The Effect of Workplace Stretching-Exercise (WSE) To Musculoskeletal Discomfort and Work Fatigue of Sewing Workers in CV. X Sukoharjo Central Java

Lis Sarwi Hastuti*
Department of Occupational Therapy, Politeknik Kesehatan Kemenkes Surakarta

ABSTRACT
Musculoskeletal discomfort and working fatigue lead to decrease of productivity, work-time loss, increase of occupational diseases and bigger expenses on health service coverage. Daily working habits are involving physical and mental activities that trigger to certain discomforts which affect the body-muscular system and the present of fatigue. Workplace Stretching-Exercise (WSE) can be used alternatively as a solution to prevent and reduce musculoskeletal discomfort as well as work fatigue. The aim of the research is to reveal the impact of workplace stretching-exercise in preventing and reducing the musculoskeletal discomfort and work fatigue amongst sewing workers in CV. X, Sukoharjo. The research was quasi experimental design with one group pre and post-test design. Research conducted in garment factory of CV. X, Sukoharjo, Central Java. The research was involving 64 female workers of sewing department which previously selected according to inclusive and exclusive criteria set earlier. The Nordic Body Map questionnaire was used to measure the musculoskeletal discomfort. The reaction timer tool and subjective fatigue questionnaire was used to measure work fatigue variable. WSE intervention was given in three consecutive weeks with two times session per day. Time spent in each was 8 minute per session. Hypothesis tested by the use of non-parametric statistic of Wilcoxon Test for paired sample. The research revealed that WSE is effective to prevent and to reduce the musculoskeletal discomfort (p value < 0.05) and work fatigue (p value < 0.05) to the sewing department workers of CV X. This data was significantly depicting different result between pre and post intervention. To implement WSE is potential to prevent and reduce musculoskeletal discomfort in female workers of the sewing department of CV X, and reduce work fatigue in female workers of the sewing department of CV X.

Keywords: musculoskeletal discomfort; work fatigue; workplace-stretching-exercise

Correspondence should be addressed to lisahasado@gmail.com
Copyright © 2016. This is an open access article distributed under the Creative Commons Attribution License. Available online at http://eproceeding.itp.ac.id/

INTRODUCTION
Musculoskeletal discomfort is discomfort or pain in muscle, joint, ligament, nerve, bone and blood circulation. Fatigue is a body mechanism as a self-protection to avoid further damage and to make recovery possible after it takes some rest. Musculoskeletal discomfort and work fatigue can influence productivity, affect working hours, increase the risk of diseases caused by working activities, and increase the cost of compensation for workers.

The research done by Waikar & Bradshaw with 203 respondents (sedentary work) on managerial level, staff, and technician suggested that most of those respondent complained about musculoskeletal discomfort, and their condition improved after they received quick exercise program. A study done by O’Connor with 36 workers who have fatigue problem...
suggested that aerobic with low intensity can reduce fatigue than exercise with moderate intensity.

The result of the first research in CV. X, in the sewing department shows that most of workers activities were done in static and unnatural position (non ergonomic) namely bending their trunk while sitting on a 45 cm chair no back rest in front of a 65 cm table, head down to the sewing machine, and they made circular movement periodically to the side and forward. It was done at least for 8 hours every day and increased the risk of musculoskeletal discomfort and fatigue on workers. Based on the data of the company’s clinic for the last 3 months (September-November 2012), 46 out of 239 visits (19.2%) complained about muscle pain (myalgia), 27 workers (11.3%) had arthritis, and 10 workers (4.2%) had fatigue problem.

Alter suggested that to prevent and reduce fatigue and musculoskeletal discomfort workers should do stretching exercise during their breaking / rest hours. Based on the above explanation, the researcher conducted the research to observe the effect of Workplace Stretching-Exercise (WSE) in reducing the musculoskeletal discomfort and work fatigue among workers in the sewing department of CV. X.

RESEARCH METHOD
This research used quasi experimental design “One groups pre and post test design”. It was conducted in a clothing company named CV. X. Workplace Stretching-Exercise for 8 minutes/session was applied before break / rest time and before the workers went home for 3 weeks, with total 36 sessions. The population of this research is all workers in the sewing department of CV. X, total 110 female workers. The technic of sampling used purposive sampling, with 64 workers as a sample selected by inclusive and exclusive criteria. The inclusive criteria are as follow: (1) the participant should be 20-40 years old, (2) The participant has been working for > 2 tahun, (3) the participant has normal blood pressure and pulse, (4) the participant should be cooperative and willing to follow the exercise program. The exclusive criteria are as follow: (1) the participant is pregnant, (2) smoking, (3) answering “yes” to the questionnaire of Physical Activity Readiness (PAR-Q & You). The research tools included: (1) Nordic Body Map (NBM), (2) Reaction Timer (RT), (3) Subjective fatigue (KS).

RESULT AND DISCUSSION
During the research period, working hour in CV. X is 11-12 hours. The characteristic of subjects and scores of Nordic Body Map,Reaction Timer, and Subjective fatigue are shown in Table 1 and 2 as follow:

<table>
<thead>
<tr>
<th>Table 1: The characteristic of the research subjects (n= 64)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristic</td>
</tr>
<tr>
<td>Education</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>IMT (kg/m²)</td>
</tr>
<tr>
<td>IMT (kg/m²)</td>
</tr>
<tr>
<td>Working hour (years)</td>
</tr>
<tr>
<td>Break/rest hours</td>
</tr>
<tr>
<td>Break/rest hours</td>
</tr>
<tr>
<td>Break/rest hours</td>
</tr>
<tr>
<td>Sports habit</td>
</tr>
<tr>
<td>Sports habit</td>
</tr>
</tbody>
</table>
Table 2: Score of Nordic Body Map, Reaction Timer, Subjective Fatigue before and after intervention (n=64)

<table>
<thead>
<tr>
<th>Instrument</th>
<th>time</th>
<th>Normal (number, percentage)</th>
<th>Low (number, percentage)</th>
<th>Medium (number, percentage)</th>
<th>High (number, percentage)</th>
<th>Very high (number, percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nordic Body Map</td>
<td>before intervention</td>
<td>0 (0%)</td>
<td>9 (14.1%)</td>
<td>41 (64.1%)</td>
<td>14 (21.8%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>after intervention</td>
<td>0 (0%)</td>
<td>30 (46.9%)</td>
<td>31 (48.4%)</td>
<td>3 (4.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Reaction Timer</td>
<td>after intervention</td>
<td>11 (17.2%)</td>
<td>46 (71.9%)</td>
<td>7 (10.9%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>before intervention</td>
<td>0 (0%)</td>
<td>7 (10.9%)</td>
<td>46 (71.9%)</td>
<td>11 (17.2%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>after intervention</td>
<td>23 (35.9%)</td>
<td>38 (59.4%)</td>
<td>3 (4.7%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Subjective Fatigue</td>
<td>before intervention</td>
<td>0 (0%)</td>
<td>7 (10.9%)</td>
<td>46 (71.9%)</td>
<td>11 (17.2%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td></td>
<td>after intervention</td>
<td>0 (0%)</td>
<td>22 (34.4%)</td>
<td>40 (62.5%)</td>
<td>2 (3.1%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Wilcoxon Analysis of Nordic Body Map, Reaction Timer and Subjective fatigue shows a significant score on each instrument p<0.000.

The score of musculoskeletal discomfort is described based on Nordic Body Map (NBM) questionnaire, while work fatigue is described based on Reaction Timer (RT) and Subjective fatigue scores (Table 2). Table 2 shows that there is a change of number on each category if compared before and after intervention. Based on Wilcoxon analysis, it is known that the scores of Nordic Body Map, Reaction Timer, and Subjective fatigue questionnaire are different significantly if compared before and after intervention (P value < 0.05). From the above data, it is concluded that Workplace Stretching Exercise can prevent and decrease musculoskeletal discomfort and work fatigue.

Workplace Stretching Exercise (WSE) can prevent musculoskeletal discomfort and work fatigue which is proven by the result of reaction timer instrument in normal category in which the pre test score showed 11 respondent. The number is increased in the post test score namely 23 respondent. In the other two instruments (Nordic Body Map and Subjective fatigue questionnaire), the number of respondent in low category is increased in post test. From the above information, it is concluded that after the respondent received WSE intervention, their musculoskeletal discomfort and work fatigue is static and even decreased and it shows that the respondent condition is getting better. It is caused by the stretching of WSE. Stretching is an effort to lengthen muscle to make it relax and flexible, and to prevent spasm. Flexibility is the joint capability to achieve full range of motion. Subjects of this research needed appropriate muscle flexibility in order to make their work more comfortable. The result of research done by Budiharjo et al. suggested that aerobik low impact with medium intensity may improve body flexibility earlier if it is done 3x per week for elderly women who were not used to do sport before.

Dynamical construction of muscles during WSE program will give more blood to muscles, to give oxygen supply and nutrition which are important for body metabolism. WSE means changing static working position to a more dynamic working position. It will stimulate metabolism process in the body, to minimize the accumulation of residue of muscle metabolism (lactic acid and CO2) and to prevent or reduce work fatigue place.

Workplace Stretching Exercise (WSE) can decrease musculoskeletal discomfort and work fatigue which is proved by the data of three instruments (Nordic Body Map, Reaction Timer and Subjective fatigue questionnaire). In overall, there is a change of the number of each category to mild category. In severe and medium category, the number is decreased in the result of pre test and post test. It is caused by the stretching in WSE program.

Subjects of this research which were workers who worked in static position got isometric contraction in certain muscles continuously and it caused muscle spasm and pain. It
was caused by contraction in blood vessel of muscle continuously and caused ischemia in ligament. The mechanism of ischemia dan muscle spasm stimulates the nociceptor which takes the impulse of pain to brain.8.

In the case of muscle spasm, the muscle fiber is shortened because myofilamen is overlapping. While doing the stretching for a few seconds, the structure of muscle fiber especially sarcomer will lengthen because the overlapping myofilamen will release and automatically lengthen the muscle fiber structure. The longer muscle fiber structure will release spasm9.

Stretching will decrease muscle spasm because muscle proprioceptor muscle spindle will be activated. Muscle spindle is function to manage the signal to brain if suddenly the muscle length and muscle tone changes. If it happened, muscle spindle will send a signal to the brain to make the muscle contracted as self-defence and to prevent any further damage. Therefore, stretching is done by holding it for a few seconds so that muscle spindle can adapt to the new length of the muscle, in order to decrease the signal to the brain. If the muscle contraction decreased while stretching, the muscle fibers will lengthen and muscle spasm will also release 9;10.

The dynamical contraction on muscles while stretching will improve blood circulation so that the oxygen supply and nutrition which are necessary for body metabolism can be more effective. Doing WSE means changing position from static to dynamic. It will stimulate body metabolism and clean the muscle metabolism residue (lactic acid and CO2) and reduce work fatigue10.

The other factors which affect the use of Workplace Stretching-Exercise (WSE) in preventing and reducing musculoskeletal discomfort and work fatigue are WSE characteristics and working hours. WSE is designed with stretching technique, aerobic with low intensity and low impact, with medium-tempo instrumental music. Aerobic with low intensity has criteria such as Rating of Perceived Exertion (RPE) score for 3-4, percentage of VO2 max 30%-49%, and percentage of hr max 35%-59%11. Research which was done by O’connor4 with respondents who had permanent fatigue showed that aerobic with low intensity can reduce fatigue more than exercise with medium intensity.

Aerobik low impact is characterized with rhythmic movements and does not require both feet to move away from the floor, yet one foot touches the floor constantly. It will make the person easier to do the movement and minimize the negative impact to the muscle. Aerobik low impact also requires the person to use minimum energy namely 3x of resting energy, so that the person will not be tired.12.

The instrumental music used in the WSE is the music of Sojiro, Japan, with medium tempo. Tempo in music is the speed of certain steps. The criterion of medium tempo is 92-104 steps/minute. This kind of music is for relaxation which gives some benefits such as to relax body and mind, give happiness and reduce work fatigue. The music with medium tempo will help body and mind to relax13. The result of this research is similar to the research done by Mau22, Riyadi, et al19, and Sumihardi, et al20 which suggests that the instrumental music gives positive effect to the respondent.

In the last part of WSE, there is a breathing movement with Pursed lip breathing technique, and WSE is closed with inhale breathing through nose and exhale through mouth by saying ‘huuuh/haaa’. There are some benefits from doing the pursed lip breathing technique namely to improve the oxygen supply, increase the power of muscles for breathing, reduce anxiety, keep up concentration, to improve breathing capability, to make body and mind fresh. The result of the research done by Natalia, et.al20 on the effectivity of pursed lip breathing suggested that pursed lip breathing is more effective to improve expiration than blowing the balloon.

The research done by Mills19 on the effect of aerobic with low intensity to the muscle strength, flexibility and balance on the elderly suggested that the group who received intervention get significant improvement in the muscle strength, flexibility and balance compared to the control group.
According to Kroemer & Grandjean\textsuperscript{16}, musculoskeletal discomfort generally occurs because of the excessive muscle contraction as the impact of over load and long working hours. It influences the blood circulation to the muscle and the metabolism process, so that the lactic acid is accumulated in the body which causes muscle pain. The aforesaid opinion is similar to the result of this research where all respondents have musculoskeletal complaint with various level from mild to severe. It occurs because CV.X established 11-12 working hours per day.

The above condition causes work fatigue for workers. It is in line with the opinion of Suma’mur\textsuperscript{17} that body position/attitude at work has positive connection with work fatigue. The working duration influences number of rest / sleeping hour every day. Due to this research, most of respondents (96,9\%) take a rest / sleep less than 8 hours every day. Workplace Stretching Exercise given to the respondent with 2 times break/rest every day reduces the musculoskeletal complaint and work fatigue because it changes the working position from static to a more dynamic position in order to improve the metabolism process.

CONCLUSION
Due to the result of the research with 64 orang respondents in CV. X, with working hours 11-12 hours/day in average where the respondents were given intervention program namely Workplace Stretching-Exercise, it can be concluded that: (1) WSE can prevent and reduce musculoskeletal discomfort on female workers in the sewing department of CV. CNJ. (2) WSE can prevent and reduce work fatigue on female workers in the sewing department of CV. X.

Based on the result of this research, we would like to give some suggestion as follow: (1) The worker should apply WSE regularly. WSE can be applied to the other worker who has similar characteristic with the worker in the sewing department. (2) The company should consider to apply WSE dan establish it as a routine program for all workers. (3) For the next researcher, they should use the instrument objectively or subjectively, any disturbing factor may be controlled. All kind of intervention should be measured, VCD of WSE should contain more than one movement package.

ACKNOWLEDGMENTS
As the writer of this report, we would like to express our gratitude to the director and all staff at CV. X especially the workers in the sewing department who were willing to be the respondent of this research, for their support, participation and cooperation during this research.

REFERENCES