

# **Analysis of Work Posture Using Rapid Entire Body Assessment (REBA) as the Risk Factor of Work Related Musculoskeletal Disorders in Inter-provincial Bus Drivers**

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**Background :** Inter-provincial bus driver is a job which force a man to work in static posture for a long time. Incorrect posture that occure for a long time may become a risk factor of Musculoskeletal Disorders (MSDs). This study was aimed to identify work-related MSDs and its association with work posture and other related factors in inter-provincial bus drivers in Bandarlampung.

**Materials and methods :** This was a cross sectional study which involved 101 inter-provincial bus drivers obtained by consecutive sampling technique. Musculoskeletal disorders were assessed using Nordic Body Map, while work posture was assessed using Rapid Entire Body Assessment (REBA). Infomation about participant demographics was also collected by quetionnaire.

**Results :** prevalence of MSDs was 73.3% and were mostly located in the lower back (36.48%) , calves (31.08%) and shoulders (28.38%). Most subjects (66.2%) had moderate risk of work posture. There was significant association between MSDs with high risk work posture ( $p=0.001$ ,  $RR=6.27$ ,  $95\% CI=1.73-22.77$ ); but there was no significant association with work period, age, nutritional status, and exercise.

**Conclusions :** High risk work posture is a risk factor of MSDs which significantly increase the risk to the occurance of MSDs in inter-provincial bus driver.

**Keywords :** Bus driver, musculoskeletal disorders, work posture, REBA

## **Introduction**

Musculoskeletal Disorders (MSDs) is one of work-related disease and contributed for 41% of all work-related disease in Great Britain and caused 37% of workers absentism.[1] In 2003, World Health Organization (WHO) had reported MSDs as most common work-related disease and was estimated to account for 60% of all occupational diseases. According to the Ministry of Health of the Republic of Indonesia in 2005, 40.5% of workers in Indonesia had work-related diseases, where 16% was musculoskeletal disorders, 6% was cardiovascular disease, 1.3% skin disease and 1% ENT disorders. MSDs is occure by the

contribution of various risk factors, including individual, occupational and psychosocial risk factors.[2,3] Transportation workers, for example is bus driver who are at risk of health problems such as MSDs, psychological problems such as fatigue and tension, intestinal disorders, and sleep disorders. These problems could result in the driving performance of the bus driver.[4]

A study conducted on bus drivers in Rajabasa Bus Station found that 74% of bus drivers suffered from Lower Back Pain which is known as one of MSDs.[5] Another study

conducted on bus drivers in Tricity found the prevalence of MSDs among drivers was 51% with the location of musculoskeletal disorders most frequently to occurred at the lower back (30.3%), followed by neck (17.3%) and knee (14.7%).[4]

According to preliminary study conducted by observation and interview on inter-provincial bus drivers who work 12-24 hours at Rajabasa Bus Station in Bandar Lampung, found that 16 out of 20 bus drivers suffered from MSDs and The location of MSDs most frequently occurred were on the waist and ankles. Bus driver must work in a static sitting position and be exposed by long-lasting vibrations. Static posture and unergonomic posture is some of risks faced by bus drivers repeatedly every day and are factors that can lead to MSDs and can have an impact on how he drive the bus that might lead to road accident. the objectives of this study was to identify and quantify ergonomics working postures in inter-provincial bus drivers that may contribute to the serious development of musculoskeletal disorders and investigate other possible contributory causes with the intention of prevention.

## Methods

This was an observational, quantitative study with cross sectional design. The study was conducted in Bandar Lampung. The study population was inter-provincial bus drivers in Bandar Lampung. Sample was selected using a consecutive sampling technique. Bus drivers who had a history of bone fracture and were diagnosed with the disease on the musculoskeletal system before working as a driver were excluded. The number of subjects in this study was 101 inter-provincial bus drivers.

Musculoskeletal Disorders were identified using Nordic Body Map to gathered information about pain and located the area. Work postures were documented by taking pictures of respondents on their driving potures using cameras. Body angels were then

measured from the pictures and given scores using Rapid Entire Body Assessment (REBA) to identify the risk level of work posture. Other data such as age, work periode, BMI, and exercise also gathered in this study. Data were analyzed using chi-square test. The analysis results were determined with  $p < 0.05$  and 95% confidential intervals (CI).

## Results

### Respondents Characteristic

There was 115 respondents joined this study, but only 101 respondents who meet the criteria to be the subject. Those subjects were inter-provincial bus drivers who had route: Ranau-Jakarta, Lahat-Bekasi, Yogya-Jambi, Yogya-Pekanbaru, Bandung-Pagaralam, Jambi-Pati, Jambi-Bali, Jakarta-Belitang, Medan-Bali and Lampung-Cilacap. Those routes takes about two until five days driving on the road. Only few drivers who had a crew to exchange driving, the driver's turnover cycle is about every 6 to 10 hours. Some subjects didn't have crew to exchange driving and just took a rest in the ship and rest areas about three to four hours. Respondents characteristic is presented in Table 1.

**Table 1.** Respondents characteristic Distribution

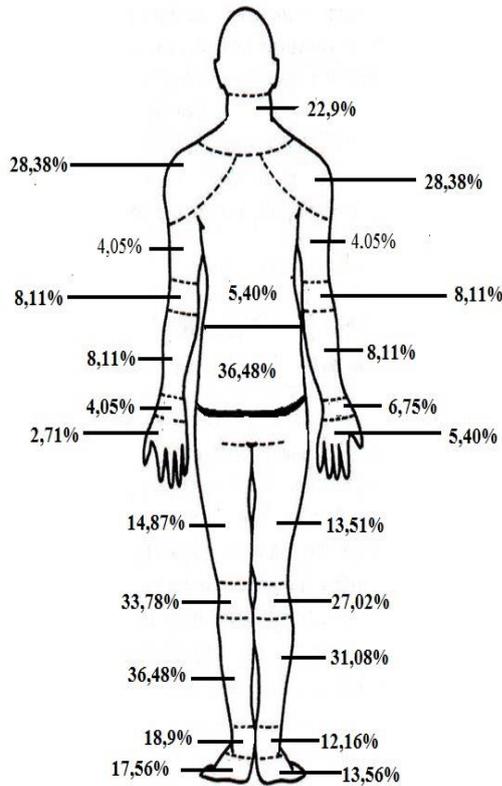
Characteristic	Categori	n (%)
Work posture	No Risk	0 (0)
	Low Risk	14 (13,9)
	Moderate Risk	58 (57,4)
	High Risk	29 (28,7)
	Very High Risk	0 (0)
Work Period	<5 years	24 (23,8)
	6-10 years	26 (25,7)
	>10 years	51 (50,5)
Age	Adolescence	12 (11,9)
	Adult	68 (67,3)
	Midle Age	21 (20,8)
Nutritional status	Normal	50 (%)
	Undernutrition	2 (%)
	Overweight	49 (%)
Exercise	No	64 (63,4)
	Yes	37 (36,6)

### Musculoskeletal Disorders Distribution

Prevalence of MSDs among inter-provincial bus drivers in Bandar Lampung found from this study was 73.3%. MSDs were mostly located on the lower back and followed by calves, knees, neck and shoulders. More data is presented in Figure 1.

**The association of Musculoskeletal Disorders with several risk factors.**

Statistical analysis of the data in this study had found that work posture has a significant association with the occurrence of MSDs in inter-provincial bus drivers. While age, working period, nutritional status, and exercise have no significant association with the occurrence of MSDs in subjects. (Table 2).



**Figure 1. Location of MSDs**

**Table 2.** The association of MSDs with several risk factors

Risk Factor	MSDs				P	RR	CI 95%
	Yes		No				
	n	%	N	%			
<b>Work Posture</b>							
High Risk	26	35,1	3	11,1	0,001	6,27	1,73-22,77
Moderate Risk	46	62,2	12	44,4		5,55	1,52-20,16
Low Risk	2	2,7	12	44,4			
<b>Work Period</b>							
>10 years	35	47,3	16	59,3	0,559	0,867	0,66-1,14
6-10 years	20	27	6	22,2		0,972	0,72-1,30
<5 tahun	19	25,7	5	18,5			
<b>Age</b>							
Midle Age	16	21,6	5	18,5	0,618	0,914	0,64-1,29
Adult	48	64,9	20	74,1		0,87	0,63-1,14
Adolescence	10	13,5	2	7,4			
<b>Nutritional Status</b>							
Malnutrition	38	48,6	13	48,1	0,776	1,035	0,82– 1,31
Normal	36	51,4	14	51,9			
<b>Exercise</b>							
No	47	63,5	17	63	0,959	1,006	0,79– 1,29
Yes	27	36,5	10	37			

## Discussion

Prevalence of MSDs among inter-provincial bus drivers in this study was found to be 73.3%. most common location of MSDs in subjects was found on the lower back area (36,48%), and followed by the calves (36,48%), shoulders (28,38%), left knee (27,02%),and neck (22,9 %). During driving, shoulders, neck, back, and lower extremities are most widely used parts of the body in a long duration and cause excessive use of the muscles at these areas.[6]

The lower back area is the most common location of MSDs found in this study. This can be caused by a long sitting posture which does not only induce a greater burden on intervertebral discs by increasing intradiscal pressure but also because of continuous vibration recieved in the tissues due to the bus machine vibration.[4] Axial burden on the spine for a long periods would cause fatigue on the back muscle and increase compression on the discus and will increase the risk of

serious injury to the spine.[7] When a certain work posture is frequently performed in a long duration of time, the burden might exceed muscle and tendon ability to adapt that will lead to inflammation which will be followed by tissue degeneration, microcracks and scar tissue formation. Once a muscle or tendon is injured, the surrounding muscles must compensate by working harder to provide support to the body. The increasing of these muscles work will lead to fatigue and stiffness on the muscles.[4,7] Besides, a long static work posture in drivers will cause the lack of oxygen supply to the tissues and manifest as MSDs.[8]

The Risk of work posture was assessed using REBA, this measurement will categorize work posture into no-risk (score 0-1), low risk (score 2-3), moderate risk (score 4-7), high risk (score 8-10), and very high risk (score 11-15).[9] In this study it was found that the REBA score in subjects were in range of 3 to 10 with the average score was 6, and most of subjects had moderate risk in work posture (57.4%). While 28.7% subjects had high risk and 13.9% had low risk in work posture. The result of cross-tabulation between work posture and MSDs also showed that most of subjects who suffered from MSDs are those who had moderate and high risk in work posture. Bivariate analysis using chi-square test showed that there was a significant association between work posture and MSDs occurrence in inter-provincial bus drivers. This result is in line with a study conducted by Ojo et al. (2014) which found that there was a significant association between work posture and MSD complaints.[10] The European Agency for Safety and Health at Work (EU-OSHA) states that there is an association between work posture to MSDs, that the work posture is at risk to cause pain when the body is twisting, bending or performing a posture which body angles are exceeding the normal body angles and are performed > 25% of working time.[8] Postural problems also relate to awkward posture, repetitive movement, excessive body usage, and improper working environment.[11]

Several studies had confirm the association between awkward posture with the risk of developing musculoskeletal pain. There is an increased in risk of musculoskeletal symptoms in the neck and shoulders when the neck is twisted or bent. The risk of neck pain increases when the neck is twisted more than 45 degrees for more than 25% of working time. An Increased risk also occurs when the neck is bent more than 45 degrees from natural neck position for more than 5% of the working time. However, if the neck is bent at a 20-degree or more for more than 40% of the working time, the risk of musculoskeletal pain increases rapidly along with the time.[12] The measurement of neck angle in subjects of this shown that some subjects had an upright neck position (10-20 degrees) but some of them had a bent neck position lower than 20 degrees that will lead to the occurrence of musculoskeletal disorders on the neck and shoulders.

REBA measurement on the trunk had found that most subjects had extension and upright position (10-20 degrees), only a small percentage of respondents trunk are bent at an angle more than 20 degrees. The position of the respondent's upper arm was at the angle of 20-45 degrees and 45-90 degrees, while the position of the forearm at the angle of 60-100 degrees and > 100 degrees which might lead to cause pain at the elbow.

Many pain complaints are located in the lower back area. Working on a bent or twisted position for more than two hours a day is a strong risk factor for back pain. Bending and twisting more than 30 degrees and maintaining that position longer than 15 minutes significantly increases the risk of back pain.[13]



Figure 2. Measurement of body angle

The results of this study also showed that respondents who suffered from MSDs were mostly (47.3%) had been working as a bus drivers for more than 10 years, but the results of bivariate analysis showed that there was no significant association between work period with MSDs among inter-provincial bus drivers. This results is contrary with the result from a research conducted by Firmanita (2015) to taxi drivers in Semarang which found that work period of > 10 years had a significant association MSDs with a working period against MSDS.[14]

Research by Hakkanen (2001) showed that the absenteeism due to sick leave was increased on workers with longer work period, it also explained that adaptation to work does not reduce the problem. Even new workers who just start to work and get used to the task might also suffered from musculoskeletal disorders due to the repetitive activities.[15]

MSDs complaints in this study are most frequently occurred among subjects in the adult age group where 64.9% of all subjects who suffered from MSDs were in the age of 26-45 years. But according to proportion, it was known that subjects from middle age group had greater risk of MSDs where 76.2% subjects whose age >45 years suffered from

MSDs. The result of bivariate analysis showed that there was no significant association between age with MSDs ( $p$  value=0,618). The results of this study is opposite with the result from a study conducted by Mozafari (2015) on truck drivers which found a significant association between age and MSD.[16] The theory said that age would increase the probability of ones to suffered from MSDs due to degeneration of muscle and bone tissues and also the reduction of synovial fluid resulting in reduced muscle and bone stability.[17] At the age of 60 year, muscle strength would decreased about 20%.[18] Based on the results of this study it can be seen that most respondents are not within the range of age with high risk of MSDs. In this study the respondents were mostly in the adult age (26-45 years) in which the functional muscles were still working well, and most respondents were not in a high risk range in generating MSDs.

Data analysis on respondents nutritional status had found that respondents who suffered from MSDs were mostly malnutrition(51.4%), but bivariate analysis found no significant association between nutritional status with MSDs occurrence. This is in contrast to the results of a study conducted by Viester et al. (2013) which found that BMI had a significant association with musculoskeletal disorders, particularly in lower extremities.[19] This study found that overweight workers had a higher risk of suffering musculoskeletal disorders compared to workers who had a normal nutritional status. According to Tarwaka (2004) MSDs which associated to anthropometric size is related to the ability of the skeletal structure to receive burdens of both body weight and work load.[18] MSDs that are often associated with nutritional status are often located on the knees, achilles, and legs.[20] Unsignificant association between BMI and MSDs in this study is possibly because subjects worked in sitting position, and did not have to bear body weight on the legs during work.

The result of this study also showed that respondents who suffered from MSDs were more in the group of subjects who did not exercise (55,4%). However the results of bivariate analysis showed that there was no significant association between exercise and MSDs among inter-provincial bus drivers. The results of this study contrary with the result of study conducted by Ariani (2009) which stated that workers with low physical fitness will tend to suffered from MSDs.[21] However, the results of this study are consistent with a study conducted by Nurliah

### Conclusions

The prevalence of MSDs among inter-provincial bus is 73.3% and mostly are located on lower back area. REBA measurement on work posture reveals that most bus drivers have moderate to high risk work posture. Work posture is a significant risk factor of MSDs in inter-provincial bus drivers. Ergonomic work posture urgently required to be applied among bus drivers to reduce the incidence of MSDs and to improve their quality of live.

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(2012) which stated that there was no significant association between exercise with the occurrence of MSDs. But cross-tabulation showed that subjects in both groups who exercised and did not exercise were mostly suffered from MSDs. This is probably due to the duration of static posture in a long time during work. As the theory stated by Flaspoler (2007) that static work posture will cause lack of oxygen supply to musculoskeletal tissues and cause MSDs.[8]

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