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The Effects of Ergonomic Exercise on Musculoskeletal Disorders among Cleaning Service Officers

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Abstract. Musculoskeletal disorders due to work are a health problem for workers who occupy top positions and impact the quality of life and work productivity. This study aimed to examine the effect of the ergonomic exercise on musculoskeletal disorders due to the cleaning service officers' workload at Universitas Muhammadiyah Yogyakarta. This study used the Pre-Experiment method with a One-group pre and post-test design. Nineteen cleaning officers were involved in this study. We used the Nordic body map (NBM) questionnaire to assess musculoskeletal disorders. The ergonomics exercise had carried out for 5-10 minutes 3 times a week. This study showed that the mean musculoskeletal disorders before receiving the ergonomic exercise were 45.11. After receiving the intervention, the score of NBM was 39.16. the statistics test found that p-value was 0.000 ($p < 0.05$). It was indicated that ergonomic exercise has a positive effect on musculoskeletal disorders due among cleaning service officers. There is an influence of ergonomic exercise on musculoskeletal complaints due to the cleaning service officers' workload at *Universitas Muhammadiyah* Yogyakarta. It is necessary to do further research on the effect of ergonomic exercise on musculoskeletal complaints due to work by controlling the factors of age, length of employment, and gender.

Keyword: Ergonomic exercise, Occupational health, Occupational health nursing, Worker population, work related to musculoskeletal disorders

INTRODUCTION

The population of workers has increased with the increasing number of the labor force. The labor force is the people categorized in working age (above 15 years old) who have been performed, currently not working, and looking for work (1). According to Republic of Indonesia Law No. 13 of 2003, the workers are the people who work for wages, salaries, or other forms of compensation (2). The data from the Indonesian Central Statistics Agency in February 2018 showed the number of working ages reached 193.55 million people, where 133.93 million people were categorized as the workforce, and 59.61 million people were classified as the non-workforce. The number of workers in Indonesia has increased in recent years. In 2013, the number of the workforce reached 120.2 million people. Subsequently, in 2014 it had achieved 125.3 million (3)

Musculoskeletal disorders occupy the first position in the workers' health disorders due to Occupational Diseases (OD) and Occupational Accidents (OA). The Labor Force Survey said that the number of MSDs in the UK reached 553,000 out of 1,243,000 workers affected by OD and OA, or about 44% of the total cases (4). This condition is similarly has found in the United States, where there have been 6 million cases of MSDs with an average of 300-400 cases per 100,000 workers. The Labor Force Survey (LFS) UK in 2015 stated, 1.1 million people in Indonesia died due to OD and OA (5).

Musculoskeletal disorders often occur due to repetitive movements in the workplace that affect the function of the musculoskeletal system. The musculoskeletal system consists of muscle tissue, tendons, ligaments, nervous system, bone structure, and blood vessels. Musculoskeletal problems often arise in the workers' neck, shoulders, forearms, upper arms, wrists, and legs (6).

Evadarianto showed that unergonomic posture could cause MSDs. This shows that physical activities that require large muscle strength, such as transporting goods and moving things manually when done with poor posture, can cause back pain and strain the backbone. The worst of the worker's posture at work will increase the MSDs risk for the workers(7).

Health workers, especially nurses, have a role in it through Occupational Health Nursing (OHN). Occupational Health Nursing has eight roles in workers' health. One of them is implementing non-pharmacological therapy (8). The non-pharmacological treatment that could be explicitly applied for MSDs is an ergonomic exercise to implement OHN caring. Ergonomics exercise is some gymnastic techniques to restore or correct the position and flexibility of the nervous system and blood flow, maximizing oxygen intake to the brain, opening the intelligence system, musculoskeletal system, sweat system, body heating system, uric acid burning system, cholesterol, blood sugar, lactic acid, oxalate crystals, carbohydrate conversion systems, electrolyte or ozone-making systems in the blood, and immune system (9).

Musculoskeletal disorders due to work that are often experienced by cleaners, if not handled, will affect increasing morbidity in workers and decreasing work productivity. Nursing management efforts are needed to solve this problem early not to harm the health and productivity of workers. Ergonomic exercise is a part of an independent nursing intervention that has been scientifically proven to have benefits, especially for the musculoskeletal system. Based on this background, research is needed on ergonomic exercise on musculoskeletal disorders due to work on cleaners.

OBJECTIVE

This study aims to determine the effect of the ergonomic exercise on musculoskeletal disorders due to the cleaning service officers' workload at Universitas Muhammadiyah Yogyakarta.

METHOD

This research is a quantitative study that used a pre-experimental method with a one-group pre-post-test design. The sampling technique in this study used 19 respondents. This research was conducted on the North Zone of Universitas Muhammadiyah Yogyakarta (UMY) cleaning service officers, following the inclusion and exclusion criteria. The inclusion and exclusion criteria in this study are as follows:

1. An employee who is willing to be a respondent in the research.
2. An employee who has musculoskeletal complaints.
3. An employee who does not handle musculoskeletal complaints.

b. Exclusion Criteria

1. An employee who participates in the research but could not follow or resign for some reason.
2. An employee with a state of illness/disability such as fractures and permanent dislocations.
3. A worker who has been taking analgesics on his job.

Subsequently, this research used questionnaires on Nordic body maps (NBM). Previously, the NBM questionnaire was known to measure to overcome musculoskeletal complaints. This questionnaire uses images of the human body divided into nine main parts: neck, shoulders, upper back, elbows, lower back, wrists/hands, waist/buttocks, knees, heels/feet. The scale of measurement results used by NBM for these components is 0-112. On this scale, the greater the score, the worse the musculoskeletal disorder (10-11).

Furthermore, the ergonomics exercise was carried out for 5-10 minutes 3 times a week. After one week of doing the respondents' ergonomic exercise intervention, a post-test was carried out using the NBM questionnaire. The ergonomic gymnastics movements consist of:

1) The opening movement, perfect standing: Body relaxed, feet shoulder-width apart, soles and toes in a specific position. Hands in front of your chest, right palms on top of your left palms, resting on your chest, with your fingers slightly apart, looking straight ahead.
2) The first movement, broaden the chest: From a perfectly standing position, the hands hang down, then the arms are rotated. Hands raised straight ahead, then up, then behind, and back down. The position of the feet is pointed and lowered according to the rhythm of the hand movements. This also applies to the next movement. When the hands are up, the ribs are stretched from each other, and the front part is lifted so that the chest cavity will widen, the air pressure inside becomes negative so that fresh air from outside flows in. Then the mind moves back and down, the chest cavity will shrink, and air will escape.
3) The second movement, bowing as in gratitude: The position of the legs remains as before, the head looks up, and the gaze is directed forward. Hands are lifted straight up. Then body bends, hands reach for ankles, firmly held, pulled, gripped as if we want to raise our bodies. After that, return to a standing position with your arms dangling.
4) The third movement, sit mightily: Start the movement as if going to prostrate. From the previous position, drop your knees to the floor, your feet standing straight, toes bent forward. The hand grips the ankle, but the head looks up. The look is ahead, so the chin is almost touching the floor.

5) The fourth movement, sitting burning: Sitting kneeling or sitting Sinden. Both feet are spread backward, so we sit on the soles of our feet. Hands with hips. Begin the movement as if going to prostrate but head up, look forward, and chin almost touches the floor. After a while (one breath-hold), then return to the burning sitting position.\
6) The fifth movement, lying as resignedly: From the previous position, the back is dropped until it touches the floor/base like a baby with two arms straight above the head, legs still bent inward, inhale deeply then slowly exhale through the mouth and feel it using the chest breath.

The data analysis test used frequency distribution to describe the characteristic of respondents and paired. T-test was used to describe the mean difference before and after receiving the intervention.

RESULTS

The Characteristics of The Respondents

Table 1 showed the characteristic of the respondents. The findings explained that most of the respondents were male (89.5%). More than half of them have been working mode than ≥ 5 years (68.4%). Furthermore, Almost half of the respondents were late adult category(42.1%).

Table 1 .1 Overview Characteristics of Respondents by Gender, Future Work and Age at Cleaning Service Officers in the North Zone of Universitas Muhammadiyah Yogyakarta, February 2020 (n = 19)

No	Characteristics	Frequency (n)	Percentage (%)
1	Gender		
	Male	17	89.5
	Girl	2	10.5
2	Working Period		
	<5 years	6	31.6
	≥5 years	13	68.4
3	Age		
	Late teens: 17-25 years	2	10.5
	Early adulthood: 26-35 years	7	36.8
	Late Adult: 36-45 Years	8	42.1
	Early age: 4 6 -55 years	1	5.3
	Late Elderly: 56-65 Years	1	5.3
	Total	19	100.0

Table 2 showed the mean difference of NBM−before and after receiving the intervention. The finding found that before receiving the intervention, the mean was 45.11±12.170. after receiving the intervention, the mean was 39.16±7.890. The p-value of this study was 0.000 (p <0.05), which means that there was a significant difference between the results of the NBM score before and after receiving the ergonomic gymnastic therapy

Table 1 .3 Test Results Statictic Paired t-test between NBM NBM Pre and Post on the Cleaning Service Officers in the North Zone of Universitas Muhammadiyah Yogyakarta, Februarys 2020 (n = 19)

Intervention	Frequency (n)	The mean	Std. Deviation	Std. Error Mean	P-value
NBM Pre-test	19	45.11	12.170	2.792	0.000
NBM Post-test	19	39,16	7.890	1.810	

DISCUSSION

General Characteristics of Respondents

Based on the study results, it is known that the respondents' sexes were 17 men and two women. The analysis of the respondents' sex needs to be done because there have been essential differences between men and women. The difference is related to the ability to work. This could be exampled from the research's point of Meruntu et al (12). According to them. There were more males than females that worked as farmers, based on each presentation. The male reached 67.7% while the female reached 32.3%. This is because men more identically own the physical work characteristic. Subsequently, according to Sumardiyono et al (13). musculoskeletal disorders in men are more significant than in women. The men reached 85.7% while the women only reached 26.6%. Men also tend to be more affected by muscle pain because men usually rely more on physical strength.

According to Antoni et al (14), men are more susceptible to arthritis gout because they have higher uric acid levels than women. Contrastly, the hormone estrogen, which women own, makes their body's endothelial tissues protected. Therefore, it makes the elasticity of blood vessels, joints, and other women's other organs better maintained.

Furthermore, based on the study results, it is known either that most of the respondents had five years of work tenure. According to Etika et al. (6), the workers who have more than five years of work tenure have a higher risk of gaining MSDs than the workers with a working period of no more than five years. This due to the working period escalation will make repetitive movements in an extended period. This has also occurred in the research of Mongkareng et al.(15). In their study, 60% of the workers (24 respondents) have a working tenure of more than five years.

Meanwhile, the total amount of workers with no more than five years of work tenure was just 16 respondents (40%). The length of work has been one of the risk factors for musculoskeletal disorders related to the length of time a person works. While the workload to be carried out increases, the risk of experiencing musculoskeletal pain also increases. The workers who have high work tenure tend to have a strong relationship with musculoskeletal disorders.

Subsequently, in this study, the respondents mostly aged between 36-45 years, with the total amount is eight respondents (42.1%). At the beginning of 35 years old age, musculoskeletal disorders have begun to be felt and will continue to increase as the age increasing. Furthermore, late adulthood is marked by a decline in physical abilities. The respondents who were categorized in late adulthood have identified a long tenure at UMY.

Jerro et al. (16) stated that the workers' in middle age faced the decline of their physical abilities due to their age escalation. A lack of workability will accompany the aging process due to changes in the body's functions. One example of the changes in body function is a decrease in muscle strength when it will be decreased due to the age increasing. This is caused by the degenerative process of regenerating tissue into scar tissue, the tissue damage, and the fluid's decline, which impacts the muscle and bone stability. At an advanced age, generally, the physical abilities also decline after it has reached its strength peak in the middle period. A lack of workability will accompany the aging process due to changes in the body's functions.

According to Tanjung and Siregar (17), after the human has reached 30 years old, they will lose approximately 3-5% of the total muscle tissue in each decade. The organs that used to well-functioned without any disturbances, at the 30 years age-old have begun to experience a decline in organ function. This can lead to the emergence of lower back pain in accordance with the changes in the body posture and the degeneration that faced.

The Effects of Ergonomic Gymnastics Due to The Musculoskeletal Complaints

Based on the data presented in table 1.3 using the paired T-test, there has been a significant difference between the pre-NBM value and the post-NBM value with a p-value of 0.000. This showed a substantial decrease in musculoskeletal disorders after doing ergonomic exercise. Ergonomic exercise performed in this study consisted of 1 opening motion and 5 core movements. The series of ergonomic exercise movements were combined with bodywork, breathing, mind, and muscle strengthening. Ergonomic exercise is a stretching activity that aimed to strengthening and relaxing the muscles. In this case, the respiratory function has harmonized with a predetermined movement (18).

Before researched respondents, researchers had conducted an ergonomic exercise experiment on two groups with the different onset of gymnastics. Group 1 performed exercise continuously for one week, while group 2 performed routine 3 times for 1 week. This observation then obtained that group 1 experienced a momentary and continued pain while had did an ergonomic exercise. On the contrary, group 2 felt the pain of some parts of the body had decreased. This is in line with the research from Suwanti et al. (19), which stated that the ergonomic exercise should be performed 3 times per week with alternating days to relieve Delayed Onset Muscle Soreness (DOMS) after doing exercise.

Delayed Onset Muscle Soreness is muscle pain and stiffness that develops 24-72 hours after doing sports activities, usually felt by the beginners/someone who has not been done sports activities for a long time. Delayed Onset Muscle Soreness can cause pain and function limitations that adversely affect a person's performance in sports activities. Delayed Onset Muscle Soreness can heal by itself, but it needs many times. Therefore, DOMS can interfere with other exercise programs and daily activities(20).

Before giving action to the respondent, some of the respondent's back body parts may experience muscle pain that should be identified, namely: neck, shoulders, back, waist, and hips. In addition, the parts of the hand that may face muscle pain are the arm and elbow. Furthermore, the leg parts that may experience muscle pain are the thighs and calves. The feeling of pain depends on the activity done by someone, such as cleaning the building, cleaning a toilet, carrying and disposing of garbage. This activity tends to put pressure on the muscles to become stiff and cause the muscles to contract.

The result of NBM measurements on respondents before doing ergonomic exercise obtained a mean value of 45.11. This is due to the daily work of the respondents who have used physical activity and have not been applied proper ergonomic movements when cleaning buildings, lifting items, and mopping the floor. After being given an ergonomic exercise, there is a decrease in the mean value, which the result of the mean value after doing the ergonomics exercise is 39.16. The results showed that ergonomic exercise significantly influenced musculoskeletal disorders of the respondents with a p-value of 0.000 ($p < 0.05$). This could happen because the ergonomic exercise conducted by respondents provides therapeutic effects to reduce musculoskeletal disorders.

The ergonomic exercise is a combination of muscle movement and breathing. When perfect movement stands of all nerves become a point of control in the brain. At that time, the mind is controlled by the sense of consciousness to be healthy and fit. When the body bends, this movement can supply oxygen to the head and increase blood flow to the upper part of the body, which can stimulate the body's relaxation response from all physical and mental tensions (18)

The ergonomics exercise, which has been done routinely, can bring a relaxation response to the body. The ergonomic exercise movements can trigger endorphin release and inhibit trigger cell activity. The gate of gelatine being closed and the impulses to the reduced musculoskeletal disorders will be transmitted to the brain. This condition madder the respondents reached a state of calm. The condition of calm/relax is being suggested because the ergonomic exercise can provide subtle massages to various glands in the body, reduce cortisol and blood production, and restore sufficient hormone expenditure that will provide emotional balance and peace of mind (21).

The exercise that has been given, in addition, reduced a spasm because of the activation of proprioceptor muscle or muscle spindles when someone does gymnastics. The muscle spindles are responsible for regulating signals to the brain about muscle length changes and excessive tone changes. When there is an excessive change in muscle tone, the muscle spindle will send alerts to the brain to make the muscles contract as a form of defense and prevent injury. Exercise that has been done routinely and regularly could make the muscles contract at a minimum, which causes muscle fibers to elongate, and muscle spasms can be reduced easier (22).

According to Dewi et al. (23), ergonomic exercise needs to be done routinely and regularly because when the heart muscle pumps harder and continuously, the arteries will reduce more pressure. Exercise ergonomics can increase heart rate, breathing, blood pumping, and body metabolism. This leads to the fulfillment of the oxygen needs because the heart will increase the blood flow to the body.

CONCLUSION

Based on the results of the research and discussion that have conveyed, some points can be concluded:

1. There is an influence of ergonomic exercise on musculoskeletal complaints on cleaning service officers of Universitas Muhammadiyah Yogyakarta with a P-value of 0.000 (p <0.05).
2. Most of the respondents are male, with the total amount is 17 respondents (89.5%), while the female was amounting to 2 respondents (10.5%). Furthermore, most respondents are aged 36-45 years (late adulthood) and average, have more than five years of work tenure.
3. Before being given ergonomic exercise, the musculoskeletal complaints of the respondents have an NBM mean value of 45.11 with Std. Deviation 12.170.
4. The musculoskeletal complaints after given ergonomic exercise had a mean value of NBM decreasing that is 39.16 with Std, Deviation 7.890.

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