampling technique used in choosing the research sample was total population technique, which covers all 27-shelving staff in the libraries and the reading rooms in Universitas Airlangga with these inclusion criteria: The respondents do not suffer from muscle and joint disorders; The respondents do not smoke; The respondents work as librarians in the shelving section.

There are two variables of this research; dependent and independent variables. The dependent variable is the complaints of MSDs, while the independent variable is the individual factors, which cover the age, working duration, and years of service.

Both the primary and secondary data were gathered from November 2017 until February 2018 in all libraries and reading rooms in Universitas Airlangga Surabaya. The primary data was obtained through an interview to identify the age, working duration, years of service, the REBA observation sheet, and the NBM questionnaire. Meanwhile, the secondary data was in the form of files and documents regarding the name and the total number of the shelving staff as well as the profile of all libraries (Campus A, Campus B, and Campus C libraries) and reading rooms in all faculties in Universitas Airlangga Surabaya.

All of the data is presented descriptively. In other words, the data obtained from distributing the questionnaire, interview, and measurement results are scrutinized in the form of table, narration, and cross-tabulation in order to simplify the description of the results. In addition, to figure out the relationship strength between variables, the Spearman rho correlation test was implemented.

RESULTS

The Individual Factors of the Respondents

The characteristics of the respondents are features that cannot be manipulated. In this research, the variables used to identify the characteristic of the respondents are the age, working duration, and years of service. Those characteristics are presented in Table 1, Table 2, and Table 3.
The Age of the Shelving Staff in the Libraries and Reading Rooms in Universitas Airlangga in 2018

<table>
<thead>
<tr>
<th>Age (Years old)</th>
<th>Frequency (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-28</td>
<td>6</td>
<td>22.2</td>
</tr>
<tr>
<td>29-36</td>
<td>9</td>
<td>33.3</td>
</tr>
<tr>
<td>37-45</td>
<td>7</td>
<td>25.9</td>
</tr>
<tr>
<td>46-54</td>
<td>5</td>
<td>18.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Age is the life span of a worker calculated from the time the worker was born until the time this research was conducted. From four age categories, it was noticed that in this research, the majority of the respondents are in the age group of 29-36 years old, that is as many as 9 people (33.3%).

The Working Duration of the Shelving Staff in the Libraries and Reading Rooms in Universitas Airlangga in 2018

<table>
<thead>
<tr>
<th>Working Duration (hour)</th>
<th>Frequency (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤8</td>
<td>12</td>
<td>44.44</td>
</tr>
<tr>
<td>&gt;8</td>
<td>15</td>
<td>55.56</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Working duration is the workers’ time in completing working activities in a day. Based on the research, it was obtained that 50% of the respondents, which is as many as 15 people, work for >8 hours a day.

The Years of Service of the Shelving Staff in the Libraries and Reading Rooms in Universitas Airlangga in 2018

<table>
<thead>
<tr>
<th>Years of Service (years)</th>
<th>Frequency (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤5</td>
<td>12</td>
<td>44.44</td>
</tr>
<tr>
<td>6 – 10</td>
<td>5</td>
<td>18.52</td>
</tr>
<tr>
<td>&gt;10</td>
<td>10</td>
<td>37.04</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>27</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Years of service can be defined as the length of time the respondents had worked calculated from the time they started working until the time when this research was conducted. From the data collection, it was noticed that from the total of 27 respondents, 12 of them (44.44%) had worked for ≤5 years by the time this research was completed.

The Working Postures of the Respondents

The assessment of the working postures of the respondents was carried out by implementing the Rapid Entire Body Assessment (REBA) method. Furthermore, the assessment was completed based on the scoring that was put into Group A, Group B, and Group C. The total score obtained was used to determine the risk level of injury by providing the level of improvement needed and by carrying out an intervention so that the improvement can be performed as soon as possible to reduce the risk that may arise.

Figure 1 until Figure 6 are examples of the assessment in determining the risk level of working postures made by the shelving staff. The first group, Group A, consists of the body, neck, and leg postures.

Figure 1 showed the posture of body extension by forming an angle of 18°, thus, the body score is 2. However, since the body twists, it is given an additional score of 1. In result, the total score for the body posture is 3. In Figure 2, the neck posture is extended by >20° and is given a score of 2 as its final score.

Figure 3 showed that the leg posture of the respondent is not considered a stable posture due to the fact that one leg is not well-supported. Therefore, the leg posture is given a score of 2 without any additional score.

After obtaining all scores of Group A (body, neck, and leg postures), those scores were put into a table and produced a score of 5. The score got in Group A then was added to the loading score to get the total score of Group A, which was 0, providing the weight sustained by the respondent was <5 kgs. Accordingly, the
total score of Group A was 5, obtained from 5 (scores of body, neck, and leg postures) added by 0 (loading score).

The upper arm posture made by the respondent showed flexion and formed an angle of 42°. Therefore, this posture obtained a score of 2. Nonetheless, when making that posture, the respondent lifted his shoulder, twisted his arm, and lifted his arm away from the body. For that reason, an additional changing score of 2 was given. In result, the score for the upper arm posture was 4.

The lower arm posture of the respondent obtained a score of 2 due to the fact that the posture formed a flexion of 27°. In other words, it can be stated that the flexion of the lower arm posture was around <60°. As a result, this posture attained a score of 4.

As for the next step, the total scores of Group A and Group B were put into Table score C (Group C) to determine the action level and the risk level category. In result, it was obtained a score of 9 as the score of Group C. This score was then also added to the score of muscle activity to obtain the grand score of Group C. In result, a score of 12 was obtained from the adding of 9 (Group C score) to 3 (the REBA grand score). After that, this score was used to identify the action level and the risk category level as presented in Table 4.

Table 4 displayed that the standing posture with arms reaching above the head and tiptoeing belongs to the very high-risk level posture. In other words, the actions to improve this working posture need to be performed as soon as possible. Other than that, the same step was carried out to the assessment of the other four working postures which results can be seen in Table 5.
Table 4. Action Level and Risk Level

<table>
<thead>
<tr>
<th>Total Score</th>
<th>Action Level</th>
<th>Risk Level</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>Very Low</td>
<td>No action needed</td>
</tr>
<tr>
<td>2-3</td>
<td>1</td>
<td>Low</td>
<td>Action may be needed</td>
</tr>
<tr>
<td>4-7</td>
<td>2</td>
<td>Moderate</td>
<td>Action is needed</td>
</tr>
<tr>
<td>8-10</td>
<td>3</td>
<td>High</td>
<td>Immediate action is needed</td>
</tr>
<tr>
<td>11-15</td>
<td>4</td>
<td>Very High</td>
<td>Action is needed as soon as possible</td>
</tr>
</tbody>
</table>

Table 5. The Working Postures of the Shelving Staff in the Libraries and Reading Rooms in Universitas Airlangga in 2018

<table>
<thead>
<tr>
<th>Working Posture</th>
<th>Total Score</th>
<th>Risk Level</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squatting</td>
<td>10</td>
<td>High</td>
<td>Immediate action is needed</td>
</tr>
<tr>
<td>Bending</td>
<td>8</td>
<td>High</td>
<td>Immediate action is needed</td>
</tr>
<tr>
<td>Standing</td>
<td>5</td>
<td>Moderate</td>
<td>Action is needed</td>
</tr>
<tr>
<td>Standing with the arms reaching up</td>
<td>11</td>
<td>Very High</td>
<td>Action is needed as soon as possible</td>
</tr>
<tr>
<td>Standing with the arms reaching up and tiptoeing</td>
<td>12</td>
<td>Very High</td>
<td>Action is needed as soon as possible</td>
</tr>
</tbody>
</table>

The Complaints of MSDs of the Respondents

The complaints of MSDs can be termed as a complaint that occurs in the skeletal muscles that range from mild to very severe complaints. The complaints can be in forms of uncomfortable feelings, pains, fatigue, and many more. The complaints of MSDs felt by the respondents that had been assessed by the instrument of Nordic Body Map (NBM) are displayed in Table 6.

Table 6. The Level of Complaints of MSDs of the Shelving Staff in the Libraries and Reading Rooms in Universitas Airlangga in 2018

<table>
<thead>
<tr>
<th>Level of MSDs Complaints</th>
<th>Frequency (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>2</td>
<td>7.41</td>
</tr>
<tr>
<td>Moderate</td>
<td>6</td>
<td>22.22</td>
</tr>
<tr>
<td>Severe</td>
<td>8</td>
<td>29.63</td>
</tr>
<tr>
<td>Very Severe</td>
<td>11</td>
<td>40.74</td>
</tr>
<tr>
<td>Total</td>
<td>27</td>
<td>100</td>
</tr>
</tbody>
</table>

Based on the analysis of the complaints of MSDs undergone by the respondents who work as shelving staff in the libraries and reading rooms in Universitas Airlangga, it was attained that all of the respondents had experienced the complaints in the skeletal muscles. Majority of the respondents underwent high-level of MSDs, that is as many as 11 people (40.74%). Furthermore, most of the complaints suffered by the respondents were in 30 body parts in the right upper arm, right lower arm, left lower arm, and right leg. Apparently, these complaints, especially in lower and upper arms, occurred due to the activity of book shifting on the shelves to provide more spaces. In the meantime, the complaint felt in the left lower arm was because the staff put the books on it before placing the books on the shelf. As for the last complaint, that is complaint felt in the right leg, was caused by the activity of placing the books on the top shelf so that the staff needed to tiptoeing for a certain period of time.

The Complaints of MSDs based on the Age of the Respondents

The respondents in the age group of 29-36 years old were noticed to have higher complaints of MSDs than the respondents in the other age groups, that is as many as 9 people (33.3%), with nobody had mild and moderate levels of complaints. Meanwhile, the high-risk level and very high-risk level were suffered by 6 and 3 people, respectively. Moreover, based on the Spearman correlation test, it was obtained that the correlation between the age and the complaints of MSDs attained the number of 0.512.

Furthermore, referring to the analysis that has been carried out, it was discovered that there is a strong and positive relationship between the age and the complaints of MSDs since the coefficient r is positive. This also indicated that the older the staff is, the higher the level of MSDs complaint is.

The Complaints of MSDs based on the Working Duration of the Respondents

Based on the analysis, it was noticed that the respondents with the working duration of >8 hours per day suffered from the higher-risk level of MSDs, that is as many as 15 people (55.56%). In addition, no one was found healthy, 2 people suffered from a moderate-risk level of MSDs, 5...
people experienced high-risk level of MSDs, and 8 people underwent a very high-risk level of MSDs.

The result of the correlation analysis between the working duration and the complaints of MSDs attained the coefficient r of 0.401. In other words, it can be declared that both variables have a moderate positive relationship. Additionally, it can also be affirmed that the longer the working duration is, the higher the risk of experiencing the complaints of MSDs is.

**The Complaints of MSDs based on the Years of Service of the Respondents**

It was reported that 10 of the respondents (37.04%) had served for more than 10 years as shelving staff. From that number, 2 of them experienced the high-risk level of MSDs, while the other 8 underwent the very high-risk level of MSDs.

The correlation score between the years of service and the complaints of MSDs was quite high, that it 0.805. Thus, it can be assumed that there is a very strong and positive relationship between the years of service and the complaints of MSDs undergone by the shelving staff, which means that the longer the years of service is, the higher the risk level of suffering from MSDs is.

**DISCUSSION**

**The Complaints of MSDs based on the Age of the Respondents**

The age of the respondents can be defined as the life span from the time when the respondent was born until the time when this research was conducted. According to Bridger (2003), the older someone gets, the higher the chance of the decrease of bone elasticity is, which results in the arise of MSDs complaints. The degeneration process of the bones is in accordance with the increase of the age. Normally, this condition starts when someone reaches the age of 30. This degeneration process can be in the form of the tissue damage and the decrease of body liquid.

After analyzing all variables, it was obtained that there is a moderate relationship between the age and the complaints of MSDs. Other than that, the age and the complaints of MSDs have a positive relationship, which means that the older the staff is, the higher the risk level of MSDs is. Tarwaka (2015) affirmed that the first complaint of MSDs is usually felt by someone above 30 years old. Then, as the number increases, the risk level also gets higher. Apparently, this due to the fact that the muscle strength and endurance of middle-aged people do decrease, which result in the increase in the complaints of MSDs.

The results of this research are in accordance with the research conducted by Pratama, Tarwaka and Suryanata (2015), which explained that there is a significant relationship between age and complaints of MSDs. Mardiman (2001) affirmed that mostly, muscle pains are suffered by people in productive. The productive ages that ranges from 15-64 years old (International Labour Organization, 2013). Furthermore, majority of the shelving staff took part in this research (33.3%) were in the age group of 29-36 years old, which can also be stated that they were still in their productive age.

**The Complaints of MSDs based on the Working Duration of the Respondents**

Working duration is calculated from the time a worker starts working until the time she/he finishes the work. The working duration can be classified into 2 categories, the category works up to 8 hours and the long work category is more than 8 hours (Jalajuwita and Paskarini, 2015). The correlation analysis between the working duration and the complaints of MSDs generated a result of the moderate relationship. Generally, the working duration of a worker ranges between 6-8 hours per day, while the rest 16-18 hours are the hours allocated to the personal life. Additionally, it is believed that a worker can work productively if she/he works for about 40-50 hours per week (Suma’mur, 1996).

However, most of the respondents work for more than 8 hours per day. The working hour for the respondents in the libraries and reading rooms in Universitas Airlangga starts from 08:00 until 17:00 with limited break time. In fact, the reading room in the Faculty of Economics and Business, which working hour starts from 08:00 and ends at 20:30. These working durations overcome by the same workers every day with the high number of visitors might trigger the occurrence of repeated working attitude. Thus, if the respondents work for 8 hours per day, it is possible that they will undergo the complaints of MSDs.
Because of that, this research is similar to the research authored by Wijayanti (2013) on the relationship between the complaints of MSDs and the working environment, working postures, and the years of service of farmers. In result, it was obtained that there is a relationship between the years of service of the farmers and the complaints of MSDs. Other than that, referring to the research carried out by Utami, Karimuna and Jufri (2017), it was also attained that there is a relationship between the years of service and the complaints of MSDs of the unloading workers. Therefore, this research is similar to the research carried out by Hardono and Kurniawan (2017) which concluded that there is a relationship between the years of service of the farmers and the complaints of MSDs.

The Complaints of MSDs based on the Years of Service of the Respondents

Years of service can be calculated from the time a worker first start working in a company until the time when this research was completed. Hardono and Kurniawan (2017) affirmed that years of service can be categorized into ≤5 years, 6-10 years, and >10 years.

The results of the analysis showed that there is a strong relationship between the years of service and the complaints of MSDs of the shelving staff in the libraries and reading rooms in Universitas Airlangga. Furthermore, the relationship was noticed positive, which can be assumed that the longer the years of service is, the higher the risk level of the shelving staff to experience MSDs.

Tarwaka (2015) explained that the complaints of MSDs increase as the increase in the years of service of a worker, along with the tediousness both physically and psychologically. Other than that, it was described that years of service is the most influential factor that increases the occurrence of MSDs, particularly for the works performed repetitively in a long period of time.

Referring to the results, this research is in line with the research piloted by Sulung and Mutia (2016), which concluded that there is a strong relationship between the years of service and the complaints of MSDs of the unloading workers. Other than that, the research carried out by Rivai, Ekawati and Jayanti (2014) also affirmed that there is a strong relationship between the years of service and the complaints of MSDs of stone breakers.

The Working Postures of the Respondents

The working postures of the respondents were assessed by implementing the Rapid Entire Body Assessment (REBA) method to attain the final score in order to determine the risk category. Squatting posture obtained the final score of 10, which made the posture to have the higher level of MSDs and in need of immediate action to correct the posture. In addition, this posture is made by the shelving staff when arranging the books on the first and second shelves. Thus, if there are many books on the first shelf to be arranged, the staff squat for a long time, which leads to the loss of balance when there is a sudden change in the posture.

Bending posture obtained the final score of 8, which makes the posture as a high-risk level posture that needs immediate actions to correct the posture. The book arrangement on the third shelf is carried out by bending due to the book catalog codes that are placed at the lower part of each book.

Standing posture got the final score of 5. Thus, this posture had a moderate-risk level of MSDs and in need of actions to correct the posture. The book alignment on the fourth shelf requires the shelving staff to stand. Hence, the standing posture is the posture which risk level is the lowest, compared to the other postures.

Standing posture with the arms reaching up had the final score of 11, which placed this posture in the very high-risk level of MSDs and in need of actions to correct the posture as soon as possible. This posture is made by the shelving staff when arranging the books on the fifth shelf since the shelf’s position is above the shoulder of the shelving staff. Therefore, this posture along with carrying a certain load when arranging the shelf is required.

Standing posture with the arm reaching up and tiptoeing obtained a final score of 12. Therefore, this posture was noticed belong to a very high-risk level working posture and in need of corrective actions as soon as possible. This posture is made when arranging the books on the sixth shelf, which height is taller than the height of the shelving staff. Additionally, this posture is considered as a non-ergonomic posture referring to the load borne by the shelving staff.

Several postures are considered as high-risk level postures due to the factors that match non-ergonomic postures. Unfortunately, almost all of the shelving staff are discovered comfortable to be in non-ergonomic working
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postures. Evidently, this is caused by the lack of understanding of the effects initiated by those non-ergonomic postures, for example, the complaints of MSDs.

Every day, the shelving staff are obliged to tidy up and to arrange 300 until 400 books, depending on the number of visitors. Nonetheless, it was reported that day by day, the number of visitors increased, which results in the increase in the working intensity and repetitive working postures of the shelving staff. Other than that, these non-ergonomic postures are also caused by the limited distance between one shelf and another, which may lead to an increase in the complaints of MSDs.

CONCLUSION

From the scrutinization that has been elucidated beforehand, it can be concluded that most of the shelving staff underwent the very high-risk level of MSDs (40.74%) caused by several working postures, such as squatting (high-risk level), bending (high-risk level), standing (moderate-risk level), standing with the arm reaching up (very high-risk level), and standing with the arm reaching up and tiptoeing (very high-risk level). Additionally, the correlation tests indicated that the working duration and the complaints of MSDs had a strong relationship, while the strong and moderate relationships were discovered between the age and the years of service and the complaints of MSDs, respectively.

ACKNOWLEDGMENT

The authors would like to acknowledge the Heads of the Library in Campus A, Campus B, and Campus C Universitas Airlangga as well as the coordinators of the reading room in all faculties in Universitas Airlangga for giving the permission and opportunity to carry out this research. Other than that, the authors are grateful for the shelving staff who are willing to be the respondents of this research and for providing the information needed to complete this research.

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