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ORIGINAL ARTICLE

Effectiveness of stretching on reducing muscle and bone pain in worker

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ABSTRACT

Musculoskeletal pain is a common work-related ailment in Indonesia. Although not fatal, it can significantly reduce worker productivity. Stretching exercises are often used to alleviate this pain. Pre-work stretching and warm-up exercises may reduce the risk of musculoskeletal pain and fatigue, improve muscle balance and posture, and promote muscle relaxation by lengthening tense muscles, thus increasing comfort during work. This study aimed to determine the effectiveness of stretching in reducing musculoskeletal pain among workers at the Opak Suli Factory in Sukaraya Bakti Village, Pancur Batu District, Deli Serdang Regency. The experimental study employed a pre-test and post-test control group design. All 38 workers at the Opak Suli Factory in Sukaraya Bakti Village, Pancur Batu District, Deli Serdang Regency, were included using total sampling and divided into an intervention group and a control group, each consisting of 19 workers. The intervention group showed a statistically significant reduction in musculoskeletal pain ($p < 0.001$), indicating that stretching was effective. In contrast, the control group showed no significant change ($p = 0.083$). In conclusion, stretching is an effective method for reducing musculoskeletal pain among the workers in this study.

Keywords: effectiveness, muscle and bone pain, stretching

Introduction

One of the work-related disorders is musculoskeletal pain, which occurs in the skeletal muscles and can range from mild to severe complaints.[1] Musculoskeletal pain is a common health issue in the workplace.[2] he body parts most frequently affected by musculoskeletal pain are the back (40%), upper extremities and neck (42%), and lower extremities (18%). Pain often arises from non-ergonomic body positions, such as climbing, bending, crawling, twisting, reaching, and from repetitive movements or excessive activity.[3] According to the 2018 RISKESDAS data, 7.9% of musculoskeletal pain cases were diagnosed by health workers. The highest prevalence was in Aceh (13.3%), followed by Bengkulu (10%), and Bali (8.5%).[4] Data on musculoskeletal pain complaints in North Sumatra showed a prevalence of 19.2%, with the highest rate among fishermen, farmers, and laborers at 31.2%; the most common complaint locations were the neck, back, and legs, affecting 60% of workers.[5]

Research indicated that 2.78 million workers died due to occupational diseases and accidents in 2018.[6] The International Labor Organization reports that musculoskeletal pain is the most common occupational disease and that these complaints have increased globally due to the rising number of jobs that involve

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continuous sitting, poor ergonomic conditions, and prolonged standing.[7] Musculoskeletal pain accounts for 40% of the global compensation costs for occupational diseases. It is caused by monotonous or repetitive movements performed for extended periods without stretching, as well as non-ergonomic postures.[8]

An initial survey of workers at an opak (a type of Indonesian chip) factory in Sukaraya Bakti Village, Pancur Batu Sub-District, Deli Serdang Regency, revealed that the factory employs 38 workers (32 women and 6 men) aged 30-50 years, who work from 08:00 to 17:00. This factory still uses manual labor for production, including peeling, molding, drying, and packaging. The work is monotonous and repetitive, leading to musculoskeletal complaints such as low back pain, neck pain, shoulder pain, and hand muscle pain among the workers.

Stretching is one method to reduce musculoskeletal pain.[9] Research by Widitia et al[10] demonstrated the effect of stretching on pain complaints among 50 chip factory workers who worked approximately 8 hours a day. Performing muscle stretching between work tasks can reduce musculoskeletal pain in workers.[11] Similarly, Kuntarti's research[12] supports the use of stretching to alleviate musculoskeletal pain. Stretching exercises before work can reduce the risk of musculoskeletal pain, improve balance, reduce fatigue, and enhance muscle coordination. Khairani and Utami[13] suggest that stretching can prevent musculoskeletal injuries and should be recommended for injury prevention. Stretching exercises, which relax tense muscles, can increase physical muscle relaxation, leading to more relaxed and comfortable muscles. However, Widitia et al.[10] found that physical activity and pre-work health checks were ways to prevent pain complaints for workers.

The stretching routine used by the current researchers differs from previous studies in that it measures the level of pain complaints and focuses more on the upper body, as workers in the opak factory report more pain in the neck, shoulder, hand, and waist. Previous research primarily measured and identified factors associated with musculoskeletal disorders in workers. Addressing these issues, the researchers aim to determine the effectiveness of stretching in reducing musculoskeletal pain among workers at the Sukaraya Bakti Village opak factory in the Pancur Batu District, Deli Serdang Regency.

Method

This study employed a quasi-experimental, pretest-posttest design with both intervention and control groups. The research was conducted from December 2022 to January 2023. Data collection spanned 10 days, from December 8 to 21, 2022. The study population consisted of all 38 workers at the Opak Suli Factory who reported musculoskeletal pain. A total sampling method was used for sample selection. The sample was divided into two groups of 19 individuals each: an intervention group and a control group. Participants were assigned to groups by lottery.

The research began with the researcher explaining the study activities to the respondents, obtaining informed consent, and administering the Nordic Body Map questionnaire as a pretest. Subsequently, the level of pain complaints was measured via interviews. Following the pain complaint measurements, the intervention group began stretching activities. Stretching activities were conducted as a group in the same room. The first 10-minute stretching session was at 10:00 AM, and the second was at 2:00 PM. The activities were performed every weekday, Monday through Friday. Respondents performed the stretching activities as shown in Figures 1, 2, and 3, which involved three types of movements. The researcher guided the group stretching activities, with respondents following the movements shown in the displayed images.

Figure 1. Stretching exercises for the shoulders and neck

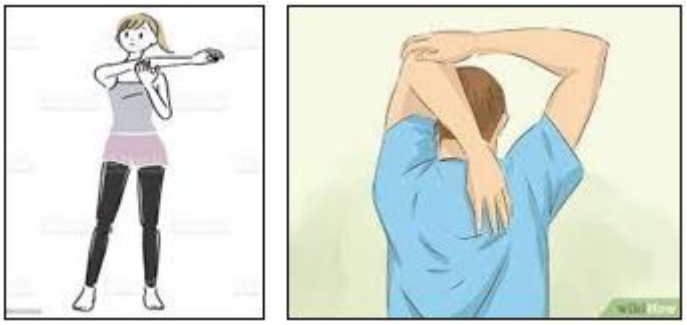

Figure 2. Elbow stretching exercises

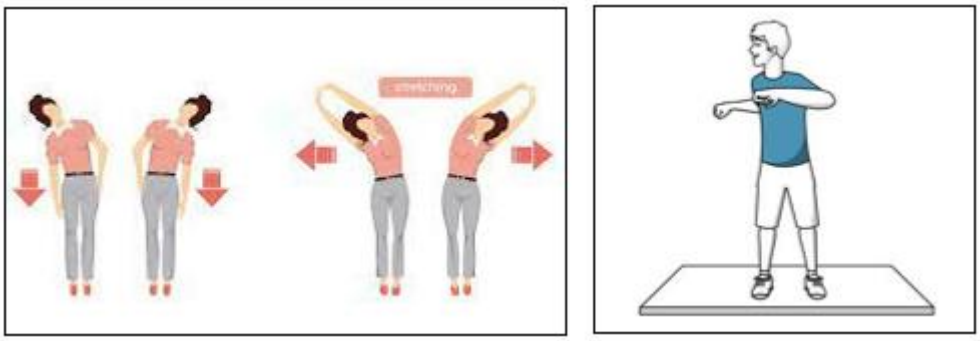

Figure 3. Stretching movements for the back

After the 14-day intervention, both the intervention and control groups completed a post-test. Subsequently, the level of musculoskeletal pain complaints was remeasured as a post-test. The measurement used a categorical scale for musculoskeletal pain complaint levels: no pain, slight pain, moderate pain, and severe pain.

The collected data were analyzed using univariate and bivariate methods. Univariate analysis described the characteristics of the respondents. Bivariate analysis measured the effectiveness of stretching before and after the intervention in the intervention group. The Kolmogorov-Smirnov test was used to assess data normality. If the data were normally distributed, a paired sample t-test was used to examine the pre-post intervention effect.

Results and Discussion

This study compared the effect of an intervention using an intervention group and a control group. Both the intervention and control groups consisted of 19 respondents. The intervention group primarily comprised respondents under 35 years old (52.6%), with a substantial portion in the 35-40 age range (31.6%) (Table 1). Conversely, the control group mostly consisted of respondents aged 35-40 (57.9%). The majority of respondents in both groups were female, with the intervention group having a higher percentage (78.9%) than the control group (68.4%).

Most respondents in the control group had experienced pain disorders for less than 3 months (73.7%). In the intervention group, the duration of pain disorders was more evenly distributed: 42.1% experienced it for less than 3 months, 26.3% for 4-7 months, and 31.6% for more than 8 months. The majority of respondents in both groups had 2-4 years of service (68.4%). The distribution of job types was identical in both groups, with stripping (36.8%) and printing (31.6%) being the most common, followed by sun-drying (21.1%) and washing (10.5%).

Table 2 presents a comparison of pain intensity levels before and after the intervention for both the intervention and control groups. Initially (pretest), high-intensity pain was prevalent in both groups, with 89.5% of the intervention group and 57.9% of the control group reporting this level. A small percentage in each group reported moderate pain. No participants reported low or very high pain levels at this stage. Following the intervention, a significant change occurred in the intervention group. The majority of

participants (94.7%) experienced a reduction in pain intensity to a moderate level, while a small minority (5.3%) continued to experience high-intensity pain. This shift suggests that the intervention was effective in alleviating pain.

Table 1. Characteristics of intervention and control groups

Characteristic	Intervention Group		Control Group	
	n	(%)	n	(%)
Age (years)				
< 35	10	52,6	3	15,8
35-40	6	31,6	11	57,9
>40	3	15,8	5	26,3
Gender				
Male	4	21,1	6	31,6
Female	15	78,9	13	68,4
Duration of pain disorder				
< 3 months	8	42.1	14	73.7
4 – 7 months	5	26.3	3	15.8
> 8 months	6	31.6	2	10.5
Work period				
< 1 year	5	26.3	4	21.1
2-4 years	13	68.4	13	68.4
> 5 years	1	5.3	2	10.5
Job type				
Printing	6	31.6	6	31.6
Peeling	7	36.8	7	36.8
Washing	2	10.5	2	10.5
Driying	4	21.1	4	21.1

In contrast, the control group showed minimal change. Specifically, 73.3% of respondents continued to report high pain levels after the same period, while 26.3% experienced a reduction to moderate levels. This difference in outcomes between the intervention and control groups further supports the conclusion that the intervention had a positive impact on reducing pain intensity.

Based on these data, we can conclude that the intervention effectively reduced pain intensity from high to moderate levels. The intervention group experienced significant changes, whereas changes in the control group were less pronounced. These findings suggest that the intervention had a substantial positive impact on reducing pain complaints.

Table 2. Differences in pain intensity levels before and after intervention

Pain level	Pretest				Postest			
	Intervention		Control		Intervention		Control	
	n	%	n	%	n	%	n	%
Low	0	0	0	0	0	0	0	0
Moderate	2	10,5	8	42,1	18	94,7	5	26,3
High	17	89,5	11	57,9	1	5,3	14	73,3
Very high	0	0	0	0	0	0	0	0

The Wilcoxon statistical test on the intervention group showed a p-value of 0.000 ($p < 0.05$), indicating that stretching had a significant effect on muscle and bone pain (Table 3). In other words, the alternative hypothesis (Ha) was accepted, and the null hypothesis (Ho) was rejected. Conversely, in the control group, the p-value of 0.083 ($p > 0.05$) indicated no significant effect (see Table 3). Following the stretching intervention, pain intensity decreased from high to moderate in the intervention group, whereas no change was observed in the control group.

This finding aligns with previous research. Oktaviani et al.[14] and Fauziah & Rita[15] reported significant relationships and differences between stretching and pain reduction. King et al.[16] demonstrated up to a 60% reduction in pain through stretching. Pamungkas et al.[17] affirmed the effectiveness and significant impact of stretching exercises on reducing pain scale scores. This study employed a stretching duration of 10 minutes,

consistent with the recommendations of Mariyanto[18] and Suganda et al.[19] who suggested 10 to 15 minutes to observe the effects of stretching.

Table 3. Effectiveness of stretching on reducing muscle and bone pain in workers

Variable	n	Mean	Min - Max	SD	p
Intervention Group					
Pretest	19	2.89	2-3	0.315	0.000
Posttest	19	2.05		0.229	
Control Group					
Pretest	19	2.58	2-3	0.507	0.083
Posttest	19	2.74		0.452	

The mechanism by which stretching reduces pain is believed to involve muscle relaxation and tension reduction. Gasibat et al.[20] stated that stretching can alleviate pain and improve joint mobility. Nurdiati et al.[21] explained that stretching enhances blood circulation and strengthens the spine, thus relieving pain. Priyoto dan Wahyuning[22] added that stretching during work breaks relaxes nerves and exercises muscles. Satriadi et al.[23] reported that stretching diminishes muscle tension, enhances blood circulation, reduces anxiety, and improves overall well-being. As a non-pharmacological intervention, stretching is a safe and effective method without side effects, and it is practical and easy to implement.[24]

Stretching is effective in reducing muscle and bone pain in workers, as evidenced by changes observed before and after the intervention in the intervention group. This is consistent with the research by Shariat et al.[25] which found significant pain score differences only in the intervention group. It is recommended that stretching be performed during work breaks to mitigate pain resulting from maintaining the same work position.[26] Stretching helps prevent muscle mass decline and increases flexibility.[27] Amoudi dan Ayed[28] contend that stretching supports the health and safety of workers and contributes to individual well-being.

Conclusion

This study demonstrates the effectiveness of stretching interventions in reducing musculoskeletal pain intensity among workers. The Wilcoxon signed-rank test revealed a significant reduction in pain intensity within the intervention group ($p < 0.001$). Conversely, no significant change was found in the control group ($p = 0.083$). Following the intervention, most participants in the intervention group experienced a decrease in pain intensity from high to moderate levels; specifically, the percentage experiencing high pain decreased from 89.5% to 5.3%, with 94.7% now reporting moderate pain. In contrast, the majority of the control group continued to experience high levels of pain (73.3%) after the same period. Therefore, stretching should be implemented as a routine workplace program, particularly for workers engaged in repetitive activities or prolonged static postures. This program could consist of brief stretching sessions conducted periodically during work hours. Furthermore, workers should receive education and training on the importance of stretching and proper techniques to enhance participation and program effectiveness. Consistent implementation of a stretching program is expected to reduce musculoskeletal pain complaints, increase worker productivity, and ultimately improve their quality of life.

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