Investigating the Association of Musculoskeletal Disorders with Elected Factors of Tehran Intercity Bus Drivers

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ABSTRACT: Background: Musculoskeletal disorders have the second ranking in terms of importance, intensity, frequency and probability of work-related diseases. Drivers are spending most of their life in this job. In Long-term injuries and diseases caused chronically problems with muscle movement which it will have a large impact on their individual and social life. Objectives: The aim of this study was to determine the influence of some individual characteristics and environmental conditions in musculoskeletal disorders among Tehran intercity bus drivers at passenger terminals in Tehran. Materials and Methods: For that, 576 drivers were interviewed and they were referred to the terminals then questioner appointment with drivers during this interview some information explained about the project and how to fill out Nordic standard questions. Also, questions relating to personal and job characteristics were spread among the drivers who have at least one year of driving experience. Results: 481 male drivers (85 percent of total) willingly participate in the study with an average driving record 13.6 years. In order of frequency: Low waist: 31.6%, upper back: 18.3%, neck: 16%, knee: 13.5%, shoulder: 9.6%, foot/ankle: 6.3%, wrist: 6%, hips/thigh: 4.2% and above elbow: 2.3%. Significantly, pain in the neck, shoulder, ankle/foot, ankle, elbow, upper back, hip of people who have slept less than 6 hours per day were different from the area of pain in people who have had much sleep more than 6 hours per day. Conclusions: In previously conducted studies, high rates of musculoskeletal disorders have been reported. The present study shows that 32 percent of drivers have experienced lower back pain. The main causes of these disorders are people's tendency to sit in a bad posture because of fatigue and drowsiness while driving.

Keywords: Musculoskeletal disorders, Drivers, Ergonomics, Nordic

INTRODUCTION

Job in our daily life, as a profession, includes factors that can have powerful effects on health, progress of a society's economic and social interaction. Working conditions can cause many problems, including musculoskeletal disorders which could contribute to the decrease of working efficiency\(^(1)\). Musculoskeletal disorders are considered up to 38 percent of all work-related illnesses\(^(2)\) and it is the most important issues which ergonomists of around the world have been confronted with it\(^(3)\). In Europe it is estimated that approximately 40 million workers are affected by these disorders (More than 30% of the workforce); it costs 0.5 to 2% of EU GDP (Gross Domestic Product of Europe)\(^(4)\). According to available statistics, the share of musculoskeletal disorders of occupational diseases in Finland and United States of America are 46 and 44 percent (respectively)\(^(5)\). According to the report of the American National Institute for Occupational Safety and Health, musculoskeletal disorders are in second rank in terms of importance, intensity, frequency and probability\(^(6)\).

Based on the figures from the Statistical Center of Iran and the Ministry of Health costs of musculoskeletal disorders in 2000 equal to a thirteenth (approximately 8%) of general state budgets\(^(7)\). Age, height, weight, gender, smoking are the known factors which can contribute to the symptoms of these disorders\(^(8-10)\). These disorders are very popular among public transport drivers\(^(11, 12)\). The rate of job absenteeism among drivers, due to musculoskeletal disorders, is higher than other working groups\(^(13)\). People
who drive more than half of their working hours suffer from back problems 3 times higher than the other working groups(14). Furthermore, according to studies back pain and musculoskeletal disorders are the main reasons for traffic accidents(15). Bus driving is considered as a stressful job in which physical and psychosocial stressors are very common(16). As regards, drivers spend much of their life in this job which long-term injuries and chronic diseases accumulate in their body over the time and then cause muscle movement disorders. These disorders will certainly have many effects on driver's individual and social life(17). Studies have shown that driving have a high risk of musculoskeletal disorders due to long time sitting and exposing whole-body to vibration(5). In order to prevent the musculoskeletal disorders in a working population, evaluation of job factors, determination of their personal characteristics and studying the relationship between these factors were required(18,19). However, very little research has been done about the Iranian drivers, especially bus drivers(5).

**Objectives**

The aim of this study was to determine the influence of some individual characteristics in musculoskeletal disorders among Tehran intercity bus drivers at four passenger terminals in Tehran (The capital of Iran). It is hoped that the results obtained from this study will be the basis for further studies.

**MATERIALS AND METHODS**

This cross-sectional study was conducted as to clarify the association of Musculoskeletal disorders with elected factors of Tehran intercity bus drivers in 2013. In this study, the prevalence of these disorders among the Tehran intercity bus drivers have been sought. In order to investigate these disorders, various organs of drivers’ body, including neck, shoulder, elbow, wrist, upper back, lower back, hip/thigh, knee and foot/ankle as well as the connection of each of them was analyzed with any of this elected factors: age, weight, height, background, time of day, amount of sleep, smoking, physical activity, marital status as well as level of education. In this study, Nordic and demographic questions have been demonstrated which their reliability and validity has been proven(10). Nordic questionnaire is included with questions about the history of musculoskeletal disorders divided into nigh areas of the body. If any of these disorders have obtained, the questionnaire specifies the time of their occurrence. Nordic questionnaire determines the emergence problem from these disorders and refer to physician and repeated problem after short time.

In this present study, P=0.5 and α=0.05 was considered due to lack of access to detailed statistics and a review of the studies was done in the past drivers. Considering the design effect, the sample volume was multiplied by 1.5 which finally 576 samples were considered. Samples were chosen based on the proportion of drivers in each of the four terminals in Tehran. Number and proportion of each category were determined by systematic sampling after listing all drivers who were working in each terminal station. After making appointment with the drivers to fully explain how to fill out questionnaires and make sure drivers are declaring that their personal information will be kept completely confidential, a new version of the Nordic questionnaire with demographic questions gave to the drivers who have been provided a minimum of one year bus driving intercity. In order to increase the accuracy of the present study, the drivers who had the experience of either a car accident or incurable diseases or congenital disorders have been excluded. When collecting the data, coding questionnaires and entering data into SPSS (version 18) were done; the statistical tests of $\chi^2$, ANOVA and T-test were performed.

**RESULTS**

481 male drivers (85% of all samples) were chosen which all of them willingly participate in the study. Demographic characteristics of the subjects are presented in table 1. 14.5% of drivers was single. 45.4% of drivers had high school or higher degree. 67.7% of subjects has been present at work on average more than 25 days per month which 64.6% of them had on average 6 to 8 hours daily driving. 13.9% of the subjects are worked for more than 8 hours a day. 46.6% of the drivers stated that they rest between 6 to 8 hours in a daily routine. 61.4% of them also identified to be smoker. And, 69.4% of drivers do not exercise at all.

The highest prevalence rate of musculoskeletal disorders (31.6%) was obtained in the lower back (LBP). Totally, 51.1% of subjects had at least one area of pain. After categorizing those who have reported problems in at least one subject in the areas of musculoskeletal disorders categories for each case, it was determined that 68.3% of them just in one area and 19.7% of them two or more than two areas suffer from musculoskeletal disorders (Figure 1). The relationship between demographic factors and ten individual features (age, weight, height, work experience, marital status, education, holidays, monthly, daily working hours, sleep, smoking, and exercise) has been studied in order to clarify the incidence of these disorders in nine areas (neck, shoulder, elbow, wrist, upper back, low back, hip/thigh, knee and foot/ankle, foot). Each individual's characteristics of the study subjects were divided into two groups of drivers and the significance was compared.
between the two groups. The results of this comparison is shown in Table 2 and 3. Age groups were classified to above and below 39 years (mean age of the study population) and a significant difference was obtained in rates of hip and wrist pain. Background of drivers were classified to two groups of above and below 21 years (mean plus standard deviation of the subjects); and also, the significant differences in the amount of elbow pain, lower back and ankle were observed among the two groups (Table 2).

Body weight of the drivers was divided into upper and lower than 83 kg (mean weight of the subjects) and significant differences were observed in the degree of wrist and shoulder pain in both groups (Table 2). Regional pain of neck, shoulder, wrist/hand, ankle/foot, elbow, upper back and hips/thighs in those who sleep less than 6 hours per day have showed significant difference with others who sleep more than 6 hours a day (Table 2). Work records of subjects were classified to both higher and lower than 21 years (mean plus standard deviation Background the subjects) and significant difference was observed in the amount of elbow pain, lower back and ankle (Table 2).

Wrist pain on drivers who smoked was showed a significant difference in pain in this area with those who did not, (Table 3). Neck and knee pain in drivers who had six grade and/or higher education have a significant difference with those who had less than fifth grade (Table 3). Neck and upper back pain which had been indicated on drivers who had less than 8 days off in a month have a significant difference with the pain in these areas of those drivers who leave more than 8 days per month (Table 3). Height of drivers were classified into higher and lower than 182 cm (mean plus standard deviation of the height of the subjects) and significant differences were observed in rates of upper back pain (Table 3).

However, a significant relationship between the incidence of musculoskeletal disorders in drivers who did not do their exercise with those who regularly exercise was not observed; and also, a significant relationship between single and married people was not found. Pain in different areas of drivers’ body who have been driving for less than 8 hours per day was shown no significant difference with the pain in the body areas of those who have to drive more than 8 hours per day.

CONCLUSIONS

Among the different types of musculoskeletal disorders, low back pain (LBP) has been reported to be the most common one(20). The study shows that 32 percent of drivers (the most common area of nine) have experienced lower back pain. Szeto G, Lam found that 81 percent of American and 49 of Swedish drivers have experienced lower back pain(5). Also, Gangopadhyay reported that 73 percent of drivers in Kolkata, India have developed back pain symptoms(20). Abdullah Zadeh and Safari mentioned that 75 percent of drivers of Tehran Bus Company on their study had experienced back pain(21). In another study by Amod borle et al., followed on Indian bus male drivers, they found 59 percent of drivers have experienced back pain and 71 percent of them have demonstrated musculoskeletal disorders in the past 12 months(8). One of the reasons for the differences in the results of their study with present study is probably the less experienced drivers who have had participated in this study. In this study, work experience was 13.6 years while in Amor borle’s study 24.5 years was reported to be an average of work experience. nevertheless, their findings showed the impact of working experience in the development of these disorders, which are in line with our findings (Table 2) and also other studies(22). Totally, it should be noted that in the study of Amod borle clearly high rate of musculoskeletal disorders can be observed. So that 64 percent of drivers in the study have shown the incidence of these disorders in the last seven days.

The study of Choobineh and colleagues reported significant relationship between the record and the prevalence of the disorder(23). In the present study, three variables of age, weight and height are always the measure of determining the initial rables which has significant relationships with symptoms of musculoskeletal disorders. In study of Grace Y. Szeto which was conducted on 481 bus drivers, only 35 individuals commented in the past 12 months which have had no significant discomfort. Besides, low back and neck pain is the most frequent disorders. While 110 (22%) of drivers reported having pain in one area, the rest have suffered in two or more than two regions (5). In this study, 68% of people who have had these disorders suffer only from one area of the body impairments and the rest of them have developed such impairments in two or more than two areas.

Due to the nature of driving in which one spends hours in poor conditions such as vibration, motion limited space, poor lighting in the front of the vehicle, drivers tend to make poor postures.

In this regard, there are significant correlations between neck pain reduction, upper back pain in drivers who do not work less than 8 days per month and the subject that 76 percent of drivers in this study have this situation. Therefore, special consideration should be given to the extent of furlough and further research in this area.

According to a study in USA, 60 percent of accidents were happened by driver’s drowsiness or fatigue(24). Hence, the importance of adequate sleep for drivers should be taken into consideration. Taking the effect of resting on musculoskeletal disorders into consideration, it was found that the nine areas of body the
7th district includes the neck, shoulder, wrist/hand, ankle/foot, elbow, upper back and hips/thighs had significant difference between those who sleep more than 6 hours and less than 6.

Based on the drivers’ statements, 13.9% of them drives more than 8 hours a day which is set to be the limit of driving in a day. However, pain in various parts of the body of people who have been driving for less than 8 hours a day have not shown significant difference with the body of drivers who drive more than that. Then, it is not commensurate with other studies(8, 25). This difference might be due to the biased answers given by the drivers rooted from their fear of being fired. It can be expected that a number of drivers have avoided answering truly because state law requires the maximum driving time for each driver to be 8 hours per day.

The results show that height, weight, age, driving record, smoking, vacation, study and sleep are variables by which the rate of musculoskeletal disorders can be affected. Drivers’ individual and social behavior can be monitored and controlled such as smoking, sleep and vacation planning, convenient and increase drivers’ awareness of the effects and finding some ways to reduce frequency of incidence of these disorders. Also, according to this cross-sectional study and the time course of these disorders, it can be suggested that in another similar work the samples should be studied prospectively (cohort). Therefore, results will be more accurately and with higher reliability. Also, in order to prevent the occurrence of these disorders it would be suggested that the next study be done on driving posture assessment.

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<tr>
<th>Table 1. Demographic characteristics of the subjects</th>
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<tr>
<td>Character(Unit)</td>
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<tr>
<td>Age (years)</td>
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<tr>
<td>Weight (Kg)</td>
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<td>Length (cm)</td>
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<td>Duration of service</td>
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<tr>
<th>Table 2. relationship between musculoskeletal disorders and each organ (A)</th>
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<td>organ</td>
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<td>------</td>
</tr>
<tr>
<td>Neck</td>
</tr>
<tr>
<td>Upper back</td>
</tr>
<tr>
<td>Wrist</td>
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</tbody>
</table>
| Knee | * | * | 0.03 | *

P-valu< 0.05 * No significant

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<tr>
<th>Table 3. relationship between musculoskeletal disorders and each organ (B)</th>
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<tbody>
<tr>
<td>Organ</td>
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<td>------</td>
</tr>
<tr>
<td>Shoulder</td>
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<td>Elbow</td>
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<td>Wrist</td>
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<td>Lower back</td>
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<td>Hip/thigh</td>
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<td>Foot/ankle</td>
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P-valu< 0.05 * No significant

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Authors’ Contribution
All the authors contributed to the conception and design of the study. Mohammad Hajiakbari drafted the first version of the manuscript. Seyed Abolfazl Zakerian, Iman Arefian & Ali Reza Morozapour revised the manuscript. All authors approved the final version.

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