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The effect of muscle stretching on the reduction of pain caused by *Occupational Cervicobrachial Disorders* (OCD) among mechanics at a Honda service workshop in Umbulharjo Yogyakarta

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ABSTRACT

Occupational Cervicobrachial Disorder (OCD) is a functional and/or organic disorder at the upper extremity due to neuromuscular fatigue caused by working activities at a fixed position or with repeated movements. The rate of musculoskeletal system disorder among mechanics in a number of countries has amounted to 76-92%. A preliminary survey using *Nordic Body Map Questionnaire* showed that the mechanics at a Honda workshop in Umbulharjo felt the work-related pain at the upper extremity. Therefore, intervention was deemed required to reduce such pain. Muscle stretching was selected as the intervention to be provided. This study is aimed at determining if muscle stretching has an effect on the reduction of OCD related pain among the mechanics at a Honda workshop in Umburharjo Yogyakarta. The study was quantitative in nature with quasi-experimental design. Based on cluster sampling technique with tracer survey methods, 30 samples were selected and divided into 2 groups, i.e., intervention group with 20 respondents and control group with 10 respondents. The measurement of pain scale was performed using Visual Analog Scale. The research results showed that there was significant reduction of pain scale upon the intervention of muscle stretching with the frequency of 6 times per week. Hence, the study comes up with a conclusion that muscle stretching has the effect on the reduction of pain caused by OCD among the mechanics at a Honda motorcycle workshop in Umbulharjo Yogyakarta.

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1. Introduction

Occupational Cervicobrachial Disorders (OCD) is a functional and/or organic disorder at the upper extremity due to neuromuscular fatigue caused by working activities in fixed position or with repeated movements (Hosokawa, 1985). Musculoskeletal system disorder is a work-related disease

(WRD) occupying the first rank in five continents with the portion of as big as 48% (Tarwaka, 2015). A report from the Indonesian Ministry of Health revealed that musculoskeletal system disorder among the workers in Indonesia has amounted to 40.5% (Kemenkes, 2017).

Musculoskeletal system disorder is a potential problem for mechanics at motorcycle workshops. The rate of musculoskeletal disorder among mechanics is still high. In Malaysia, musculoskeletal disorder reaches 87.4% to 91.7%, while in India 85%, in Bangladesh 77%, and in Norway 76% (Faisal et.al., 2014; Akter et.al., 2016; Vyas et.al., 2017).

An observation using Google Map application revealed that there were at least 3 Honda motorcycle workshops in Umbulharjo District. The Office of Transportation, Communication, and Informatics of Yogyakarta City recorded that the number of motorcycles in Umbulharjo District had amounted to 10.740 units (DPK & IK, 2017). This number, added with the amount of motorcycles brought into the district by students from other places, would be bigger. This would affect the needs for service and repair among the motorcycle users. Hence, workshops as the service providers of motorcycle maintenance and repairs would become busy with customers.

On the other hand, based on a preliminary survey using Nordic Body Map Questionnaire, the researcher found that the mechanics at a Honda workshop suffered from pain at their upper extremity during the work. Hence, the researcher considered it was necessary to conduct an intervention to reduce the pain. Muscle stretching was selected for this effort since it was considered as low-cost, easy, practicable, and efficient (Dallas et.al., 2014;Creswell, 2016).

Based on the above description, the researcher was encouraged to conduct the study on the Effect of Muscle Stretching on the Reduction of Pain Caused by *Occupational Cervicobrachial Disorders* (OCD) among Mechanics at a Honda Service Workshop in Umbulharjo Yogyakarta.

2. Materials and Method

2.1. Research Design

The research was quantitative in nature with a quasi-experimental method (nonequivalent control group). In this design, the researcher divided the subjects into two groups, i.e control group and experimental group. Both groups were similarly provided with pre-test and post-test. However, a treatment was provided only for the experimental group (Creswell, 2016; Notoatmodjo, 2014). The research model scheme was:

1. Experimental group O1 _____ X1 _____O2
2. Control group O1 _____ O2

Explanation:

- There were 3 groups, where 2 were the experimental groups and 1 was the control group
- O1: Measurement of pain scale before the treatment
- X1: Group with muscle stretching treatment 6 times per week
- O2: Measurement of pain scale after the treatment

2.2. Population

Based on the Google Map observation, there were 3 Honda motorcycles workshops across Umbulharjo District where each of them employed 10 mechanics so that there were 30 mechanics. Population is defined as the total number of research objects (Notoatmodjo, 2014). Hence, the population of this research were 30 mechanics of Honda motorcycles workshops in Umbulharjo District, Yogyakarta.

2.3. Samples

Sample is the representative of a population. This research applied the total sampling technique where the number of samples was equal to the number of populations (Sugiyono, 2017). Hence, the sample of this research consisted of 30 respondents.

2.4. Data Analysis

A univariate analysis was implemented to determine the frequency distribution, whereas a bivariate analysis was conducted using Shapiro-wilk test, Kruskal wallis, Wilcoxon, Paired T-test, Mann Whitney Test, One way ANOVA, and Post hoc (Dahlan, 2015).

2.5. Research Instruments

1. Informed Consent to obtain respondents' consent/agreement.
2. Questionnaire to obtain age, service year, and exercise variables.
3. Stopwatch to measure pulses to obtain respondents' work load
   Heart rate calculation formula

$$\text{Pulse per minute} = \frac{\text{10 Pulses}}{\text{Stopwatch counting time}} \times 60$$

4. Visual Analogue Scale (VAS) to obtain the OCD pain scale
5. Camera to document the research, and writing utensils

2.6. Research Duration

The research was conducted from July to September 2022.

3. Results and Discussion

3.1. Results

3.1.1. Respondents' Risk Factors

The most age in the research was ≥ 30 years (56.7%) and the longest service year was > 5 years (56.7%). Whereas, the most workload was low workload (86.7%). Further, 66.7% of the respondents did not do exercise.

3.1.2. Difference in Neck Pain Before and After Treatment with Muscle Stretching

Table 1. Description, Normality, and Difference in Neck Pain Before and After the Treatment

Neck Pain	Group	Mean ± SD	Median (min – max)	p¿
Pre	Treatment 1	4.30 ± 1.25	4 (2 – 6)	0.436*
	Control	4.20 ± 1.14	4 (2 – 6)	0.479*
Post	Treatment 1	1.50 ± 0.97	2 (0 – 3)	0.095*
	Control	4.60 ± 1.08	4 (3 – 6)	0.030
Difference	Treatment 1	-2.80 ± 0.92	-2.5 (-4 – (-2))	0.004
	Control	0.40 ± 0.52	0 (0 – 1)	0.000

*Explanation : * Normal (p > 0,05); ¿ Shapiro-wilk*
Source : Primary Data

Table 1 showed that there was a decrease in the average value for the Treatment 1 group. The average value for the Treatment 1 group was 4.30 and after the intervention it was reduced to 1.50, hence there was a difference of 2.80. However, for the Control group, there was an increase in the average value, where the initial value of 4.20 increased to 4.60, hence there was a difference of 0.40. The results of normality tests using the Shapiro-Wilk test before the treatment on the groups 1, 2, and the control group revealed that the data were normally distributed since the p > 0.05. Data normality after the treatment of group 1 was normally distributed with p > 0.05, whereas with the control group it was not normally distributed with p < 0.05. The differences in the group 1 and control group were not normally distributed with p < 0.05.

Table 2. Neck Pain Difference (Pre, Post and Difference) Based on Treatment

Neck Pain	Pre	Post	p	Difference
Treatment 1	4.30 ± 1.25	1.50 ± 0.97	<0.001¶*	-2.80 ± 0.92
Control	4.20 ± 1.14	4.60 ± 1.08	0.046†*	0.40 ± 0.52
p	0.612§	<0.001‡*		<0.001‡*

*Explanation : * Significant (p < 0,05); § One Way ANOVA; ‡ Kruskal wallis; ¶ Paired; † Wilcoxon*
Source : Primary Data

Table 2 showed that based on the difference test using the paired test, the neck pain difference of the Treatment 1 group before and after the treatment was significant since the value of p = <0.011 < α = 0.05 with the difference of 2.80. Meanwhile, based on the Wilcoxon Test, the difference of neck pain of the control group before and after the treatment was significant since p = 0.046 > α = 005 with a difference of 0.40. Based on the difference test using one way anova, the difference of neck pain before the treatment between group 1 and control group was not significant since the p = 0.612 > α = 0.05. After the treatment, the difference of neck pain between group 1 and control group was significant since the difference test using the Kruskal Wallis Test resulted in the value p = <0.001 < α = 0.05 and the difference of neck pain between the group 1 and control group was significant since the value p = <0.001 < α = 0.05.

3.1.3. Difference of Shoulder Pain Before and After the Intervention with Muscle Stretching Technique

Table 3. Description, Normality, and Difference of Shoulder Pain Before and After the Treatment

Neck Pain	Group	Mean ± SD	Median (min – max)	p¿
Pre	Treatment 1	5.60 ± 1.51	6 (2 – 7)	0,022
	Control	5.60 ± 1.51	6 (2 – 7)	0,022
Post	Treatment 1	2.20 ± 1.03	2 (0 – 4)	0,043
	Control	5.80 ± 1.55	6 (2 – 7)	0,006
Difference	Treatment 1	-3.40 ± 0.84	-3 (-5 – (-2))	0,172*
	Control	0.20 ± 0.63	0 (0 – 2)	0,000

*Explanation : * Normal (p > 0,05); ¿ Shapiro-wilk*
Source : Primary Data

Table 3 showed that there was a decrease in the average value of the Treatment 1 group. The average value of the Treatment 1 group before the intervention was 5.60, and after the intervention it decreased to 2.20, a difference of 3.40. However, in the control group there was an increase in the average value with the initial figure of 5.60 becoming 5.80, a difference of 0.20. Normality test using Shapiro-Wilk Test before the treatment on group 1 and control group showed that the data was not normally distributed since the value of p < 0.05. Data normality after the treatment of group 1 and control group was not normally distributed since the value of p > 0.05. Whereas, the difference of group 1 was normally distributed since the value of p > 0.05, while the difference of the control group was not normally distributed since the value of p < 0.05.

Table 4. Difference of Shoulder Pain (Pre, Post and Difference) Based on Treatment

Shoulder Pain	Pre	Post	p	Difference
Treatment 1	5.60 ± 1.51	2.20 ± 1.03	0.004†*	-3.40 ± 0.84
Control	5.60 ± 1.51	5.80 ± 1.55	0.317†	0.20 ± 0.63
p	0.212‡	0.001‡*		<0.001‡*

*Explanation : * Significant (p < 0.05); ‡ Kruskal wallis; ¶ Paired t; † Wilcoxon*
Source : Primary

Table 4 showed that, based on the difference test using Wilcoxon Test, the difference of shoulder pain of group 1 before and after the treatment was significant since the value of p = 0.004 < α = 0.05 with a difference of 3.40. Meanwhile, based on the Wilcoxon Test, shoulder pain of the control group before and after the treatment was not significant since p = 0.317 > α = 0.05 with the difference of 0.20. Based on the difference test using Kruskal Wallis Test, the difference of shoulder pain before the treatment between group 1 and control group was not significant since the value of p = 0.212 > α = 0.05. After the treatment, the difference of shoulder pain between group 1 and control group became significant since the value of p = 0.001 < α = 0.05.

3.2. Discussion

In this research, the number of respondents with the age of ≥ 30 was greater than those aged < 30. The difference in age of the workers would significantly affect the illness of musculoskeletal

disorder (Zoer et.al., 2014). Musculoskeletal disorder occurs more frequently to the older workers and would have a big impact on their work capacity (Palmer & Goodson, 2015). The number of respondents with > 5 years of service was higher than those with ≤ years of service. The workers with more than 5 years of service had the risk of 8.92 times to suffer from OCD compared to those with < 5 years of service. The number of respondents with low workload was bigger than those with medium workload. Physical workload was found to be an independent risk factor to cause a musculoskeletal disorder (Brighenti-Zogg, 2016). Respondents with no exercise were greater in number than those doing exercise. Intensive physical exercise for 6-10 weeks would improve O2 utilization in the muscles and would improve muscular contraction energy, would increase the number of capillaries which help muscle fibers improve the blood circulation and strengthen the bones, ligaments, and tendons, which hence would minimize the risk of injuries (Harsono, 2018). In other words, the absence of exercise would increase the risk of injuries.

The research results revealed that there was a significant decrease in the pain scale after the implementation of treatment in the form of muscle stretching at the frequency of 6 times per week for 30 days at the upper extremity consisting of neck, back, and shoulder. Hence, it means that there was an effect of treatment in the form of Muscle Stretching for 6 times per week on the reduction of pain due to OCD consisting of neck, upper back, and shoulder. This is in line with a study by McGowan that muscle stretching at work may reduce occupational MSD among employees (McGowan, 2018). Another study to analyze the impact of muscle stretching and aerobic exercise on cases of dysmenorrhea revealed that there was a significant difference between before and after the treatment on the reduction of dysmenorrhea, so that it is concluded that muscle stretching and aerobic exercise have impact on the reduction of dysmenorrhea (Gram, 2014). Gram et. al, also conclude that physical exercise (muscle stretching) at work could reduce neck and shoulder pain among office employees regardless of the level of supervision. This finding brings in important practical implications for workplace intervention in the future (Harutunian et.al., 2011).

Reduction of the respondents' pain scale after the treatment of Muscle Stretching was inseparable from how the pain was felt by them. Based on the Gate Control Theory, pain occurs due to the presence of sensory stimulation, both small and big, which may be attributed to the work factors, employee factors, as well as psychosocial and psychological factors. Such a stimulus is received by a nociceptor in the spinal nerve which is further transmitted to the brain so that the pain is felt (Moayedi & Davis, 2013; Mendell, 2014).

The Gate Control Theory also states that intensive tactile stimulation applied at the same spot would result in the elimination of pain in certain parts of the body since such a stimulation would affect tiny nerve tissues to be distributed through the dorsal horn of the spinal cord (Ropero & Taniguchi, 2016).

In simple words, it can be said that pain stimulus can be challenged with tactile stimulus. In this research, the role of tactile stimulus is played by muscle stretching. Muscle stretching works well and effectively in improving the range of muscle movements so that the muscle movements become more relaxed (Sharman et.al., 2016; Kirmizigil et.al., 2014).

The results of this research also revealed that the treatment of 6 times per week had the effect to reduce pain due to OCD. This is related to the frequency of the treatment, since there are at least 3 important parameters which potentially affect the success of muscle stretching treatment, i.e frequency, intensity, and duration (Apostolopoulos et.al., 2015). This means that the more frequently muscle stretching is performed, the more will be the potential to affect the success. It is known that frequency, intensity, and duration are proved to improve level of relaxation during muscle stretching (Freitas et.al., 2016). Higher stretching intensity would improve the maximum angle and longer stretching duration is an important factor in reducing passive torque (Freitas et.al., 2015). A previous study has revealed that musculoskeletal symptoms can be reduced immediately with a rest and by increasing the frequency of the rest (Martins et.al., 2015).

As for the control group, based on the results of the pre-test and post-test, it was shown that there was an increase in the average value of pain scale for the side neck, back neck, upper back, shoulder, and arm. Whereas, the pain scale average values for hands were found to be the same between the pre-test and the post-test. This was due to the failure in implementing prevention as well

as arrangement measures. Meanwhile, the works performed were those with awkward posture, standing or sitting in long duration, heavy position of the upper legs, extensive hand fist, and the use of vibrating equipment/tools which may lead to the occurrence of musculoskeletal disorders (Eerd et.al., 2016).

4. Conclusion

It is concluded from this study that:

1. There were 30 people as the respondents. Most of them were those with the age of ≥ 30 years (56.7%), most service years of > 5 years (56.7%), most workload was categorized as low workload (86.7%). As many as 10 respondents (33%) did exercise, 60% of them did it ≥ 3 times a week and 100% of them did it in medium intensity for ≥ 10 minutes.
2. There were differences in the pain scale at the 3 body parts measured before and after the Muscle Stretching treatment 6 times per week.
3. There were differences in the pain scale at the 3 body parts measured before and after the Muscle Stretching treatment 3 times per week.
4. Muscle Stretching treatment 6 times per week has significant effects on the reduction of pain caused by OCD.

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