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WORK POSTURE, WORKING PERIOD & SMOKING HABITS CAUSE LOW BACK PAIN COMPLAINTS IN SHIPYARD WORKERS IN THE WELDING SECTION AT PT. X CITY BATAM IN 2023

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Abstract

Musculoskeletal disorder (MSD) complaints that are often felt by almost all populations in the world are low back pain (LBP) complaints. Workers experience several risk factors: work posture, service length, and smoking habits. Squatting, standing, and sitting positions that are not ergonomic can cause the body to tire easily, causing musculoskeletal muscle disorders. This study aims to determine the relationship between work position, working period and smoking habit with low back pain complaints among shipyard workers in the welding section at PT X Batam City in 2023. This research is quantitative research with a cross-sectional study design. The population in this study were 110 welding shipyard workers (welder) with a sample size of 86 people (solving formula). The research instruments used were questionnaires and RULA worksheets. The sampling technique used was Simple Random Sampling. The statistical test used is a program on a computer where two kinds of data analysis will be carried out, namely univariate analysis and bivariate analysis. The statistical test results show a significant relationship between work posture and low back pain complaints, namely p-value = 0.000 and Pearson correlation = 0.871. There is a significant relationship between the working period with low back pain complaints, namely value = 0.000 and Pearson correlation = 0.490 & there is a significant relationship between smoking habits with low back pain complaints, namely value = 0.015 & pearson correlation = 0.261. There is a relationship between work posture, work period and smoking habits with low back pain complaints with a p-value <0.05. As for the suggestions in this study, for work postures, work station design can be carried out according to the welded products, while the working period for workers with high working periods can be limited to the number of working hours and to reduce smoking habits, the implementation of no smoking in the work environment area and appreciation for workers who do not smoke and proven good medical check-up results..

Keywords: ***Working Posture, Working Period, Smoking Habits & Low Back Pain***

INTRODUCTION

According to Great Britain Data (2017), MSDs are the 2nd highest occupational disease in the world (LFS, 2017). The World Health Organisation explains that there are approximately 150 types of musculoskeletal disorders worldwide that cause sufferers to experience pain, mental disorders, limited movement and absence from work, all of which are classified as musculoskeletal disorders, often experienced by workers as low back pain (LBP) (WHO, 2019). LBP is a musculoskeletal disorder (MSD) complaint that is most often felt by almost the entire population in the world. It is estimated that 2.02 million workers die due to various diseases related to musculoskeletal disorders, especially related pain disorders in the lower back (Azzahra et al., 2022). Work-related NBP/LBP is responsible for an estimated 21.8 million years of life lost (DALYs), or up to 35% of the world's population's life years lost (Alifah Sifai et al., 2018). In developing countries, about 15-20 per cent of the population suffers from LBP continuously (A & Pratiwi, 2023). According to the Indonesian Ministry of Health, the prevalence of LBP in Indonesia is 18 per cent (Ministry of Health, 2018). A study conducted in 13 major cities in Indonesia found that 21.8 per cent of 8,160 participants suffered from low back pain with five main clinical symptoms: stabbing sensation, electric shock sensation, burning sensation, tingling and excessive pain (Almayda, 2022). Other factors such as physical activity, work, working hours and smoking cause lower back pain (Shiri et al., 2019). Factors that increase the risk of back pain in workers include age, gender, body mass

index, smoking habit, job position, work period, workload, duration, repetition and environmental factors. Smoking behaviour is strongly associated with complaints of LBP; nicotine in cigarettes can vasocontract blood vessels, thereby reducing blood flow to intervertebral cells. Smoking behaviour causes a reduction in bone mineral content, causing pain due to cracks or bone damage (Irawan et al., 2022). A long working period can lead to permanent disc cavity narrowing and spinal degeneration, which causes LBP. (Kumbea, N. P., Sumampouw, O. J., & Asrifuddin, 2021) Explain the work postures that people often do when working: standing, sitting, bending, squatting, walking, etc. Welding is the most common work in the construction industry, especially the shipyard industry. Welding is the most frequent work in the construction industry, especially the shipyard industry. Production with raw metal materials, such as welding, is a very important job. Until now, almost all metals can be welded. They are considering that not a few new techniques in the welding process have been discovered. Two metals are joined by heating or melting. The joining of metal parts is made molten or melted using a flame arc or with the metal itself so that the two ends/metal fields are strong and not easily separated (Prayogo, 2018).

During the welding process, the work posture of each employee varies according to the product to be welded. Welding can be done standing, sitting or squatting. Working positions such as standing and squatting are certainly not ergonomic, making the body tired quickly and causing skeletal muscle disorders (gotra). If ignored for a long time, it will cause fatigue, plus each worker has a different posture, resulting in decreased concentration and possible decreased performance (Linoe et al., 2022). When workers perform the welding process, they face unergonomic and uncomfortable working conditions such as bending, squatting for a long time, or other things that cause disorders of the musculoskeletal system. According to several studies, work-related risk factors cause musculoskeletal system disorders (Wardani, R., Silaban, G., & Ashar, 2023). The existence of a ship, both when built (New building Ship) and the repair process (repair/docking process), is always related to shipyards as a major part of the maritime industry (Hendrawan, 2020). One of the largest industrial cities in Indonesia is Batam, where the shipyard industry in the Batam free port area is the largest in Indonesia.

There are many shipyards in the sekupang, tg. uncang, batu ampar and kabil areas. The number of people working there is more than fifty thousand. Shipyards in Batam produce international standard ships ordered by oil and gas companies; even ships produced in Batam are used in many countries, even in the Middle East (Gara, 2023). PT.X is a shipbuilding and repair company located in Batam. The company has a land area of 21 hectares. The work activities include welding, cutting, grinding, blasting, painting, etc. Based on an initial survey conducted in February 2023 on ten workers, 70% of workers complained that they often experience pain in the lower back, cramps in the back, and difficulty standing or slowness. Welding is suspected to work more in a squatting position for a long time, which can lead to LBP. The formulation of the problem in this study is "Is there a relationship between work posture, working period and smoking habit with low back pain complaints among shipyard workers in the welding section at PT X Batam City in 2023?". This study aims to determine whether there is a relationship between work posture, working period and smoking habits with low back pain complaints among shipyard workers in the welding section at PT X Batam City in 2023.

METHOD

This research is quantitative research with a cross-sectional study design. The population in this study were 110 shipyard workers in the welding section (welder). The research subject is the shipyard workers in the welding section (welder) at PT X Batam City in 2023. The number of welding shipyard workers who can be used as samples in this study is 86. The sampling technique chosen by the researcher is the Simple Random Sampling technique. Data analysis is obtained from data processing with a statistical program on a computer. The data analysis used is univariate analysis and bivariate analysis.

RESULTS AND DISCUSSION

Univariate Analysis

This analysis is used to obtain a statistical description of the respondents, namely the relationship between work posture, work period and smoking habits with low back pain complaints. The assessment was conducted on 86 (eighty-six) welders as the research sample with the RULA (Rapid Upper Limb Assessment) method and questionnaires.

Table 1. Results of Respondents Based on Work Posture

No	Work Posture	Frequency	Percentage (%)
	Posture acceptable	0	0
	Further investigation, changes may be required	42	48,84
	Further investigation, immediate changes possible	42	48,84
	Immediate investigation & change	2	2,32
	Total	86	100

In table 1, workers (welders) at PT X for acceptable postures are 0 people (0%), for further investigation, changes may be needed as many as 42 people (48.84%), further investigation, immediate changes may be as many as 42 people (48.84%), for investigation and immediate changes as many as 2 people (2.32%). So there is a category of respondents' work posture that most are further investigation, changes may be needed and further investigation, immediate changes may be as many as 42 people (48.84%) each.

Figure 1. Squatting Work Posture in Welding

Figure 2. Standing Work Posture in Welding

Table 2. Results of Respondents Based on Length of Service

No	Period of service	Frequency	Percentage (%)
1	< 3 Years	32	37,21
2	≥ 3 Years	54	62,79
	Total	86	100

In table 2, welders who work at PT X with a tenure of <3 There are 32 people (37.21%), while the tenure of >3 years is 54 people (62.79%). So, there is a working period of respondents> 3 years, which is the most common, namely 54 people (62.79%).

Table 3. Results of Respondents Based on Smoking Habits

No	Smoking Habit (per Day)	Frequency	Percentage (%)
1	Iya	80	93,02
2	Tidak	6	6,98
	Total	86	100

For table 3, welders who work at PT X for those who have a habit of smoking every day are 80 people (93.02%), and for those who do not have a habit of smoking every day, six people (6.98%). So there are respondents who have the most smoking habits, namely 80 people (93.02%).

Table 4. Respondent Results Based on Low Back Pain (LBP) Disability Levels

No	Level of Disability	Frequency	Percentage (%)
1	0 - 20 %; *Minimal Disability*	38	44,19
2	21 - 40 %; *Moderate Disability*	34	39,53
3	41 - 60 %; *Severe Disabilty*	12	13,95
4	61 - 80 %; *Crippled*	2	2,33
5	81 - 100 %; *Bed Bound*	0	0
	Total	86	100

Results for Table 4, welders who work at PT X with LBP disability levels are; 0-20%; Minimal Disability as many as 38 people (44.19%), 21-40%; Moderate Disability as many as 34 people (39.53%), 41-60%; Severe Disability as many as 12 people (13.95%), 61-80%; Crippled as many as two people (2.33%). So, the level of disability of respondents with low back pain complaints is Moderate Disability, as many as 34 people (39.53%).

Bivariate Analysis

Statistical tests in order to determine the relationship between the independent variable and the dependent variable. The normality test if the data distribution is normal uses the pearson correlation test while for abnormal data distribution uses the spearman's test. Using the SPSS 25 computer programme with $p < 0.05$ (95% confidence level).

Table 5. Results of the Relationship between Work Posture and Low Back Pain Complaints

No	Work Posture	Tingkat Disabilitas Keluhan Low Back Pain (LBP)												Pearson Cor.	Nilai Sig/p-value
		MiD		*MoD*		*SeD*		*CrD*		*bD*		Total			
		N	%	N	%	N	%	N							
1	WP1	0	0	0	0	0	0		0	0		0	00	0,871	0,000
2	WP2	38	90,48	4	9,52	0	0			0		2	00		
3	WP3	0	0	30	71,43	12	28,57	0		0	0	2	00		
4	WP4	0	0	0	0	0	0		00		0		00		

Description

a. WP1 = Posture acceptable
b. WP2 = Further investigation, changes may be required
c. WP3 = Further investigation, immediate changes possible
d. WP4 = Immediate investigation and change
e. MiD = Minimal Disability
f. MoD = Moderate Disebality
g. SeD = Severed Disability
h. CrD = Crippled Disability
i. BbD = Bed Bound Disability

Table 5 shows the results of 86 welders as a sample: welders who have work postures for the category of further investigation, changes may be needed that have a Minimal Disability level of 38 people (90.48%), for the Moderate Disability level as many as four people (9.52%). Work postures for the category of further investigation, immediate changes may have a Moderate Disability level of as many as 30 people (71.43%) and a severe Disability level of as many as 12 people (28.57%). At the same time, welders who have work postures for the Investigation category and immediate changes have a Crippled Disability level of 2 people (100%). The Pearson Correlation statistical test result is 0.871, which can be interpreted as having a perfect correlation, so H0 is rejected. At the same time, Ha is accepted, and there is a significant relationship with a value = 0.000 <0.05.

Table 6. Results of the Relationship between Working Period and LBP Complaints

No	Period of Service	Disability Level of Low Back Pain (LBP) Complaints												Pearson Cor.	Sig value/ pvalue
		MiD		*MoD*		*SeD*		*CrD*		*BbD*		Total			
			%	N	%	N	%	N	%	N	%		%		
	< 3 Years	25	78,33	5	15,62	2	6,25	0	0	0	0	32	100	0,490	0,000
	≥ 3 Years	13	24,07	29	53,71	10	18,52	2	3,7	0	0	54	100		

Based on data from Table 6, 86 welders as a sample: welders with a work period < 3 years who have a Minimal Disability level of 25 people (78.13%), for a Moderate Disability level, as many as five people (15.62%), for the Severe Disability level as many as two people (6.25%). At the same time, welders who have a working period> 3 years who have a Minimal Disability level are 13 people (24.07%), for the Moderate Disability level, as many as 29 people (53.71%), for the Severe Disability level, as many as ten people (18.52%), for the Crippled Disability level as many as two

people (3.7%). The Pearson Correlation statistical test result is 0.490, which can be interpreted as having a moderate correlation, so H0 is rejected. At the same time, Ha is accepted, and there is a significant relationship with a value = 0.000 <0.05.

Table 7. Results of the Relationship between Smoking Habits and Low Back Pain Complaints

No	Smoking Habit	Disability Level of Low Back Pain (LBP) Complaints												Pearson Cor.	Sig value/ p-value
		MiD		*MoD*		*SeD*		*CrD*		*BbD*		Total			
			%		%	N	%	N	%		%	N			
	Yes	32	40	34	42,5	12	15	2	2,5	0	0	80	100	-0,261	0,015
	No	6	100		0	0	0	0	0	0	0	6	100		

In Table 4.9, 86 welders as a sample: welders who have a habit of smoking with a Minimal Disability level of as many as 32 people (40%), Moderate Disability level of as many as 34 people (42.5%), Severe Disability level as many as 12 people (15%), for Crippled Disability level as many as two people (2.5%). Welders who have a habit of not smoking have Minimal Disability levels of as many as six people (100%). Pearson Correlation statistical test results are -0.261, which can be interpreted as having a weak correlation, so H0 is rejected. At the same time, Ha is accepted, and there is a significant relationship with a value = 0.015 <0.05.

DISCUSSION

Work Posture

In Table 1, the frequency of work postures in the welding section at PT X; for further investigation, changes may be required for as many as 42 people (48.84%); for immediate changes may be as many as 42 people (48.84%), for investigation and immediate changes as many as two people (2.32%). RULA (Rapid et al.) is used in work posture assessment. RULA is an effective method for assessing the risk of activities that focus on the movement of the upper extremities, such as hands, arms, shoulders, neck, and back (Wardani et al., 2023). The risk level of the activity in question leads to the working position. This can occur because workers perform work with poor posture, causing the risk of musculoskeletal injury (Nova & Hariastuti, 2022). This correlation is also reinforced in research by (Nelfiyanti et al., 2023), that the hunched position is a posture that is not ergonomic, so improvement is needed as soon as possible. Based on the description above, work postures need follow-up according to the level of risk resulting from the measurement of the RULA method. The risk of postures at work that are not ergonomic can increase the risk of musculoskeletal disorders that lead to low back pain.

Period of Service

Referring to Table 2, the tenure of the welding department at PT X for a tenure of <3 Years is 32 respondents (37.21%), for a tenure of >3 years is 54 respondents (62.79%). It can be seen that respondents are dominated by a working period of > 3 years. Working time is one of the causes of musculoskeletal disorders in workers. The longer a person is exposed to risk, the higher the risk of developing low back pain (Saputra, 2020). It is also stated that there are several important risk factors associated with low back pain, namely age, over 35 years, smoking, working 5-10 years, workplace, obesity and family history of musculoskeletal disorders (Pandjukang et al., 2020). In line with research (Putro et al., 2022), most of the results of respondents with a tenure of > 3 years were 24 people (60%), while a tenure of < 3 years was 16 people (40%) with a total of 32 respondents. Seeing the description above, a working period of > 3 years is more the number of respondents so that this risk factor can lead to lower back pain.

Smoking Habit

Based on Table 3, the frequency of smoking habits in the welding department at PT X who have a habit of smoking every day, is 80 people (93.02%), and those who do not have a habit of smoking every day are six people (6.98%). Smoking habits can increase muscle complaints; this is closely related to the length and level of smoking habits because the longer and higher the frequency of smoking, the greater the number of myalgia complaints (Afro & Paskarini, 2022). Smokers who consume more than one pack of cigarettes per day have more giant red blood cells with increased red blood cell volume, which is explained as a response to tissue hypoxia after exposure to carbon monoxide and may reduce the affinity for carbon monoxide. Oxygen for haemoglobin is likely to affect the level of oxygen saturation in the blood (Kodir & Margiyati, 2022). Based on research (Rase et al., 2021), people who smoke are 1.9 times more at risk of back pain. Referring to the description of the results above, smoking habits are found in almost all respondents, namely 80 people (93.02%), which means that they have a relatively high risk of LBP.

Complaints of Low Back Pain (LBP)

Based on Table 4, LBP complaints in the welding section at PT X with the level of LBP disability are; 0-20%; Minimal Disability as many as 38 people (44.19%), 21-40%; Moderate Disability as many as 34 people (39.53%), 41-60%; Severe Disability as many as 12 people (13.95%), 61-80%; Crippled as many as two people (2.33%). Low back pain / low back pain is a complaint of pain or other disorders in the muscles or spine, starting from the base of the neck to the hips. As for the results (Bahtiar & Rahman, 2022), non-disabled respondents as many as 43 people (33.1%), mild disability as many as 55 people (42.3%), moderate disability as many as 31 people (23.8%) and severe disability as many as one person (0.7%) and no one lost the capacity of the whole body. The Oswestry Disability Index (ODI) questionnaire was used to measure the level of disability of LBP and to determine the interference with daily activities felt by respondents. This questionnaire consists of nine components that describe the level of discomfort in each component in the form of a percentage caused by low back pain (LBP). The average value can describe the type of component most affected by interference based on the level of low back pain (LBP) interference. So, it can be said that the higher the value of the average ODI component, the higher,r the pain experienced by respondents.

Relationship between Work Posture and LBP Complaints in the Welding Section

Based on the research data, namely Table 5, of the 86 welders studied as a sample, welders who have work postures for the category of further investigation, changes may be needed which have a Minimal Disability level of 38 people (90.48%), for the Moderate Disability level as many as four people (9.52%). Work postures for the category of further investigation, immediate changes may have a Moderate Disability level of as many as 30 people (71.43%) and a severe Disability level of as many as 12 people (28.57%). At the same time, welders who have work postures for the Investigation category and immediate changes have a Crippled Disability level of 2 people (100%). Based on the description of Table 5, the results obtained are welders who have work postures for the Investigation category, and immediate changes have a higher risk of having LBP complaints than the further investigation category; immediate changes may be or the further investigation category, changes may be required. Based on statistical tests using SPSS 25, the significance value/p-value = 0.000 <0.05, which means it correlates, while the Pearson Correlation test results = 0.871, which has a perfect correlation. So, it shows a relationship between work posture and LBP complaints in welding workers. So H0 is rejected, and Ha is accepted. Based on the work sector, the welder is a job that has the highest musculoskeletal risk among other jobs due to the lack of available work facilities, and welding work carried out in a squatting and squatting position (Ayudea et al., 2022). Previous research found that workers with abnormal back posture were 2.5 times more likely to experience low back pain than workers with normal back posture (Syuhada et

al., 2018). Based on the description above, the results showed a significant relationship between work posture and low back pain / LBP complaints.

The Relationship of Working Period with LBP Complaints in the Welding Section

Based on the research data in Table 6, out of 86 welders with a work period of <3 Years who have a Minimal Disability level of as many as 25 people (78.13%); for a Moderate Disability level, as many as five people (15.62%); for a Severe Disability level, as many as two people (6.25%). At the same time, welders who have a working period> 3 years have a Minimal Disability level are 13 people (24.07%); for a Moderate Disability level, as many as 29 people (53.71%); for a Severe Disability level, as many as ten people (18.52%), for the Crippled Disability level as many as two people (3.7%). Based on the description in Table 4.8, welders with a working period of > 3 years have a higher risk of LBP complaints than those with a working period of < 3 years. Statistical test results using SPSS 25, the significance value/p-value = 0.000 <0.05, which means it correlates, while the Pearson Correlation test results = 0.490, which has a moderate correlation. These results can be interpreted that there is a significant relationship between the working period and LBP complaints in welding workers. So that H0 is rejected and Ha is accepted Working for a long time will cause the disc cavity to atrophy for a long time, causing spinal degeneration, which causes LBP. This is by research conducted (Laksana & Srisantyorini, 2020), finding a relationship between working hours and musculoskeletal problems (p-value = 0.013). Based on this study, respondents with a work period ≥ 3 years have a five times higher potential than workers with a work period < 3 years because musculoskeletal disorders can cause low back pain.

The Relationship between Smoking Habits and LBP Complaints in the Welding Department

In the results of the study, namely Table 7, of the 86 welders studied as a sample, welders who have a smoking habit with a Minimal Disability level of 32 people (40%), for a Moderate Disability level, as many as 34 people (42.5%), for the Severe Disability level as many as 12 people (15%), for the Crippled Disability level as many as two people (2.5%). At the same time, the welder who has a habit of not smoking with a Minimal Disability level is six people (100%). In statistical tests using SPSS 25, the significance value/p-value = 0.015 <0.05, which means it correlates, while the Pearson Correlation test results = -0.261, which has a weak correlation. This description can be interpreted as having a significant relationship between smoking habits and complaints of LBP in welding workers. So H0 is rejected, and Ha is accepted. Boshuizen et al. (Nur Ani, 2019) found a significant relationship between smoking habits and back pain, especially in jobs that require muscle power. The relationship between smoking and LBP is because nicotine in cigarettes can reduce blood flow to tissues. Smoking can also cause mineral deficiencies in the bones, causing pain in damaged or cracked bones (Ayudea et al., 2022). In line with Prasarn's research (2012), there is a significant relationship between smoking history and low back pain disability as measured by the Oswestry Disability Index (ODI), where the worst ODI score was reported in active smokers (44.33%), followed by previous smokers (38.11%) and finally non-smokers (36.02%). Looking at the above description, the results of the study showed a significant association between smoking habits and LBP complaints.

CLOSING

Conclusion

In the research conducted on 86 respondents (welder), it can be concluded: "There is a relationship between work posture, working period and smoking habit with LBP complaints among shipyard workers in the welding section at PT X Batam City in 2023". The results are described as follows;

1. Based on the work posture of 86 respondents (100%), the results were obtained for a score of 3 or 4 as many as 42 people or 48.84% (further investigation, changes may be needed), work

posture with a score of 5 or 6 as many as 42 people or 48.84% (further investigation, immediate changes are possible) & work posture with a score of 7 as many as two people or 2.32% (for investigation and immediate changes as much).

2. Based on the length of service of 86 respondents (100%), the results for < 3 years were 32 people or 37.21%, while the length of service> 3 years was 54 people or 62.79%.
3. Based on the smoking habits of 86 respondents (100%), the results obtained for Respondents who have a habit of smoking every day are 80 people or 93.02%, and for those who do not have a habit of smoking every day are six people or 6.98%.
4. Based on LBP complaints using the ODI questionnaire from 86 respondents (100%), the results obtained for Minimal Disability (0-20%) were 38 people or 44.19%, Moderate Disability (21-40%) were 34 people or 39.53%, Severe Disability (41-60%) were 12 people or 13.95% & Crippled (61-80%) were two people or 2.33%.
5. There is a significant relationship between work posture and LBP complaints in the welding section at PT X Batam City in 2023, shown by p-value = 0.000 <0.05, which means it has a correlation & Pearson Correlation test results = 0.871, which means it has a perfect correlation. Therefore, H0 is rejected while Ha is accepted.
6. There is a significant relationship between working period and LBP complaints in the welding department at PT X Batam City in 2023 as evidenced by p-value =0.000<0.05, which means there is a correlation & Pearson Correlation test result = 0.490, which means there is a moderate correlation. So, H0 is rejected while Ha is accepted.

There is a significant relationship between smoking habits and complaints of low back pain in the welding department at PT X Batam City in 2023 as evidenced by value = 0.015 <0.05, which means it has a correlation & Pearson Correlation test results =-0.261, which means it has a weak correlation. So, H0 is rejected while Ha is accepted.

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