Original Article

# Assessment of risk factors for coronary artery disease in military personnel: A study from Iran

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## Abstract

**Introduction:** Cardiovascular diseases are the most significant cause of mortality. Although the risk factors of this disease are well known, the strength of these factors varies in different populations and needs to be investigated. **Aim:** The aim of this study is to estimate the amount of the effect of each classic risk factor on CAD (coronary artery disease) among Aja personnel. **Materials and Methods:** This matched case-control study was conducted on 1000 male Aja personnel admitted selecting Aja hospitals in Tehran in 2017. The samples were selected using purposive-graded sampling method. The 250 military patients hospitalized for CAD were considered as a case group. Each case was individually matched for age and service force with tree military patients without CAD. Data were gathered using standard demographic information and history of risk factors questionnaire and analyzed using SPSS 23 and statistical tests. Odds ratio measured trough Cochran–Mantel–Haenszel test and used to estimate the amount of the effect of each classic risk factors on CAD. **Results:** Data analysis indicated that the risk factors including diabetes, hyperlipidemia, smoking, hypertension, and positive family history of CAD enhance the probability of CAD as much as 79.2%, 77.3%, 67.7%, 64.1%, and 56.6%, respectively. **Conclusion:** Diabetes and other modifiable risk factors have the greatest impact on CAD among the concerned Aja personnel. Hence, the authorities can consider the independent amount of the effect of each risk factor and modify them in order to prevent the disease more effectively and purposefully among the personnel.

**Keywords:** Coronary artery disease, matched case-control study, risk factor

## Introduction

Coronary artery disease (CAD), or more commonly known as heart disease, is usually a result of plaque buildup in coronary arteries, a condition called atherosclerosis.[1] Cardiovascular diseases are the most common cause of death in the world and the most important cause of disability and decreased the quality of life.[2] According to statistics, about 50% of deaths (5 million out of 12 million deaths) in developed countries are caused by cardiovascular diseases.[3] In Iran, the statistics also show that the prevalence of such diseases is very high.[4]

In the United States, the estimated direct cost of cardiovascular diseases was $358 billion in 2015 and it was $46.8 billion for CADs. These values are expected to reach $4370 and $4.6 billion in 2020, respectively.[5] According to statistics, direct (i.e. hospitalization and treatment) and indirect (i.e. absence from work and unemployment) costs imposed by CAD on Iran's oil industry are estimated to be 26.77 billion Rials (currency in the Islamic Republic of Iran).[6]

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**Access this article online**

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_109_19



**How to cite this article:** Mirzaeipour F, Seyedmazhari M, Pishgooie AH, Hazaryan M. Assessment of risk factors for coronary artery disease in military personnel: A study from Iran. J Family Med Prim Care 2019;8:1347-51.

There have been many risk factors introduced for cardiovascular diseases, especially CAD. A majority of such risk factors are associated with culture, a shift from traditional life to machine life, nutrition, industrialization, occupation, and, in general, lifestyle changes.[7] In general, the risk factors of CAD are classified into modifiable and nonmodifiable categories. Nonmodifiable category consists of risk factors such as age, menopause, and family history of the disease.[8] Modifiable risk factors affecting the CAD include smoking, low physical activity, alcohol consumption, poor socioeconomic status, some drugs, such as oral contraceptives, and certain diseases, such as obesity, especially abdominal obesity, diabetes, hyperlipidemia, hypertension, stress, depression, and nutrition.[8-10] The dietary factors imposing cardiovascular diseases or related risk factors include high-fat diets, high-sodium foods, foods with saturated fats, refined carbohydrates, low levels of fatty acids, processed foods, fast foods, and fried foods as well as low consumption of fruits, vegetables, and high-fiber foods.[11] Despite the identification of these risk factors, the amount of CAD is still increasingly high. While diabetes, smoking, hypertension, hyperlipidemia, and positive familial history are well known for cardiovascular disease, their amount of effect on different populations is unknown. On the one hand, most studies in Iran have been carried out on the ordinary people and little information is available regarding the military personnel. It should be noted that the working and environmental conditions of military personnel are very different from those for ordinary people and these conditions can also affect the risk factors of CAD.[12] Considering these cases, the present study aimed to estimate the amount of the effect of each classic risk factor on CAD among the Aja personnel. The findings would pave the way for proper planning to prevent major risk factors that are more likely to cause CAD and to decrease the organization's funding on secondary risk factors, thereby improving the personnel's health status while reducing the additional costs in the organization.

## Materials and Methods

This research is a matched case-control study. The statistical population of this study is male military patients referring to selected Aja military hospitals in Tehran. The hospitals were selected from the other hospitals due to their high frequent visits. In this study, the purposive graded sampling method was used based on the specifications of the units under study. The number of selected samples from each hospital was proportional to the number of patients admitted to the hospital.

According to the same study,[13] to determine the sample size at 95% confidence level and 80% test power, the number of about 225 samples, needed for the case group, was calculated using the following formula:

$$n = \frac{2\left(Z1-\alpha/2+Z1-\beta/2\right)^2 \times \left[P\left(1-P\right)\right]}{P1-P2},$$

taking into account $\alpha = 0.05$ (first type error) and $\beta = 0.1$ (second type error), $P1 = 35.8\%$ and $P2 = 59.5\%$ were obtained. To increase the power of the study, the researchers conducted 250 samples for the case group and 3 samples for the control group; in other words, 750 samples were taken for the control group (totaling 1000 samples). Accordingly, the cases and controls are frequently matched on age and service forces.

After obtaining the ethics approval and permission from Aja University of Medical Sciences, coordination was made with the selected Aja hospitals and the researcher visited these hospitals for sampling. According to the inclusion criteria (included being military, being a man, diagnosis of CAD for the patient from a year ago, being aged between 30 and 65 years old when the disease occurs, and willingness to participate in research), 250 male military patients hospitalized for CAD were selected. Not more than a year had been passed from the diagnosis of their disease. The control group ($n = 750$) was also selected according to the inclusion criteria (included being military, being a man, lack of CAD for the patient, being aged between 30 and 65 years old, and willingness to participate in research) from military patients admitted in noncardiac care units. After assigning the subjects into two groups, the research objectives were explained to them, and then, their written informed consent forms were received. Data were collected by the researcher through adopting a researcher-made questionnaire. The questionnaire had been developed based on reliable sources[14-16] in two parts. The first part contains the information, including age, marital status, weight, height, level of education, economic status, military service branch, military service force, military grade/rank, military service history in Aja, and smoking. The second part of the questionnaire included yes/no questions about the presence of diabetes, hypertension, and hyperlipidemia. It should be noted that the past 5 years were concerned to determine the history of each factor among the patients. Furthermore, all 750 samples in the control group were tested by a 12-lead ECG to remove the probability of the CAD. The ECG test results were examined by an expert and the absence of CAD was confirmed.

Face and content validity of the questionnaires were investigated by 10 faculty members and the required revisions were made according to their comments. Due to the demographic nature of the questionnaire, there was no need for reliability confirmation.

### Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics version 23.0. To describe the concerned units, absolute and relative frequency, mean, and standard deviation were used and the Kolmogorov–Smirnov test was used to determine the distribution of the statistical population. Because of the normal distribution of data ($P > 0.05$), the Chi-square test, Fisher's exact test, and independent *t*-test were used. To measure the amount of effect of each risk factor on CAD, odds ratio (OR) was measured via the Cochran–Mantel–Haenszel test.

## Results

According to the findings, the participants' age ranged from 35 to 65 years with the mean and standard deviation values

of 52.17 ± 7.87. In addition, 96.6% of the samples (966 persons) were married and 45.9% (459) had a bachelor's degree. In terms of work experience in Aja, the majority of the participants (81.1%) had a background above 20 years and 28.5% were colonels. In general, 59.8% of the samples had a middle-income level. Independent *t*-test, Chi-square, and Fisher's exact test showed that both groups were homogeneous regarding the above specifications. However, they differed in terms of military service branch and the frequency of military personnel in the control group (54.9%) was significantly more than their frequency in the case group ($P = 0.048$). Regarding the body mass index, it was also shown that individuals with a BMI greater than 25 kg/m$^2$ were significantly more in the case group than in the control group ($P < 0.001$) [Table 1].

Data analysis also revealed that the frequency of risk factors of hypertension ($P = 0.003$), hyperlipidemia ($P = 0.002$), diabetes ($P = 0.005$), smoking ($P = 0.008$), and positive family history of CAD ($P = 0.019$) in the case group was significantly higher than their frequency in the control group. In line with the ultimate goal of the study, the results of data analysis showed that the risk factors of diabetes, hyperlipidemia, history of smoking, smoking, hypertension, and positive family history of CAD increase the probability of coronary heart disease as much as 79.2%, 77.3%, 74.4%, 67.7%, 64.1%, and 66.6%, respectively [Table 2].

**Table 1: Individual and occupational characteristics of the subjects**

| Group | Index | Case | Control | Total | *P* |
|---|---|---|---|---|---|
| Age | Mean±SD | 52.33±7.65 | 52.12±7.94 | 52.17±7.87 | 1 |
| Marital status | Married | 96.4% | 96.7% | 96.6% | 0.84 |
| Level of education | BS | 46% | 45.9% | 45.9% | 0.1 |
| Experience in Aja | Over 20 years | 85.6% | 79.6% | 81.1% | 0.29 |
| BMI | 25–30 kg/m$^2$ | 64% | 58.4% | 59.8% | 0.001 |
| Degree | Colonel | 31.2% | 27.6% | 28.5% | 0.055 |
| Category | Military | 47.6% | 54.9% | 53.1% | 0.048 |
| Income level | Middle | 66% | 68.4% | 67.8% | 0.72 |
| Service forces | Air force | 40% | 40% | 40% | 1 |
| | Ground force | 40% | 40% | 40% | |
| | Sea force | 20% | 20% | 20% | |

## Discussion

The present study assessed the relationship between classic atherosclerotic risk factors and CAD among Aja personnel. We found a strong positive association between hyperlipidemia, smoking, hypertension, positive family history of CAD, diabetes, and CAD in this population.

The current study showed that smoking enhances the probability of CAD among Aja personnel as much as 67.7%. In accordance with this finding, Grosz *et al.* (2007) study was to examine 250 military pilots over 10 years in terms of coronary heart disease risk factors. After a 10-year follow-up, it was found that there is a direct and significant relationship between smoking and CAD, with 31.7% of patients having had a history of smoking.[17] Joharimoghadam *et al.* compared 338 military men with 1954 nonmilitary men. In this study, individuals were evaluated within a year. The findings of this study implied that although the frequency of smokers in the military group was higher than their frequency in the nonmilitary group, the risk of CAD was equal in both groups.[18] In this case, the findings of this study contradict the findings of our study and the findings obtained from previous studies. This can be caused by the age difference between military men and nonmilitary ones; in Joharimoghadam *et al.* study, military men were of a lower age than nonmilitary men, whereas previous studies indicated that there is a direct relationship between age and the risk of cardiovascular disease, including CAD.[19-21] Therefore, the lower age of military men might have resulted in a lack of correlation between smoking and the risk of CAD.

This study showed the association between hyperlipidemia and CAD among the Aja personnel (OR = 1.773). In this case, in a large prospective study conducted by Lin *et al.* in 2015 in Taiwan, 130,000 of patients with traumatic brain damage as well as 258,000 of healthy individuals were followed up over 10 years. Individuals in the case and control group were homogenous in terms of age and gender. After a 10-year follow-up, it was found that the incidence of hyperlipidemia among patients with CAD was significantly higher than that among the healthy subjects.[22] In the cross-sectional study on 651 military men, the comparison of patients with CAD and healthy individuals showed that there was no significant relationship between hyperlipidemia and the risk of CAD.[23] The findings of this study contradict those of the present study and the findings achieved from previous

**Table 2: Relationship between risk factors and coronary heart disease**

| Results / Risk factors | Case[a] *n*=250 | | Control[a] *n*=750 | | Value | Risk estimate[b] Odds ratio | | *P*[c] |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 95% Confidence interval | | |
| | Yes | No | Yes | No | | Lower | Upper | |
| Diabetes | 41 | 209 | 74 | 676 | 1.792 | 1.187 | 2.705 | 0.005 |
| Hyperlipidemia | 56 | 194 | 105 | 645 | 1.773 | 1.235 | 2.546 | 0.002 |
| Smoking | 47 | 203 | 91 | 659 | 1.677 | 1.14 | 2.466 | 0.008 |
| Hypertension | 74 | 176 | 153 | 597 | 1.641 | 1.186 | 2.269 | 0.003 |
| Positive family history | 49 | 201 | 101 | 649 | 1.566 | 1.075 | 2.282 | 0.019 |

[a]Cases and controls are frequently matched on age and service forces [b]Risk estimate measured by using Cochran's and Mantel–Haenszel test [c]*P*-value measured by using Chi-square

studies.[24-26] The main reason for the difference between the result of this study and the present study is the design of this study that was cross-sectional and this type of study does not explicitly specify the precedence and cause/effect.

In the present study, diabetes, among other risk factors, had the greatest impact (OR = 1.792) on CAD. Similar results were reported in the previous studies.[27] In a large prospective study, 388,000 of persons were evaluated within 10 years. This study concluded that the incidence of CAD among patients with diabetes was significantly higher than its incidence among healthy subjects. In other words, it was found that there was a direct relationship between diabetes and CAD.[22] In a study conducted by Masoudkabir *et al.* in Iran, it was revealed that a unit increase in the incidence of diabetes causes a 12.9 unit increase in the incidence of the CAD.[28]

Hypertension is a very important risk factor for developing cardiac diseases. One study, by Turin *et al.* in Japan, evaluated blood pressure and CAD among 5834 persons over 18 years. In this study, it was found that the probability values of CAD in 45-year-old men with hypertension and healthy men the same age were 26.95% and 14.12%, respectively. According to the findings of this study, the risk of CAD is higher among men with hypertension than among healthy men. Furthermore, the probability values for women with hypertension and healthy women aged 45 were 14.85% and 6.21%, respectively. This finding also indicates a higher risk of CAD in women with hypertension.[29] In contrast, Leiba *et al.* carried out a study in Israel on 22,981,300 military personnel with the aim of evaluating the relationship between hypertension and CAD and its resulting mortality rate. This cohort study showed that mortality from CAD was 51% higher among patients with hypertension than among the healthy subjects, although this study reported no relationship between hypertension and CAD.[30] Regarding the lack of correlation between high blood pressure and CAD in this study, one important point can be noted is that the population studied in this study is different from our study.

Investigations have shown that genetic factors can affect CAD. The positive family history of CAD, as a genetic factor, can affect the incidence of this disease as well. Many studies have examined the relationship between the positive family history of CAD and the incidence of this disease. In a cross-sectional study by Hindieh *et al.* in Canada, 763 patients with premature coronary syndrome with an age range of 46–53 years were concerned. The findings of this study showed that the prevalence of vascular diseases such as CAD was significantly higher among patients with a positive family history of heart disease than among those who had no such a history. This relationship remained meaningful even after modifying the effect of the intervening variables. In this study, it was also shown that the CAD is more severe among patients with a positive family history of heart disease than among patients without a positive family history.[31] Other studies on 349 individuals who had referred for angiography were researched by Sunman *et al.* Patients with a positive family history of heart disease suffered from a higher severity of CAD.[32]

Although there are many studies in the world about the relationship between classic risk factors and CAD, no research has been conducted in Iran to measure the magnitude of this effect on CAD in the military personnel.

## Conclusion

The findings of this study suggested that diabetes, hyperlipidemia, smoking, high blood pressure, and positive family history of CAD had the strongest effect on coronary heart disease in Aja personnel, respectively. Although the positive family history of CAD is a nonmodifiable risk factor (as the weakest risk factor of the CAD among Aja personnel), other factors can be moderated. In other words, changing lifestyle and modifying bad habits such as overeating and smoking as well as encouraging more mobility among Aja personnel, and especially doing group exercises, can decrease the probability of CAD through eliminating the risk factors such as diabetes, high blood pressure, hyperlipidemia, and obesity. All in all, since few quantitative studies have examined the risk factors of CAD among the Iranian military personnel and with regard to the novelty of this research in this field in the Islamic Republic of Iran, the findings can pave the way for future research.

## Limitations

Some of the samples were not fully aware of their medical records or they were not completely sure about that, so the researcher was referring to their medical records in order to match the information provided by the patients and the information provided by their medical records.

### Financial support and sponsorship

The study was financially supported by Aja University of Medical Sciences grant no. 695512.

### Conflicts of interest

There are no conflicts of interest.

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