Correlation of Standing Work Position and *Musculoskeletal Disorders* (MSDs) Complaints on Rack Frame Bending Section Workers in Informal Industry of Rack Making in Surabaya, Indonesia

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Abstract

This research was conducted to analyze the correlation between standing work position and complaints of musculoskeletal disorders on rack frame bending workers in the informal industry of rack making in Surabaya, Indonesia. When doing rack bending, standing work position was affected by work position. The jobs forced workers to work with non-ergonomic standing work position. This caused workers to experience complaints on the skeletal system (MSDs) faster. This research was an observational research with cross sectional design. The sample used a total population of 5 workers. Data obtained by interview, measurement of height and weight and observation of work position. The data analysis method used was descriptive statistics. It was known that due to non-ergonomic standing work position, 40% of rack frame bending workers had a moderate and high MSDs risk category while 20% of other workers were in the low category. In addition, it was known that 40% of workers had low and moderate MSDs complaints category and 20% of other workers had high MSDs complaints category. Based on the results, the standing work position on the rack frame bending workers had a strong and positive correlation with a correlation coefficient of 0.655. In addition to the work position, there was a strong correlation between age, working period, and BMI with MSDs complaints of rack frame bending workers. It was recommended that the employer adjust the frame size on each bending machine and provide seat for workers to rest.

Keywords: *standing work position, musculoskeletal disorders complaints, REBA, NBM*

Introduction

Musculoskeletal complaints are complaints of skeletal muscle parts that are felt by a person starting from a complaint of bearable to unbearable pain. Complaints to this disorder are usually termed *musculoskeletal disorders*[3]. According to Peter Vi, there were several factors that can cause *musculoskeletal disorders* (MSDs) such as excessive muscle stretching, repetitive movements, unnatural working attitudes, secondary causes, and combination factors[4].

According to the *European Survey on Working Condition* in 2005, around 24.7% of European workers complained back pain, 22.8% complained muscle pain, and about 45.5% of workers reported working with fatigue while 35% were assigned to handle heavy loads in their work[5]. In Europe, this occupational disease affected millions of workers and can spend billions of euros to fund treatment for workers. Whereas in chronic cases, MSDs can even caused disability which can caused workers to stop working[6].

Workers in the rack frame bending section in the informal rack making industry in Surabaya, Indonesia, worked with standing work position. This section required workers to work with changing work position while standing, that was stooping and twisting their waist to press and lift the lever so that the rack frame can be bent. The working process of the rack frame bending section was carried out for 7 working hours/day or >50% work shift. Based on observations, it was known that the frequency of repetitive motion in rack frame bending section every 30 seconds was 6 times, and there were

workers who's complaining pain in some of their limbs.

According to previous research on welders with standing work position, showed that there was a correlation between standing work position and MSDs complaints especially on the neck, back, and shoulders, also the risk of MSDs was included in the moderate category[8]. In addition, based on the results of research conducted on *weaving* workers at PT. Delta Merlin Textile, Kebakkramat, Karanganyar, known that there was a very strong correlation between standing work position and musculoskeletal complaints and a positive direction of correlation[9].

Thus, the purpose of this research was to learn the direction and strength of the correlation between working position and *musculoskeletal disorders* complaints in rack frame bending section workers in the informal industry of rack making in Surabaya, Indonesia.

Material and Method

Based on the data collection method, this research was observational, data obtained by observing without giving any treatment to the objects of research during the research. Based on the analysis, this research was descriptive statistics, which described the process by analyzing the strength and direction of correlation between variables.

The population of this research were all workers in the rack frame bending section in the informal industry of rack making in Surabaya Indonesia, with total of 5 people. Sampling of this research used the total sampling method, namely the sample used in this research were all members of the population. Variables in this research were age, working period, Body Mass Index (BMI), work position and musculoskeletal disorders complaints. The data collected in this research were only primary data obtained by interviews, measurements of height and weight and observation of work position.

Findings

The research results of workers data collection about the workers age, working period, Body Mass Index (BMI), work position and musculoskeletal disorders complaints were obtained by different methods. Age and working period obtained by interview method, while BMI obtained by calculating using formulas related to measurement of height and weight.

Assessment of work position were done using the Rapid Entire Body Assessment (REBA) method. The application of REBA method is intended to prevent the risk of injury to the musculoskeletal system muscle.

Table 1. Frequency Distribution of MSDs Risk Category on Rack Frame Bending Section Workers Using REBA Method

MSDs Risk Category	Frequency (n)	Percentage (%)
Low	1	20%
Moderate	2	40%
High	2	40%
Total	5	100%

The risk level of MSDs is divided into several categories, namely very low, low, moderate, high and very high risk but in this research there were no workers with very low and very high MSDs risk categories. Therefore, based on Table 1, it was known that the majority of 40% of workers had moderate and high MSDs risk category and 20% of other workers had low MSDs risk category.

For example, the risk level of MSDs on one of the rack frame bending section workers was known in the high category because it got a final score of 10 (high category final score = 8-10). The final score was obtained from the position score of the position of the neck, body, legs, upper arm, forearm, wrist, type of *coupling*, type of muscle activity (repetitive movements, significant changes in body posture, and unstable body posture during work) and load or workers force which were of course also significant (the position is becoming flexion-extension or getting more non ergonomic). The risk level of high MSDs category certainly required action to improve work posture as soon as possible to minimize and prevent the occurrence of higher musculoskeletal complaints in workers.

The assessment of musculoskeletal complaints in this research used the *Nordic Body Map* (NBM) method. *Nordic Body Map* is a method used to assess the severity of the disruption of the musculoskeletal system[4]. This method can be used to know the level of complaints felt by workers on 28 limbs ranging from feeling bearable to unbearable pain. Determining the level of MSDs complaints can be done by seeing the result of the workers' body map analysis.

Table 2. Frequency Distribution of MSDs Complaint Levels on Rack Frame Bending Section Workers Using NBM Method

MSDs Complaints Level	Frequency (n)	Percentage (%)
Low	2	40%
Moderate	2	40%
High	1	20%
Total	5	100%

The level of MSDs complaints was divided into 4 categories, namely low, moderate, high and very high, but in this research there were no workers with very high MSDs complaints. Based on Table 2, the majority of 40% workers had low and moderate MSDs complaints, while 20% of other workers have a higher level of MSDs complaints.

Table 3. Correlation between MSDs Risk Category and Complaints Level on Rack Frame Bending Section Workers

MSDs Risk Category	MSDs Complaints Level						Total		Association Coefficient
	Low		Moderate		High				
	n	%	n	%	n	%	n	%	
Low	0	0%	1	100%	0	0%	1	100%	0.655
Moderate	1	50%	1	50%	0	0%	2	100%	
High	1	50%	0	0%	1	50%	2	100%	

The correlation between standing work position and MSDs complaints can be seen in Table 3. Based on the results of data analysis that produced the table above, it was known that all workers who had a low MSDs risk category had a moderate MSDs complaints. In addition, it was known that the association coefficient value was 0.655 which means that there was a strong and positive direction of correlation that means the higher the risk of *musculoskeletal disorders* (the risk of work position), the level of *musculoskeletal disorders* complaints on rack frame bending section workers will also becomes higher. This was in line with research carried out on plywood making that there was a correlation between standing work position and musculoskeletal complaints on plywood makin in Ketapang, Kendal (p=0,001)[10]

Research result about workers age, working period and Body Mass Index (BMI) with MSDs complaints can be found in the tables below.

Table 4. Correlation between Age and MSDs Complaints Level on Rack Frame Bending Section

Age	MSDs Complaints Level						Total		Association Coefficient
	Low		Moderate		High				
	n	(%)	n	(%)	n	(%)	N	(%)	
15-19	1	100%	0	0%	0	0%	1	100%	0,756
20-24	0	0%	0	0%	1	100%	1	100%	
25-29	1	33%	2	67%	0	0%	3	100%	
Total	2	40%	2	40%	1	20%	5	100%	

Based on the table above, the results showed that all workers (100%) aged 20-24 years were at a high level of MSDs complaints. In that age group was dominant productive age to work, because workers in this age group will try to work for a long time to get bigger salary. According to Oborne (1995) stated that age is the main cause of complaints on muscle, because as we get older or age increases than the muscle strength decreases[11]. Supported by a research stated that MSDs are the most common and symptomatic health problems in middle and old age. The results of the research revealed that the age group with the highest rate of back pain and muscle fatigue was aged 20-24 years for men[12]

According to the data analysis that has been done, the age and MSDs complaints level on rack frame bending workers had a strong correlation and a positive or same direction of correlation that seen from the association coefficient of two variables by 0.756.

Table 5. Correlation between Working period and MSDs Complaints Level on Rack Frame Bending Section

Working period	MSDs Complaints Level						Total		Association Coefficient
	Low		Moderate		High				
	n	(%)	n	(%)	n	(%)	N	(%)	
<6 years	1	50%	0	0%	1	50%	2	100%	0,607
6-10 years	1	33%	2	67%	0	0%	3	100%	
Total	2	40%	2	40%	1	20%	5	100%	

Based on the table above it was known that workers whose 6-10 working period were mostly 67% of workers with moderate levels of MSDs complaints. According to the data analysis that has been done, working period and the level of MSDs complaints on rack frame bending workers had a strong correlation and a positive or same direction of correlation that seen from the association coefficient of the two variables by 0.607.

This was not in line with the theory which states that when a muscle receives excessive workload that is carried out repeatedly for a long time, complaints will arise due to damage in joints, ligaments and tendons[4].

So based on this theory, the working period was directly correlated to MSDs complaints. However, based on the results of the data analysis, it was known that the working period of the worker had a strong and postive direction of correlation or in line with the level of MSDs complaints. In accordance with research conducted on informal workers, that there was a relation between working period and MSDs complaints. Based on the results of the research, it was known that workers who experience high MSDs complaints were workers with <5 years working period not workers with a working period of > 5 years[13].

Table 6 . Relation Between Body Mass Index (BMI) and MSDs Complaints Level on Rack Frame Bending Section Workers

BMI	MSDs Complaints Level						Total		Association coefficient
	Low		Moderate		High				
	n	(%)	n	(%)	n	(%)	N	(%)	
Thin	1	50%	0	0%	1	50%	2	100%	0.607
Normal	1	33%	2	67%	0	0%	3	100%	
Total	2	40%	2	40%	1	20%	5	100%	

Based on the table above, it was known that workers included in the thin BMI category had complaints of low and high MSDs around 50% each, whereas in the normal BMI category, the majority of workers around 67% had moderate MSDs and the remaining 33% have low MSDs. According to a research, it was said that height, strength, and body mass were also considered could increase the risk of MSDs but the evidence is far from convincing[14]. But based on the results of other studies conducted at *maintenance* workers PT. Antam Tbk 2014 UBPE, Pongkor, stated that there was a significant relation between BMI and MSDs complaints[15].

According to the data analysis that has been done, BMI and MSDs complaints level of workers in rack frame bending section have strong and a positive direction of correlation that can be seen from the association coefficient of both second variables by 0,607.

Conclusion

The existence of a strong degree of correlation between working position with MSDs complaints on rack frame bending section workers. In addition, the strong and same direction of the correlation (positive) between the characteristics of workers which are age, tenure, and body mass index (BMI) with MSDs complaint level. The advice given to the company is the company should be evaluating the work station that is usually occupied by rack frame bending section workersd. If reshaping the work station to minimize the risk of MSDs requires a large amount of money, the employer can adjust the size of the bending machine lever to the size of the rack that is about to be bend by workers (specialization of frame size on each bending machine) to reduce workers to work with hunchback positions that are too low. In addition to reduce MSDs complaints on workers in standing work position, the employer can provide seats for rack frame bending section workers around the bending machine area so that workers can rest to relax tired limbs after work in a standing work position.

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