Job stress and susceptibility to cardiovascular diseases: A case-control study

Kobra Farokhi Moghadam[1], Yousef Mohsenzade[2], Heshmatollah Nourmoradi[1], Reza Beiranvand[3], Kourosh Soleiman Nejad[2], Ali Delpisheh[4*], Sima Avish[5], Tahereh Sahraei[5]

1. Department of Environmental Health Engineering, Faculty of Health, Ilam University of Medical Sciences, Ilam, Iran
2. Department of Cardiology, Faculty of Medicine, Ilam University of Medical Sciences, Ilam, Iran
3. Department of Epidemiology, Faculty of Medicine, Dezful University of Medical Sciences, Dezful, Iran
4. Research Center for Prevention of Psychosocial Injuries, Ilam University of Medical Sciences, Ilam, Iran
5. Faculty of Medicine, Ilam University of Medical Sciences, Ilam, Iran

[*]**Corresponding author:** Tel: +98 8432225733; fax: +98 8432225733
Address: Research Center for Prevention of Psychosocial Injuries, Ilam University of Medical Sciences, Ilam, Iran
E-mail: alidelpisheh@yahoo.com
Received; 31/01/2015 revised; 14/02/2015 accepted 25/02/2015

Abstract

Introduction: Job stress is one of the main characteristics of modern life which is increasing and has been recognized as an important risk factor of cardiovascular diseases. The present study was conducted to determine the association between job stress at work environment and cardiovascular diseases.

Materials and methods: A number of 300 persons including 150 cases and 150 controls were considered in the present study. The participants were diagnosed as patient or healthy persons, based on the cardiologist visits. Then, ERI and demographic questionnaires were completed by interview with subjects. After data collection, the data was interpreted, scored and analyzed using SPSS-16 (Chi-square and independent sample t tests).

Results: Mean age of subjects was 54.2±11.3 years. There was a significant difference between case and control groups in term of extrinsic effort and esteem reward (p=0.05). No significant difference was also observed between case and control groups in term of effort and reward imbalance (p=0.059). Mean fasting blood sugar and triglycerides in patients with effort-reward imbalance was higher than in patients with effort-reward balance (p=0.05).

Conclusion: Cardiovascular disease has a close association with risk factors including job stress. Health education and screening of risk factors of cardiovascular diseases are recommended to early diagnosis of such diseases.

Keywords: Job stress, cardiovascular disease, case-control study

Introduction

Job stress is a common feature of modern life which is increasing and has harmful effects on the cardiovascular system (1). Factors including chemicals exposure, physical factors and mental stress at work environment affect the cardiovascular system. Work-related risk factors that lead to cardiovascular diseases have often not been considered by physicians and scientists. Normally, individual risk factors such as gender, family history, hypertension, smoking, high blood cholesterol, diabetes and obesity have been examined by various researchers. In the United State, heart diseases and strokes are the main causes of the most deaths (2). Job

[Downloaded from demo.medilam.ac.ir on 2026-11-15]

stress is mental and emotional responses occurred in persons who feel that there is not a balance between their ability and work (1, 3). Cardiovascular diseases in Iran, such as many countries in the world, are the major cause of mortality. It may be due to rapid changes in the lifestyle of people in our society (4). Various studies in Iran have been shown that the prevalence of job stress is relatively high (14.4 %) (5). Recent studies showed that psychosocial factors have the substantially effects on the cardiovascular diseases. Annually, the mortality due to the cardiovascular diseases causes millions of deaths in the developing and developed countries (5,6). In USA, the cost of stress related diseases, particularly cardiovascular diseases, is equivalent to 12% of the working time of the employees and it causes an economic loss of equivalent to 4 billion $ annually (6). It is expected that about 25 million deaths from cardiovascular diseases will annually occur after year of 2020. Heart diseases are rising at lower age in Iran. Psychosocial stress by psycho-neuro-physiological mechanisms and stimulation of the nervous system, especially the sympathetic response, can increase the cardiovascular diseases morbidity rate (5). Job stress is subjective in nature and cannot be directly measured by physical and chemical measures. Arnold and Feldman (1989) reported that job stress is caused by the reaction to new or threatening factors in the work environment. In order to identify the job stress components and their quantity effects, theoretical models are required. Two models including job stress and effort–reward Imbalance (ERI) are often used to study the job stress. Job stress mechanisms to make the cardiovascular diseases are numerous. Physiological variables such as blood pressure, high cholesterol levels, increase in left ventricular mass, high hormone levels especially catecholamine hormone, high plasma fibrinogen concentrations, increase in platelets, inflammation, and atherosclerosis operates are the main direct mechanisms that affect on job stress. Lifestyle changes such as smoking, alcohol consumption and low physical activity are the major indirect mechanisms that influence on the cardiovascular system activity. The relationship between job stress and a lot of cardiovascular diseases risk factors such as diabetes, body mass index, hypertension, hyperlipidemia, diabetes, obesity, smoking, alcohol consumption, low triglyceride and low high-density lipoprotein, heart rhythm and metabolic syndrome has been investigated in various studies. But, there is contradictory among findings in this field (1). Therefore, the present study was carried out to determine the association between job stress at work environment and cardiovascular diseases.

Materials and methods

Over the present case-control study, a total 300 persons including 150 cases and150 controls were selected in Ilam city in 2014. The subjects were diagnosed as patient or healthy persons, based on clinical and biochemical tests by cardiologist visits. The sample size was calculated through the statistical software program of Epi-info with 95% confidence intervals (CI) and power 80%. The case group was enrolled and randomly selected. All the cases data were collected at cardiologists offices in Ilam city. The controls with the same diagnosis for cases were tested by cardiologist and the diagnosis for those was negative. ERI (Effort-Reward Imbalance) questionnaire including 17 questions in two scopes of effort and reward was applied for measuring job stress. Efforts were measured by 6 questions that it connects to work requirements. A total score of more than 3 in this scope shows that the enough effort has been made. Rewards were examined by 11 questions including three scopes of financial rewards, not being respected at work and job security. The reward was measured by sum of these three scopes. If

[Downloaded from demo.medilam.ac.ir on 2026-11-15]

the sum of the three indices is less than 7, the reward are low. The ERI questionnaire was translated in Persian language and the reliability and validity were proved. T-test was used to confirm the questionnaire. The ERI and demographic information questionnaires were completed at the offices. The information about the medical history of the persons (case and control) as well as diabetes mellitus, BMI, LDL, HDL and triglycerides were collected using the latest persons laboratory sheets. To avoid interview bias, the interviewer was kept unaware from the results of the exercise test and diagnose of the physician. After data collection related to cases and controls, the ERI questionnaire was interpreted and were analyzed using SPSS-16 (chi-square and independent sample T-tests).

Results

In this study, A number of 300 people including 168 males (56%) and 132 females (44%) with mean age of 54.2±11.3 years were selected in two groups of case (n=150) and control (n=150). Table 1 shows the occupational situation of the participants. Among the participants, 47.4%, 77.3% and 64.7% of them had low external attempts, financial dissatisfaction and low rewards, respectively.

Table 1. The occupational situation of the participants.

Occupational situation	Group	
	Case	Control
Householder (%)	29.3	50.7
Farmer (%)	14.7	8.6
Employee (%)	23.3	17.3
Retired (%)	8.7	2.7
unemployed	0.7	7.0
Workers (%)	6.0	2.0
Other (%)	17.3	18.0

Low external attempts in cases and controls were 60% and 45.3%, respectively. Sufficient external attempt was also 40% in cases and 54.7% in controls. These differences between the two groups of case and control were statistically significant (OR=0.553, %95 CI=0.35–0.87, p=0.011). As seen from Table 2, 72.7% of the cases and 56.7% of the controls expressed that receive low reward. This difference between them was also statistically significant (OR=2.03, %95 CI: 1.25 – 3.29, p = 0.004).

As shown in Table 3, it was found from the relationship between cardiovascular disease and effort-reward balance that 66.0% and 55.3% of the cases and control groups had effort-reward imbalance, respectively. This difference between two groups was not significant (OR=1.56, %95 CI=0.983–2.49, p=0.059). The mean score of outer effort in all the participants was 3.51±1.62. This value in the case group was 0.54 more than control group that was statistically significant (p= 0.003).

Table 2. The relationship between cardiovascular diseases and reward status.

Study Groups	Reward status	N	Percent	P-Value*
Case	Low reward	109	72.7	0.004
	high reward	41	27.3	
Control	Low reward	85	56.7	
	high reward	65	43.3	

*Chi- square.

[Downloaded from demo.medilam.ac.ir on 2026-11-15]

Table 3. The relationship between cardiovascular diseases and reward-effort balance.

Study Groups	Reward – effort status	N	Percent	P-Value*
Case	Reward – effort imbalance	99	66.0	0.059
	Reward – effort balance	51	34.0	
Control	Reward – effort imbalance	83	55.3	
	Rreward – effort balance	67	44.7	

*Chi-square.

The mean of fasting blood sugar (FBS) in all the participants was 127.52±54.93 mg/dl. FBS in persons with effort-reward imbalance and persons with effort-reward balance were 134.25±60.28 and 117.13±43.7 mg/dl, respectively. The mean of FBS in the persons with effort-reward imbalance was 17.12 mg/dl more than the persons with effort-reward balance (p=0.004). The mean of triglycerides (TG) in the applicants was 161.91±72.4 mg/dl. The mean of TG in persons with effort-reward imbalance was 154.4±68.48 mg/dl and for persons with effort-reward balance was 173.71±77.04 mg/dl.

Table 4. Assessments of the effort-reward balance on a cardiovascular disease according to the amount of triglycerides in the case and control groups.

Study Groups	Reward – effort status	N	Mean of TG (CI: 95%)	SD	P-Value*
Case	Reward – effort imbalance	84	160.5 (144.4-173.1)	64.7	0.023
	Reward – effort balance	44	194.3 (166.9-211.8)	68.5	
Control	Reward – effort Imbalance	73	147.3 (119.9-166.1)	72.2	
	Reward – effort balance	56	157.3 (144.9-202.3)	80.0	
Total	Reward – effort imbalance	157	154.4 (141.0-164.8)	68.4	
	Reward – effort balance	100	173.0 (163.2-197.9)	77.0	

Independent sample t- test*; CI, confidence interval; TG, triglycerides; SD, standard deviation.

As seen from Table 4, the mean of TG in persons with effort-reward imbalance was more than persons with effort-reward balance (p=0.023). The number of cigarettes smoked per day in case group was more than the control group. With an increases the number of cigarettes per day, the number of vessels involved in cardiovascular patients was increased. The correlation coefficient (r) between the number of cigarettes smoked and the number of vessels involved in cardiovascular patients was 0.206 (Table 5 and Figure 1).

Table 5. The relationship between the number of cigarettes and the number of vessels involved in patients with cardiovascular disease.

Variables	No standardized coefficients	Standardized coefficients	CI 95%	P-Value*
Number of vessels involved (Independent variable)	1.67	0.17	(1.36-1.93)	0.0001
Number of cigarettes smoked (Independent variable)	0.206	0.13	0.013-0.399	0.037

*Linear regression. CI, Confidence interval.

[Downloaded from demo.medilam.ac.ir on 2026-11-15]

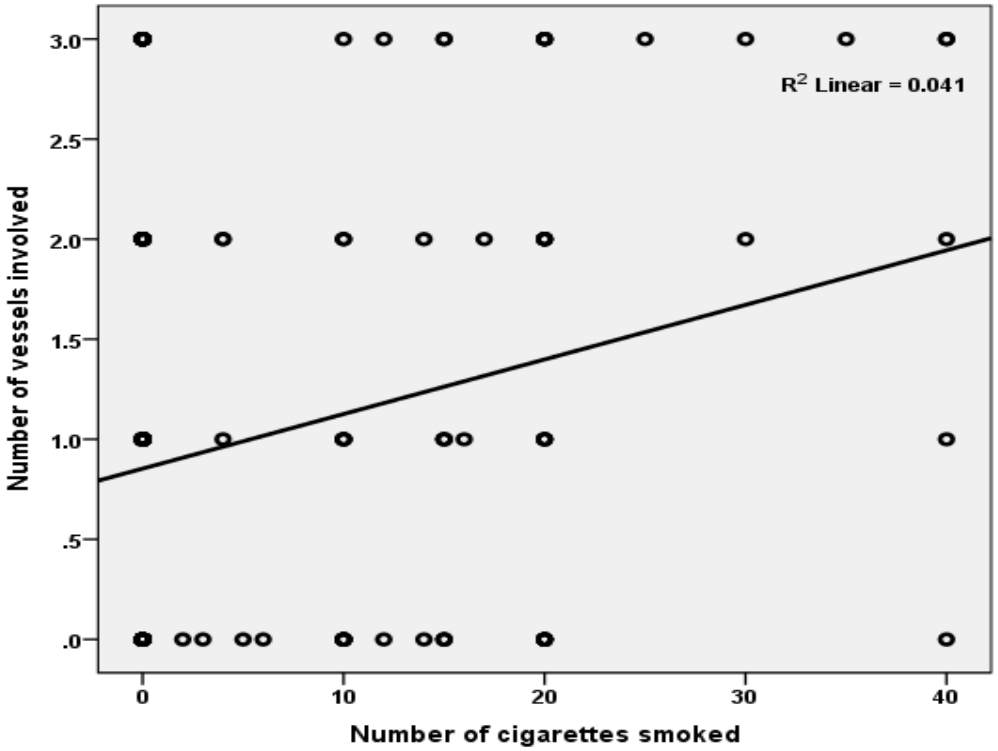


Figure 1. The relationship between the number of cigarettes smoked and the number of vessels involved in cardiovascular disease.

The mean BMI (body mass index) of the case and control groups was 28.04±3.43 and 26.55±3.79 years, respectively. There was significant difference between mean BMI of the case and control groups (p=0.003). In overall, 68.7 % of the control group and 28.0 % of the case group had hypertension that this deference was statistically significant (p=0.001).

Discussion

In this study, the effects of job stress on the risk of cardiovascular diseases morbidity were evaluated in Ilam city, Iran. The results showed that the patients with cardiovascular diseases in comparison with healthy persons were exposed to more stressful conditions. In this study, the job stress factors (including outer efforts, financial satisfaction and reward) of the case group were higher than the control group (p=0.011). Heidari Pahlavian et al. (2010) and Yadegarfar et al. (2005) also reported that job stress factors in the case group were significantly higher than the control group (1, 5). Xu et al. (2009) also showed that job stress significantly increased the risk of cardiovascular diseases morbidity in china, which it may be due to the presence of important independent risk factors of CHD (7). The results of acute and chronic stress effects in incidence of cardiovascular diseases by Pesic et al. (2004) study showed that the chronic stress in the workplace was an important risk factor for cardiovascular diseases. But, the acute stress did not differ between the case and control groups (8). Hamer et al. (2006) reported that there was no significant relation between inflammatory responses, cardiovascular diseases and job stress (9). Our results showed a significant difference between the case and control groups in term of job type (p=0.003). But, there was not found a significant relationship between job stress and job type in two groups (p=0.333). Pourreza et al. (2010) showed the significant relationship between job stress and job type in the studied groups that was not in accordance with our study (10). Wamala et al. (2000)

[Downloaded from demo.medilam.ac.ir on 2026-11-15]

reported that there was an inverse significant relationship between job classes and cardiovascular diseases (CHD) risk. Women with high level of job class had 4 times more exposed to cardiovascular diseases risks than women with lower job class (11). In this study, no significant relationship was observed in the case and control groups between mean of work exprience (months) with job stress (p=0.205). This result was in consistent with the results from other studies (12, 13) and was contrary to the results of some studies (14). The present study showed that the mean of triglycerides in persons with effort-reward imbalance was more than persons with effort-reward balance (p=0.023). Yadegarfar et al. (2010) reported that there was a linear relationship between rate of triglycerides and job stress in the patients with cardiovascular diseases, but it was not significant (1). Rang Amiz et al. (2005) showed that there was a significant relationship in term of high triglycerides between employed and housewives women. Their study also showed the significant relationship in term of high triglycerides between between the employed men in noisy jobs and quietly jobs, employed men with shift jobs and non-shift jobs (4). In this study, the rate of diabetes morbidity in the case and control groups in view of the effort-reward balance was statistically significant (p=0.005). This result was not consistent with results from other studies (1, 4). There was statistically significant difference in cardiovascular patients based on vessels involved in term of effort-reward balance (p=0.026), that was consistent with results from other studies (15-18). The number of cigarettes smoked in the case group was more than the control group. With an increases the number of cigarettes smoked per day, the number of vessels involved in cardiovascular patients was increased. In other reports, the significant relationship was not found between job stress and cigarette smoking which was contrast with the present study (19). Unlike the Azimi et al. study (20), there was observed a significant relationship between living location and cardiovascular diseases.

Conclusion

Job stress is one of the major characteristics of modern life which is increasing and has been recognized as an important risk factor. Cardiovascular disease has a close association with risk factors including job stress. Health education and screening of risk factors of cardiovascular diseases are recommended to early diagnosis of such diseases.

Acknowledgement

The authors are grateful to the Vice Chancellery for Research of Ilam University of Medical Sciences for the financial support of this research (Grant no: 917014/133).

References

1. Yadegarfar G, Alinia T, Gharaaghaji asl R, Allahyari T, Sheikhbagloo R. Study of Association between Job Stress and Cardiovascular Disease Risk Factors among Urmia Petrochemical Company Personell. J Isfahan Med Sch. 2010; 112(28): 645-59.
2. Szeszenia-Dąbrowska N, Wilczyńska U, Sobala W. [Occupational diseases in Poland in 2013 and their causative agents]. Med Pr. 2014;65(4):463-72.
3. Choi B, Dobson M, Ko S, Landsbergis P. Job strain and lifestyle factors. CMAJ. 2014;186(1):63-4.
4. Rang- Amiz F, Boshtam M, Ansari R, Yazdani A. [The relationship between different occupations and risk factors of heart diseases]. J Armaghan-e-

[Downloaded from demo.medilam.ac.ir on 2026-11-15]

Danesh. 2005; 10 (37): 59-69. (Persian)
5. Heidari Pahlavian A, Gharakhani M,Mahjub H. [A comparative study of stressful life events and stress coping strategies in coronary heart disease patients and non-patients]. Sci J Hamdan Univ Med Sci. 2010; 17(3):33-8. (Persian)
6. Mushtaq M, Najam N. Depression, anxiety, stress and demographic determinants of hypertension disease. Pak J Med Sci. 2014;30(6):1293-8.
7. Weixian Xu, Yiming Zhao, Lijun Guo, Yanhong Guo and Wei Gao. Job stress and coronary heart disease: A case control study using a Chinese Population. J Occup Health. 2009;51(2):107-13.
8. Hadži Pešić M. Stress and coronary heart disease. Med Biol. 2004; 11(1): 45-8.
9. Hamer M1, Williams E, Vuonovirta R, Giacobazzi P, Gibson EL, Steptoe A. The effects of effort-reward imbalance on inflammatory and cardiovascular responses to mental stress. Psychosom Med. 2006;68(3):408-13.
10. Pourreza A, Barat A, Hosseini M, Akbari-Sari A, Oghbaie H. [Relationship between socioeconomic factors and coronary artery disease among under-45 year-old individuals in Shahid Rajaee Hospital, Tehran, Iran: A case-control study]. J Sch Public Health. 2010; 7 (4) :25-32.(Persian)
11. Sarah PW, Murray A, Myriam HM, Schenck-Gustafsson K, Orth-Gomer K. Job stress and the occupational gradient in coronary heart disease risk in women The Stockholm Female Coronary Risk Study. Soc Sci Med. 2000; 51(4):481-9.
12. Safari S, Habibi E, Dehghan H, Mahaki B, Hassanzadeh A. Job stress, education and work ability among refinery workers. TKJ. 2013; 5 (3):1-10.
13. Bahrami A, Akbari H, Mousavi S, Hannani M, Ramezani Y. [Job stress among the nursing staff of Kashan hospitals]. Feyz. 2011; 15 (4): 366-73.(Persian)
14. Nourani S, Hadizadeh Talasaz Z, Shakeri MT, Modarres Gheravi M. The relationship between occupational stress and happiness of midwives who work in the hospitals and health centers of Mashhad. Iran J Obstet Gynecol Infertil. 2013; 16(74):1-9.
15. Bayazi MH, Rastgari T. Relationship of type 2 behavior patterns, hardiness and stress with coronary heart disease. Psychol Res. 2005; 8(1):40-58.
16. Ramachandruni SA, Handberg EA, David SB. Acute and chronic psychological stress in coronary disease. Curr Opin Cardiol. 2004; 19(5):494-9.
17. Hallman T, Thomsson H, Burell G, Lisspers J, Sellerlind S. Stress, Burnout and coping: Differences between women with coronary heart disease and healthy matched women. J Health Psychol. 2003; 8(4):433-45.
18. Bakhsheepoor A. The relationship between type A personality and experienced stress with heart attack. Psychol Resh. 1998; 4(3): 3-14.
19. Kouvonen A, Kivimaki M, Virtanen M, Pentti J, Vahtera J. Work stress, smoking status, and smoking intensity: an observational study of 46,190 employees. J Epidemiol Commun Health. 2005; 59(1): 63-9 .
20. Vahedian Azimi A, Sadeghi M, Movafegh A, Sorouri Zanjani R, Hasani D, Salehmoghaddam AR. [The relationship between perceived stress and the top five heart disease characteristics in patients with myocardial infarction]. J Zanjan Univ Med Sci. 2011; 20(78): 99-111. (Persian)

[Downloaded from demo.medilam.ac.ir on 2026-11-15]