

## Risk factors of cardiovascular diseases in a worker population in Isfahan province (Isfahan Electricity Production and Distribution Company)

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### Abstract

**BACKGROUND:** Cardiovascular disease (CVD) is known as a health threat worldwide. In Iran, similar to other countries, CVD is the first leading cause of death. Higher prevalence of cardiovascular risk factor leads to the higher prevalence of CVD. Previous studies revealed that CVD prevention depends on healthy lifestyle and people's behavior. This study was conducted to determine the prevalence of cardiovascular risk factors among occupational population of the Isfahan Electricity Production and Distribution Company and to plan a strategy for CVD prevention in this population.

**METHODS:** This cross-sectional study was conducted on all 585 occupational populations of Isfahan Electricity Production and Distribution Company in 1999. Data collection was based on questionnaire including demographic characteristics, medical history, and physical examination. Information on sex, age, education, occupation, marital status, smoking, physical activity, and sleeping hours were obtained as demographic characteristics, CVD risk factor and non-communicable disease history as medical history. Height, weight, waist circumference, hip circumference, and blood pressure were measured. Fasting blood sugar (FBS), total cholesterol, LDL-C, HDL-C, triglyceride (TG) were tested for each person.

**RESULTS:** Finding of this study showed that out of total population, 4.2% had high FBS, 33.3% high LDL-C, 48.2% high total cholesterol, 26.4% low HDL-C, and 51% had high TG. Obesity was seen in 13.6%, overweight in 46.7%, abdominal obesity in 42.8%, and sedentary lifestyle in 75%. In addition, 16.4% were current smoker and 5.8% of them were ex-smoker. Furthermore, those with hypertension and diabetes were 16% and 7.2%, respectively.

**CONCLUSION:** Considering high prevalence of CVD risk factors in occupational population of Isfahan Electricity Production and Distribution Company, recognition of CVD risk factors could provide ground for interventional programs to prevent CVD in this company and maybe in other similar companies.

**Keywords:** Cardiovascular Diseases, Risk Factor, Electricity Production and Distribution Company, Prevention and Control.

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### Introduction

Nowadays, cardiovascular diseases (CVD) are known as one of the major human health-threat risk factors. It is the most important cause of mortality among many people of the world and also Iran.<sup>1</sup> Statistics show that more than one-third of mortalities in Isfahan are related to it.<sup>2</sup> The increasing prevalence of

CVD and high human and economic losses caused by them has emphasized the importance of prevention and control of these diseases. Increased prevalence of these diseases has occurred along with growing prevalence of their risk factors. In some studies, increased prevalence of risk factors was due to people's life style and its changes.

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CVD risk factors generally are divided into two changeable and unchangeable categories. Changeable risk factors are factors related to lifestyle such as physical activity, diet, smoking and alcohol and physiological and biochemical factors such as increased blood pressure, weight, blood glucose and cholesterol. Removing each of the above factors, the chance of cardiovascular disease would be reduced.<sup>3</sup>

According to the results of a study in Isfahan in 1999, 16 percent of people suffered from obesity, 21 percent with hypertension, 33 percent high LDL-C, 6 percent diabetes, 53 percent had no acceptable physical activity and 11 percent were smokers.<sup>4</sup> However, similar studies in subsequent years represented increasing prevalence of these risk factors in our society.<sup>5</sup>

Increased prevalence of CVD risk factors and accordingly increase in prevalence of the diseases itself in Iran made researchers to design some interventional programs in order to decrease or at least fix the risk factors.<sup>6</sup> However, among the adults of the society who are considered as the main and determining group of the society, employees are the most important group; therefore, modifying their lifestyle is of high importance, because social and economic structure of the society directly is affected by this group. Among the employees, workers and staff composed a large population. In addition to their important role and due to job structure, accessibility and training them is easy and also any change in their behavioral structure such as diet modification, physical activity and conducting periodic examinations are possible all together. Using the findings of Isfahan Healthy Heart Program, the prevalence of CVD risk factors among the workers of Isfahan and Najaf Abad cities calculated in 2001.<sup>7</sup> On the other hand, the role of workers of some departments such as Electric Power Stations and Generators is very vital and sensitive. The workers of such department not only have a very high stress during their job, their presence at work is also very important and crucial. Hence, conducting of a special study in this group for CVD risk factors seems necessary. The present study aimed to determine the prevalence of this risk factor among the workers of Isfahan Electricity Production and Distribution Company in order to provide an interventional strategy to control and prevent cardiovascular disease in future, first at the company level and later in the entire country.

### Materials and Methods

This was a cross-sectional study done in 1999 on all the staff of Isfahan Electricity Production and Distribution Company which comprised 585 subjects. After

signing the consent form for entering into the project, they were evaluated by a trained physician. A questionnaire was designed and its reliability was approved using test-retest method. It consisted of three parts of demographic data, medical history and physical examinations. The individual and demographic characteristics of samples included age, sex, education, job, marital status, type and frequency of tobacco consumption and type and amount of physical activity. The history of risk factors for CVD, suffering from these diseases and other non-communicable diseases registered in medical history and the results of physical examinations were mentioned in third part of the questionnaire.

After settlement of trained team in Electrical Power Department, the staff referred to complete the questionnaire one by one. First, the demographic data were completed by trained interviewer. Then, the medical history part was completed using the samples' medical history by the physician and thereafter, physical examinations including measurement of height, weight, waist and hip circumference conducted using the standard protocol. The blood pressure of all the participants was measured and registered in physical examination part.

Height measurement done while the person stood straight, shoulders width, hip and heels stuck to wall and knees attached and hands were loosely near the body and head as auriculoorbital (Frankfurt) plane (straight looking front) with no shoes using a meter gauge. Their weight was also measured with a thin cloth using a scale. Their body mass index (BMI) calculated by dividing weight (kg) to squared height (m). BMI less than 25 was defined normal, 25 to 29.9 was defined as overweight and greater than or equal to 30 as obesity.<sup>8</sup> Waist and hip circumference done using a tape meter with thin cloth in standing position. Waist circumference (WC) measured at the middle of the lowest rib cage and the top part of the pelvis, and hip circumference (HC) was measured in the prominence area of femoral bone. In WC measurements in men, values higher than 102 cm and in women higher than 88 cm considered abnormal. Thereafter, waist to hip ratio (WHR) was measured. This rate was abnormal providing that it was more than 1 in men and more than 0.8 in women.<sup>8</sup>

Blood pressure (FBS) was measured before taking blood samples after 5 minutes resting in sitting position two times from the right hand (30 seconds intervals between the two tests) and the mean of the two measurements was registered as the blood pressure. According to the criteria of JNC VII (Joint National Committee), having systolic blood pressure equal or higher than 140 mmHg and/or diastolic BP equal or

higher than 90 mmHg and/or consumption of anti-hypertensive medication was defined as hypertension.<sup>9</sup>

A fasting blood samples (12-14 hours of fasting) was taken and sent to the laboratory of Isfahan Cardiovascular Research Center. Fasting blood sugar (FBS), total cholesterol (T.Chol), triglyceride (TG), LDL Cholesterol and HDL cholesterol were measured using enzymatic method through Pars kits via Hitachi 902 autoanalyzer in laboratory of Isfahan Cardiovascular Research Center. LDL-C equal or higher than 130 mg/dL or T.Chol equal or higher than 200mg/dL and HDL-C lower than 40 mg/dL in men and lower than 50 mg/dL in women, and also TG higher than 150 mg/dL considered as high levels of blood's lipids.<sup>10</sup> FBS greater than 126 mg/dL or having the history of diabetes defined as high blood sugar.<sup>11</sup>

In this study, those who smoked at least a cigarette per day considered as smokers, those who have passed three months since previous smoking considered as ex-smokers and the rest considered as non-smokers. Furthermore, the amount of physical activity considered as four categories including physical activity during leisure time, in work place, walking and at home. The physical activity for every four types of physical activities measured based on metabolic equivalent task (MET). Every MET equals to 305 mg/kg/min Oxygen.<sup>12</sup>

After completing all the questionnaires, they were revised initially, and then corrected, if necessary. The data were entered via EPI software and finally analyzed through SPSS software.

## Results

In this study, all the 585 staffs of Isfahan Electricity Production and Distribution Company with age range of  $40.5 \pm 9.4$  years were studied. Only 54 of them

were females (9.2%). Fifty samples were single (8.5%) and the rest were married. Eighty participants (13.7%) had elementary education and lower and 59 participants (10.1%) had secondary education. In addition, 147 participants (25.1%) were high-school graduates and 290 of them (49.6%) had academic degree.

Table 1 shows the mean and standard deviation of CVD risk factors in staff of Isfahan Electricity Production and Distribution Company and table 2 also shows the frequency percentage of these factors in studied subjects.

As table 2 shows, out of 585 staff of Isfahan Electricity Production and Distribution Company, 4.2 percent suffered from high blood sugar, 33.3 percent with high LDL-C, 48.2% with high T.Chol, 26.4 percent had low HDL-C and 51 percent had high TG. Obesity was observed in 13.6 percent of them, overweight in 46.7 percent, abdominal obesity in 42.8% and unacceptable physical activity in 75 percent of them. 16.4 percent of them were smokers during the time of study and 5.8 percent were the ex-smokers. Moreover, 16 and 7.2 percent of them had hypertension and diabetes respectively.

## Discussion

According to the findings of this study, out of the entire staff, 16 percent had hypertension, 4.2 percent had high blood sugar, 33.3 percent had high LDL-C, 48.2 percent had high total Cholesterol, 26.4 percent had low HDL-C and 51 percent had high TG. In addition, in 7.2 and 13.6 percent of the cases, they had diabetes and obesity, respectively. 46.6 percent had overweight, 42.8 percent had abdominal obesity and 75 percent had unacceptable physical activity. In addition, 16.4 percent were current smoker and 5.8 percent were ex-smoker at the time of study.

**Table 1.** Mean of CVD risk factors in staff of Isfahan Electricity Production and Distribution Company

Risk factors	Mean	SD	MEDIAN	Maximum	Minimum
Height (Cm)	170.99	7.64	171.00	194.00	147.00
Weight (kg)	76.46	12.64	76.00	120.00	42.00
BMI (Kg/m <sup>2</sup> )	26.13	3.84	26.12	40.27	15.81
Waist Circumference (Cm)	90.26	11.01	91.00	127.00	55.00
Hip Circumference (Cm)	100.23	6.86	100.00	128.00	79.00
Waist to Hip Ratio	0.90	0.07	.91	1.12	0.62
Fasting Blood Sugar (mg/dl)	88	22	84	297	56
Total Cholesterol (mg/dl)	198	39	197	385	94
LDL-C (mg/dl)	117	28	117	245	33
HDH-C (mg/dl)	46	11	46	95	19
Triglyceride (mg/dl)	183	108	154	926	45
Systolic BP (mmHg)	113.42	15.25	110.00	180.00	75.00
Diastolic BP (mmHg)	75.22	10.18	75.00	130.00	100.00

**Table 2.** CVD risk factors in staff of Isfahan Electricity Production and Distribution Company

Risk factors	n (%)
High FBS	24 (4.2)
High blood pressureP	94 (16)
High LDL-C	190 (33.3)
High total cholesterol	275 (48.2)
High triglyceride	291 (51)
Low HDL-C	151 (26.4)
Current smoker	96 (16.4)
Ex-smoker	34 (5.8)
Obesity	79 (13.6)
Abdominal obesity	249 (42.8)
Low working physical activity	319 (75)

Abnormal values: FBS  $\geq$  126; LDL  $\geq$  130; T.Chol  $\geq$  200; TG  $\geq$  150; Male: HDL  $<$  40; Female: HDL  $<$  50

Current smoker: at least smoking a cigarette per day

Abdominal obesity: male, 102  $>$  cm WC; female, 88  $>$  cm

Low working physical activity: activity  $<$  19  $\frac{\text{met hour}}{\text{day}}$

In staff of Isfahan Electricity Production and Distribution Company, mean systolic and diastolic blood pressure approximately was 113 and 75 mm Hg respectively and 16 percent of staff suffered from hypertension. In a study on 3000 Indian staff,<sup>13</sup> mean systolic and diastolic blood pressure respectively reported to be  $122 \pm 13.3$  and  $83 \pm 9.5$  mmHg which was only 8 mmHg higher than the findings of the present study; while the percentage of people with hypertension in Indian study was approximately two times more than staff of Electricity Company. In addition, a study on staff of Research Center of Oil and Gas and Powerhouses in Brazil<sup>14</sup> obtained a closer statistics so that systolic and diastolic blood pressure were  $116 \pm 15.1$  and  $75 \pm 10.5$  mmHg, respectively, and the prevalence of hypertension was 18.2 percent. On the other hands, the prevalence of this disease in 19 to 70-year-old population of Isfahan<sup>4</sup> showed that amount of hypertension in staff of Electricity Company was relatively much better than the whole population of this city; however, the frequency of 16% of hypertension is still noteworthy and considerable.

FBS in the present study was significantly lower compared to India ( $101 \pm 32.6$ ) and Brazil ( $91.9 \pm 16.1$ )<sup>15,16</sup> and even compared to urban population of Isfahan ( $98 \pm 13.7$ ); however, the frequency of diabetes prevalence was more compared to Brazilian staff (2.5%), and was a little more compared to Isfahan staff (6%) and significantly lower compared to Indian staff (15%).<sup>4,13</sup> Other reports in Iran also reported 1.5 percent for Khoarasan Province and 6.3 percent for Tehran.<sup>17,18</sup> Therefore, the prevalence of

diabetes in staff of Electricity Company was almost similar to the population of the community or at most one to two percent more.

However, unlike the results of a study pertaining to FBS, the staff of Electricity Company had higher values of T.Chol and LDL-C than Indian staff (180.5 and 114.4 respectively)<sup>13</sup> and people of Isfahan; but it was lower comparing to a study in a working community in Rio de Janeiro (208.4 and 132.3 respectively)<sup>14</sup> as well as a study on Tehran's people (220.6 and 128 respectively).<sup>16</sup> The reason also may be due to the differences in diet. The amount of red meat, animal fats and hydrogenated oils was very effective on cholesterol level. According to the results of an interventional study from Isfahan Healthy Heart Program,<sup>7</sup> the type and amount of consumed fat was very undesirable before conducting any intervention in offices and firms of Isfahan which can justified the statistics of the present study.

In terms of HDL-C, except the Brazilian staff which their mean was slightly higher than other studies including the whole population of Isfahan, they showed lower levels of HDL-C than staff of Electricity Company.<sup>4</sup> The frequency of HDL-C lower than normal (with the same criteria for this study) was 67.2 percent in Indian staff<sup>13</sup> and 57.6 percent in urban population of Isfahan<sup>4</sup> which was better comparing to status of Electricity Company staff than the both above mentioned studies. However, in Tehran City,<sup>16</sup> HDL-C lower than 35 mg/dL observed in 5.4 percent and it was seen only in 8.7 percent of Brazilian staff<sup>14</sup> which was due to difference in the index. Considering the effect of physical activity on amount of HDL-C and statistics related to physical activity of such people, the results seem reasonable and logical.

The TG level of Electricity Company staff relatively was higher than Isfahan population. In this regard, the study related to Indian staff showed that 38 percent of staff had TG levels higher than 150 mg/dL.<sup>13</sup> Generally, it seems that high levels of TG follows the pattern of Isfahan region; however it requires a serious program although it is considered as a metabolic disorder with a very high frequency. Serum TG levels closely is related to the type of diet, obesity and overweight which the results justified the frequency of 60 percent for overweight and obesity among these people as well as served food in restaurants of firms and offices.

However, the frequency of obesity and overweight (60.3%) in this study indicates worse status of other subjects in India (35%) and Brazil (42%)<sup>13,14</sup> than our staff. On the other hand, the frequency of this factor in staff of Electricity Company was even higher than the whole community (Isfahan). However, considering

the average amounts of BMI in other mentioned studies including India ( $23.7 \pm 3.4$ ), Brazil ( $26.5 \pm 4.5$ ), Isfahan ( $24.8 \pm 3.8$ ), Tehran ( $25.7 \pm 4.1$ ) and also a study in Japanese staff ( $23.2 \pm 0.1$ ),<sup>16</sup> it was indicated that average BMI in the present study was close to the Brazilian study, however, it was significantly higher than others. Hence, the obesity in were recorded in Tehrane (14.4%),<sup>17</sup> Semnan (14.5%),<sup>19</sup> and Isfahan (36.6% overweight and 11.4% obesity) for men was comparable considering that the majority of staffs were males.<sup>20</sup> In addition, another study on Iranian men showed that mean WC in married and single men was 89.3 and 83.8 cm<sup>21</sup> and considering that most of Electricity Company staff were married, it can be concluded that the waist circumference of these people is almost in accordance with Iranian population. However, this amount was higher compared to Indian staff. Therefore, overweight and obesity in Electricity Company staff generally was high. The reason may be due to work type which was more sedentary (sitting position) and the results related to physical activity indicated this claim.

One of the other risk factors was smoking. In comparison with some Indian (36%)<sup>13</sup> and Japanese staff (52%),<sup>19</sup> the frequency of smoking was lower, but it was a little higher comparing to Brazilian staff (12.4%).<sup>14</sup> In another study on firms' staff, it was indicated that 13.6 percent were smokers but 15.9 percent reported to be cud consumers which totally indicated 31.4 percent of staff smoke tobacco.<sup>22</sup> Also, 26% of men were smokers which was much more than amount of Electricity Company staff.<sup>4</sup> These results showed that generally the studied subjects of this study were in a better situation in terms of smoking. In addition, since obesity and smoking are inversely associated, the results still seem reasonable.

On the other hand, the type of working activity also is of high importance by itself. For instance, jobs with minimum movement and high concentration are the reasons create underlying risk factors through sedentary lifestyle as an independent factor.<sup>23-25</sup> Therefore, the jobs of Electricity Company staff which are mostly with no special physical activity, can be attributed to high rate of some of risk factors to their job requirements in this department.

### Conclusion

According to the findings of the present study, it was indicated that CVD risk factors is of high frequency in Electricity Company staff and conducting interventional measures seem necessary to prevent from the above actors and consequently prevent from the cardiovascular diseases. Now, according to clinical sys-

tems in factories and some organizations that are organizing their activities along with general measures, there are some special opportunities provided for preventive measures for occupational injuries and public risk factors. Therefore, in order to continue this research, preventive programs can be implemented for this class of society and similar staff of other administrations.

### Conflict of Interests

Authors have no conflict of interests.

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