

Self-Reported Work-Related Musculoskeletal Problems and Associated Risk Factors Among Three-Wheel Car Drivers in Ethiopia: A Cross-Sectional Community-Based Study

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Background: Globally, the demand for mobility is increasing. Three-wheel cars are one of the best options for meeting this demand and creating new job opportunities in most developing countries, including Ethiopia. Drivers are highly susceptible to developing musculoskeletal disorders (MSDs). Even though several studies on other groups of drivers have been conducted, little is done in Ethiopia among three-wheel car drivers.

Objective: This study investigated the prevalence of MSDs and identified their associated risk factors among three-wheel car drivers in Ethiopia.

Methods: A community-based cross-sectional research was conducted among drivers of three-wheel cars from August 05 to October 07, 2022. A stratified sampling followed by a simple random sampling technique was used to select 422 respondents. Structured and pretested questionnaires adapted from the Nordic Musculoskeletal Questionnaire were used to collect the data. Epi-data version 4.2.0.0 and SPSS version 20 were used to enter and analyze the collected data, respectively.

Results: In the previous 12 months, 62.45% of three-wheel car drivers had musculoskeletal disorders in any body region (95% CI: 58.36, 66.14). The back pain was the most frequently reported site of pain in this study. This study showed that the habit of doing physical exercise, work experience, site of service, taking rest breaks while driving, and having comfortable sitting posture was risk factor for musculoskeletal pain.

Conclusion: In this study, the overall 12-month prevalence of musculoskeletal problems among three-wheel car drivers was high. Periodic health checkups for drivers, lifestyle changes, delivering training, and creating awareness are important to address this high-burden occupation-related problem.

Keywords: musculoskeletal disorder, driver, three-wheel, risk factor, Ethiopia

Introduction

The global demand for mobility is rapidly increasing. In Ethiopia, various modes of transportation, primarily cars, buses, and three-wheeled auto-rickshaws, are widely used in urban, suburban, and rural areas. Three-wheel cars are a popular mode of public transportation in developing countries. It is a modern version of the rickshaw known by various names such as three-wheeler, trishaw, auto-rick, bajaj, tricycle, and baby taxi, among others.¹ They are vehicles with petrol/diesel engines, a fuel capacity of 10.5 liters, seating for four passengers, and adequate luggage space. It can travel at speeds of up to 80 kilometers per hour and is ideal for intra-city commercial public transportation.²

The issue of health and safety is a major source of concern in the driving profession, especially among three-wheel car drivers.³ Three-wheel cars are one of the best choices for intra-transportation systems because of relatively cheap, easily accessible, and an emerging job opportunity in developing countries, including Ethiopia.⁴ In Ethiopia, it also provides a service for passengers traveling from the urban centers to the neighboring rural kebeles.

Musculoskeletal disorders are a leading cause of disability and absenteeism among workers and are regarded as a major public health issue with personal and socioeconomic consequences.⁵ Self-reported musculoskeletal disorders are self-reported pain, ache, or discomfort for all or at least one symptom in the past 12 months in any of different body regions like the back, neck, shoulder, elbow, hand, ankle, and knee, as well as muscle cramping and poor circulation of blood in the leg and buttock.^{6,7} In today's world, the transportation sector shows significant development, which has resulted in workplace health issues. As a result, occupational health and safety are major concerns for human well-being.⁶

The global prevalence of musculoskeletal disorders (MSDs) (LBP) is increasing from 60% to 70%, with a 5% incidence rate.⁸ Because of ergonomic risk factors, driving is frequently linked to the occurrence of musculoskeletal disorders.^{9,10} Across-country studies have revealed a significant proportion of musculoskeletal pain among three-wheel car drivers, ranging from 15.5% to 68.15%.^{1,11} MSDs are thought to be multifactorial diseases caused by the interactions of various risk factors that differ between occupations.¹² Due to this, conducting multidimensional biopsychosocial assessments is a comprehensive and important approach to clearly understanding perceptions, behaviors, thoughts, and emotions about musculoskeletal pain concerning each component of the model as biological, psychological, and social.^{13,14}

Prolonged sitting, whole-body vibration,⁶ length of time while driving per week and engine type,¹⁵ carrying extra passengers, brand of the three-wheeler, number of passengers beside the driver,¹ ergonomic mismatch, work environment, unergonomic handling of objects, and prolonged uncomfortable postures while driving have all been identified as risk factors for MSDs.¹⁶ Furthermore, various studies have found that the design and type of vehicle seat, as well as long driving hours, the nature of road surfaces,⁶ and competitive pressure, are the main contributing risk factors to LBP and musculoskeletal disorders in general.^{17–20}

Several studies on the prevalence of MSDs and associated risk factors among other groups of drivers are being conducted. However, little is known about the scope of the problem and the extent to which these risk factors are linked in Ethiopia among three-wheel car drivers, and no prior research has been conducted in Debre Markos town. As a result, this study aimed to determine the prevalence of MSDs and their associated risk factors among three-wheel car drivers in Debre Markos, Ethiopia.

Methods and Materials

Study Setting, Period and Design

A community-based cross-sectional study of 422 drivers of three-wheel cars was conducted in Debre Markos town, East Gojjam zone, Northwest Ethiopia, from August 05 to October 07, 2022. Debre Markos is the capital city of East Gojjam Zone, with a population of 101,582 people, 52.0% of whom are male.²¹ It is found 300 km and 265 km away from Ethiopia's capital (Addis Ababa) and the capital of the Amhara Region (Bahir Dar), respectively. The town has 1886 three-wheel transportation facilities divided into 16 major stations. Also, the 16 stations are divided into two groups: those that provide service within the town (10 stations) and those that provide service to passengers traveling from the town to the surrounding rural kebeles (6 stations).

Study Population

All selected 422 three-wheel car drivers were our study population. Drivers who invest all of their time in driving, those with more than one year of experience, and drivers who were willing to participate and were on duty during the data collection period were included in this study. All participants signed informed consent forms before enrolling, as approved by the ethical committee. Individuals with a history of MSDs before joining the profession, as well as those with MSDs of traumatic origin, were excluded from this study.

Sample Size Estimation

The sample size is determined using a single population proportion formula with the following assumptions: the prevalence of MSDs (unknown for the study area) was 50%, with a 5% margin of error (d) and 95% confidence interval.¹

$$n = \frac{(z\alpha/2)^2 xP(1-P)}{d^2} = 384$$

By taking 10% of the non-response rate, the total sample size was 422.

Sampling Technique and Procedure

A total of sixteen stations are stratified into two groups those that provide service within town and those that provide service to passengers travelling from the town to neighboring rural kebeles. The updated lists of the plate numbers of three-wheel cars were taken from the city administration road and transport office with respective stations. A proportional allocation of the total sample size for the two strata was done. Then, the plate number of the three-wheel car was randomly selected from a table of random numbers. A total of 422 three-wheel car drivers who met the eligibility criteria were interviewed.

Data Collection Tool and Procedures

The sociodemographic, personal, ergonomic, anthropometric, and musculoskeletal data were collected through a pretested structured questionnaire developed by reviewing the literature.^{1,15,22–24} The questionnaire contains five main parts. Part-I contains the sociodemographic condition of the respondents and comprises a list of 9 items. Part-II also contains personal/lifestyle characteristics of the respondents; and it comprises 4 items, whereas Part-III contains ergonomic and work-related conditions of the respondents; and comprises 8 items. Then, Part-IV also contains anthropometric measurements, which comprise 3 items. Part-V contains musculoskeletal symptoms assessed using a standardized Nordic questionnaire and comprises 10 items (see [Annex I](#) of [Supplementary Material](#)). To ensure that the message from a question was consistent, the questionnaire was translated from English into Amharic (the local language) and then back to English. Professional experts then reviewed the translation.

Anthropometric measurements (height and weight) were taken in an upright, ergonomic standing position using a digital weighing scale and measuring tape meter. To ensure the dependability and validity of the tool, a pre-test was conducted among 21 respondents from the nearby Finote Selam town. The Cronbach's alpha value for the questionnaire was 0.76, which indicates that it is acceptable because it is greater than 0.60.²⁵ As a result, the reliability of the questionnaire in this study was determined to be acceptable.

Study Variables

The dependent variable is the prevalence of musculoskeletal disorders, anyone reported as having pain and discomfort in any body region like the back, neck, shoulder, elbow, hand, waist, buttock, knee, and leg in the past 12 months.^{6,7} Whereas the sociodemographic information of three-wheel drivers includes age in years, ethnicity, religion, education, marital status, average monthly income, site of service, and employment status; Personal/lifestyle factors: alcohol drinking habit, smoking behavior, and habit of doing physical exercise; Anthropometric measurements: height, weight, and BMI; Ergonomic factors: back support, number of passengers beside the driver, sitting posture, working hours per day, working hours per week, rest breaks between driving, work experience, and brand of the three-wheel car; and musculoskeletal symptoms: back, neck, shoulder, elbows, and hand were considered as predictor variables.

Data Processing and Analysis

Data cleaning was done to make sure the data were accurate, comprehensive, consistent, and free of missing values and variables. Then, it was coded manually, entered into Epi Data version 4.2.0.0 and exported to SPSS version 20 for analysis. Descriptive statistics were performed on numerical values (mean, standard deviation, frequencies, and proportion) to describe the study population with dependent and independent variables. Variables that appear to be associated ($p < 0.25$) in the bivariate binary logistic regression analysis are considered in the multivariable analysis. Variables such as the age of the respondents, the habit of doing physical exercise, ownership status, site of service, taking rest breaks while driving, alcohol consumption, comfortable sitting posture, and comfortable back support were associated in the bivariate binary logistic regression analysis. Crude odd ratio (COR), adjusted odds ratio (AOR), and 95% confidence

interval (CI) are estimated. Variables scored $p < 0.05$ were considered statistically significant predictor variables. Model fitness was also tested using the Hosmer–Lemeshow test (p -value = 0.61), and the value indicated that the model is a good fit (p -value > 0.05). A multi-collinearity check between variables was done using a variance inflation factor (VIF), and there is no correlation detected between variables.

Results

A total of 102 three-wheel drivers are excluded from this study due to ineligibility, as 45 of them due to having a previous history of MSDs before joining this profession and 57 of them due to having MSDs of traumatic origin because of their exposure to traffic accident and injuries. Then, a total of 1784 three-wheel drivers are eligible for this study and 422 of them are selected. All 422 filled-out questionnaires were returned and analyzed, yielding a 100% response rate.

Individual Characteristics of the Participants

The majority of the participants [413 (97.9%)] were male. Of the total respondents, above half [241 (57%)] were young, found in the age range of 20–30 years, with a mean age of 26.78 years (± 3.76). More than half of the respondents [216 (51.2%)] were single. Regarding the educational level, the majority of the participants [227 (53.7%)] were attending college and above. Three-fourths of the respondents drive their private three-wheeler. About 408 (96.7%) and 248 (58.8%) of the respondents were from the Orthodox religion and had an income of between 3000 and 6000 ETB, respectively. Nearly three-fourths of the respondents [308 (72.95%)] are from those who give within city transportation services (Table 1).

Table 1 Sociodemographic Characteristics Among Three-Wheel Car Drivers in Debre Markos Town, East Gojjam Zone, Northwest Ethiopia, 2022 (n = 422)

Variables	Frequency	Percent (%)
Sex		
Male	413	97.9
Female	9	2.1
Age of the respondents		
20–30	241	57.0
31–41	144	34.3
42–52	32	7.5
52–60	5	1.2
Marital status		
Single	216	51.2
Married	190	45.0
Divorced	14	3.4
Widowed	2	0.4
Educational level of the respondents		
Primary school	15	3.7
Secondary school	180	42.6
College and above	227	53.7

(Continued)

Table 1 (Continued).

Variables	Frequency	Percent (%)
Religion		
Orthodox	408	96.7
Muslim	10	2.5
Protestant	4	0.8
Ethnicity		
Amhara	422	100
Ownership status		
Owner	328	77.7
Employee	94	22.3
Average monthly income (ETB)^a		
<1500	14	3.3
1500–3000	105	24.8
3001–6000	248	58.8
>6000	55	13.1
Site of service		
Within town	308	72.9
Neighboring rural Kebele's	114	37.1

Note: ^aETB= Ethiopian Birr (1 ETB = 0.0308\$, on January 26, 2022).

Personal Characteristics of the Respondents

Two hundred thirty-nine (56.6%) out of 422 respondents have a habit of doing physical exercise. Regarding the smoking habits of the respondents, about 17 (4.1%) and 27 (6.2%) of them were a past and current smoker, respectively. Three-fourths of respondents [324 (76.9%)] have a body mass index falling within the range of 18.5–24.9 (healthy). Majority of the respondents [291 (69%)] consumed alcohol. Before entering the driving profession, approximately 66 (15.7%) of respondents had a history of musculoskeletal disorder diagnosis (Table 2).

Prevalence of Musculoskeletal Disorders

According to the findings of this study, the prevalence of musculoskeletal disorder in any body part in the past 12 months among three-wheel drivers was 62.45% (95% CI: 58.36, 66.14). The most common reported body part of pain was back pain (59.9%), followed by neck pain (50.4%), shoulder pain (47.1%), elbow/forearm pain (37.6%), and hand/wrist pain (35.5%) (Figure 1).

In this study, multi-site pain was assessed and the result shows that 45% of subjects reported single-site pain, 31%, 19%, and 5% reported pain in two, three, and four sites, respectively.

Comparative Results of Musculoskeletal Disorders Across the Site of the Service and Year of Work Experience

Drivers who provide service for passengers traveling from the town to the neighboring rural kebeles reported a higher prevalence of MSDs as compared to those who provide service within the city (except shoulder pain). Furthermore, a higher prevalence of MSDs was reported among those who drove for more than 5 years (Table 3).

Table 2 Personal Characteristics Among Three-Wheel Car Drivers in Debre Markos Town, East Gojjam Zone, Northwest Ethiopia, 2022 (n = 422)

Variables	Frequency	Percent (%)
Habit of doing physical exercise		
Yes	239	56.6
No	183	43.4
Smoking status		
Never	378	89.7
Past/former smoker	17	4.1
Current smoker	27	6.2
Alcohol consumption		
Yes	291	69.0
No	131	31.0
Body Mass Index (BMI)		
Under weight (< 18.5 kg/m ²)	15	3.7
Healthy (18.5–24.9 kg/m ²)	324	76.9
Overweight (25–29.9 kg/m ²)	80	19.0
Obese (≥30 kg/m ²)	3	0.4

Factors Associated with Musculoskeletal Disorder

The multivariable binary logistic regression analysis showed that the habit of doing physical exercise, site of service, taking a rest break while driving, comfortable sitting posture, and comfortable back support had a statistically significant association with musculoskeletal disorders at p-value ≤ 0.05 (Table 4).

The habit of doing physical exercise was significantly associated with MSDs. Physically inactive drivers had 2.7 times higher odds of having MSDs than those who are physically active (doing physical exercise regularly) (AOR = 2.7, 95% CI: 1.5, 4.9). In this study, the site of service was found to be a risk factor for musculoskeletal pain. Drivers who give service to passengers traveling from the town to neighboring rural kebeles had 2.8 times higher odds of having MSDs than those who give service within the town (AOR = 2.8, 95% CI: 1.1, 3.0). Similarly, drivers who do not take a rest break had 2.3 times higher odds of developing MSDs than those who take a rest break (AOR = 2.3, 95% CI: 1.3, 4.2). Similarly, drivers who sat

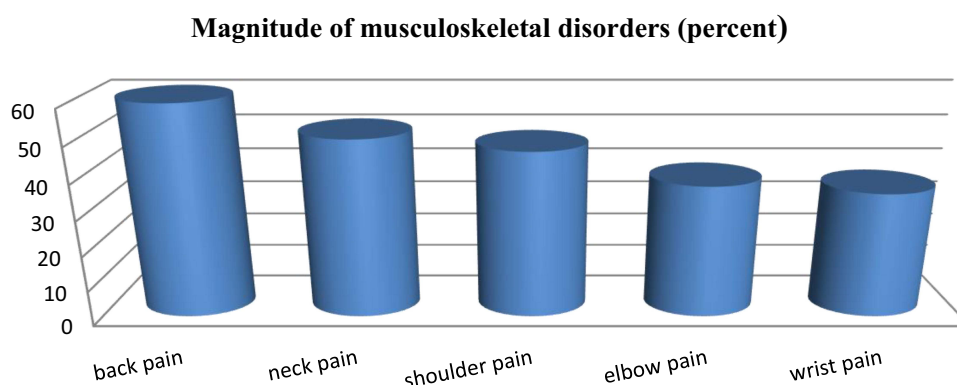


Figure 1 Graphical representation of the magnitude of musculoskeletal disorders among the three-wheel car drivers in Debre Markos town, East Gojjam zone, Northwest Ethiopia, 2022.

Table 3 Comparative Results of Musculoskeletal Disorders Across the Site of Service and Years of Driving Among Three-Wheel Car Drivers in Debre Markos Town, Northwest Ethiopia, 2022 (n = 422)

Variables	Musculoskeletal Disorders by Body Region (%)					p-value
	Lower Back Pain	Neck Pain	Shoulder Pain	Elbow/Forearm Pain	Hand/Wrist Pain	
Site of service						
Within town service	48.5	37.8	49.3	27.7	31.4	
Neighboring rural kebeles	62.4	53.9	48.6	47.8	35.9	<0.001
Years of driving						
<5 years	43.4	36.2	33.7	29.1	19.8	
≥5 years	59.8	51.4	49.2	39.1	38.7	0.003

Table 4 Bivariate and Multivariable Binary Logistic Regression Analysis of Factors Associated with MSDs Among Three-Wheel Car Drivers in Debre Markos Town, North West Ethiopia, 2022 (n = 422)

Variables	MSDs (Frequency)		COR (95% C.I.)	AOR (95% C.I.)
	Yes	No		
Physical exercise				
Yes	125	114	1.00	1.00
No	132	51	2.3(1.5, 4.4)*	2.7(1.5, 4.9)**
Ownership status				
Owner	125	202	0.2(0.7, 4.2)	0.4(0.8, 3.7)
Employee	68	26	1.00	1.00
Site of service				
Within town	172	136	1.00	1.00
Neighboring rural kebeles	93	21	3.5(1.5, 4.2)*	2.8(1.1, 3.0)**
Rest break				
Yes	132	102	1.00	1.00
No	142	46	2.4(1.3, 3.9)*	2.3(1.3, 4.2)**
Alcohol consumption				
Yes	172	119	2.9(1.8, 4.9)*	1.8(0.9, 3.4)
No	44	87	1.00	1.00
Comfortable sitting posture				
Yes	35	103	1.00	1.00
No	174	110	4.7(2.5, 8.5)*	3.2(1.1, 4.6)**
Work experience				
<5 years	120	102	1.00	1.00
≥5 years	154	46	2.9(2.4, 9.5)*	2.4(1.6, 3.1)**

Notes: *Significant at P<0.25, **Significant at P<0.05, 1.00 = reference.

Abbreviations: COR, crude odds ratio; AOR, adjusted odds ratio; C.I, confidence interval.

in an unergonomic posture had 3.2 times higher odds of developing MSDs than those who sat in a comfortable sitting posture (AOR = 3.2, 95% CI: 1.1, 4.6). Respondents who drove a three-wheel car for five years and above had 2.4 times higher odds of having MSDs than those who drove a three-wheel car for four years and below (AOR = 2.4, 95% CI: 1.6, 3.1) (Table 4).

Discussion

According to this study, three-wheel drivers are at a higher risk of developing MSDs. The findings of this study show that 62.5% (95% CI: 58.4, 66.1) of respondents had musculoskeletal pain or trouble in at least one part of the body in the previous 12 months.

This finding is consistent with the prevalence of MSDs reported in other studies: 60.4% among Malaysian commercial vehicle drivers,²⁶ 60.8% among Hong Kong urban bus drivers,²⁷ 64.2% among taxi drivers in Addis Ababa,²⁸ 64.8% among occupational drivers in Nigeria,²⁹ 65% among truck drivers in Nagpur, India,³⁰ and 58.8% among commercial minibus drivers in Accra, Ghana.³¹

The results of this study were lower than those conducted in Kano, Nigeria (73.5%),³² in a city in central India, India (68.1%),¹¹ in the United Kingdom (81.0%),³³ and in Dhaka city, Bangladesh (78.0%),¹⁶ among drivers on the prevalence of MSDs in any body parts on the past 12 months. The disparity could be explained by the repetitive and physically demanding nature of driving in those countries, which may contribute to a higher prevalence of MSDs. Furthermore, in later studies, study participants may have spent more time driving, increasing their risk of MSDs.

However, the result of this study was higher than those conducted in Jimma town, Ethiopia (26.3%),¹ in Galle District, Sri Lanka (30.3%),²³ and in Ghana (34.3%).³⁴ These variations could be due to differences in the level of infrastructure, like road design and safety, and differences in methodology, sample size, and population.

In this study, the proportion of study subjects with single and multi-site pain was assessed. This is due to the result of several recent population-based studies that have shown that people often have pain at several body sites concurrently.^{35–37} Out of the total study subjects [264 (62.5%)] reported having MSDs, 45% have reported single-site pain, 31%, 19%, and 5% reported pain in two, three, and four sites, respectively. A significant proportion of drivers have multi-site pain, and the possible explanation for such result is that one local pain accompanies another, irrespective of the pain site. The result of this study is almost consistent with other studies.³⁸

Back pain was the most frequently reported source of pain in this study. Similarly, different studies have revealed that back pain was the most commonly reported/affected body part among drivers,^{23,39} which could be attributed to prolonged stiff posture during working hours, vibration, loading goods of passengers, and high work stress due to various reasons, as well as other psychosocial stress.²³

Physical inactivity was found to be a factor, which was significantly associated with MSDs. Physical inactivity has been linked to several diseases. As a result, science suggests that a person should engage in at least three days of physical activity per week, for at least thirty minutes per day. However, nearly half of the drivers have no habit of engaging in physical activity (they had less than three days of physical exercise). As a result, physically inactive drivers had a higher risk of developing MSDs in this study. Being physically inactive was strongly linked to MSDs. This finding is in line with studies done in Israel and Italy.^{10,40,41}

In this study, those who give service to passengers traveling from the town to the neighboring rural kebeles had a higher prevalence of MSDs than those who give service within the town. This variation is because those who provide service for passengers traveling from town to neighboring rural kebeles are highly exposed to various ergonomic risk factors identified in other studies, such as a rough road surface,⁶ a high number of extra passengers and people besides the driver,¹ relatively long driving hours,¹⁵ and heavy object loading and unloading.¹⁶ These factors make driving risky and, as a result, contribute to the development of musculoskeletal disorders.

In addition, this study found a high prevalence of MSDs in three-wheel car drivers who had inadequate rest periods during the working day. The result of this study is consistent with a study conducted among drivers in mineworkers.^{34,42,43}

In the present study, an uncomfortable seating posture was associated with a higher prevalence of MSDs among three-wheel drivers. Three-wheel drivers frequently maintain awkward body postures while on the job in order to avoid discomfort caused by a poor ergonomic chair. Leaning to one side, bending and twisting, and excessive stretching are all examples of these postures. These positions, when combined with an uncomfortable chair, can put mechanical stress on the spine and its surrounding soft structures, eventually resulting in MSDs. This finding is in line with other studies done in, Israel.¹⁰

This study also found that work experience (years of driving) was a risk factor for musculoskeletal problems. It is attributed to the fact that the onset of musculoskeletal problems is associated with prolonged exposure to various ergonomic risk factors. As the number of years spent driving increases, so does the driver's exposure to various types of ergonomic risk factors. This finding is in line with a study conducted among drivers.^{44,45}

Limitation

The primary limitation of this study was that we were unable to use diagnostic tools to improve the validity of self-reported symptoms. Furthermore, because we are using a cross-sectional study design, ruling out recall bias is difficult because more severe and recent pains or difficulties are remembered better than less severe and older ones. The absence of face validity testing and the failure to incorporate some important factors like psychological stress and other related factors are also limitations of this study. However, we attempted to mitigate the effect by employing a standardized questionnaire for assessing musculoskeletal pain.

Conclusion

In conclusion, this study found a high prevalence of MSDs among three-wheel car drivers. Pain in the back is the most common body region affected, followed by neck pain, shoulder pain, elbow/forearm pain, and hand/wrist pain, respectively. High-risk factors associated with the development of MSDs include physical inactivity, site of service, rest breaks, comfortable sitting posture, and comfortable back support. According to the findings, a large number of three-wheel drivers are at risk of developing decreased well-being. It may be beneficial to raise awareness among drivers to encourage them to exercise and take frequent breaks at work. Furthermore, in the study area, periodic health checkups for drivers, lifestyle changes, and delivering training are important to address this high-burden occupation-related problem.

Abbreviations

AOR, Adjusted Odd Ratio; BMI, Body Mass Index; CI, Confidence Interval; LBP, Lower Back Pain; MSDs, Musculoskeletal disorders; VIF, Variance Inflation Factor.

Data Sharing Statement

All data generated or analyzed during this study are included in this article. The data that support the findings of this study are also available from the corresponding author upon reasonable request.

Ethics Approval and Consent to Participate

Ethical clearance was obtained from the Ethical Review Committee of the College of Health Sciences, Debre Markos University. Those three-wheel car drivers who were selected to participate were informed about the purpose of the study, the importance of their participation, and their ability to withdraw at any time. Written informed consent was obtained before data collection. The ethical approval number of the study was HSC/R/C/Ser/No/357/14. This study complies with the Declaration of Helsinki.

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Disclosure

The authors declare that they have no competing interests.

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