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The Risk Factors of Low Back Pain Among Industrial Convection Workers

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Abstract

Background: *Low back pain is one of the musculoskeletal disorders caused by poor body activity. This study aims to determine the Risk Factors Related to the Incidence of Low Back Pain among Industrial Convection Workers in Mangkang.*

Method: *This study is a quantitative research with Descriptive Correlation research design and Cross Sectional approach. Research purpose to increase the efforts to prevent low back pain complaints and minimize the incidence of low back pain complaints. The population of this study was 30 employees of industrial convection of Cv. Moko in Mangkang, Central Java, Indonesia. The instrument used in this study was a questionnaire. The data was analyzed using Chi Square test data analysis.*

Research Results: *Chi Square test showed that there is a correlation between age and the incidence of Low Back Pain (LBP) (ρ value 0.000), between working period and LBP (ρ value 0.000), between BMI and LBP (ρ value 0.001), between workload and LBP (ρ value 0.005), between work duration and LBP (ρ value 0.000), between work attitude and LBP (ρ value 0.002).*

Conclusion: *There is a relationship between risk factors and the low back pain among industrial convection workers in Mangkang Central Java Indonesia.*

Keywords: *Low back pain, BMI, Period load duration, Work attitude*

Introduction

Work-related disease is a disease suffered by workers due to the risk factors such as workplace conditions, work equipment, materials used, production processes, work methods, company waste and production. One of the most common occupational health problems in the world and affecting almost the entire population is low back pain (Fauzia, 2015).

Since October 2010, the International Association for the Study of Pain (IASP) has also stipulated the Global Year against Acute Pain, focusing on the pain with less attention and treatment. The IASP states that people around the world experience muscle pain more often than the other pain categories. According to the experts, the problem is complex and extensive, including various types of pain such as neck pain, joint pain, low back pain, bone pain, and widespread chronic pain (Nauval, 2013).

Low Back Pain (LBP) is a common health problem worldwide. According to the World Health Organization (WHO), the most prevalence in industrialized countries is estimated at 60% to 70%, with an adult prevalence of 5% per year. While in children and adolescents, the incidence is not as much in adults, but the prevalence continues to increase. According to the research conducted by Damian Hoy (2010), the number of disability-adjusted life years (DALY) due to LBP increased from 58.2 million in 1990 to 83 million in 2010 (Silvia, 2016).

A survey of 1,000 workers in offices aged 18 years or more across the United States, 2 out of 3 office workers felt pain and aches in their body in the last 6 months. The American Osteopathic Association (AOA), 2013 in the survey showed that in the last 30 days, about 62% of respondents experience low back pain, 53% of neck pain, 38% of shoulder pain, 33% of wrist pain, and 31% of upper back pain (Kristanti, 2014).

Nearly 80% of the population in the industrialized countries has experienced Low Back Pain (LBP). In the United States, its prevalence in 1 year ranges from 15-20% whereas incidence based on new patient visit to the doctor is 14.3%. The epidermatologic data on LBP in Indonesia does not yet exist (Tjokorda and Sri Maliawan, 2009). Data for the number of LBP patients in Indonesia is not known for certain, but it is estimated that LBP patients in Indonesia vary between 7.6% - 37% of the total population in Indonesia (Silvia, 2016).

The results of the preliminary case study using a simple interview method on December 5, 2016 towards the convection industry workers in Mangkang showed that 5 out of 4 people complained of back pain after 7 hours working in a sitting position. Moreover, if the workload was over, they could work for 9 hours a day. Most of the employees claimed to have back pain complaints. The workers performed their job sitting on a chair without a backrest, which caused pain or stiffness in the lower back. It led to a risk factor for lower back pain to the industrial workers. Working with a sitting posture for quite long can generate the soft abdominal muscles and curving spine, causing feelings of fatigue and pain in the back. From these complaints, it has an impact on the work and its workers. For the workers, they had no choice but to be absent in work due to back pain. In addition, the workers needed to seek a simple medication which caused them to be less focused during the working hours. Various treatments cost a lot of time and money. If the workers continued to work despite having the pain, they could not work optimally. Due to the necessity to fulfill daily needs, the workers forced themselves to keep working and ignored the complaints they experienced. For the workplace, there will be a shortage of workers because of many employees who were forced to be absent. Work completion will be delayed. The attendance level decreases so that the energy required by the convection is reduced. The workplace should seek new employees to meet the target needs of the order.

Methods

Research Design

This research is a quantitative research by using descriptive correlational research design. This research was conducted by using cross sectional approach (Nursalam, 2011).

Research Subject

The population of this research is all employees of industrial convection Cv. Moko in Mangkang. The sampling technique used is the total sampling technique which explains that if the population is less than 100 people, then all samples should be obtained (Arikunto, 2013). The total sample of 30 people is categorized as industrial convection workers in Mangkang.

Instrument

The instrument used in this study is a questionnaire.

- Questionnaire A contains the biodata of respondents consisting of respondent's name, age, working period, weight, height.
- Measure the pulse according to the operational standards of pulse measurement. Observation sheet to record the recovery pulse measurement results with P1 - P3 ≥ 10 or P1, P2 and P3 all <90, normal recovery pulse. If the average P1 is recorded ≤ 110, and P1 - P3 ≥ 10, then the workload is not excessive. If P1 - P3 <10 and P3> 90, it is considered overload so there should be any improvements.
- Questionnaire B is used to measure a sitting attitude in work consisting of 15 questions, using the Guttman Scale type. It consists of 8 favorable questions with the yes answer which score is 2 and no answer score is 1 and 7 unfavorable questions with yes answer score is 1 and no answer score is 2. It is measured using the Guttman Scale type.
- Questionnaire C is used to measure the duration of work. If the duration of work is ≤ 7 hours of work, it is not at risk for the low back pain incidence, meanwhile, if the duration of work is > 7 working hours, it is more at risk for the incidence of low back pain.
- LBP incidence observation sheet Observation sheets and physical examinations were used by researchers and were accompanied by physiotherapy to assess the risk factors of low back pain incidence.
- The Validity Test of working attitude of sitting Questionnaire has been validated by Rina Puji, 2009 with the result of r_{xy} (r count) obtained then compared with r_{table} product moment with n (number of respondents) as much as 20 with the level of significance of 5% known by r table 0,444. If $r_{xy} > r_{table}$ then the item in the questionnaire is valid. After calculation or test with SPSS program 12.00 version, the results found that 15 questions tested are valid.
- The reliability test uses Cronbach's alpha. In the working attitude of sitting Questionnaires, it has

value of r_i (r Alpha) then compared with r_{tabel} product moment with n (number of respondents) as much as 20 with the significance of 5% known by r table 0,444. If $r_i > r_{table,}$ it means the instrument is reliable. The value of r_i obtained in this study amounted to 0.963, hence 15 questions are perceived reliable because the value $r_i > 0.444$.

Research Ethics

The researcher asked the informed consent from the respondents for their participation in a study. This approval sheet which mentions the title and benefits of the research is given to the respondents who meet the criteria. To maintain the confidentiality, the name of the respondents will not be included in the research. However, the sheet is marked with the code or initial name. The confidentiality of respondent information will be guaranteed by the researcher.

Data Analysis

The data analysis technique used consists of two stages:

Univariate Analysis

Univariate analysis is used to explain or describe the characteristics of each research variable measured by the researcher, both independent and dependent variables in the form of frequency distribution. The independent variable in this research is risk factors which consist of work load, work duration and work attitude. On the other hand, the dependent variable observed is low back pain case in industrial convection workers.

Bivariate Analysis

Bivariate analysis is performed on two variables that were suspected to be related or correlated (Notoatmodjo, 2012). The formula of this analysis is used to determine the relationship between independent variable with the dependent variable. The statistical test used in this study is Chi Square test because the scale of data measurement is ordinal scale (categorical data) and nominal. Analysis of results from chi square test:

1) If p value ≤ 0.05 then H_0 is rejected and Ha is accepted and stated "there is a correlation between risk factors with the incidence of low back pain in industrial convection in mangkang.

2) If p value > 0.05 then H_0 is accepted and Ha is rejected and stated "there is no correlation between risk factors and the incidence of low back pain in industrial convection in mangkang.

Results

Table1. *The Frequency Distribution of Respondents Based on Risk Factors*

Risk Factors	Frequency (n)	Percentage (%)
Age		
< 30 Years old	13	43.3
≥ 30 Years old	17	56.7
Working Period		
< 1 Year	12	40.0
≥ 1 Year	18	60.0
BMI		
Underweight	11	36.7
Normal	9	30.0
Overweight	10	33.3
Work Load		
Light	10	33.3
Normal	8	26.7
Heavy	12	40.0
Work Attitude		
Poor	12	40.0
Good	18	60.0
LBP		
At risk	17	56.7
No risk	13	43.3

Based on Table 1, it shows that most respondents who aged ≥ 30 years were 17 people (56.7%). It was found that 18 respondents (60.0%) had a working period of ≥ 1 year. There were 11 people (36.7%) of Industrial convection workers who had mass body index with an underweight category. There were 18 workers (60.0%) who had working hours > 7 hours. Most of the industrial convection workers had a good working attitude represented by 18 people (60.0%). There were 17 people (56.7%) workers who were at risk of experiencing the incidence of low back pain.

Table2. *The Relation of Age with the Incidence of Low Back Pain*

Age	Low Back Pain Incidence				N	Total	P Value
	At Risk		No Risk				
	N	%	n	%			
< 30 Years	2	15.4	11	84.6	13	100.0	0.000
≥ 30 Years	15	88.2	2	11.8	17	100.0	
Total	**17**	**56.7**	**13**	**43.3**	**30**	**100.0**	

Based on Table 2, on the respondents aged <30 years, there were 2 respondents who were at risk for low back pain incidence (6.7%) and 11 respondents were not at risk for low back pain incidence (36.7%). On the respondents aged ≥ 30 Years, there were 15 respondents who were at risk of low back pain incidence (50.0%) and 2 respondents were not at risk for low back pain incidence (6.7%).

The result of statistical test with chi square test obtain ρ value of 0.000 <α (0.05), hence it is concluded that there is a relation between age with the incidence of low back pain at industrial convection workers in Mangkang.

Table3. *The Relation of Working Period with the Incidence of Low Back Pain*

Working Period	Low Back Pain Incidence				n	Total	ρ Value
	At Risk		No Risk				
	n	%	N	%			
< 1 Year	2	16.7	10	83.3	12	100.0	0.000
≥ 1 Year	15	83.3	3	16.7	18	100.0	
Total	**17**	**56.7**	**13**	**43.3**	**30**	**100.0**	

Based on Table 3, it shows that in the working period of < 1 year, the respondents who were at risk for low back pain were 2 respondents (6.7%) and those who were not at risk for low back pain were 10 respondents (33.3%). Meanwhile, in the working period of ≥ 1 Year, there were 15 respondents who were at risk of low back pain (50.0%) and 3 respondents were not at risk of low back pain (10.0%).

The result of statistical test with chi square test obtained ρ value of 0.000 <α (0.05), it is concluded that there is relationship between working period with the incidence of low back pain in industrial convection workers in Mangkang.

Table 4. *The Relation of BMI with the Incidence of Low Back Pain*

BMI	Low Back Pain Incidence				n	Total	ρ Value
	At Risk		No Risk				
	n	%	N	%			
Underweight	1	9.1	10	90.9	11	100.0	0.001
Normal	7	77.8	2	22.2	9	100.0	
Overweight	9	90.0	1	10,0	10	100.0	
Total	**17**	**56.7**	**13**	**43.3**	**30**	**100.0**	

According to Table 4, there was 1 respondent (3.3%) with an underweight body who was at risk with the incidence of low back pain and as much as 10 respondents (33.3%) were not at risk for low back pain. The respondents with normal weight who were at risk of the low back pain incidence were 7 people (23.3%) and 2 respondents (6.7%) were not at risk for low back pain. The respondents with overweight body who were at risk with the incidence of low back pain were as much as 9 respondents (30.0%) and as much as 1 respondent (3.3%) was not at risk of low back pain.

The result of chi square test with kolmogorov-smirnov z obtained ρ value of 0.001 <α (0.05), it is concluded that there is a correlation between body mass index with the incidence of low back pain in industrial convection workers in Mangkang.

Table 5. *The Relation of Work Load with the Incidence of Low Back Pain*

Work Load	Low Back Pain Incidence				n	Total	ρ Value
	At Risk		No Risk				
	n	%	N	%			
Light	1	10.0	9	90.0	10	100.0	0.005
Normal	7	87.5	1	12.5	8	100.0	
Heavy	9	75.0	3	12.5	12	100.0	
Total	**17**	**56.7**	**13**	**43.3**	**30**	**100.0**	

According to Table 5, respondents with a light workload who were at risk of low back pain incidence were as much as 1 respondent (3.3%) and who were not at risk of low back pain were as much as 9 respondents (30.0%). Respondents with normal workload who were at risk of low back pain incidence were as much as 7 respondents (23.3%) and who were not at risk for low back pain were as much as 1 respondent (3.3%). Respondents with a heavy workload who were at risk of low back pain incidence were as much as 9 respondents (30.0%) and who had no risk of low back pain were as much as 3 respondents (10.0%).

The result of chi square test with kolmogorov-smirnov z obtained ρ value of 0.005 <α (0.05), it is concluded that there is a relation between workload with the incidence of low back pain in industrial convection workers in Mangkang.

Table 6. *The Relation of Work Duration with the Incidence of Low Back Pain*

Work Duration	Low Back Pain Incidence				n	Total	ρ Value
	At Risk		No Risk				
	n	%	n	%			
≤ 7 Hours	2	16.7	10	83.3	12	100.0	0.000
> 7 Hours	15	83.3	3	16.7	18	100.0	
Total	**17**	**56.7**	**13**	**43.3**	**30**	**100.0**	

Based on Table 6, it shows that in the respondents who had a working duration of ≤ 7 hours, those who were at risk for low back pain incidence were 2 respondents (6.7%) and those who were not at risk for low back pain were 10 respondents (33.3%). Meanwhile, the respondents with working duration> 7 hours who were at risk of low back pain were as much as 15 respondents (50.0%) and those who were not at risk of low back pain were 3 respondents (10.0%).

The result of statistical test with chi square test obtained ρ value of 0.000 <α (0.05), it is concluded that there is a relationship between working duration with the incidence of low back pain in industrial convection workers in Mangkang.

Table 7. *The Relation of Work Attitude with the Incidence of Low Back Pain*

Work Attitude	Low Back Pain Incidence				n	Total	ρ Value
	At Risk		No Risk				
	n	%	n	%			
Poor	11	91.7	1	8.3	12	100.0	0.002
Good	6	33.3	12	66.7	18	100.0	
Total	**17**	**56.7**	**13**	**43.3**	**30**	**100.0**	

Based on Table 7, in the respondents who had poor work attitude, there were 11 respondents (36.7%) who were at risk of low back pain incidence and 1 respondent (3.3%) was not at risk of low back pain. In the respondents who had a good working attitude, those who were at risk of the low back pain incidence were as much as 6 respondents (20.0%) and who were not at risk of low back pain were as much as 12 respondents (40.0%).

The result of statistical test with chi square test obtained ρ value of 0.002 <α (0.05), it is concluded that there is a correlation between working attitude with the incidence of low back pain in industrial convection workers in Mangkang.

Discussion

Age

Based on the results of the study, age is one of the risk factors of low back pain due to the increasing age of the bone and this situation began to occur in the age of 30 years old. In the age of 30, there will be degeneration occurs such as tissue damage, changes of normal tissue into scar tissue, fluid reduction. It causes the stability of the bones and muscles to be reduced so that the older a person the higher the risk of bone elasticity is decreased that triggers musculoskeletal symptoms. LBP is also often experienced by people of productive age between 20-35 years, due to the length of working duration (Defriyan, 2011).

The results of this study are in line with the research conducted by Defriyan (2011) "Factors Related to Low Back Pain Complaints on Tapis Fabric Processing in Bandar Lampung Family Art Studio" which found that the workers in Family Art Studio aged <30 years are as many as 11 workers (36.7%) compared with the workers aged ≥ 30 years which consists of 19 workers (63.3%).

Working Period

Based on the results of the study, working period is one of the risk factors of low back pain due to the accumulation of work activities done in a long period of time. If the activity is carried out continuously within the range of years, it can cause a disruption in the body. The physical pressure over a period of time results in a decrease in muscle performance and a symptom of a lower movement. It is caused by the accumulation of the pressures over a long period of time, which leads to the poor health conditions (Khaizun, 2013).

This study is in accordance with the research conducted by Said (2016) "The relationship between Static Duration and Low Back Pain on Tailor" that the incidence of back pain is more common in the working period of ≥ 1 Year of 88 respondents (85.4%). This happens to the worker because the level of muscle endurance often used for work will decrease as the person works for a long period of time.

BMI (Body Mass Index)

Based on the results of research, the factor of BMI with overweight category is more at risk with low back pain complaints since overweight person will try to support the weight from the front by contracting the lower back muscles. As the weight increases, the spine will be more depressed to receive the load, thus it facilitates the occurrence of damage and danger to the bone structure. If it continues gradually, it will cause suppression of the spinal cord leading to a hernia nucleus pulposus. The fat in the abdominal area consists of subcutaneous fat and intra-abdominal fat which can be detected by the examination (Zar, Abu 2012).

This study is in line with the research conducted by Said (2016) "The relationship between Static Duration and Low Back Pain on Tailor" that most respondents (51.9%) who experienced LBP are categorized as overweight and respondents with normal weight are (48.4%) and there are (33.3%) of the respondents who is underweight.

Work load

Based on the result of the research, work load become one of risk factors because every work is a burden for the worker, either physical or mental burden. The workload determines how long a person can work according to his work capacity. The greater the burden, the shorter the time a person can work without fatigue or disruption. Any kind of job which requires muscle or brain is a burden to the workers. The burden can be physical, mental or social in accordance with the type of job (Putranto, et al., 2014).

This research is similar with the research conducted by Desi (2015) "Factors Related to the Subjective Fatigue Complaint of Tailor in Punjung Island of Dharmasraya Regency" that most of the (61.9%) tailors performed a heavy workload. Sewing can be categorized into physical work and brain work. The overall activity of sewing workers resulting in the back complaints is

a complaint of skeletal muscles that cause a various kind of pain. It happens due to the repetitive workload for a long period of time which leads to a joint pain, ligament and tendon damage.

Work Duration

Based on the results of research, the duration of work is one of the risk factors of low back pain because the longer a person sits in the workplace, the more the muscle tension around the back and the strain of the back ligament, particularly the posterior longitudinal ligament is increased. It is known that the posterior longitudinal ligament layer is the thinnest among the other ligaments as high as L2-L5 which is the area of LBP. This condition causes more frequent disturbance / damage in this area which causes a fatigue and tissue ischemia around the area. In addition, many pain-sensitive tissues around the lumbar vertebrae have a greater potential to become painful by hyperalgesia. Static sitting time for 91-300 minutes has a risk of LBP 2.63 times greater than sitting for 5-90 minutes. Meanwhile, the subject who has no chance to relax their bodies during the work has a 3.5 times greater risk for the occurrence of LBP (Triwibowo, Heri and Indah 2014).

This study is in line with a study conducted by Said (2016) "The Relationship of Static Duration with Low Back Pain on Tailor" that found that low back pain occurrence is more common in the duration of work> 7 hours (52.8%). This result is similar to a study conducted by Putu et al in 2015 entitled "Long Staying Relationships with Low Back Pain Events at Computer Operators of Travel Companies in Manado" states that the duration of sitting within 7-9 hours per day is 21 respondents (70 %) who experienced LBP.

Work Attitude

Based on the result of the research, work attitude which is not ergonomic is more at risk because all the work in the project is performed manually. Besides, the work attitude of the workers which is too forceful will cause the body to be easily tired and the body position will avoid the natural work attitude (Septiawan, 2013).

This study is in accordance with research conducted by Kharizun (2013) entitled "Factors of Subjective Complaints on the Back of the Sarong Weaving Workers in North Wanarejan Village Pemalang". Sitting attitude which is not ergonomic is performed by 16 respondents (16.0%) while 8 respondents (9.7%) experienced subjective complaints of back pain. The ergonomic sitting attitude is performed by 30 respondents (30.0%) and as many as 20 respondents (18.3%) had subjective complaints of back pain.

Conclusion

1. Some of the industrial convection workers in Mangkang have the risk of low back pain as much as 17 respondents (56.7%).
2. There is a significant relationship between age and the incidence of low back pain.
3. There is a significant relationship between the duration of work and the incidence of low back pain.
4. There is a significant relationship between BMI and the incidence of low back pain.
5. There is a significant relationship between the workload and the incidence of low back pain.
6. There is a significant relationship between the length of work and the incidence of low back pain.
7. There is a significant relationship between work attitude and the incidence of low back pain.

Suggestions

For the Community

Provides information about the adverse effects of risk factors of low back pain and enhance the level of personal health in working optimally.

For Health Workers

As an input to better understand the risk factors of low back pain in order to plan the safety and health programs in the workplace.

For Nursing Professionals

Research purpose to increase the efforts to prevent low back pain complaints and minimize the incidence of low back pain complaints.

For the Company

It is expected to provide input and contribution in arranging a healthier and more comfortable work environment to avoid back pain incidence. Hence, it can increase the efficiency and productivity as well as optimal health workforce on industrial convection workers in Mangkang.

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