Original Article

Evaluation of ischemic heart disease and its risk factors among the employees of a steel production factory in Iran

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ABSTRACT

Introduction: Cardiovascular diseases are responsible for about 30% of mortalities around the world. Although physical inactivity has been known as a risk factor for these diseases, few studies have investigated the role of occupational inactivity in the workplace as a predisposing factor for ischemic heart disease. The aim of this study was to compare the risk factors of ischemic heart disease between the production and administrative workers in a steel production factory. Materials and Methods: In this cross-sectional study, participants included two groups of production and administrative workers. Collected data comprised demographic characteristics, medical history, and physical examination of employees. Statistical analysis was performed with SPSS 16 software, using chi-square test for qualitative variables and t-test for quantitative variables. Results: In overall, 248 men consisting 135 (54.4%) production workers and 113 (45.6%) administrative workers were enrolled in the study. The mean age of the production and administrative workers was 36.84±7.11 and 38.12±6.5 years, respectively. The mean length of work experience in the production and administrative workers was respectively 11.35±6.04 and 12.56±6.21 years. The prevalence of ischemic heart disease and its risk factors among production and administrative workers were respectively as follows: ischemic heart disease 0.7% and 6.2%; hypertension 5.9% and 6.2%; dyslipidemia 11.1% and 15%; diabetes 0.7% and 0.9%; smoking 12.6% and 3.5%; and elevated body mass index 59.3% and 0.7%. Amongst these items, only ischemic heart diseases prevalence was significantly lower in production workers compared with administrative workers (p=0.02). Conclusion: According to our results, continuous sedentary work may increase the possibility of ischemic heart disease and its risk factors in men. In contrast, occupations with dynamic or static physical activity as walking, manual labor, etc have a protective effect on the incidence of ischemic heart diseases and its risk factors. Therefore, encouraging the employees to increase their physical activity in daily life and in the workplace is beneficial in preventing ischemic heart diseases.

Keywords: Ischemic heart disease, Physical activity, Workers

Introduction

Cardiovascular diseases (CVD) are responsible for nearly 30% of fatality worldwide [1], and this figure even reaches up to 50% in developed countries [2]. In Iran, about 38% of mortalities are due to coronary artery diseases [3]. Conventional researches into cardiovascular diseases have primarily studied the individual risk factors such as smoking, family history, diabetes, etc., while fewer research has been carried out in the field of occupational risk factors [4, 5].

Previous researches reported that exposure to some chemical and physical agents in the workplace could be a risk factor for CVD [6]. Exposure to solvents, carbon monoxide, carbon disulfide, heavy metals, hot or cold environment, noise, and sedentary jobs are the risk factors that can lead to cardiovascular disorders in the employees [7, 8]. Although physical inactivity has been known as a risk factor for these diseases, few researchers have yet evaluated inactivity in the workplace [9]. Studies have demonstrated a decline in the number of physically demanding occupations, however, there has been an increase in sedentary occupations which involve being seated in over 70% of the time at work [10].

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Based on previous studies, no certain core mechanism is known regarding the effect of sedentary jobs on CVD. However, some theories have been proposed, including that seated position results in decreased activity of lipoprotein lipase, reduced insulin activity, and impairment in glucose metabolism [11, 12]. Morris and colleagues compared the risk of cardiovascular disease among urban bus drivers and driver assistants and concluded that sedentary jobs can increase the risk factors of CVD [13]. Conversely, a systematic review by Van Uffelen *et al*. revealed discrepant and inconclusive findings regarding the relationship between sedentary jobs and cardiovascular diseases, diabetes and cancer [14].

Most people between 15 and 64 years spend more than half of their waking times in the workplace [15]. Workplaces provide good opportunities for health promotion studies, since access to 85% of the population is possible through these places [16].

Although physical inactivity has been known as a risk factor for ischemic heart disease, few studies have investigated the role of occupational inactivity in the workplace as a predisposing factor for these diseases. This study aimed to investigate the risk factors for ischemic heart disease among workers of the production sector and compare it with the administrative workers in an Iranian steel factory during one year.

Materials and Methods

This cross-sectional study was conducted on 248 male workers at a steel manufacturing company in North Khorasan province, Iran during 2017. Participants included production workers-those with heavy physical work- and administrative workers-those with sedentary jobs. It was optional for all subjects to enroll in the study.

The production workers were mainly steelworkers in the jobs such as turnery, welding, metalwork, metal fusion, and assembly with static and dynamic physical activities. In contrast, the administrative workers were those with seated and monotonous work during at least 70% of the work time. Demographic characteristics and medical history of studied population were collected and recorded by a medical research assistant on the cheklist.

Physical examination was done by a physician specialized in occupational medicine. The height of each individual was measured in straight stand-up position, while shoulder width, hip, and heels were against the wall with hands along the body, and knees stuck together and straight fixed head. Weight was determined using scales with a light dress and no shoes. Body Mass Index (BMI) was calculated by dividing weight (kg) by the square of height (meters). In this study, BMI above 25 was considered as overweight.

Blood pressure was obtained by the average blood pressure measured twice (at 30-second intervals) from the right hand in seated position after 5 minutes rest. Subsequently, blood sample was taken after 10-12 hours of fasting for biochemical tests.

In this study, in case of blood triglyceride levels above 150 or cholesterol above 200 or low density lipoprotein (LDL) above 130 and high density lipoprotein (HDL) below 35 or consumption of the relevant drugs were considered as dyslipidemia. Individuals with fasting blood sugar (FBS) of less than 100mg/dl were considered normal and people with FBS ≥100 mg/dl and less than 126 mg/dl were abnormal or pre-diabetic, while those with blood sugar ≥ 126 mg/dl in two tests were considered diabetic. Workers who smoked one cigarette or more per day were considered smokers and the rest were grouped as non-smokers [17, 18].

The inclusion criteria were having at least one year of work experience, an informed consent to participate in the study, and no history of heart disease, diabetes, and dyslipidemia at the commencement of recruitment. Employees with combined jobs and those with any previous job displacements were excluded.

Data from observations, examinations, and para-clinical assessments were entered into a computer database, and statistical analysis was performed using SPSS-16. Descriptive statistical methods including indices of central tendency, scattered, and frequency of distribution, as well as analytical, statistical methods including Chi-square for qualitative variables and t-test to compare quantitative variables were used.

Results

In this study, 248 patients were enrolled, all of whom were men, which ranged between 23 and 59 years. Results from Kolmogorov–Smirnov test showed normal distribution of the observations (α=0.09). Of the 248 cases, 135 (54.4%) were production workers and 113 (45.6%) worked in office as administrative workers. The means of age in the production workers and office workers were 36.84±7.11 and 38.12±6.59 years, respectively. The mean of work experience were 11.35±6.04 and 12.56±6.21 in the production and administrative workers, respectively. Data related to systolic blood pressure, diastolic blood pressure, total cholesterol, triglycerides, LDL, HDL, and FBS, are depicted as Table 1. The prevalence of qualitative variables such as hypertension, dyslipidemia, diabetes, obesity, and smoking in both groups are presented in Table 2. The study subjects were assigned to three groups of healthy, pre-diabetic, and diabetic based on their FBS levels (Table 3).

Discussion

The main objective of this study was to investigate the relationship between risk factors of ischemic heart disease and working conditions of the workers regarding physical activity. Results of the study indicated that the risk of ischemic heart disease was significantly higher in the office workers than that in the production line workers (6.2 % compared with 0.7%, p= 0.02). In other words, occupations with constantly sedentary nature are independently associated with a higher risk of ischemic heart disease and some of its risk factors in men. In contrast, occupations associated with physical activity (walking, manual labor, etc.) have a protective effect on the incidence of cardiovascular disease risk factors. We found that some

cardiovascular risk factors such as smoking, exposure to chemicals, and shift working was higher among production workers.

Contrary to our findings, a study by Petersen et al. showed that frequent heavy lifting at work (static occupational activities), especially in those with low mobility, can lead to increased risk of ischemic heart disease in men [19]. Several cohort studies revealed an association between occupational physical activity with cardiovascular disease and its mortality [20-22].

A cohort study in Canada showed occupations involving predominantly standing increase 2-fold risk of heart disease compared with occupations involving predominantly sitting [23].

A case-control study showed that repeated carrying of weighty loads at work leads to increased risk of myocardial infarction, while walking and regular physical activities in the workplace (dynamic jobs) can reduce the risk [24].

Although the mean systolic and diastolic blood pressures in the production workers were higher than that of office workers, and this difference was statistically significant between the two groups, chronic hypertension in the workers of production and office workers were similar [5.9% and 6.2%, respectively). This finding was not consistent with the result of the study by Fakhrzadeh *et al*. in which the prevalence of hypertension and associated risk factors were evaluated in a 25-64 year old population. In this study, the prevalence of hypertension in men was 29%, and such difference may be due to differences in the studied population and the definition of variables [25]. Moreover, our results are inconsistent with the results of Assadi study comparing the cardiac risk factors in various industries, since she found that the prevalence of hypertension was higher in workers with heavy physical work compared with office clerks [4].

The elevated mean of blood pressure in the production workers can be attributed to exposure to noise and excessive physical activity in the workplace. Sancini et al. demonstrated that exposure to noise and several physical factors are associated with cardiovascular disease [6]. High blood pressure leading to stroke and CVD can result in disability and job losses. Thus controlling hypertension among the workers can reduce further consequences [26, 27].

In the current study, the prevalence of smoking in the production workers was significantly higher than office workers ($P<0.01$). Similarly, in the study by Assadi, a significant relationship was observed between smoking and various occupational groups, so that the prevalence of smoking in car industry was 18.8% vs. 3.6 % for those who had lighter working style, which is consistent with our study [4]. In a health survey in USA, changes in cigarette smoking prevalence by occupation was evaluated. During the period of study, cigarette smoking prevalence decreased from 31.7% to 24.2% among white-collar workers, from 43.7% to 39.2% among blue-collar workers, and from 37.2% to 34.5% among service workers [28].

Our findings indicate that the office workers had a slightly higher BMI than the production workers, which is directly associated with the inherent nature of their job and inadequate physical activity. However, no significant relationship was found between the two groups ($P= 0.8$). In a study by Mostafavi *et al*. [29], the prevalence of obesity in men was reported 11.7 %, and 33.3% of the subjects were overweight. However, our finding that 60% of the individuals in both groups were overweight was not matched to the result of Mostafavi et al., but was in line with the outcome of a study by Nooritajer *et al*. estimating the association between hypertension and BMI in a population of workers in which the prevalence of obesity was 68% [30].

The prevalence of type 2 diabetes in our study population was much lower than that in the general population of Iran (0.1% vs. 5.5%) [31]. The office workers, with minor differences, had higher incidence of diabetes than the production workers. In our study, the prevalence of pre-diabetes in both groups was approximately 27 %, while it was 43% among 1903 drivers being studied by Izadi et al. [17]. Despite an insignificant relationship, the prevalence of dyslipidemia in the office workers was higher than that in the production workers, which is consistent with a study conducted by Nakanishi *et al*. in Japan [32].

The current survey was a cross-sectional study which is considered a limitation since made it impossible to examine the causal relationship. Furthermore, because the workforce in this study was young, it is possible that differences in the incidence of CVD risk factors and the associated occupational factors occur in the aging population. This issue needs to be investigated in further studies. Another limitation of this study was lack of assessment of physical activity in leisure time and nutritional status in the studied groups. Furthermore, it is likely that some of the workers had been assigned to low-risk jobs due to CVD or existence of its risk factors; hence, there is a possibility of healthy workers effect in this study.

Conclusion

In our study, the risk of ischemic heart disease and some of its risk factors were higher in the group of sedentary workers. Therefore, encouraging the employees to increase physical activity in daily life and the workplace can be very effective in preventing cardiovascular disease. Moreover, screening programs for early detection of non-communicable diseases and implementation of health promotion programs such as smoking prevention, nutrition improvement, obesity control, etc to improve employees' health status will enhance organizational productivity.

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Table 1. Comparison of quantitative variables between the two studied populations.

Variables	Production Workers Mean±SD	Administrative Workers Mean±SD	P-value
Age	36.8±7.11	38.1±6.5	0.14
Work experience	11.3±5.5	12.5±6	0.12
Body mass index	25.7±3.2	25.9±3.7	0.74
Systolic blood pressure	121.88±10.64	117.65±9.28	0.001
Diastolic blood pressure	79.08±6.55	77.10±6.69	0.02
Triglyceride	170.51±52.31	163.8±53.23	0.5
Cholesterol	192.31±31.52	187.71±32.68	0.4
LDL	105.59±19.46	103.27±24.42	0.7
HDL	38.72±5.88	39.01±5.05	0.8
Fasting Blood Sugar	93.16±13.72	92.13±27.69	0.6

Table 2. Comparison of the prevalence of cardiovascular disease and its risk factors between the two studied groups

Variables	Production Workers N (%)	Administrative Workers N (%)	P-value
Hypertension	8 (5.9%)	7 (6.2%)	0.5
Dyslipidemia	15 (11.1%)	17 (15%)	0.35
Diabetes	1 (0.7%)	1 (0.9%)	0.7
Overweight and Obesity	80 (59.9%)	68 (60.7%)	0.8
Smoking	17 (12.6%)	4 (3.5%)	0.01
Ischemic heart disease	1 (0.7%)	7 (6.2%)	0.02

Table 3. Comparison of fasting blood sugar levels between the two studied groups

Study groups	Normal N (%)	Pre-diabetic N (%)	Diabetic N (%)
Production Workers	64 (71.9%)	24 (0.27%)	**1 (1.1%)**
Administrative Workers	49 (72.1%)	18 (26.5%)	**1 (1.5%)**
P-value		0.9	