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ADDITION *OF DEEP CROSS-FRICTION MASSAGE IS* BETTER THAN *SLOW STROKE BACK MASSAGE* AFTER *MCKENZIE EXERCISE* TO IMPROVE FUNCTIONAL ABILITY AND WORK PRODUCTIVITY OF STONE BREAKERS WITH *NON-SPECIFIC LOW BACK PAIN*

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ABSTRACT

Low back pain (LBP) is a condition of discomfort or acute pain in the fifth and sacral lumbar region (L5-S1). The purpose of this study was to prove the application of the intervention of adding deep cross-friction massage is better than slow stroke back massage after McKenzie exercise to improve functional ability and work productivity in stone crushers with non-specific LBP. In this study, researchers used a pretest-posttest control group design. With the number of non-specific samples of LBP in the village of Awang Bangkal Barat 12 people. The results showed that there were significant differences based on the paired-sample t-test parametric statistical test with p-value 0.00 <0.05 before and after in the treatment group and the control group based on the average ODI score and productivity. The conclusion of this study is that the addition of deep cross-friction massage is better than slow stroke back massage after McKenzie exercise to improve functional ability and work productivity of stone crushers with non-specific LBP.

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1. INTRODUCTION

A preliminary study conducted in Awang Village, West Bangkal, Karang Intan District, Banjar Regency, South Kalimantan Province is one of the centers of stone breaking. Because the need for construction goods, especially stone, continues to increase, some people in the village of Awang Bangkal Barat make it home industry a medium to low scaleThe breaking of stones in Awang Village, West Bangkal is done by men and they work for an average of more than 5 years. The workers take advantage of natural products because the surrounding settlements are close to the hills. The work process includes breaking the stone into several pieces and then collecting the stone fragments. and then lift the stones into the truck and arrange them, the number of stones transported by truck using a cubic count. Stone crusher workers work for ± 7-8 hours every day, from Monday to Saturday from 08.00 to 16.00-17.00 Wita, taking 1 hour rest to meet needs such as eating, and praying. When doing their work, stone-breakers work by standing and then bending/a static and repetitive body position for a long time and is done in the open so it is very risky for LBP to occur. In line with research conducted by [1];[2], almost one third of cases can be attributed to occupational risk factors and the impact of ergonomic interventions in the workplace. According to [3], the primary causes of LBP are:

Excessive muscle stretching, repetitive activities, non-ergonomic work attitudes, secondary causes: pressure, vibration, microclimate. While the factors causing LBP according to [4], individual factors such as age, gender, smoking habits, physical activity, physical strength and body size. The majority of stone crusher workers consider that complaints of pain or pain in the lower back are normal things caused by daily work, so that the pain or pain they feel is not treated. Seen on the sidelines of work, workers often rest because of fatigue and complaints

International Journal of Social Science (IJSS)
Vol.2 Issue.2 August 2022, pp: 1483-1490
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caused by lower back pain, this can have an impact on decreasing work production. After the stones are broken into several pieces, they are arranged before being sold to form small mounds to facilitate the lifting process into the truck.

Researchers observed the process of breaking stones in Awang Village, West Bangkal. This survey found that stone breaking was done by bending the body and breaking stones using a sledgehammer/hammer was done repeatedly in a static and repetitive body position for a long time. From the results of interviews and examinations conducted at the beginning of the study using the modified Oswestry disability index (modified ODI) to determine the problem of LBP, from 18 workers, 12 workers or 66.7% of workers experienced complaints in the lower back. Two workers in the minimum disability category of 0%-20% and 10 workers with moderate disability category 21%-40%. Stone crusher workers generally experience pain in the upper arms, neck, shoulders and waist after breaking stones. Complaints are most often felt in the lumbar region.

Preventing the development of LBP to become more severe requires appropriate treatment. Interventions can be given in the form of pharmacological and non- pharmacological. In terms non- pharmacology, the intervention given can be in the form of exercise or

T test because the data are normally distributed. Hypothesis testing to determine the difference in the mean of two unpaired data between the Treatment Group and the Control Group used an independent sample T test parametric statistic test because the data were normally distributed.

2. RESEARCH METHOD

The research method used in this study is the experimental method. In this study, the researchers used a pretest-posttest control group design. The purpose of this study was to prove that the application of the intervention of adding deep cross-friction massage was better than slow stroke back massage after McKenzie exercise to improve functional ability and work productivity of stone crushers with non-specific LBP. This research was conducted in Awang Village, West Bangkal, Karang Intan District, Banjar Regency, South Kalimantan Province. This research was conducted from September 2020 to June 2021. The target populations in this study were all workers who experienced non-specific LBP in Awang Bangkal Barat village, and the affordable population was non-specific LBP in Awang Bangkal Barat village 12 people. The populations in this study were stone crushers in Awang Village, West Bangkal, Karang Intan District, Banjar Regency, South Kalimantan Province, totaling 12 people. The sample size required in this study is based on the formula [5].

The data that has been obtained is then processed and analyzed with the help of a computer program SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago: SPSS Inc. to test the hypothesis that has been set with the following stages: Descriptive analysis includes the mean, standard deviation, on the variables of age, years of service, BMI whose data were taken before the initial intervention was carried out. The normality test uses the Shapiro Wilk test which aims to determine whether the data is normally distributed. Homogeneity test using Levene's test which aims to determine the homogeneity of the data. Hypothesis testing to determine the difference in the mean of two paired data between the pretest and posttest in each Treatment Group and Control Group used a paired-sample T test parametric statistic test because the data were normally distributed. Hypothesis testing to determine the difference in the mean of two unpaired data between the Treatment Group and the Control Group used a parametric independent sample T test because the data were normally distributed.

3. RESULTS AND ANALYSIS

Table 1.1. Characteristics of respondents

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Variable (age, BMI, and years of service)	n	Average and Deviation Baku	*P-Value*
Age (years)	12	47,75±2,63	1.00[1]
TB (cm)	12	165,25±8,75	1.00[1]
Weight (kg)	12	59,83±7,40	1.00[1]
BMI (kg/m^2)	12	21,58±2,15	1.00[1]
Years of service (years)	12	9,42±8,56	1.00[1]

[1]*Lavene's test*

The characteristics of the respondents in Table 1.1 the mean age of the subjects in this study was 47.75 ± 2.63, with the results of the Lavene's test getting a p-value of 1.00. The average height was 165.25 ± 8.75, with Lavene's test results obtained p-value 1.00. The average body weight was 59.83 ± 7.40, with Lavene's test results obtained p-value 1.00. BMI obtained an average of 22.82 ± 6.27, with the results of Lavene's test obtained a p-value of 1.00. The average working period was 9.42 ± 8.56, with Lavene's test results obtained p-value 1.00.

Table 1.2. Normality test

Variabel	**n**	**Group**	**Statistics**	***P-Value***
ODI *Pretest*	1	Treatment	0,90	0,41
	2	Control	0,98	0,96
ODI *Postest*	1	Treatment	0,82	0,09
	2	Control	0,83	0,11
Productivity *Pretest*	1	Treatment	0,92	0,53
	2	Control	0,86	0,21
Productivity *Postest*	1	Treatment	0,93	0,61
	2	Control	0,858	0,18

The results of Table 1.2 can be concluded that all variables have a normal data distribution because the p-value> 0.05. It can be seen in the ODI pretest that both the treatment group and the control group had p-values of 0.41 and 0.96, respectively. In the ODI posttest, both the Treatment Group and the Control Group had p-values of 0.09 and 0.11, respectively.

The pretest productivity of both the treatment group and control group had p-values of 0.53 and 0.21, respectively, and the post-test productivity of both the treatment group and control group had p-values of 0.61 and 0.18, respectively.

International Journal of Social Science (IJSS)
Vol.2 Issue.2 August 2022, pp: 1483-1490
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Table 1.3. Different test of ODI and productivity in each group

Variabel	n	Group	*Pretest* (Average± Deviation standard)	*Postest* (Average± Deviation standard)	*P-Value*
ODI	12	Treatment	22,66±2,42	14,66±1,63	0,00
		Control	22,00±2,82	18,00±2,52	0,02
Productivity	12	Treatment	0,29±0,16	0,79±0,28	0,00
		Control	0,24±0,11	0,47±0,10	0,00

The results of Table 1.3 showed that the mean ODI pretest in the Treatment Group was 22.66±2.42 and the average ODI posttest was 14.66±1.63, thus there was a significant difference based on the paired-sample t test parametric statistical test with p-value 0.00 < 0.05. In the control group, the pretest ODI average was 22.00±2.82 and the posttest ODI average was 18.00±2.52, thus there was a significant difference based on the paired-sample t test parametric statistical test with p-value 0.00 < 0.05.

The pretest productivity obtained in the treatment group average of 0.29±0.16 and the post-test productivity obtained an average of 0.79±0.28 with a p-value of 0.00 <0.05. In the control group, the average pretest productivity was 0.24±0.11 and the post-test productivity average was 0.47±0.10, thus there was a significant difference based on the paired-sample t test parametric statistical test with a p-value of 0.00 < 0.05.

Table 1.4. Different test after intervention in the *deep cross-friction massage group* after *McKenzie exercise* and *slow stroke back massage* after *McKenzie exercise*

Variabel	n	Group	*Postest* (Average± Deviation standard)	*P-Value*
ODI	12	Treatment	14,66±1,63	0,02
		Control	18,00±2,52	
Productivity	12	Treatment	0,79±.0,28	0,02
		Control	0,47±0,10	

Results Table 1.4 The average ODI score in the Treatment Group is 14.66±1.63 better than the ODI score in the Control Group, which is 18.00±2.52 with statistical tests using independent sample t-test, the p-value is 0, 02 < 0.05. It can be concluded that there is a significant difference between the ODI scores in the treatment group and the control group.

The average productivity in the treatment group was 0.79±0.28, which was higher than the control group, which was 0.47±0.10. The statistical test using the independent sample t-test obtained a p-value of 0.02 <0.05. It can be concluded that there is a significant difference between productivity in the treatment group and the control group.

Discussion

Characteristics of Research Subjects

Data on the characteristics of research subjects in Table 1.1 mean age 47.75±2.63 with the youngest age being 42 years and the oldest being 50 years. In line with research conducted [6], it is stated that in general, skeletal muscle complaints begin to be felt at working age, which is 25-65 years. The first complaint is usually felt at the age of 35 years and the level of complaints will continue to increase with age. This study is also in line with research conducted by [7], with increasing age bone degeneration will occur and this condition begins to occur when a person is 30 years old.

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BMI characteristics data obtained an average of 22.82±6.27, the results showed that there was no significant relationship between BMI and the incidence of LBP. In line with research conducted by [8], that the BMI of respondents who are at risk of experiencing LBP complaints are 23 people (46.9%), less than those who are not at risk of experiencing LBP complaints, which are 26 people (51.1%). This study is also in line with research conducted by [7], the results showed that there was no significant relationship between BMI and the incidence of LBP in farmers in Munca Village, Pesawaran Regency.

The working period of the workers is more than 5 years, the average is 9.42 ± 8.56. In this case, it can be linked between years of service and the incidence of LBP complaints. So the longer the working period, the longer a person is exposed to LBP risk factors, the greater the risk for experiencing LBP. According to research [9], batik workers who experience the most LBP complaints are those who have a working period of > 10 years and have the most complaints of LBP. In line with research conducted by [7], there is a relationship between tenure and the incidence of LBP.

ODI Difference Test and Productivity in Each Group

The average ODI value in Table 1.3 is based on the modified ODI questionnaire, in the Treatment Group before the intervention was given an average of 22.66 ± 2.42 and decreased to 14.66 ± 1.63 after the intervention was given. 3 times a week for 3 weeks. In the control group before being given the intervention, the average was 22.00±2.82 and it decreased to 18.00±2.52 after being given the intervention 3 times a week for 3 weeks.

The average value of productivity in Table 1.3 was measured using a cubic count (m^3) in the Treatment Group before being given the intervention, the average was 0.29±0.16 and increased to 0.79±0.28 after being given the intervention 3 times a week for 3 weeks. In the control group before being given the intervention, the mean was 0.24±0.11 and increased to 0.47±0.10 after being given the intervention 3 times a week for 3 weeks.

The results of the statistical analysis test are in line with previous research conducted by [10], concluding that the *McKenzie exercise* has proven to be effective in reducing pain and disability levels and increasing spinal mobility. Then in a study conducted by [11], *McKenzie exercise* performed three times a week for eight weeks had a significant therapeutic effect on *health-related quality of life* (HRQoL) in patients with *long-term mechanical low-back pain* (LMLBP). Research conducted by [12], the increase in functional activity and productivity occurs due to the improvement of working conditions and the provision of *McKenzie exercise*.

Research conducted by [13], concluded that *deep cross-friction massage is* efficient for non-specific LBP in reducing pain and increasing functional activity. Research conducted by [14], comparison of ODI scores showed that *slow stroke back* massage intervention was more effective in improving functional ability in LBP cases.

Addition *of Deep Cross-Friction Massage* After *McKenzie Exercise* Better than *Slow Stroke Back Massage* After *Mckenzie Exercise*

The results of the analysis of the ODI score in Table 1.4 in the Treatment Group were smaller, namely 14.66±1.63 while in the Control Group 18.00±2.52. The results of the ODI measurement before being given an intervention in the Treatment Group, two people in the minimum disability category with a score of 0%-20% and four people in the moderate disability category with a score of 21%-40%, after being given the intervention there was a decrease in disability, five people in the disability category at least with a score of 0%-20% and one person with moderate disability with a score of 21%-40%. In the control group before the intervention was given, three people were in the minimal disability category with a score of 0%-20% and three people with moderate disability with a score of 21%-40%, after being given the intervention there was a decrease in disability, four people in the minimal disability category with a score of 0% -20% and two people with moderate disability with a score of 21%-40%.

The results of the analysis of productivity in the treatment group were greater, namely 0.79±0.28, while in the control group it was 0.47±0.10. The increase in productivity of stone crusher workers based on cubic (m3) before being given the intervention in the Treatment Group got 1.77 m3 per day, increased after being given the intervention to 4.87 m3 per day. Where in the treatment group before the intervention was given 1.61 m3 per day, it increased after being given the intervention to 2.99 m3.

In line with research conducted by [15], *McKenzie exercise* can reduce disability in LBP cases.mechanism *McKenzie exercise* in the extension position that is maintained for a certain time will result in a stretch in the soft tissue of the anterior ligament so that it will return the spine to the extension position. This can help cause disc thrust posteriorly. Then in the spasming muscle there will be relaxation (relaxation) by intermittent and continuous stretching of the antagonist muscle. This relaxation occurs due to stretching which will stimulate the Golgi tendon resulting in a reflex relaxation of the muscles concerned and intermittent stretching will improve microcirculation by *pumping action* thereby reducing irritation of afferent nerves which cause reflex increases in muscle tone. Furthermore, there will be pressure on the disc to the posterior side so that a movement is obtained that pushes the nucleus ventrally. As a result, the dynamic motion of repeated extensions can increase disc and corpus fluid which

International Journal of Social Science (IJSS)
Vol.2 Issue.2 August 2022, pp: 1483-1490
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will then decrease the viscosity of the nucleus pulposus to an anterior position and can reduce irritation to the surrounding tissue.

The results of the statistical analysis test are also in line with previous research conducted by [16], showing that *deep cross-friction massage* can be a useful therapeutic technique for *non-specific* LBP patients because it can reduce pain and increase functional activity, this is in accordance with the results Conventional studies on the physiological effects of *deep cross friction massage* applied to the deep muscle layers with high pressure will stimulate small muscles in the lumbar region such as the lumbar multifidus and rearrange the pattern of muscle fibers causing chronic muscle tension. Previous research conducted by [17], proved that *deep cross-friction massage* has an effect in reducing myogenic low back pain for health workers at Siloam Hospital Surabaya. The mechanism of *deep cross-friction massage* for pain reduction, namely with certain movements and directions, will help increase circulation so that the spasmed tissue will get adequate nutrition, oxygen, blood, and help transport metabolic waste, lactic acid, and facilitate muscle tissue repair processes. . Research conducted by [18], *deep cross-friction massage causes* the link band and trigger point to decrease because the required energy can be met. *Deep cross-friction massage* is applied perpendicular to the fibers in an attempt to separate each fiber at the trigger point area which provides mechanical effects, local hyperemia, analgesia, and scarring of the ligamentous, tendon and muscle structures. *Deep cross friction massage* can cause stimulation of nociceptive endings connected to Aδ fibers and mechanoreceptor fibers found in soft tissues connected to large diameter Aβ. These large-diameter fibers have an effect on cells in the posterior horn and tend to inhibit the transmission of small-diameter nociceptive information, thereby closing the pain gate. As a result, in terms of pain modulation, *deep cross-friction massage* will cause presynaptic inhibition and inhibit pain, if pain is reduced then functional ability and productivity will increase.

Research conducted by [19], proved that there was an improvement in the level of pain and functional ability of LBP patients after receiving *slow stroke back massage* as measured using ODI. Research conducted by [20];[21], *slow stroke back massage* with slow strokes provides a warm sensation by causing vasodilation in local blood vessels. Increased blood circulation due to vasodilation of blood vessels in the rubbed area so that cell activity increases and will reduce pain due to reduced muscle spasm. The mechanism of action of *slow stroke back massage* stimulates the superficial nerves in the skin which are then transmitted to the brain in the hypothalamus. The descending nervous system releases endogenous opiates, such as endorphins. The release of endorphins results in increased levels of endorphins in the body which stimulates the production of the hormone dopamine and serotonin. The increased dopamine hormone causes reduced anxiety while the increased serotonin hormone can reduce sleep disturbances. The release of endorphins can block the transmission of painful stimuli, thereby reducing anxiety and pain. Gently rubbing with a certain direction and time is a sensory integration technique that affects the activity of the autonomic nervous system. The descending nervous system works to release neuroregulators that block the transmission of painful stimuli. Beta-A neurons stimulate mechanoreceptors which cause a decrease in the transmission of delta-A and C thus closing the defense mechanism and reducing the perception of pain, if pain is reduced then functional ability and productivity will increase.

Interventions *of deep cross-friction massage* after *McKenzie exercise* or *slow stroke back massage* after *McKenzie exercise* can be utilized and added in hospitals and in the field because it is easy and inexpensive to provide interventions for patients with *non-specific* LBP. The results of this study can also be used as reference material for physiotherapy education in the management of patients with *non-specific* LBP. And it can be used as a reference for further research by identifying risk factors that have not been discussed, because this study describes the effect of providing interventions, both *deep cross-friction massage* after *McKenzie exercise* and *slow stroke back massage* after *McKenzie exercise* in improving functional ability and work productivity in breaking workers. stones with *non-specific* LBP.

CONCLUSION

Based on the analysis of the research that has been done and the discussion, it can be concluded that:

1. The addition *of deep cross-friction massage* after *McKenzie exercise* can improve the functional ability of stone crushers with *non-specific* LBP.
2. The addition *of deep cross-friction massage* after *McKenzie exercise* can increase work productivity in stone crushers with *non-specific* LBP.
3. The addition *slow stroke back massage* after *McKenzie exercise* can improve the functional ability of stone crushers with *non-specific* LBP.
4. The addition *of slow stroke back massage* after *McKenzie exercise* can increase work productivity in stone crushers with *non-specific* LBP.
5. The addition *of deep cross-friction massage* is better than *slow stroke back massage* after *McKenzie exercise* to improve functional ability of stone crusher workers with *non-specific* LBP.

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6. The addition *of deep cross-friction massage* is better than *slow stroke back massage* after *McKenzie exercise* to increase work productivity of stone crushers with *non-specific* LBP.

Suggestions

Some suggestions that can be put forward based on the findings and studies in this study are:

1. *Deep cross-friction massage* after *McKenzie exercise* is suggested to be added as a physiotherapy intervention in improving functional ability and work productivity in stone crusher workers with *non-specific* LBP.
2. *Slow stroke back massage* after *McKenzie exercise* is suggested to be added as a physiotherapy intervention in improving functional ability and work productivity in stone crusher workers with *non-specific* LBP.
3. Can be used as a development for further research where researchers can examine fatigue in stone crusher workers with non-specific LBP..

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