



Development of a Workplace Health Promotion Model to Treat Work-Related Musculoskeletal Disorders

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Abstract. This study aims to examine the health promotion model to tackle WMSDs. The health promotion models studied were stretching exercises from the Ministry of Health of the Republic of Indonesia and stretching exercises developed by researchers (PKDTK). The method used is quantitative analysis, namely paired samples t-test and independent samples t-test. The sample in this study were workers in the garment industry and the sampling technique used was purposive sampling. The results of paired samples t-tests showed that stretching exercises from the Ministry of Health and stretching exercises developed by researchers affected decreasing the degree of WMSDs. The results of the independent samples t-test showed that there was a significant difference in the degree of reduction in WMSDs among garment workers who used the Ministry of Health's stretching exercises and those who used PKDTK's stretching exercises. Based on the average value of the degree of decrease in WMSDs, PKDTK stretching exercises have a higher average value compared to the Ministry of Health's stretching exercises.

Keywords: health promotion · stretching exercises · WMSDs

1 Introduction

Workers are a high-risk group for various health problems caused by work processes, work environment, and worker behavior so they have the potential to experience work-related illnesses. Every leader or owner of a company or institution expects the company or institution to develop as well as possible. This requires consequences, companies or institutions must be run efficiently, and productively and avoid all factors that can hamper the pace of the production process, and avoid all forms of losses. The form of loss referred to can cover all fields, both in the marketing of products and in the form of extra costs because workers/laborers experience work-related accidents or work-related illnesses, as well as general illnesses that require medical and nursing expenses. Even hidden human resource losses such as high absenteeism, and low worker productivity due to low physical fitness, including losses due to damaged work facilities and environment and company image [1].

The reality in the workplace, every worker/laborer will be at risk of work-related accidents and or work-related illnesses. This risk varies from the mildest to the most

severe and even death, depending on the type of work or profession. For this reason, it is necessary to increase promotion and prevention efforts to reduce as low as possible the risk of disease arising from work or the work environment [2].

One of the ten work-related illnesses/injuries is work-related musculoskeletal disorders (WMSDs). WMSDs are ranked second after Occupational Lung Disorders. WMSDs can be in the form of complaints such as discomfort, pain, weakness, swelling, stiffness, and tingling and numbness in several parts of the body. Tissues that can be injured include muscles, tendons, ligaments, nerve tissue, and blood vessels. WMSDs commonly experienced by workers are in the neck muscles (neck strain), shoulders (shoulders tendinitis and bursitis), arms, wrists, and fingers (hand and wrist tendinitis, carpal tunnel syndrome, tennis/golfer elbows (epicondylitis), and low back pain/lower back (LBP). Complaints are felt ranging from very mild to severe complaints. If the skeletal muscles receive static loads repeatedly and for a long time, it can cause damage to muscles, nerves, tendons, joints, cartilage, and intervertebral discs. This condition can result in decreased productivity, lost working time, and increased risk of work-related accidents and or work-related illnesses, thereby increasing workers' compensation costs. Costs consist of costs incurred for treating workers who experience WMSDs, as well as income lost due to workers who are absent or absent from work because of these WMSDs [3].

Research in Iran with the subject of office employees found the most common complaints from employees were neck pain (69.2%), and lower back/hip pain (58.2%), followed by knee complaints (41.8%), complaints in the shoulder (35.2%) and pain in the upper back (34%). When employees experience these complaints, their work productivity decreases or even causes lost time injuries [4]. The prevalence of WMSDs in Indonesia based on those ever diagnosed by health workers is 11.9% and those based on symptoms are 24.7%. The highest prevalence of WMSDs based on occupation is a farmer, fisherman, or laborer, namely 31.2%. Prevalence tends to increase and reaches a peak in workers between the ages of 35 to 55 years [5].

Some of these studies provide an illustration that worker behavior is one of the predisposing factors for the occurrence of WMSDs. The intended behavior is a work attitude or work position that causes the muscles to receive static loads repeatedly and for a long time while working. This is an indicator that health behavior has not become a culture of workers in production activities at work.

Health behavior according to [6] is all activities or activities of a person, both observable and unobservable, related to maintaining and improving health. Health maintenance includes efforts to prevent or protect oneself from illness and other health problems, promote health, and seek healing when sick or has health problems. According to [7], health behavior is all forms of individual experience and interaction with their environment, especially regarding knowledge and attitudes about health and actions related to health.

In 2007, the Ministry of Health R.I. through the Directorate of Occupational Health Development, developed occupational health services, to spur improvements in the quality of human resources for working people, so that they continue to exist and be able to compete in the era of globalization and free markets. Occupational health services are not enough just to protect the health of workers from the adverse effects caused by exposure to health hazards originating from the work environment and work, but today's occupational health must prioritize workplace health promotion (WHP) programs. WHP

is defined as an activity program that is planned through a process of increasing knowledge, attitudes, behavior, and skills, from, by, for, and with the community at work, by influencing working conditions and the work environment, to achieve workers' control over their health, to achieve health improvement. And productivity [1].

WHP is part of the occupational health service, which carries out efforts to improve the degree of physical, mental, and social health of workers as well as in the context of preventing diseases that have a clear high prevalence among workers (especially those related to lifestyle) in addition to supporting human resources in achieving performance, career paths and the highest productivity of the organization or workplace. When viewed in a broader context, WHP is a series of integrated activities that cover the management and prevention of diseases, both common diseases, and work-related illnesses, as well as optimally improving the health of workers. So it can be concluded that WHP is an activity program that is planned and aimed at improving the health and work capacity of workers and their dependent family members in the context of the workplace [1].

In 2016 the Ministry of Health of the Republic of Indonesia initiated the creation of stretching exercises as a guide for companies or agencies in implementing WHP. With this stretching exercise module, it is hoped that office or factory workers can practice it to avoid WMSDs. In its development, the implementation of the WHP has not been carried out by many agencies or companies, and there have not been many studies that have tested the effectiveness of these stretching exercises. This is evident from the incidence of WMSDs in Indonesia in 2017, WMSDs disorders, especially low back pain, ranked first as the cause of disability according to sex in the Bangka Belitung Islands Province, ranking first in women of 907 per 100,000 women (0.91%) while in men -men by 779 per 100,000 men (0.78%) [8].

Based on the facts and phenomena described, to support the implementation of the WHP which has long been a government program, researchers are interested in formulating a health promotion model in the workplace to overcome the degree of WMSDs among working people in the garment industry. To see the effectiveness of WHP using stretching exercises, this study will compare the Ministry of Health's version of stretching exercises and the researchers' version. This comparison is to find a better or more appropriate model of stretching exercises used in the garment industry.

2 Research Methods

2.1 Place and Time of Research

This research was conducted in the garment industry in Sukoharjo Regency and Surakarta City, Central Java Province, with the consideration that the incidence of WMSDs in the garment industry is quite high, and is a place that has characteristics according to the object of this study. This research was conducted for 3 (three) months.

2.2 Research Design

This research is a quantitative study, which will be carried out using an experimental method (experiment research) with a factorial design used to determine the impact of

stretching exercises on the degree of WMSDs. Researchers manipulate one or more factors (variables) and perform tests under controlled conditions to determine the effect of factor manipulation on the dependent variable.

2.3 Research Samples

Research subjects are part of the population studied. The research subjects were determined by purposive sampling, based on the following inclusion criteria: (1) aged between 20–40 years, (2) working period > 2 years, (3) answered “no” to the Physical Activity Readiness Questionnaire (PAR-Q & You), (4) have normal blood pressure and pulse rate, and (5) cooperative and willing to take part in the WHP program in the form of SE. Exclusion criteria in this study were: (1) pregnant women workers, and (2) workers with WMSDs who were not willing to be studied. Based on these criteria, a total sample of 64 garment workers was obtained. Of the 64 people, they were divided into two groups, namely the PKDTK Stretching Gymnastics group and the Ministry of Health’s stretching gymnastics group.

2.4 Operational Definition

The variables of this study are as follows:

- a. Independent variable: stretching exercise/SE
- b. Dependent variable: degree of WMSDs

The operational definitions of the research variables are:

- a. Stretching exercises

Stretching exercise (SE) is a form of ergonomic exercise that is designed to be applied in the workplace in the form of short exercises and can be performed regularly at certain times (breaks) at work using the principle of stretching movements and moderate-tempo musical accompaniment. In this study SE was divided into 2, consisting of 1) Kemenkes stretching exercises were applied before breaks and workers’ rest periods with a duration of 4 min per session, 3x a week for 6 weeks. 2) PKDTK stretching exercises are applied before breaks and workers’ breaks with a duration of 10 min per session, 3x a week for 6 weeks. Measuring tools used in the Training Module.

- b. WMSDs degrees

WMSDs are a discomfort to pain in the muscular, joint, ligament, nervous, bone, and circulatory systems that a person feels ranging from very mild complaints to very pain. The WMSDs degree measuring instrument in this study was evaluated using the Nordic Body Map (NBM) instrument. NBM is a tool that can identify the parts of the muscle that are experiencing complaints with levels of complaints ranging from Not Painful (TS), Slightly Painful (AS), Painful (S), and Very Painful (SS). By looking at and analyzing the body map, it is possible to estimate the type and level of skeletal muscle complaints felt by workers. NBM is an instrument to assess body segments felt by the operator (according to the operator’s perception), whether very painful, painful,

Table 1. Variable Measurement

| No | Variable | Indicator | Measurement Scale |
|----|-----------------------------|---|---|
| 1 | <i>Stretching exercises</i> | 1) Kemenkes stretching exercises 2) PKDTK stretching exercises | SPO |
| 2 | WMSDs degrees | - NBM | Ordinal Scale 1 = No Pain 2 = Slight pain 3 = Pain 4 = Very Painful |

moderately painful, or not painful. This work is done manually with an unnatural work attitude and is carried out for a long time, namely for 8 working hours. The data scale for this variable is ordinal [9]. The measuring tool used was a questionnaire. The data scale used is an interval. Measurement of each variable can be seen in Table 1.

2.5 Data Collection Techniques

The instrument in this study used a questionnaire. The questionnaire used was partly adopted from a valid and reliable questionnaire (WMSDS degree). The questionnaire developed by the researcher is based on the indicators or dimensions of the variables following the relevant theoretical studies and then distributed to the research subjects. The WHP questionnaire in the form of an SE will be distributed to the stretching exercise instructors. Besides using questionnaires, data collection techniques also use secondary data, namely staffing data and health service data at garment industry locations.

2.6 Data Analysis

Data analysis in this study used the t-test, used to determine the effectiveness of the WHP application on the degree of WMSDs. The independent sample t-test test is to find out the difference in the effectiveness of the WHP application or intervention in 2 different subject groups (the control group and the treatment group) by looking at the Sig value < 0.05. The paired t-test is to determine the difference in effectiveness before and after the application of the intervention in the same 1 group of subjects (the treatment group) by looking at the Sig value < 0.05.

3 Research Results

3.1 Description of Stretching Exercises

Stretching Exercise/Workplace Exercise is a series of exercises for stretching the body's muscles, designed in the form of a concise gymnastics, very possible to do in the workplace and effectively reduces the tension of the skeletal muscles which tend to contract statically while working and increases the flexibility of the muscles so that the movements in each joint can occur freely. In this study, a comparison was made to test which



Fig. 1. Example of the Ministry of Health's Stretching Exercise

is better between stretching exercises from the Ministry of Health (Gymnastics A) and PKDTK stretching exercises (Gymnastics B). In general, the differences between the two gymnastics are as follows:

a. The Kemenkes stretching exercise is carried out with a duration of approximately 15 min, done standing and consisting of 15 movements. An example of the Ministry of Health's stretching exercise can be seen in Fig. 1.

b. PKDTK stretching exercises are performed accompanied by moderate-tempo instrumental music with a duration of about 10 min. They can be done regularly at certain times, either when going to do activities or after activities (rest). Gymnastics is divided into 3 parts (warm-up - core - closing) consisting of 30 kinds of movements, with the following explanation:

- 1) The Warm-up Part, performed at work in a sitting position, consists of 18 movements.
- 2) Core Part, performed at work in a lying position on a mat, consisting of 6 movements.
- 3) Closing Section, performed at work in a standing position, consisting of 6 movements.

This exercise is expected to reduce tension in the neck muscles, shoulder muscles, back muscles, lumbar muscles (lower back), arm muscles, wrist muscles, and leg muscles, and can reduce the risk of work-related skeletal muscle disorders (WMSDs). Examples of PKDTK stretching exercises can be seen in Fig. 2.

3.2 Data Description

The description of the data in this study can be seen in Table 2.

In Table 2 it is known that stretching exercises using the Ministry of Health method (Gymnastics A) has helped reduce the degree of WMSDs. Likewise, stretching exercises with the PKDTK method have helped reduce the degree of WMSDs. This shows that the two stretching exercises, both from the Ministry of Health and PKDTK, are effective in reducing the degree of WMSDs. However, to test the significance level of this effect, it will be proven by a different test.



Fig. 2. An example of PKDTK stretching exercises

Table 2. Data Description

| Group | WMSDs degrees | Minimum | Maximum | Means |
|--------------|-------------------|---------|---------|-------|
| Gymnastics A | WMSDs Before | 1,11 | 2,50 | 1,676 |
| | WMSDs After | 1,00 | 2,25 | 1,502 |
| | Decrease in WMSDs | 0,04 | 0,32 | 0,174 |
| Gymnastics B | WMSDs Before | 1,11 | 2,29 | 1,424 |
| | WMSDs After | 1,07 | 2,11 | 1,266 |
| | Decrease in WMSDs | 0,04 | 0,29 | 0,159 |

3.3 T-Test

Paired Sample T-Test. Paired t-test is to determine the difference in effectiveness before and after the application of the intervention in 1 group of the same subject (treatment group) by looking at the sig value < 0.05 . The results of the paired sample t-test can be seen in Table 3.

Table 3. Paired Sample T-Test Results

| Group | WMSDs degrees | Mean | T value | Sign |
|--------------|---------------|-------|---------|-------|
| Gymnastics A | WMSDs Before | 1,676 | 9,175 | 0,000 |
| | WMSDs After | 1,502 | | |
| Gymnastics B | WMSDs Before | 1,424 | 7,000 | 0,000 |
| | WMSDs After | 1,266 | | |

Table 4. Independent Sample T-test results

| Group | Mean | T value | Sign |
|--------------|-------|---------|-------|
| Gymnastics A | 0,174 | -2,282 | 0,030 |
| Gymnastics A | 0,234 | | |

In Table 3 it is known that there is a significant difference in the degree of WMSDs before and after doing stretching exercises from the Ministry of Health, this is shown by a significance value of $0.000 < 0.05$. For the effect of stretching exercises with PKDTK, there is a significant difference in the degree of WMSDs, this is indicated by a significance value of $0.000 < 0.05$.

Independent Samples T-Test. Independent samples t-test, used to determine the effectiveness of the application of stretching exercises on the degree of wmsds. The results of the independent sample t-test can be seen in Table 4.

Table 4 shows that the average value of the reduction in the degree of WMSDs for garment workers using the PKDTK stretching exercise (Gymnastics B) is 0.234, which is 0.174, which is greater than the average value using the stretching exercise from the Ministry of Health (Gymnastics A). The results of the t-test show that the significance value is $0.030 < 0.05$, this means that there is a significant difference in the degree of WMSDs reduction between the use of PKDTK stretching exercises (A gymnastics) and stretching exercises from the Ministry of Health (Gymnastics B).

4 Discussion

Workplace health promotion (WHP) is defined as a planned activity program through the process of increasing knowledge, attitudes, behavior, and skills of people in the workplace, by influencing working conditions and work environment, to achieve workers' control over their health and to achieve increased health and productivity [10]. WHP is one of the components of occupational health service activities, which carries out efforts to improve the degree of physical, mental, and social health of workers, in the context of preventing diseases whose prevalence is high among workers and supporting human resources in achieving the highest performance, career paths, and organizational productivity-height [10].

One model of health promotion at work is to do sports at work. Sport is a structured, planned, and repetitive body movement performed by a person to maintain or improve physical fitness. Exercise habits will affect the level of freshness of a person's body. The high risk of musculoskeletal complaints, especially muscle complaints, is influenced by the level of body fitness. Musculoskeletal complaints will increase due to a lack of muscle flexibility due to increased physical activity without adequate physical fitness.

Work-related musculoskeletal disorders (WMSDs), are one of the most common occupational diseases. WMSDs are widespread worldwide and increase health problems in the workplace [11]. These disturbances reduce the physiological efficiency of human body systems, causing WMSDs to become a serious public health problem in both

developed and developing countries [12]. This study examines the impact of stretching exercise as a health promotion model. The health promotion model that will be developed in this study is the Workplace Health Promotion (PKDTK) model to tackle WMSDs in garment industry workers. As a comparison or control in this study using the stretching exercise model developed by the Indonesian Ministry of Health.

The results of the paired sample t-test on the degree of WMSDs showed that there was a significant difference in the reduction in the degree of WMSDs in garment workers before and after using the PKDTK model of stretching exercise and the Ministry of Health's model of stretching exercise. This shows that there is an influence of PKDTK and the Ministry of Health's stretching exercises on reducing the degree of WMSDs, meaning that stretching exercises can reduce WMSDs complaints in garment workers. The results of the independent sample T-test on reducing WMSDs in workers show that there is a difference in the effect of PKDTK stretching exercises and the Ministry of Health's stretching exercises on reducing WMSDs. Based on the average value, it shows that the PKDTK model stretching exercise has more effect on reducing the degree of WMSDs compared to exercise.

The results of this study support research conducted by [13] which found that exercise is effective in increasing the body's muscular endurance in elderly workers because stretching done in the workplace can facilitate the reduction of musculoskeletal stress. In addition, according to [14], the benefits of stretching include increased flexibility, range of motion, circulation, posture, and stress relief. The results of other studies show that stretching at work has been shown to reduce discomfort and musculoskeletal injuries in office workers, factory workers, and firefighters [15].

Based on the results of this study, shows that HPW is very important in efforts to improve the degree of physical, mental, and social health of workers, as well as in the context of preventing diseases whose prevalence is high among workers and supporting human resources in achieving the highest performance, career path, and organizational productivity.. Stretching exercises carried out in the workplace, whether using the Ministry of Health's stretching exercises or PKDTK stretching exercises developed by researchers, have been proven to be able to reduce the degree of WMSDs in garment workers. The Ministry of Health's stretching exercises are easier to apply, but the exercises developed by researchers are more effective in reducing the degree of WMSDs.

5 Conclusion

The results of this study indicate that the Kemenkes stretching exercise and PKDTK stretching exercise affect reducing the degree of WMSDs in garment workers. The results of different tests also showed that PKDTK stretching exercises had a better effect than PKDTK stretching exercises. Based on these results, health promotion in the workplace by doing stretching exercises is very important in efforts to improve the degree of physical, mental, and social health of workers, as well as in the context of preventing diseases with a high prevalence among workers and supporting human resources in achieving performance, career paths, and organizational productivity. The highest.

This research is an initial study to determine the effect of stretching exercises on WMSDs in garment workers. Further research is expected to develop this research to

make it even better, for example by including the variable length of service as a variable that can influence the incidence of WMSDs in the workplace.

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