Jurnal Berkala Kesehatan

Journal Home Page:
https://ppjp.ulm.ac.id/journal/index.php/berkala-kesehatan

Vol. 12 No.1
DOI: 10.20527/jbk.v12i1.25580
ISSN: 2477-3190 | e-ISSN: 2541-6472

Original Research Article

Low Back Pain among Online Motorcycle Taxi Drivers: Review of Posture, Work Duration, Fatigue, Driver Characteristics

ABSTRACT

Low back pain (LBP) is a common musculoskeletal disorder among online motorcycle taxi drivers, often caused by prolonged working hours, static sitting posture, and high levels of work fatigue. This condition affects the lower back region, involving muscles and nerves, and may radiate to the lower extremities. This study aimed to analyze working posture, work duration, driver characteristics and fatigue level with LBP complaints among drivers in the Tembalang area. A cross-sectional study was conducted in October 2025 involving 64 respondents selected using a linear time function sampling method. Data were collected through structured interviews using questionnaires, the BRIEF Survey to assess trunk posture, and the Visual Analogue Scale (VAS) to measure pain intensity, supported by photographic documentation. Data were analyzed using Chi-square tests (95% confidence level). The results showed that 56.3% of respondents experienced high-intensity LBP. Age (p=0.039), work duration (p=0.038), and fatigue (p=0.009) were significantly associated with LBP, while smoking, trauma history, and posture were not. In conclusion, age, prolonged work duration, and fatigue are key factors influencing LBP among drivers. Preventive efforts should focus on work regulation, fatigue management, and active rest strategies

©2026 Jurnal Berkala Kesehatan. Published by Universitas Lambung Mangkurat

Ummi Lailatul Maghfiroh[1*)], Ekawati[2], Ida Wahyuni[2]

[1] Occupational Safety and Health, Faculty of Public Health, Diponegoro University
[2] Section Occupational Safety and Health, Faculty of Public Health, Diponegoro University

Correspondent Email:
ummilailatul.osh25@gmail.com

Article Info

Submitted	:	03 April 2026
In reviewed	:	04 April 2026
Accepted	:	26 May 2026
Available Online	:	23 July 2026

Keywords:
Low Back Pain;
Working Posture;
Work Duration;
Fatigue;
Online Motorcycle Taxi Drivers

How to Cite:
Maghfiroh UL, Ekawati, Wahyuni I. Low Back Pain among Online Motorcycle Taxi Drivers: Review of Posture, Work Duration, Fatigue, Driver Characteristics. Jurnal Berkala Kesehatan. 2026;12(1):45-52.

INTRODUCTION

Motorcycle taxi transportation *online* is a motorcycle-based service that has evolved along with technological advancements. The service utilizes smartphone-based applications, allowing users to place orders conveniently. In addition to functioning as a means of transportation for passengers and goods, motorcycle taxis *online* It is also used for a variety of other purposes, such as purchasing goods and ordering food[1]. Presence of motorcycle taxis *online* aims to facilitate the community to carry out daily activities with the support of technology that continues to develop and can be used for 24 hours. Although it provides convenient access and economic opportunities, working as an online motorcycle taxi driver is associated with a relatively high risk of occupational health problems[2].

Citing Law No. 23 of 1992 concerning Health, workplaces are obliged to strive to maintain occupational health so that workers, their families, the community, and the surrounding environment remain safe. A mismatch between job demands and one's performance at work can lead to musculoskeletal disorders. One of the work-related diseases that is often a complaint in the transportation sector is musculoskeletal disorders are low back pain[3].

Low back pain is a common occupational health problem in workers with long periods of static sitting and repeated exposure to physical workloads. According to the data *World Health Organization* (WHO) states that low back pain is around 33% of the population in developing countries with persistent pain[4]. Data from *Centers for Disease Control and Prevention* (CDC) in 2019 showed that the incidence of back pain in adults in the United States generally increases with age. In the age group of 18-29 years, as many as 28.4% of individuals experience back pain, while in the age group of 30-44 years, this figure increases to 35.2%. This percentage continues to increase in the 45-64 age group, reaching 44.3%, and reaching the highest figure of 45.6% in individuals aged 65 years and above[5]. Many risk factors can affect low back pain in workers, such as excessive workload, static posture when sitting, long working duration, and frequency or repetition of movements. Workers who engage in unergonomic postures will experience discomfort due to prolonged muscle tension. In addition to ergonomic factors, there are several other aspects that can contribute to the onset of low back pain, such as age, length of working life, lifestyle, and posture that is not ideal at work[6].

An imideal posture for a driver is done in a sitting position on a vehicle that is relatively long with heavy driving pressure. Improper sitting posture during motorcycle driving can lead to excessive muscle contraction[7]. The muscles in the back area work harder to adjust the position of the body as well as support the weight from the movement of the upper limbs[8]. As a result, the waist area that serves as the main support can experience fatigue, increasing the risk of cramps and pain in the lower back. Fatigue resulting from excessive muscle use over a long period of time can exacerbate this problem, leading to decreased muscle flexibility and disorders of the overall skeletal system[9].

Online motorcycle taxi drivers are a profession that is prone to lower back pain complaints due to a high workload when riding a motorcycle, as well as static work positions for a long duration while working. When the occurrence of pain is left persistent, it will be very sensitive to muscle tension which makes it worse. The back muscles will have spasms because the oxygen supply in the bloodstream to the muscles becomes reduced. Based on the results of a preliminary study of 9 online motorcycle taxi drivers in the Tembalang area, most of the drivers work for a long duration of up to 12 hours per day. This condition is related to complaints of fatigue and lower back pain, 77.8% admitted that they often felt pain in the lower back and felt that it was very disruptive to work. Therefore, the purpose of this study is to analyze the relationship between posture, work duration, driver characteristics and fatigue level to lower back pain complaints in online motorcycle taxis in the Tembalang area.

This study was conducted in the Tembalang area, Semarang City, which represents a major educational and economic center characterized by high population mobility, supported by the presence of Diponegoro University as a large higher education institution. The high level of mobility in this area has led to an increased demand for app-based transportation services, including online motorcycle taxis, resulting in a high number of drivers and elevated work intensity. Consequently, drivers in this area are exposed to various occupational risk factors, such as prolonged working hours, high trip frequency, and sustained static sitting postures. In addition, the geographical characteristics of Tembalang, including its hilly terrain and traffic congestion during peak hours, contribute to increased physical workload and biomechanical stress on the musculoskeletal system, particularly in the lumbar region. Despite these conditions, studies specifically examining risk factors for low back pain among online motorcycle taxi drivers in this area remain limited. Therefore, this study is necessary to provide scientific evidence regarding occupational health conditions and to support the development of preventive and promotive strategies for musculoskeletal disorders in high-mobility settings.

METHODS

This research is a quantitative research with *a cross-sectional approach*. The study population consisted of all online motorcycle taxi drivers operating in the Tembalang area of Semarang with a total of 64 drivers sampled based on the *linear time function sample formula*. The inclusion criteria are drivers who have been actively working in the Tembalang area and are male drivers with a minimum working experience of three months, and are willing to fill out a complete questionnaire. The exclusion criteria are female drivers because there are physiological factors that affect low back pain, drivers who have severe or chronic spinal diseases (e.g. *hernia nucleus pulposus*, severe scoliosis, severe osteoporosis) and drivers who fill out incomplete questionnaires.

The research instruments were a questionnaire conducted by an interview process, using *a BRIEF Survey* to measure back work posture, a VAS (*Visual analogue scale*) sheet to describe pain complaints subjectively, a *Subjective Self Rating Test questionnaire sheet* from *the Industrial Fatigue Research Committee* (IFRC) and photos of posture while driving. The data analysis used in this study is a *Chi-square statistical test* to measure the relationship between causative factors and the

DOI: 10.20527/jbk.v12i1.25580 2026; 12(1): 44-51

incidence of low back pain. If cells with an expected value of less than five are found, then analysis adjustments are made. Statistical testing was carried out at a significance level of 95% (α = 0.05). This research has obtained **research ethics approval** from the Faculty of Public Health, Diponegoro University with the number 350/EA/KEPK-FKM/2025

RESULT AND DISCUSSION

Table 1. Variable Frequency Distribution

Variable	Frequency (n)	Percentage (%)
Age		
Young Age (≤35 years)	41	64,1
Old Age (>35 years)	23	35,9
Smoking Habits		
No Smoking	13	20,3
Light Smokers	22	34,4
Moderate Smoker	27	42,2
Heavy Smokers	2	3,1
History of Bone Trauma		
Never Hurt	60	93,8
Have Been Injured	4	6,2
Work Posture		
Medium Risk	22	34,4
High Risk	42	65,6
Duration of Work		
Normal (≤8 hours)	13	20,3
Abnormal (>8 hours)	51	79,7
Work Fatigue Levels		
Low	24	37,5
Medium	37	57,8
High	3	4,7
Lower Back Pain Complaints		
Low Pain	28	43,7
High Pain	36	56,3
Total	**64**	**100**

Based on table 1, it was found that most of the respondents were in the age group of ≤35 years old (64.1%), which reflects that the job as a motorcycle taxi driver *online* dominated by productive age with high demands on work activities. Based on smoking habits, the largest proportion is found in the category of moderate smokers (42.2%), which has the potential to contribute to a decrease in physical health conditions. The majority of respondents had no history of bone trauma (93.8%), so complaints of low back pain experienced tended to be more influenced by occupational factors than previous injury factors. Judging from the work posture, most drivers fall into the category of high-risk work postures (65.6%), which indicates exposure to ergonomic risks during driving activities. In addition, abnormal working duration or working more than 8 hours per day was the most dominant condition (79.7%), which indicated a high daily workload and had the potential to increase work fatigue. Related to the level of work fatigue, most respondents were at a moderate level (57.8%) and the incidence of low back pain complaints in motorcycle taxi drivers *online* in the Tembalang area, most of them felt high pain (56.3%).

Table 2. Test Results of Independent Variables (X) and Bound Variables (Y)

Variable	Lower Back Pain Complaints				Total		p-value
	Low Pain		High Pain				
	f	%	f	%	n	%	
Age							
Young Age	14	34,1	27	65,9	41	100,0	**0.039**
Old Age	14	60,9	9	39,1	23	100,0	
Smoking Habits							
No Smokers	5	38,5	8	61,5	13	100,0	

Variable	Lower Back Pain Complaints				Total		p-value
	Low Pain		High Pain				
	f	%	f	%	n	%	
Light Smokers	10	45,5	12	54,5	22	100,0	**0.976**
Moderate Smoker	12	44,4	15	55,6	27	100,0	
Heavy Smokers	1	50,0	1	50,0	2	100,0	
History of Bone Trauma							
Never	26	43,3	34	56,7	60	100,0	**0.795**
Have Been Injured	2	50,0	2	50,0	4	100,0	
Work posture							
Medium Risk	12	54,5	10	45,5	22	100,0	**0,208**
High Risk	16	38,1	26	61,9	42	100,0	
Duration of Work							
Normal	9	69,2	4	30,8	13	100,0	**0,038**
Abnormal	19	37,3	32	62,7	51	100,0	
Work Fatigue Levels							
Low	16	66,7	8	33,3	24	100,0	
Medium	12	32,4	25	67,6	37	100,0	**0,009**
High	0	0,0	3	100,0	3	100,0	

Based on table 2 test results *Chi-Square* Age variable with a value *p-value* 0.039, working duration *p-value* 0.038, and the level of work fatigue has a value of *p-value* of 0.009 indicates that there is a statistically significant relationship, so that These factors are thought to contribute to the emergence of low back pain complaints. Meanwhile, smoking habits, history of bone trauma, and work posture did not show a significant association in the study.

Age with Low Back Pain Complaints

As we age, the bone structure and joints in the lower back area undergo physiological changes. Bone density naturally decreases in line with the aging process, which also affects the body's ability to regenerate or form new bones. Entering the age of about 30 years, the process of bone compaction begins to decline and is followed by degeneration in the form of tissue damage and decreased fluid levels in bones and joints. This condition causes reduced bone and muscle stability, increasing the risk of low back pain. The information in the table in this study, the age of the respondents was grouped into two, namely under the age of up to 35 years (64.1%) including young age and (35.9%) the other respondents were over 35 years old which was included in the old age.

Based on the results of statistical tests using the *Chi-Square* obtained *p-value* = 0,039 ($p < 0.05$), so it can be concluded that there is a significant relationship between age and lower back pain complaints felt by motorcycle taxi drivers *online* in the Tembalang area. This condition may occur because online motorcycle taxi drivers in the younger age group tend to have longer working durations and higher work intensity compared to older age groups. Prolonged working hours require drivers to maintain a static sitting posture for extended periods, which increases pressure on the lumbar spine and may lead to low back pain complaints. In addition, non ergonomic working postures while riding, such as a slouched sitting position or inadequate back support, can further increase the load on muscles and spinal structures. Furthermore, younger drivers generally exhibit higher work mobility and more frequent trips, which contribute to increased mechanical load on the musculoskeletal system. These conditions may result in back muscle fatigue and consequently elevate the risk of low back pain among younger drivers. These results are in accordance with the research of Ariani L, et al. (2023) who conducted research on motorcycle taxi drivers *online* with results Statistical tests *Chi-Square* between the age variable and the NPB complaint showed a p value of 0.000 ($p<0.05$) which means that there is a significant relationship between age and motorcycle taxi drivers *online* in Palembang City.[10]

In the age group of ≥35 years, degenerative changes in the musculoskeletal system begin, including a decrease in the elasticity and strength of the paraspinal muscles, reduced lumbar segment stability, and degeneration of the intervertebral discs, resulting in a decrease in the body's ability to maintain a static sitting posture for a long time. This condition is aggravated by the accumulation of exposure to occupational risk factors in motorcycle taxi drivers *online*, such as long working duration and high levels of work fatigue, which simultaneously increase the mechanical load on the lumbar region. Therefore, the older the driver, the higher the susceptibility to lower back pain complaints.

Smoking Habits with Lower Back Pain Complaints

Smoking habits of motorcycle taxi drivers *online* It is a habit that has been done for a long time.

Cigarettes are considered to relieve stress and boredom when waiting for orders. While in fact, the components of cigarette content are very dangerous for blood circulation in the body. Chemical components in cigarettes such as nicotine and carbon monoxide will accumulate in the body resulting in inhibited transport of oxygen and nutrients to the muscles. This condition for a long time as a result of which the tissues and discs of the body will experience ischemic which causes injury and pain[11]. In this study, the smoking habits obtained by the respondents were different, namely respondents were categorized as non-smokers (20.3%), light smokers (34.4%), moderate smokers (42.2%) and those who were included in the category of very small heavy smokers (3.1%).

Based on the results of statistical tests using the *Chi-Square* obtained *p-value* = **0,976** (p > 0.05). So it can be concluded that there is no significant relationship between smoking habits and complaints of low back pain in motorcycle taxi drivers *online* in the Tembalang area. Based on the same results, from the research of Ariani, L et al. (2023) which showed that between smoking habits and low back pain in motorcycle taxis *online* in Palembang City there was no significant relationship in the last few months with the results The p value is 0.528[10].

The results of this study are not in line with the research conducted by Sunardi (2021) from Test *Chi-square* show *p-value* = 0.003 so it is concluded that there is a relationship between smoking habits and complaints *musculoskeletal disorders* (MsDs) on motorcycle taxi drivers *online* in Kendari City, especially pain that is felt very often in the lower back pain. This difference is likely influenced by the smoking intensity of the respondents in this study tending to be lower, so nicotine exposure has not sufficiently produced physiological changes that contribute to musculoskeletal disorders[12]. In addition, the work pattern of motorcycle taxi drivers *online* which is more dynamic with a break between trips, not sitting static for a long time and high consumption of drinking water is the effect of cigarettes does not seem dominant.

History of Bone Trauma with Lower Back Pain Complaints.

A person who has a history of trauma to the lower back area is known to have a higher risk of developing musculoskeletal complaints later in life. Previous injuries, such as impacts, falls, or traffic accidents, can cause spinal segment instability, disorders in soft tissues (muscles, ligaments, and tendons), as well as biomechanical changes in the lumbar region. This condition can reduce the ability of tissues to withstand weight and maintain optimal posture, so that individuals with a history of bone trauma are more susceptible to experiencing low back pain, especially when exposed to work activities with static loads. In this study, the category of history of bone trauma was categorized into two, namely respondents who had never experienced an injury (93.8%) and respondents who had experienced a very small injury (6.2%).

Based on the results of statistical tests using the *Chi-Square* obtained *p-value* = 0,795 (p > 0.05), so it can be concluded that there is no significant relationship between the history of bone trauma and complaints of low back pain in motorcycle taxi drivers *online* in the Tembalang area. The results of this study can be influenced because of the 60 respondents who did not experience a history of trauma or injury due to a back accident were fewer than those who had a history of trauma, while the remaining four respondents had experienced only minor injuries in the past.

Work Posture with Low Back Pain Complaints

A work posture that is not in accordance with ergonomics can increase the pressure on muscles and joints. If a person continuously maintains the same position for a long enough time, the muscle will undergo isometric contraction, which means the muscle contracts without any change in the length of the muscle fibers. A high risk of muscle load can arise as a result of poor working posture performed for long periods of time without rest time. This situation is often experienced by motorcycle taxi drivers *online* who tend to ignore working time and can survive driving distance and continuously for a sufficient amount of time until finally stop looking for customers. Increased load on the back muscles resulting from a prolonged and ergonomic sitting position can inhibit the flow of oxygen to muscle tissue due to the pressure on blood vessels[12].

The results of the research produced through Test *Chi-Square* Obtained Scores *p-value* = 0,208 (p > 0.05), so that it can be concluded that no there is a significant relationship between the posture and complaints of low back pain in motorcycle taxi drivers *online* in the Tembalang area. This result can be influenced by various factors, especially the driver's age, the duration of working hours, and how far the driver rides the motorcycle every day. Although the results of the statistical test found that there was no significant relationship between work posture and lower back pain complaints, from cross-tabulation, it can be seen that of the 64 respondents who had There are 65.6% of motorcycle taxi drivers *online* who have a posture is at high risk of developing low back pain. These findings are consistent with a study conducted by Susanty Dewi Winata et al. among online motorcycle taxi drivers

in West Jakarta in 2021, which reported no significant association between riding posture and musculoskeletal complaints, with a p-value of 0.682 ($p > 0.05$)[13]. Furthermore, a study conducted by Hafidzah et al. among motorcycle taxi drivers in Malang City in 2024 demonstrated similar results, where statistical analysis yielded a p-value of 0.342 ($p > 0.05$), indicating no significant relationship between riding posture and musculoskeletal disorders (MSDs) among drivers.[14]

Duration of Work with Low Back Pain Complaints

Working for a long time in one particular type of job without paying attention to ergonomic aspects can increase the risk of problems with the muscular and bone system, especially if a person performs similar actions several times. This condition makes a person more susceptible to injury due to repetitive movements, which are pain that appears in muscles, bones, and tendons. In this study, the duration of work is grouped into two, namely normal working hours less than 8 hours while working respondents (20.3%) and working hours of more than 8 hours were included in the abnormal category of respondents (79.7%). If abnormal working hours are left untreated, it can cause difficulties in completing work tasks, increase fatigue and increase the risk of serious injuries to skeletal muscles.

Based on the results of statistical tests using the *Chi-Square* obtained *p-value* = 0,038 ($p < 0.05$), so it can be concluded that There is a significant l relationship between the duration of work and complaints of low back pain in motorcycle taxi drivers *online* in the Tembalang area. This condition may occur because prolonged working hours require drivers to maintain a static sitting position while riding for extended periods, thereby increasing pressure on the lumbar spine as well as the load on the back muscles. In addition, in this study, the majority of respondents were in the younger age group, who are physically more capable of working for longer durations[15]. As a result, they tend to have longer working hours and higher work intensity in order to achieve a greater number of orders.These results are in accordance with research conducted by Syaiq Ibnu (2023) on motorcycle taxi drivers *online* motorcycle in Makassar City, the results of the study show that most motorcycle taxi drivers *online* from the results of statistical tests *Pearson Correlation* Obtained Scores *p-value* by 0.048 ($p < 0.05$), which indicates that there is a significant relationship between the length of working time per day and lower back pain complaints in motorcycle taxi drivers *online*[16].

The long duration of work causes the muscles that support the spine to experience constant static contraction so that muscle blood flow is reduced and there is an accumulation of metabolites that trigger pain. In addition, motorcycle taxi drivers *online* With long working hours, they tend to have limited rest time as well as frequency *Active Break* low, so the muscle recovery process does not take place optimally.

Levels of Work Fatigue with Lower Back Pain Complaints

Symptoms of fatigue that often appeared in this study included easy thirst, excessive sleepiness, headache or heaviness in the head, shoulder and back muscle pain, and decreased concentration and motivation. This study produced variations in respondent results in the low category (37.5%), moderate category fatigue (57.8%) and severe category fatigue (4.7%). Work fatigue that is at a moderate to high level in motorcycle taxi drivers *online* showed a significant contribution to the increased incidence of low back pain.

Based on the results of statistical tests using the *Chi-Square* obtained *p-value* = 0,009 ($p < 0.05$), so it can be concluded that there is a significant relationship between the level of work fatigue and complaints of low back pain in motorcycle taxi drivers *online* in the Tembalang area. The results of this study are in line with the findings of Surani et, al. (2022) which states that there is a level of relationship between fatigue and skeletal muscle pain complaints in motorcycle taxi workers *online*, because work fatigue is a risk factor for bone pain. It is defined because it relates to the characteristics of work performed in a sitting position for a long duration.[17]

Physiologically, fatigue leads to a decrease in the function of the core supporting muscles (*Core Stabilizers*) which plays a role in maintaining the stability of the lumbar segment. When these muscles are not able to work optimally, the mechanical load on the spine increases and the posture becomes less stable, so the pressure on the intervertebral discs, ligaments, and soft tissues in the lower back area increases. In addition, the job characteristics of motorcycle taxi drivers *online* which demands a static sitting position for a long time, a high frequency of daily travel, and a lack of rest time are sources of fatigue that trigger chronic muscle tension.[17,18]

Based on the results of the study, online motorcycle taxi drivers are advised to implement better work time management to reduce the risk of low back pain complaints, especially by limiting the duration of continuous driving and providing adequate recovery time. Drivers are encouraged to take a break of at least 30 minutes after driving for 3–4 hours and apply *active breaks* in the form of stretches and light movements that focus on the spine, shoulders, waist to reduce muscle tension and

accumulated fatigue. In addition, the adjustment of the driving position and the ergonomic setting of the vehicle need to be considered so that the driving posture becomes more comfortable and stable, so that it can reduce biomechanical pressure on the lumbar segment.[19,20]

CONCLUSION

This study demonstrated that low back pain among online motorcycle taxi drivers is primarily associated with age, prolonged working duration, and work-related fatigue. A continuous workload without adequate recovery time plays a role in increasing biomechanical pressure on the lower spine, thus triggering the appearance of pain complaints. Based on the findings of this study, it can be concluded that low back pain among online motorcycle taxi drivers in the Tembalang area is influenced by several factors, particularly age, working duration, and work fatigue level. Younger drivers tend to have higher work intensity and longer working hours, which increase exposure to prolonged static sitting positions and repetitive workloads. These conditions contribute to increased muscle fatigue and greater pressure on the lumbar spine, ultimately leading to low back pain complaints.

AUTHOR'S CONTRIBUTION STATEMENT

UM contributed to the study conceptualization, research design, data collection, data processing, statistical analysis, interpretation of findings, and preparation of the original manuscript draft. The EW and IW contributed to methodological guidance, validation of the research process, critical review of the results, manuscript revision, and overall supervision of the study. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest related to the publication of this manuscript. The authors have no financial, professional, or personal relationships that could have influenced the study design, data collection, analysis, interpretation of results, or the decision to publish this work.

REFERENCE

1. Anindhita W, Arisanty M, Rahmawati D. Analisis penerapan teknologi komunikasi tepat guna pada bisnis transportasi online. Indocompac. 2016;2:712–29.
2. Tampubolon L. Pengaruh fasilitas, kualitas pelayanan dan kepercayaan terhadap kepuasan pelanggan pengguna jasa Maxim di Kota Batam [Skripsi]. Batam: Universitas Putera Batam; 2021.
3. Aprianto B, Hidayatulloh AF, Zuchri FN, Seviana I, Amalia R. Faktor Risiko Penyebab Musculoskeletal Disorders (MSDs) Pada Pekerja: A Systematic Review. J Kesehat Tambusai. 2021;2(2):16–25.
4. Anggraika P, Apriany A PD. Hubungan Posisi Duduk Dengan Kejadian Low Back Pain (Lbp) Pada Pegawai Stikes. J 'Aisyiyah Med. 2019;4(1):1–10.
5. Centers for Disease Control and Prevention (CDC). Back, lower limb, and upper limb pain among U.S. adults, 2019. NCHS Data Brief No. 415 [Internet]. Hyattsville, MD: National Center for Health Statistics. 2019. Available from: https://www.cdc.gov/nchs/data/databriefs/db415-H.pdf
6. Nurdiawati E, Daningrum D, Lestari GT. Hubungan Masa Kerja, Lama Kerja, dan Postur Kerja Duduk dengan Keluhan Low Back Pain pada Pengemudi Bus. J Public Heal Matters. 2024;1(1):20–8.
7. Sekkay F, Imbeau D, Chinniah Y, Dubé PA, de Marcellis-Warin N, Beauregard N, et al. Risk factors associated with self-reported musculoskeletal pain among short and long distance industrial gas delivery truck drivers. Appl Ergon. 2018;72(May):69–87.
8. Feriyanti D, Purnawan A, Purnama F. Hubungan Umur, Lama Berkendara Dan Posisi Duduk Dengan Keluhan Nyeri Punggung Bawah Pada Pengendara Ojek Online Di Wilayah Kecamatan Pamulang. Fram Heal J Vol. 2022;1(2).
9. Afif N, Jayanti S, Wahyuni I. Hubungan Postur Kerja, Durasi Mengemudi Dengan Keluhan Nyeri Punggung Bawah (NPB) Pada Sopir Truk Barang Antar Kota Di CV Semeru Putra Semarang. J Kesehat Masy [Internet]. 2021;9(1):65–71.
10. Ariani L, Indriyani Y, Ernia R, Purnamasari S. The correlations of age and length of work with low back pain complaints in online motorcycle taxi drivers in Palembang. J Indones Public Heal. 2023;18(2):9–13.

11. Rahmani N, Kubillawati S. Dan Kebiasaan Merokok Dengan Keluhan Low Back Pain (Lbp) Pada Pengemudi Bus Differences of Driving Duration , Body Posture and Smoking Habits With Low Back Pain (Lbp) Complaints on Bus Drivers. J Ilm Kesehat dan Kebidanan. 2021;11(2):143–54.
12. Sunardi, Wati A, Alchamdani, Ayathollah A. Faktor yang Berhubungan dengan Keluhan Musculoskeletal Disorders (MSDs) pada Pengendara Ojek Online. J Penelit Kesehat Suara Forikes. 2021;12(November):155–9.
13. Winata S, Mariyamah T, Satyadi E, Hersamsi G, Purnamawati P. Corelation Between Driving Position and Other Factor to Musculoskeletal Complaints with Reba in Online Taxibike Drivers in West Jakarta 2021. J MedScientiae. 2023;2(3):283–9.
14. Hafizhah N, Fanani E. Analisis masa kerja, posisi kerja dan keluhan musculoskeletal disorders pada driver ojek di Kota Malang. Sport Sci Heal. 2024;6(3):278–292.
15. Dwiseli F, Rahmadani Y, Syafitri N, Hairuddin. Hubungan Kelelahan Kerja Dengan Keluhan Musculoskeletal Disorders Pada Pengemudi Bus Terminal Regional Daya. J Kesehat Akper Kesdam II Sriwij Palembang [Internet]. 2023;12(3):1–8. Available from: http://publications.lib.chalmers.se/records/fulltext/245180/245180.pdf%0Ahttps://hdl.handle.net/20.500.12380/245180%0Ahttp://dx.doi.org/10.1016/j.jsames.2011.03.003%0Ahttps://doi.org/10.1016/j.gr.2017.08.001%0Ahttp://dx.doi.org/10.1016/j.precamres.2014.12
16. Batutah SI, Mulyadi S. Risk Factors Analysis Of Low Back Pain Motorcycle Online Ojek Drivers in The City Of Makassar. J SILOLIPU Commun Media Acad Community Soc. 2023;23(2):297–302.
17. Surani A, Faidlullah H. Hubungan Tingkat Kelelahan Terhadap Keluhan Work-Related Musculoskeletal Disorders (Wmsds) Pada Ojek Online Di Yogyakarta. Repos Univ 'Aisyiyah Yogyakarta; 2022.
18. Haqi DN, Dwiyanti E. Perumal V. Haidar M, Rosydah A, Sahri M. Analysis of Individual and Biomechanical Risk Factors Associated with Musculoskeletal Disorders in Online Motorcycle Taxi Drivers. Knowledge Dynamics Journal 2025;2(8):323–332.
19. Tanjung JR, Tan WPP, Santosa M. Driving and Back Pain among Online Motorcyclist Transportation in Jakarta. Journal of Urban Health Research. 2024;2(3):9–17.
20. Pratiwi AS, Widjasena B, Jayanti S. Risk Analysis of Musculoskeletal Disorders Complaints Among Online Motorcycle Drivers. Disease Prevention and Public Health Journal. 2024;18(1):34–40.