Work-related and ergonomic risk factors associated with low back pain among bus drivers

Original Article

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ABSTRACT

Background: Low back pain (LBP) is the commonest form of work-related musculoskeletal disorders, which cause huge economic losses to individuals as well as to the community. Bus drivers have been found to be at an increased risk of LBP owing to several factors associated with physical and occupational circumstances. There is scant knowledge on the problems of LBP among bus drivers in Egypt.

Aim: To identify the prevalence of LBP among bus drivers and to determine the ergonomic and occupational risk factors associated with this problem.

Materials and Methods: This is a cross-sectional study including 180 public bus drivers who were interviewed using a questionnaire containing items on some sociodemographic, ergonomic, and occupational characteristics. Lifestyle risk factors such as BMI and history of tobacco smoking were also included in the questionnaire.

Results: The prevalence of LBP was high (73.9%). LBP was significantly associated with work duration of more than 10 years, working more than 8 h/day and more number of accidents while driving the bus in the previous year. Regarding ergonomic risk factors, those complaining of uncomfortable seat and steering wheels showed significantly higher prevalence of LBP.

Conclusion: Public bus drivers in this study experienced high prevalence of LBP, which was associated with long duration of work, driving for more than 8 h daily and uncomfortable seat and steering wheels. Ergonomic and occupational risk factors associated with LBP can be modified by proper organizational strategies and health plans. Therefore, assessment of the sitting biomechanics and regular maintenance of buses are recommended to prevent any adverse health effects.

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INTRODUCTION

Low back pain (LBP) is one of the work-related musculoskeletal disorders and considered one of the leading causes of activity limitation, disability, inability to work, and work absenteeism[1]. LBP is the commonest form of work-related musculoskeletal disorders which cause huge economic losses to individuals as well as to the community. Worldwide, the incidence of 37% of LBP was attributed to occupation. In the year 2000, work-related LBP was estimated to cause more than 800 000 disability-adjusted life years lost annually[2]. Professional drivers have been found to be at high risk for developing LBP. In most studies done on bus drivers, the prevalence of LBP was more than 50% in either developed or developing countries[3–5].

Occupational, ergonomic and psychosocial risk factors have been found to be related to back pain in this occupational group. The main physical factors are prolonged sitting, whole-body vibration, the ergonomic mismatch between anthropometric sizes of the drivers and their physical environment, and the type of vehicle seat, whereas occupational risk factors include long daily working hours, years of driving and pressure to compete[6–10].

Research supports a number of measures to reduce work hazards for bus drivers including the following: to have bus lanes to reduce traffic congestion, to have automated information systems to reduce passenger inquiries and to develop emergency procedures and alarm systems to enhance driver security. It is also important to schedule breaks and improve work schedules to reduce work load and to support ergonomic design of buses for seat and steering wheel[11].

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Ergonomics can play an important role in the reduction of risk of injury to the drivers by applying workplace modifications (engineering controls), administrative and management practice changes (administrative controls) and education of the workers (work practice controls). According to our best knowledge, there were no published researches in Egypt about the occupational and ergonomic risk factors of LBP among bus drivers. Therefore, this study aimed to determine the 12-month prevalence of LBP and associated occupational and ergonomic risk factors among bus drivers in Cairo.

MATERIALS AND METHODS

This is a cross-sectional study including 180 transport bus drivers attending periodic medical examination at health insurance hospital, Cairo. The duration of field work was 6 months (from January to June 2016). Excluded criteria were those working in private work during off time period either as bus/microbus drivers or taxi and those with organic diseases such as rheumatoid arthritis.

Sample size and data collection tools

The sample size was calculated as a population survey, using Epi info program version 7, (Atlanta, Georgia, USA). From the results of published researches on a similar population, the following parameters were assumed: prevalence of LBP of 70%, confidence limits as 7%, confidence level at 95%; from the analysis of these parameters, a sample size of 141 bus drivers was required to estimate the prevalence of LBP. As the objectives of this study included identifying risk factors associated with LBP, the sample size was increased to 180 bus drivers, which is a sufficient sample to find a significance difference of 20% in the prevalence of LBP between those with and without risk factor.

The included bus drivers were interviewed using a questionnaire on some sociodemographic characteristics such as age, marital status, and education. Lifestyle factors included BMI and tobacco smoking. Occupational factors including duration of work, daily driving hours, working days per week, rest period during work, work satisfaction, and reported accidents during past 12 months. Ergonomic factors included comfortable seat, back support, and comfortable steering wheels. LBP was assessed using Standardized Nordic Musculoskeletal Questionnaire[12].

Height in centimeters and weight in kilograms were measured with standard clothing without shoes. Obesity was assessed by measuring the BMI as follows: BMI=weight (kg)/height (m2). According to WHO classification[13], overweight was considered at BMI greater than or equal to 25 to less than 30 kg/m² and obesity at BMI greater than or equal to 30 kg/m2.

Statistical analysis

Data were analyzed using IBM SPSS program version 21 (IBM Corporation, USA, Armonk, New York). Descriptive analysis was done for measuring the prevalence of LBP whereas bivariate analysis was applied to determine factors associated with LBP. Both unadjusted odds ratios (OR) with 95% confidence intervals (95%CI) and P value were displayed in all bivariate analysis. Risk factors significantly associated with LBP in bivariate analysis were further analyzed using binary logistics regression model to identify the independent predicted risk factors with their adjusted OR and 95%CI.

Ethical approval

All participants were informed about the study objectives and agreed to participate in the study after signing the informed consent form. Moreover, confidentiality was assured by having an anonymous questionnaire. The protocol of this study was approved by the Research Ethics Committee of the Faculty of Medicine, Ain-Shams University, Egypt.

RESULTS

A total of 180 bus drivers were included in this study; all of them were males, and their mean age (SD) was 37.5 (9.2) years. Of 180 male bus drivers, 133 (73.9%) reported LBP within the past 12 months. The older the age of the drivers, the higher the frequency, being reported in 77.1% among those in the age category 30–49 years and 86.4% among those aged 50 years and above. There were no significant differences between educational level, marital status, tobacco smoking and BMI and LBP (Table 1). Most bus drivers in this study did not practice any regular exercise.

Table 1: Public bus driver characteristics and low back pain, Cairo, 2016

Variables	Number of bus drivers	LPB n (%)	OR (95%CI)
Age (years)			
<30[a]	53	33 (62.3)	
30–49	105	81 (77.1)	2.05 (1.00–4.20)
≥50	22	19 (86.4)	3.84 (1.01–14.64)
Marital status			
Single	40	27 (67.5)	

Married	108	79 (73.1)	1.31 (0.60–2.88)
Divorce/widowed	32	27 (84.4)	2.60 (0.81–8.30)
Education			
Noneducated (illiterate)	19	15 (78.9)	1.37 (0.43–4.35)
Educated[a]	161	118 (73.3)	
Tobacco smoke			
Nonsmoker[a]	57	37 (64.9)	1.92 (0.96–3.84)
Smoker	123	96 (78.0)	
BMI			
Normal[a]	78	55 (70.5)	
Overweight	87	66 (75.9)	1.31 (0.66–2.62)
Obese	15	12 (80.0)	1.67 (0.43–6.49)

CI: confidence interval, LBP: low back pain; OR, odds ratio.
[a]: Reference group

The relation between occupational factors and LBP was displayed in Table 2. LBP was significantly higher among those working more than 10 years (OR=2.42; 95%, CI=1.23–4.87). In addition, those working for more than 8 h/day experienced higher frequency of LBP (83.7%; OR=2.93; 95%, CI: 1.45–5.93). Inadequate rest during daily work was associated with higher significant LBP (78.5%) than those who reported adequate rest (OR=2.01; 95%, CI: 1.02–4.01). Bus drivers who reported 6 times or more absenteeism during the past year were more exposed to LBP (OR=2.42; 95% CI: 1.22–4.77). Bus drivers who reported more than two accidents while driving experienced higher LBP (84.5%) compared with those with 1–2 times reported accidents during the past year (OR=1.8; 95%,CI: 1.38–8.60). The other occupational factors such as number of working days per week and work satisfaction were insignificantly associated with LBP.

Table 2: Occupational factors associated with low back pain, Cairo, 2016

Variables	Number of bus drivers	LBP n (%)	OR (95%CI)
Work duration (years)			
≤10[a]	71	45 (63.4)	2.42 (1.23–4.87)
>10	109	88 (80.7)	
Daily working hours			
≤8 h[a]	88	56 (63.6)	2.93 (1.45–5.93)
>8 h	92	77 (83.7)	
Working days per week			
5 days[a]	67	49 (73.1)	1.06 (0.54–2.11)
6 to 7 days	113	84 (74.3)	
Adequate rest during daily work			
No[a]	59	38 (64.4)	2.01 (1.02–4.01)
Yes	121	95 (78.5)	
Work satisfaction			
Satisfied[a]	63	45 (71.4)	1.21 (0.61–2.41)
Not satisfied	117	88 (75.2)	
Number of accidents while driving the bus during the last year			
No[a]	49	30 (61.2)	
1–2 times	73	54 (74.0)	1.80 (0.83–3.91)
3–5 times	58	49 (84.5)	3.45 (1.38–8.60)

Number of (absenteeism) during the last year			
<6 times[a]	71	45 (63.4)	2.42 (1.22–4.77)
≥6 times	109	88 (80.7)	

Regarding the association between LBP and ergonomic factors, the results showed that those who complained of uncomfortable seat experienced higher significant LBP (81.8%; OR=2.83; 95% CI: 1.43–5.59). Moreover, LBP among those complaining of uncomfortable steering wheel was significantly higher (81.9%; OR: 2.08; 95% CI: 1.01–4.31; Table 3).

Table 3: The association between ergonomic factors and low back pain among bus drivers, Cairo, 2016

Variables	Number of bus drivers	LBP n (%)	OR (95%CI)
Comfortable seat			
Yes[a]	70	43 (61.4)	2.83 (1.43–5.59)
No	110	90 (81.8)	
Comfortable back support			
Yes[a]	93	68 (73.1)	1.09 (0.56–2.12)
No	87	65 (74.3)	
Comfortable steering wheel			
Yes[a]	108	74 (68.5)	2.08 (1.01–4.31)
No	72	59 (81.9)	

CI: confidence interval, LBP: low back pain, OR: odds ratio.
[a]: Reference group.

Using stepwise binary logistic regression to identify the predictable risk factors associated with LBP after adjustment for age and other independent factors, the model returns five predictable risk factors (Table 4). Bus drivers working greater than 8 h daily were more likely to experience LBP compared with those working 8 h or less. Those working for more than 10 years were 6.6 times more prone to LBP than those working 10 years or less. Moreover, those who reported one to two accidents or more than two accidents within the past 12 months were 3.2 and 4.2 times, respectively, more likely to experience LBP compared with those not reporting any accidents. ORs of experiencing LBP was 8.34 (95% CI: 3.01–23.09) and 3.70 (95% CI: 1.43–9.54) for those who complained of uncomfortable seats and uncomfortable steering wheels, respectively.

Table 4: Work-related and ergonomic-independent variables associated with low back pain among bus drivers, Cairo, 2016, using logistic regression analysis

Variables	*P* value	Adjusted OR[a]	95%CI
Daily working >8 h	<0.001	9.02	3.11–26.15
Work duration >10 years	0.020	6.64	1.35–32.81
1–2 episodes of accident in the past year	0.028	3.19	1.15–8.84
3–5 episodes of accident in the past year	0.012	4.22	1.35–13.17
Uncomfortable seat	<0.001	8.34	3.01–23.09
Uncomfortable steering wheel	0.008	3.70	1.43–9.54

CI: confidence interval; OR, odds ratio.
[a]: Adjusted for age and other independent variables.

DISCUSSION

The results of this study revealed a high prevalence of LBP among public bus drivers (73.9%), which increased with age to reach 86.4% among bus drivers aged 50 years and older. This finding is higher than what was reported in many studies in Africa, for example, Akinpelu *et al.*[14] in Nigeria reported a prevalence of 64.8% whereas Abledu *et al.*[15] in Ghana reported a figure of 58.8%. Our figure is also higher than what was reported in Asia, for example, Tamrin *et al.*[16] reported a prevalence of 60.4% in Malaysia, whereas Jadhav[17] in India reported 67.4% prevalence of LBP among public bus drivers. Even on comparison with many studies in developed countries[4,18], our figure was relatively higher. However, few studies reported similar prevalence of LBP as our result[3,5], whereas another few studies in developed countries reported higher prevalence of LBP than our figure[19,20]. Accordingly, the prevalence of LBP in this study is considered high. There are many risk factors investigated in this study. Regarding work-related risk factors, this study showed a significant strong association between daily working hours and LBP. Those driving for more than 8 h/day were at much higher risk of complaining from LBP than those driving for less than or equal to 8 h. Similar results were reported in other studies[3,8–10,15]. Driving for prolonged hours could expose the drivers to musculoskeletal problems as a result of awkward postures, sitting for long time without body movement and whole-body vibration.

In addition to the risk of prolonged hours of driving daily in this study, the duration of work as a driver was significantly associated with LBP as well. There are controversial results in published reports for this point; some reports were in agreement with our finding[9,14,16,18] whereas other studies were in contrary to our result[3,8,14]. Prevalence of longer driving years is accompanied with cumulative vehicle-induced vibration, which is considered one of risk factors of developing LBP[21].

Regarding other work-related risk factors and LBP, the findings of this study showed that the number of self-reported accidents during the past 12 months was significantly associated with LBP, as drivers who reported more accidents had 3–4 times the risk of LBP compared with those not reporting any accidents during work, even after adjustment for age, duration of working days per week and daily driving hours. There are many factors related to accidents, including LBP, stress, longer driving time in congested streets and other co-morbidities such as heart diseases and diabetes[22]. Based on bivariate analysis of this study, inadequate rest periods were another work-related risk factor that contributed to LBP; however, after adjustment for other confounding factors using logistic multivariate model, this association disappeared. Some studies reported positive association between continuous driving for more than 4 h without adequate rest periods and high prevalence of LBP among drivers[10,23].

The current study findings showed insignificant association between work satisfaction and LBP. The literatures showed inconsistent results regarding this association as some were in accordance with our finding[15,17] whereas other studies were in contrary to ours[10,24].

Using the multivariate regression analysis, the results of this study showed no association between the number of times of absenteeism during the past 12 months and the prevalence of LBP. Few studies have supported this association[25,26].

In addition to the previous work-related risk factors and their relation to LBP in the current study, some ergonomic risk factors were analyzed. Seat discomfort was associated significantly with high LBP. Drivers who reported uncomfortable seats were at 8 times higher risk for LBP than those not reporting uncomfortable seats. Similarly, drivers who complained of steering wheels of their vehicles had higher LBP than those not reporting uncomfortable steering wheels. Many epidemiological studies indicated that prolonged sitting on uncomfortable seats with awkward postures and without lumber support or back support will lead to increasing posture stress, which in turn causes musculoskeletal problems such as LBP[7,8,16,27]. However, Lis *et al.*[23] reported that sitting itself was not associated with the increase of the prevalence of LBP, but the risk effect of prolonged sitting increased significantly when both whole-body vibration and awkward postures were combined.

Furthermore, we investigated the relation between some lifestyle characteristics of the drivers and the status of LBP. Regarding the association between tobacco smoking and LBP, the finding of this study suggested no association. Many studies reported similar findings of no association between smoking and LBP[9,15,17,28] whereas one study by Miyamoto *et al.*[29] in Japan suggested smoking habit as a risk factor for LBP. BMI was not associated with the prevalence of LBP in the present study. Again, there were no agreements about the risk of BMI and LBP in the literature; some studies had identified BMI as a risk factor for high prevalence of LBP[9,30] whereas other studies considered a high BMI not a risk factor for LBP[28,31]. In this study, we did not investigate the association between physical exercise and LBP, as most study participants (>95%) reported lacking regular exercise.

LIMITATIONS OF STUDY

In this study, we used the cross-sectional method, which is characterized by the problem of temporal effect (causal effect); therefore, we could not certainly determine

the relation between the study risk factors and the onset of LBP. Reporting bias and recall bias were other limitations. The findings are generalizable to the bus drivers who work only in their job hours without spending more time driving nonpublic cars. The strengths of this study include providing new information about the size of LBP among the public bus drivers and identifying the possible risk factors associated with this problem.

CONCLUSION

The prevalence of LBP among public bus drivers is considered one of the highest figures. The risk factors significantly associated with high prevalence of LBP were daily driving for more than 8 h, prolonged duration of job as drivers, uncomfortable seat and steering wheels and the number of self-reported accidents. These main risk factors in this study are considered modifiable ones. There is a need to tailor intervention programs to be implemented for bus drivers to reduce the size of LBP among them. Ergonomic and occupational risk factors associated with LBP can be modified by proper organizational strategies and health plans. Therefore, assessment of the sitting biomechanics and regular maintenance of buses are recommended to prevent any adverse health effects.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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