

Original Article

Association Between Occupational Stress and Risk Factors of Cardiovascular Disease in Locomotive Operators

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ABSTRACT

Background: Occupational stress is the leading cause of many disorders in employees. Drivers are a high-risk group for work-related stress. The purpose of this study was to determine the association between cardiovascular risk factors and occupational stress among locomotive operators.

Methods: This cross-sectional study recruited 350 locomotive operators. The Osipow questionnaire was used to measure stress. After 10 hours of fasting, systolic and diastolic blood pressures were recorded. Intravenous blood samples were also taken. Two groups of job stress were included as “trivial and trivial-to-average stress” and “average-to-acute and acute stress”. The Mann–Whitney *U* test was utilized to compare the risk factors of cardiovascular disease between the 2 groups. The association between education level and job experience was assessed using the χ^2 test.

Results: Of the 350 participants, 250 (71.43%) individuals reported average-to-acute stress, 30 (8.57%) reported acute stress, and 70 (20%) reported average stress. There was a significant relationship between education level and job experience ($P=0.000$). There were no significant differences between the 2 groups in the smoking rate ($P=0.92$), triglyceride level ($P=0.55$), and diastolic blood pressure ($P=0.21$), while the trivial and trivial-to-average stress group had significantly higher blood glucose levels ($P=0.024$) and systolic blood pressures ($P=0.000$) than the other group. Finally, the blood cholesterol level in the average-to-acute and acute stress group was significantly higher than that of the other group ($P=0.000$).

Conclusions: High rates of occupational stress were reported in the studied locomotive operators. Stress may have effects on blood glucose, triglyceride, and cholesterol levels in this job group. (*Iranian heart Journal 2018; 19(2): 20-26*)

KEYWORDS: Risk factors, Cardiovascular disease, Occupational stress, Osipow, Locomotive operators, Cardiovascular risk factors

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Cardiovascular disease is the main cause of mortality in developed countries inasmuch as it is responsible for more than 50% of all mortalities.¹ In spite of a decline in the fatality from heart disease in recent years, the frequency of chronic heart disease is still high in modern societies.² Therefore, cardiovascular disease remains a critical public health problem for countries and their health-care organizations.³ The occurrence of cardiovascular disease is greatly determined by its risk factors.⁴ The increased mortality rate is frequently attributed to the associative risk factors of cardiovascular disease such as tobacco consumption, lack of physical activity, hypertension, overweight, hyperinsulinemia, and hypercholesterolemia.⁵ Occupational stress is physical and psychological strain which happens when there is an inconsistency between the objective or cognitive demands for the job and the individual's compatibility.⁶ It has been described as the feeling of pessimistic emotional states such as disappointment, reduced work undertaking, occupational discontent, poor motivation, anxiety, depression, and unhappiness attributed to job-related factors.⁷ Occupational stress is associated with various types of chronic health problems such as hypertension and cardiovascular disease.⁸ Previous studies have demonstrated the role of stress in the development of cardiovascular disease,⁹ with certain relationships between occupational stress and hypertension and heart disease.^{8,10} In addition, according to the recent review studies, a relationship exists between psychosocial stress and cardiovascular disease.¹¹ According to the literature, 30% of workers suffer from work-related stress in the developed countries and the rate of workers with stress in

the underdeveloped countries is worse than that in the developed societies.^{11,12} Higher incidence rates of cardiovascular disease were found between shift workers and bus and taxi drivers.¹³ A previous study showed that the level of occupational stress was high among public transport drivers, who were exposed to various stressors due to the nature and type of their job.¹⁴ The relationships between stress and cardiovascular risk factors such as diabetes, body mass index, hypertension, hyperlipidemia, smoking, and triglyceride level have been previously investigated and these studies have reported conflicting results.^{15,16} Based on the above information about the high prevalence of heart disease and stress as a risk factor for cardiovascular disease, we sought to determine the relationship between occupational stress and the rate of cardiovascular disease in locomotive drivers.

METHODS

Participants

This study was conducted as a cross-sectional descriptive-analytical research in 2015. The sampling method was cluster sampling, with each cluster being a province in Iran. From each cluster, 29 subjects were sampled and also from Tehran Province 31 subjects were participated. The study group was comprised of 350 locomotive operators in 12 provinces of Iran—namely Azerbaijan, Fars, Lorestan, Khorasan, Mazandaran, Markazi, Semnan, Tehran, Khuzestan, Yazd, Isfahan, Hormozgan, and Zanjan. In this study, based on 95% confidence interval, 8% error level, and 80% study power, a total of 325 samples were estimated for the sample size. Finally, given a churn rate of 10%, 350 samples were collected. The following formula was used to estimate the sample size based on the aforementioned information:

$$n = \frac{(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2 \times P \times (1-P)}{d^2} = \frac{(1.96 + 1.28)^2 \times 0.5 \times 0.5}{(0.08)^2} = 325$$

The “*P*” in this formula is the prevalence of stress in locomotive operators. According to the literature, no published study has reported the prevalence of job stress in locomotive operators in Iran; therefore, to determine the sample size for the present study, we considered a prevalence rate of 50% for stress.

Measurements

A questionnaire was used for gathering demographic and job stress information. The questionnaires were filled through interviewing the respondents. For measuring job stress, the Osipow questionnaire (reviewed in 1998) was used.¹⁷ The questionnaire consists of 60 questions grouped in 6 subscales, with 10 questions in each subscale. The answers were ranked based on a 5-point Likert scale (1 to 5). The total score of all the questions was calculated and interpreted according to the manual of the questionnaire. The scores ranging between 60 and 119 were referred to as mild stress, between 120 and 179 as average stress, between 180 and 239 as average-to-acute stress, and between 240 and 300 as acute stress. Based on the scores of the Osipow questionnaire, the subjects were divided into 2 groups: the mild and mild-to-average stress group and the average-to-acute and acute stress group. The validity and reliability of the questionnaire has been confirmed in previous studies.¹⁸ A questionnaire was used to gather job experience and level of education.

All subjects with at least 3 years of job experience were included, and individuals with any history of diabetes or heart disease and those using medications for hypertension, hyperlipidemia, blood pressure, and cholesterol were excluded from the study.

All the participants were given a written information sheet about the study and were asked to refer to a health-service center after 10 hours of fasting for blood lipid and glucose measurement as well as systolic and diastolic blood pressure test. (The tests were confirmed by an attending physician.) The test was carried

out in the sitting position using a standard mercury manometer after a short resting time. The result was the average of 2 consecutive tests. Additionally, an intravenous blood sample was taken to check cholesterol, triglyceride, and blood glucose level concentrations using an automatic analyzer.

Statistical Analysis

In this study, the results are reported in 2 parts. In the first part, descriptive statistics were used to describe the frequencies and percentages for the prevalence of occupational stress in the locomotive operators and in the next part, inferential statistics were conducted, after performing the Shapiro–Wilk test to assess the normality of the variables. In addition, the χ^2 test was applied to evaluate the association between the level of education and job experience in the 2 groups affected by stress. Further, comparisons were made in terms of the smoking rate; glucose, triglyceride, and cholesterol level; and diastolic and systolic blood pressures between the 2 groups using the Mann–Whitney *U* test. The data were analyzed using SPSS, version 16.0 (SPSS Inc, Chicago, IL, USA).

RESULTS

In the present study, 350 locomotive operators participated. The age range of the study population was between 24 and 59 years, with the mean age of 36.7 ± 8.13 years, and all the subjects were male. The average working hours of the locomotive operators were 13.62 ± 3.64 hours, and 59 (16.86%) of the study samples reported to be smokers. The level of cholesterol was higher than 200 mg/dL in 39 (11.14%) participants, triglyceride level was above 240 mg/dL in 21 (6%), systolic blood pressure was higher than 140 mm Hg in 11 (3.14%), and diastolic blood pressure was higher than 90 mm Hg in 17 (4.86%).

The results of the Osipow questionnaire showed average stress in 70 (20%) participants,

average-to-acute stress in 250 (71.43%), and acute stress in 30 (8.57%). Therefore, 70 (20%) participants were placed in the mild and mild-to-average stress group and 280 (80%) in the average-to-acute and acute stress group. The Shapiro–Wilk test to assess the normality of the variables showed that the distribution for all the variables—namely blood glucose, triglyceride, and cholesterol levels and diastolic and systolic blood pressures—was not normal ($P=0.000$).

The frequencies of education level and job experience in both groups are demonstrated in Table 1. The results of the χ^2 analysis confirmed that there was a significant association between the level of education and job stress in both groups. Additionally, job experience and job stress had significant associations in both groups ($P=0.000$). According to this result, the association between the age level and job stress in the 2 groups was significant (Table 1).

There was no significant difference between the 2 groups in terms of smoking per day. On the other hand, the mean difference in blood glucose levels between the 2 groups was determined and it was significantly higher in the trivial and trivial-to-average stress group than in the average-to-acute and acute stress group ($P=0.024$). No significant difference was found between the 2 groups apropos the level of blood triglycerides ($P=0.55$). The level of blood cholesterol in the mild and mild-to-average stress group was significantly higher than that in the other group ($P=0.000$). For diastolic blood pressure, there was no considerable difference between the 2 groups ($P=0.21$). The mean difference in systolic blood pressure between the 2 group was reported to be significant insofar as the systolic blood pressure average in the subjects with trivial and trivial-to-average stress was higher than that in the subjects with average-to-acute and acute stress ($P=0.000$).

Table 1. Association between the level of education and job experience in both groups affected by stress

Parameter	First Group [*] n=70 (20%)	Second Group ^{**} n=280 (80%)	P value
Level of education			
High school	23 (32.86)	28(10.0)	0.000
Diploma	28(40.0)	197(70.36)	
Associate degree	19(27.14)	55(19.64)	
Job experience (y)			
1-10	24 (34.28)	173(61.78)	0.000
11-20	19(27.14)	51(18.22)	
>20	27(38.57)	56(20.0)	
Age (y)			
20-30	16 (22.86)	122 (43.57)	0.006
30-40	27 (38.57)	97 (34.64)	
40-50	22 (31.43)	47 (16.78)	
>50	5 (7.14)	14 (5.00)	

*Trivial and trivial-to-average stress **Average-to-acute and acute stress

Table 2. Comparisons of the cardiovascular risk factors between the 2 groups affected by job stress

Risk Factor	First Group (n=70)	Second Group (n=280)	P value ^{***}
Smoking rate (per day)	3.11±11.2	3.25±8.9	0.92
Blood glucose level	97.2± 42.7	85.3±12.3	0.024
Blood triglycerides level	179.2±103.3	171.4±78.3	0.55
Blood cholesterol level	145.3±32.7	194.3±17.6	0.000
Diastolic blood pressure	76.2±21.8	79.6±11.7	0.21
Systolic blood pressure	132.2±13.2	113.3±13.1	0.000

*Trivial and trivial-to-average stress **Average-to-acute and acute stress *** From the Mann–Whitney *U* test

DISCUSSION

The present study was conducted to determine work-related stress and its association with the risk factors of cardiovascular disease. A relatively high rate of job stress was observed in this study insofar as average and acute stress was observed in 80% of the participants.

The correlation between smoking and stress was positive but not significant. Kouvonen et al¹⁵ (2005) reported a nonsignificant relationship in this regard. Pelfrene et al¹⁹ (2002) demonstrated no significant relationship between the risk factors of cardiovascular disease and job stress. The results of the present study are consistent with the findings of the previous studies in this regard. At any rate, considering the cross-sectional nature of the current study and the negative correlation between job stress and the risk factors of cardiovascular disease in the long term, further studies are needed to determine the probable correlation between stress and the risk factors of cardiovascular disease.

We found a significant and strong correlation between job stress and blood glucose. Golmohammadi et al²⁰ (2006) conducted a study on diabetic patients and found a significant relationship between job stress and diabetes. However, their results are not perfectly comparable with the findings of the present study due to the use of different tools in the studies. Belkic et al²¹ (2004) reported a significant correlation between the risk factors of cardiovascular disease, whereas the results reported by Demiral et al²² (2006) did not confirm those findings. The results of the current study are consistent with the findings of the study carried out by Belkic et al²¹ (2004).

We found a nonsignificant relationship between occupational stress and blood triglyceride levels and a significant correlation between occupational stress and blood cholesterol levels. Previous studies such as those performed by Su et al²³ (2001) and Netterstrom et al²⁴ (1991) demonstrated no significant relationship between stress and high blood cholesterol

levels. In contrast, a survey performed by Kobayashi et al²⁵ (2005) found a significant and positive relationship between high blood cholesterol levels and stress, which chimes in with our results. The probable reasons for the different findings may be related to the nature of the current study and the cultural divergence when designing the questionnaire. Furthermore, Kobayashi et al²⁵ (2005) and Yadegarfar et al²⁶ (2010) determined no significant relationship between stress and high blood triglyceride levels, which is in agreement with the results of the present study.

Our results showed significant relationships between stress, level of education, job experience, and age. According to the results of a study conducted by Balakrishnamurthy and Shankar²⁷ (2009), younger subjects experienced higher levels of stress. The main reasons for the incidence of higher stress among younger workers may be in consequence of their comparatively low level of work experience in a new environment. The results of the present study are concordant with the findings of the previous studies in this field.

We observed high diastolic blood pressure among the participants, but there was no significant relationship between high diastolic blood pressure and job stress. A large survey in the city of Tehran, entitled "Healthy Blood" (1997), reported high diastolic blood pressure in about 23% of the population.²⁸ Warren et al²⁶ (2010) found no relationship between job stress and the risk factors of cardiovascular disease, although they observed a high rate of stress among their study participants. Our results are inconsistent with those reported by Warren et al²⁶ (2010).

Study Limitations

The results of the present study (as a cross-sectional study) are less reliable than those reported by studies conducted in a longer period of time. Therefore, our results cannot be drawn upon as a basis to claim that there is no relationship between job stress and the risk

factors of cardiovascular disease. Long-term studies are required to find the probable relationship and confirm the validity of the results. Another limitation of the current study was the participants' relatively low level of concentration when filling out the questionnaire during the interview because to avoid any inconvenience to the locomotive operators, we conducted the interview session at the end of their work shift. Poor cooperation of the staff due to their time shortage was another limitation of the study.

CONCLUSIONS

The majority of the participants in the present study suffered from high occupational stress. Nonetheless, no significant relationship was found between job stress and the risk factors of cardiovascular disease, which may be due to the nature of the study (cross-sectional) and the relative young age of the participants.

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