

Risk Analysis of Musculoskeletal Disorders Complaints Among Online Motorcycle Drivers

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ABSTRACT

Background: Musculoskeletal Disorders (MSDs) are disorders in muscles, tendons, ligaments, joints, peripheral nerves, and blood vessels characterized by very mild complaints to very painful complaints. MSDs are caused by several factors, including work posture, work duration, vibration, and occupational stress. Work activities in online motorcycle drivers require drivers to perform static work postures with long duration, which results in the risk of MSDs complaints. This research aims to analyze the risk of MSDs complaints in online motorcycle taxi drivers in Depok City. **Method:** The method used in this research is the analytic method with a cross-sectional approach. The population was all online motorcycle taxi drivers in Depok City, with a sample of 40 respondents using the linear time function method. The instruments of this research were the Quick Exposure Check (QEC) questionnaire to determine work posture, work duration, vibration, and occupational stress, and the GOTRAK complaint questionnaire in SNI 9011:2021 to determine the risk of musculoskeletal complaints. **Results:** The results showed that 90% of online motorcycle taxi drivers experienced MSDs complaints in the upper body, with the hand being the most complained part. A correlation test using Kendall's tau-b showed that there is a significant relationship between work duration ($p=0.048$), and occupational stress ($p=0.032$) with the risk of MSDs complaints. In contrast, work posture ($p=0.299$) and vibration ($p=0.488$) have no significant relationship with the risk of MSDs complaints. **Conclusion:** Work duration and occupational stress are related to the risk of MSDs complaints.

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Introduction

The development of informal work sectors in Indonesia has enormously impacted the national economy. The informal sector is one of the main sources of income among some workers. According to data by the Central Statistics Agency or Badan Pusat Statistik (BPS), informal sector workers in Indonesia reached 78.14 million people as of February 2021. This number has continuously grown since the Industrial Revolution 4.0, in which many human activities in the informal sector have been integrated with technology. One of them is shown by the increase in online transportation. In 2017, it was estimated that there were approximately 900,000 online *ojek* drivers in Jakarta [1]. The large number of online *ojek* drivers needs to be a common concern, especially for their occupational safety and health. The Minister of Transportation reported that in 2017 as many as 79% of online motorcycle taxi drivers experienced traffic accidents. The work activities of online motorcycle taxi drivers require workers to perform static work postures with long duration, which can result in musculoskeletal complaints, commonly known as Musculoskeletal Disorders (MSDs). MSDs are disorders in muscles, tendons, ligaments, joints, peripheral nerves, and blood vessels characterized

by very mild complaints to very painful complaints. MSDs are also known as cumulative trauma disorders and manual handling injuries. Cumulative trauma disorders are discomfort, disability, impairment, or persistent pain in muscles, joints, tendons, and other soft tissues caused by repetitive movements and postures [2]. Manual handling injuries are hazards caused by lifting, lowering, pushing, and pulling objects [3]. According to the Labour Force Survey (LFS), in 2020, as many as 470,000 workers had musculoskeletal disorders, and most of them experienced upper body and neck complaints. The Working Environment and Health study reported that the proportion of musculoskeletal pain that occurred several times a week in the general working population in Denmark increased with a percentage of 31% in 2012 to 33% in 2018 [4]. Several factors affecting musculoskeletal system disorders in the industrial sector are inadequate workplaces, repetitive activities, inappropriate work equipment design, irregular rest schedules, and unnatural work attitudes [5].

Work posture is defined as a good or neutral posture when the position of joints reaches the center of the maximum movement area or is in the middle of the full range of motion [6, 7]. Most musculoskeletal complaints are directly caused by heavy working positions such as lifting objects, pushing, pulling, bending, holding heavy loads, awkward posture, and repetitive movements [8, 9]. This heavy position requires the muscles to exert more pressure that exceeds the optimum strength. The research on motorbike riders in India showed that improper driving posture contributes to risk factors for MSDs complaints in the spine, shoulders, and arms [10]. Holding the motorcycle hand grip in a sitting position also resulted in neck and wrist complaints in riders. Another study on the weavers in Karama Village, West Sulawesi, showed a significant relationship between work posture and MSDs [11].

Generally, MSDs complaints are felt in the elbows, neck, hands, and lower body. Work duration is one of the factors that contribute to MSDs. Based on the Occupational Safety and Health Administration (OSHA), if a person performs awkward postures at work for more than two consecutive hours, the condition is considered critical when combined with other risk factors. Work performed in a sitting position for more than four consecutive hours can increase the risk of Work-Related Musculoskeletal Disorders (WRMSDs) to the back, shoulders, and neck [12]. Environmental factors such as vibration can also affect the occurrence of musculoskeletal disorders in online motorcycle drivers. Vibrations from motorcycles make online *ojek* drivers vulnerable to whole-body vibrations (WBVs) and Hand-Arm Vibrations (HAVs). WBV results from operating various equipment in manufacturing industries such as food production, mining and construction, agriculture, and general operating equipment while sitting, resting in vehicle backseats, or standing [13]. HAVs are caused by mechanical vibration or shock due to impact forces applied to the hand-arm surfaces through the entire palm or fingers. Types of machines that generate vibration are grinding machines, power tools, tamping machines, or other impact tools [13]. Considering the research in Malaysia, a study proved that HAV is a risk factor affecting the prevalence of MSDs in male traffic policemen using high-powered motorbikes [14].

One of the important causes of MSDs is psychosocial factors such as occupational stress. Occupational stress is an individual cognitive assessment that comes from work-related stressors [15]. This condition might cause a consequence of health and behavioral changes. Several factors that cause occupational stress are toxic work environments, excessive workload, lack of knowledge, extreme pressure, and low decision-making latitude [15]. In addition, occupational stress related to long work duration can cause musculoskeletal complaints, and psychosomatic problems, and weaken the immune system [16]. Previous studies proved that many professional drivers in vehicles such as buses, trucks, cars, taxis, minivans, cranes, and forklifts complain of WRMSDs caused by occupational stress [17]. It means that work-related stressors, whether psychosocial, organizational, or individual, are identified as an important risk factor for musculoskeletal disorders.

Based on a preliminary study, online motorcycle drivers in Depok City have musculoskeletal complaints in the shoulder, waist, back, and arm. Most of the driver's activities are performed with a static sitting posture during work or rest. Drivers work for more than 8 hours and rest for 3-4 hours. Drivers felt psychosocial demands coming from unsatisfactory income. Based on the descriptions

above, this quantitative study aimed to determine the risk factors affecting musculoskeletal complaints among online motorcycle drivers in Depok City.

Materials and Method

The method used in this research is the analytic method using a cross-sectional approach. The population was all online motorcycle taxi drivers in Depok City, with a sample of 40 respondents using accidental sampling. Sampling calculation was determined by using the linear time function method. The instruments used in this research were the Quick Exposure Check (QEC) questionnaire to determine work posture, work duration, vibration, and occupational stress, and the Occupational Skeletal Muscle Disorders complaint questionnaire in SNI 9011:2021 to determine the risk of musculoskeletal complaints. Data in this research were collected through interviews, observation, documentation, and literature study. The QEC result was obtained from the respondent's answers and the researcher's observation. Meanwhile, the Occupational Skeletal Muscle Disorders complaint questionnaire was obtained from the respondent's answers. The independent variables are work posture, work duration, vibration, and occupational stress, and the dependent variable is musculoskeletal disorders risk. Bivariate analysis using Kendall's tau-b test was conducted to analyze the relationship between independent variables with dependent variables. This research was declared to be ethically appropriate by the health research ethics committee with ethical clearance No. 213/EA/KEPK-FKM/2023, issued on April 27, 2023.

Results and Discussion

Results

Table 1 shows that the majority of online motorcycle drivers had work posture with investigate and change immediately category as many as 32 drivers (80%). There are 21 drivers (52.5%) that work for more than 8 hours. In the measurement of vibration, almost all online motorcycle drivers experienced high vibration exposure, namely 36 drivers (90%). The highest prevalence of occupational stress level was found in the low category of as many as 19 drivers (47.5%). The results of MSDs risk showed that 36 drivers (90%) of online motorcycle drivers complained of MSDs.

Table 1. Results of Univariate Analysis

Variables	Total (%)
Work Posture	
Investigate and change immediately	32 (80)
Investigate further and change soon	7 (17.5)
Investigate further	1 (2.5)
Work Duration	
>8 hours	21 (52.5)
≤8 hours	19 (47.5)
Vibration	
High	36 (90)
Moderate	4 (10.0)
Occupational Stress	
High	3 (7.5)
Moderate	18 (45)
Low	19 (47.5)
Musculoskeletal Disorders Risk	
Had complaint	36 (90)
No complaint	4 (10)

The prevalence of MSDs complaints information among online motorcycle drivers is shown in Table 2. Based on the body part, the highest prevalence was found in hand (70%). This was followed by the shoulder and lower back (62.5%). Table 3 shows that based on Kendall's tau-b test, the variables work duration and occupational stress obtained $p < 0.05$, whereas the variables work posture and vibration obtained $p > 0.05$. Therefore, work duration and occupational stress are significantly associated with MSDs risk.

Table 2. Prevalence of MSDs Complaints Divided by Body Parts

Body part	Prevalence (%)
Neck	60
Shoulder	62.5
Elbow	35
Upper back	50
Arm	45
Lower back	62.5
Hand	70

Table 3. Results of Bivariate Analysis

Variables	Musculoskeletal Disorders Risk (N (%))			
	Had complaint	No complaint	R	P (CI 95%)
Work Posture				
Investigate and change immediately	28 (87.5)	4 (12.5)	0.16	0.299 (0.06-0.25)
Investigate further and change soon	7 (100)	0 (0)		
Investigate further	1 (100)	0 (0)		
Work Duration				
>8 hours	17 (81)	4 (21)	0.31	0.048 (0.17-0.43)
≤8 hours	19 (100)	0 (0)		
Vibration				
High	32 (88.9)	4 (11.1)	0.11	0.488 (0.03-0.26)
Moderate	4 (100)	0 (0)		
Occupational Stress				
High	2 (66.7)	1 (33.3)	0.33	0.032 (0.23-0.54)
Moderate	15 (83.3)	3 (16.7)		
Low	19 (100)	0 (0)		

Discussion

The work posture is a body posture carried out when doing work, which includes the body's position from the upper body to the lower body [18]. Work posture is one of the physical factors that can cause musculoskeletal disorders due to excessive pressure received by the muscles, tendons, and ligaments around the joints when the body performs awkward postures or static positions for a long time.

Static positions such as prolonged sitting will result in fatigue and subjective complaints in the neck, shoulders, back, hands, waist, and legs. According to the measurement of work posture in this research, the work posture of online motorcycle drivers is in the high category, which needs to be investigated and changed immediately (80%). This happens because of the influence of various exposure scores across several factors. For instance, most online motorcycle drivers obtained high exposure scores in back and neck posture, while shoulder/arm and wrist posture obtained moderate exposure scores. This research shows that the work posture did not correlate with MSDs risk with a p-value of $0.299 > 0.05$. This finding was supported by research on online *ojek* drivers in Palembang City. The study shows that the sitting position has no significant relationship with low back pain among online *ojek* drivers [19].

The similarities in these two researches are caused by other factors affecting the results of work posture measurements. Measurement of sitting position among drivers in Palembang City is influenced by the long duration in a sitting position while working, while the measurement of work posture in this research is influenced by the combination of several factors, including posture in certain parts of the body and exposure to driving, vibration, work pace, and stress. In contrast, the study of female online *ojek* drivers in Medan City has different results. The study proves that the less ergonomic the driver's work posture, the more MSDs complaints felt by drivers [20]. These two studies differed due to differences in measurement methods and body parts analyzed. The previous study used Rapid Entire Body Assessment (REBA) to assess the neck, back, arm, wrist, and feet. Meanwhile, the method used in this research was the QEC to determine the back, shoulder/arm, wrist, and neck posture.

Based on the results of observations and analysis in this research, most work postures in online motorcycle drivers are in the almost neutral position or there is no bending/twisting more than 20° in the back, the shoulder/arm position is around the waist with infrequent movements, the wrist is almost in a straight position but occasional bending movements when turning the motorbike, the neck is in a straight position parallel to the body most of the time yet with occasional bending while the drivers are looking at their cellphone.

In the present study, drivers who work for more than 8 hours (52.5%) are greater than drivers who work for less than or equal to 8 hours. The longer duration of sitting position performed by online motorcycle drivers causes more workload received by lumbar part. As a consequence, if the workload exceeds the body's work, it can lead to the conditions that are a factor in causing low back pain, namely disc herniation [21]. A significant relationship between work duration with MSDs risk among online motorcycle drivers was obtained with a p-value of $0.048 < 0.05$. This result aligned with a previous study of online *ojek* motor-riders in Denpasar City. There is a positive relationship between driving duration with non-specific low back pain complaints [22]. Some muscles have poor endurance when involved in prolonged conditions. Muscles such as the erector spine, internal oblique, and transversus abdominus muscles will tire easily since they have poor endurance. Besides, other muscles also show discomfort as early as 20 to 30 minutes while working in a sitting position [22]. MSDs complaints in the lower back of online motorcycle drivers in this research may be influenced by static positions that are carried out for a long duration so that the back muscles hold the load for too long.

This research indicates that nearly all online motorcycle drivers (90%) experienced high exposure to vibration. This high-vibration exposure can be a risk factor for the onset of musculoskeletal complaints, especially Low Back Pain (LBP) [32]. This type of mechanical vibration transmitted throughout the body is known as whole-body vibration (WBV). Exposure to WBV comes from the use of machinery and vehicles in industry, agriculture, and public facilities. The impact of vibration exposure from vehicle use can risk LBP, intervertebral disc herniation, and degeneration of the spine in drivers [23]. The results in this research are obtained from the driver's perception about how long drivers are exposed to vibrations produced by motorcycles, where most online motorcycle drivers use motorcycles for more than 4 hours per day. However, the results of this study are not in accordance with previous research showing the results of 'low' category exposure among motorcycle riders in India [24]. The difference between this two research is influenced by the assessment conducted to determine the type and specifications of the vehicle among motorcycle riders in India. Vehicles with proper use of front suspension and wheel dimensions make vibration exposure low. Suspension on motorcycles is useful for smoothing vehicle handling and braking systems to provide driver safety from vibrations and bumps in the road [24, 25, 33].

Kendall's tau-b test in this research shows that vibration did not correlate with MSDs risk where the p-value reached $0.488 > 0.05$. The results in this study are not in accordance with previous research showing a relationship between whole body vibration (WBV) and the incidence of low back pain (LBP) among online motorcycle drivers in Jakarta City [23]. This happens due to the measurement of work-related factors considered a risk of LBP, including duration, intensity, and working time. The measurement of WBV in online motorcycle drivers in Jakarta City was based on vibration intensity. The duration of vibration could not be measured accurately because the duration differs every day depending on the circumstances and the number of customers obtained [23]. The impact of WBV is influenced by duration and intensity [23]. The absence of a relationship between vibration and MSDs complaints in this research is due to differences in measurement methods. Vibration measurement is only based on the perception and memory of the driver regarding the duration of how long the driver is exposed to vibration. Vibration exposure in online motorcycle taxi drivers does not occur continuously but is interspersed with pauses during certain activities, such as waiting for customers or orders. In addition, neither measurement nor assessment of the type and specifications of the vehicle used among drivers can also affect the study results.

Based on the result, occupational stress levels among online motorcycle drivers were in the low category (47,5%) and moderate category (45%). The measurement of occupational stress is based on the driver's perception of stress caused by overall work factors. A previous study of motorbike

riders in India is in line with the results of this research, where the stress was found to be primarily low for all motorbikes [24]. Furthermore, another study has found that work organization, communication, and financial resources are related to occupational stress [26]. Based on the interview results, financial factors such as income per day might be contributing to the occupational stress of online motorcycle drivers. The driver's perception of job targets can lead to high psychological demands, which also cause high strain at work. This condition of high strain can result in the risk of MSDs complaints in the lower back, shoulders, and neck [27].

The correlation test using Kendall's tau-b test shows that occupational stress is significantly associated with MSDs risk in online motorcycle drivers with a p-value of $0.032 < 0.05$. Musculoskeletal complaints can result from a combination of physical workload, especially poor work posture with psychological stress [9]. Previous research supported strong evidence that job stress is significantly associated with work-related musculoskeletal disorders (WMSDs) among commercial minibuss drivers [28, 29]. High work pace/pressure, constrained and awkward posture, and work strain were the factors causing cumulative effects of job stress. In contrast, this research has different results from previous research on taxi drivers. There is no relationship between stress with neck and shoulder pain among taxi drivers [30]. The different methods used in these two researches might affect the result. The survey from the International Stress Management Association with 25 questions, was used to determine the stress of taxi drivers so that the measurement could be more detailed. Some factors that may affect the absence of a relationship between the variables were sitting position for a long duration, type of vehicle, type of wheel, and other activities performed by the driver [30-32]. In this research on online motorcycle drivers in Depok City, it can be concluded that occupational stress might be influenced by static work postures over a long duration. Although there is a relationship between occupational stress and MSDs complaints, an in-depth and detailed assessment is needed to determine the level of occupational stress precisely.

Conclusion

Based on this finding, it can be concluded that work posture, work duration, vibration, and occupational stress were important risk factors for MSDs among online motorcycle drivers, especially work duration and occupational stress which has a relationship to the risk of MSDs. The work posture of online motorcycle drivers in Depok City needs to be investigated and changed immediately. In addition, there is a relationship between work duration and occupational stress with the risk of MSDs. Meanwhile, there is no significant relationship between work posture and vibration with the risk of MSDs. To reduce the risk of MSDs, the researcher suggests that it is recommended for online motorcycle drivers to apply ergonomic work postures when riding motorcycles.

Declaration

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