

Prevalence of Obesity, Overweight and Other Cardiovascular Risk Factors among Iranian Military Personnel in 2022

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ABSTRACT

Introduction: The incidence and prevalence of cardiovascular disease (CVD) have increased in Iran, considering the importance of documenting and generating information about the risk of CVD in the military community, the current study aimed to measure the prevalence of risk CVD factors as well as predict the 10-year risk of CVD among the Iranian military personnel. The FRS items include age, gender, total cholesterol, high density lipoprotein cholesterol (HDL-C), systolic blood pressure, status of diabetes and smoking.

Methods: This cross-sectional study was conducted on 1025 male military personnel in 2022. For comparative analysis, ANOVA or t-test, as well as the Chi-square (or Fisher's exact) test was used. All statistical analyses were conducted using SPSS 22 software. The statistical significance level was set at 0.05.

Results: The prevalence of hypertension was 2.3 % and increased with age. The prevalence of overweight and obesity increased with age and was 54.7% as well as 14.1%, respectively, in those 40- 45 years of age. Diabetes affected 6.2% of the oldest group and 8.2% of participants aged 40-45 years. TC was increased in one-third of understudied cases. The percentage of abnormal LDL-C was 57.5%. These results were accompanied by increased TG in 34.6%, low HDL-C in 36.4%, and FPG >100 mg/dl in 13.2% of subjects. Out of a total of 608 participants over 30 years of old, a low FRS (<10%) was calculated for 571 (93.9%), the others, were classified as moderate (5.6%) and high (0.5%) risk. The prevalence of hypertension among the high and moderate FRS risk group was higher than low-risk group older persons have a higher 10-year CVD risk level ($p < 0.001$). The level of, blood pressure, FPG, LDL, TC, and TG, in the high-risk group, was significantly higher than in the two other groups ($P=0.001$).

Conclusion: Although a high proportion of military personnel had a low risk of CVD in the next 10 years, the high prevalence of overweight and other risk factors such as LDL level needs special attention.

Key words: Cardiovascular risk; Iranian; Military; Personnel; Framingham risk score

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INTRODUCTION

Cardiovascular disease (CVD) has been an increasing trend during the last decade in Iran¹ as well as all over the world² and this disease is now considered as one of the main causes of death. It is predicted that more than 23 million deaths from CVD will occur in the world by the end of the current decade.³ Such an upward trend of mortality is also predicted in Iran.¹ Poor nutrition, high blood pressure, smoking, obesity, lipid and blood glucose disorders, and stress are among the most important determinants of CVD.² Due to the nature of military work, assigned duties and lifestyle may make the employees of this occupational group, the risk of CVD in this group is somewhat different from the general population. Although the selection process during the recruitment of the armed forces is expected to lead to the formation of a population that is on average healthier than the general population, at the same time, military activities and carrying out military missions are usually associated with degrees of occupational stress,⁴ that can be related to the incidence of CVD and its risk factors.⁵ Probably for this reason, military personnel are more exposed to cardiovascular risk.^{6,7} Accurate and timely CVD statistics is essential for monitoring and managing the disease prevention measures. In Iran, no national data are available on the prevalence of CVD risk factors among militaries. Since most CVD risk factors are modifiable, it is worthy to focus on the documentation of CVD risk in Iranian military population. CVD risk assessment tools help accurate identification and treatment of people at high risk of CVD in clinical practice.⁸ Different CVD risk prediction models have been used in the literature.⁹ The Framingham Risk Score (FRS) estimates 10-year CVD risk using data on smoking status, age, sex, total cholesterol (TC), diabetes status, systolic blood pressure, and high-density lipoprotein cholesterol (HDL).¹⁰ Considering the increasing trend of CVD and the limited studies conducted on CVD risk assessment among Iranian military personnel, documenting and generating information could be useful, so the current study aimed to measure the prevalence of obesity, overweight and other CVD risk factors as well as to predict the 10-year risk of CVD among the Iranian military population.

METHODS

Data and population

This cross-sectional study was conducted on 1025 male military personnel in 2022. Statistical population was Iranian male military personnel. Random sampling was done among military personnel. The inclusion criteria were as follows: willingness to participate in study and no CVD disease. The exclusion criteria were following a certain diet and lack of cooperation for required information in the research. Data related to age, height and weight, smoking habit, diabetes, systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol concentration (TC), triglyceride (TC), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), Fasting plasma glucose (FPG), uncontrolled blood pressure (blood pressure (BP) \geq 140/90 mmHg) and cardiovascular diseases were collected via a predesigned checklist. Weight (kg) was measured with minimal clothing and bare feet using a standard digital scale with an accuracy of 100 grams. Height (cm) was measured using a tape measure without shoes and an accuracy of 0.5 cm. Body mass index (BMI) was calculated

as weight (kg) / height (m) 2. BP was measured using a standard sphygmomanometer by a trained nurse and after at least 5 minutes of rest in a sitting position. Blood samples were taken after 12 hours of fasting. Prediction of 10-year CVD risk was performed by FRS. FRS were determined based on CVD risk factors including age, HDL-C, systolic hypertension (treated/untreated), total cholesterol, smoking habits, and status of diabetes. The range of the total score could be between -3 and 21. The 10-year risk percentage of CVD, calculated according to the total FRS (-3 or less points: < 1%, -2 points: 1.1%, -1 point: 1.4%, 0 point: 1.6%, 1 point: 1.9%, 2 points: 2.3%, 3 points: 2.8%, 4 points: 3.3%, 5 points: 3.9%, 6 points: 4.7%, 7 points: 5.6%, 8 points: 6.7%, 9 points: 7.9%, 10 points: 9.4%, 11 points: 11.2%, 12 points: 13.3%, 13 points: 15.6%, 14 points: 18.4%, 15 points: 21.6%, 16 points: 25.3%, 17 points: 29.4%, 18 points or more: > 30). The 10-year CVD risk categorized as follows: low; FRS < 10%, moderate; FRS = 10–19%, and high; FRS ≥ 20%.¹¹

Statistical analyses

The normal distribution of the data was evaluated using visual inspection using histograms with superimposed normal curves and quantile-quantile (Q-Q) plots. The histogram provided an initial assessment of the distribution shape, where a symmetric, bell-shaped curve aligned with the theoretical normal distribution suggested normality. The Q-Q plot further complemented this evaluation by comparing the observed quantiles against expected normal quantiles; adherence of data points to the diagonal reference line supported the normality assumption.¹² The means ± standard deviations (SDs), or frequency (percentage) were used for the description of continuous and categorical data respectively. For comparative analysis, ANOVA or t-test, as well as the Chi-square (or Fisher's exact) test was used. All statistical analyses were conducted using SPSS 22 software. The statistical significance level was set at 0.05.

RESULTS

A total of 1025 military men entered into the study. The mean of age was 31.98 year with 6.9 standard deviation. The mean of BMI was 24.8 kg/m² with 3.04 standard deviation. The prevalence of hypertension was 2.3 % and also increased with age (P=0.0001). The prevalence of overweight and obesity were 31.2 and 5 %, respectively. The prevalence of obesity increased with age and reached 14.1% in those 40- 45 years of age. More than 10% of the participants were current smokers. Diabetes affected 2.4% of total population as well as 6.2% of the oldest group and 8.2% of participants aged 40–45 years. TC was increased in one-third of subjects. The percentage of those with abnormal LDL-C, TG, HDL-C and FPG were 57.5, 34.6, 36.4, and 13.2%, respectively. All of these abnormalities increased with age. More details were shown in table 1 (table 1).

Out of a total of 608 participants over 30 years of old, A low FRS (<10%) was calculated for 571 (93.9%), the others, were classified as moderate (5.6%) and high risk (0.5%). Smoking habit, was less prevalent in subjects in low FRS risk group compared to other 2 groups (P = 0.001). The prevalence of hypertension was higher among the high FRS risk group (P = 0.0001). According to Table 2, older individuals have a higher risk level for CVD (P = 0.001). Also the level of BP, FPG, LDL, TC, TG,

in high risk group were significantly than intermediate and low risk groups ($P < 0.05$). The HDL level in high-risk group was significantly lower than intermediate and low risk groups ($P = 0.001$) (table 2).

Table 1. Characteristics of the study population according to age groups

Variables	20-30 years of age	30-40 years of age	40-45 years of age	≥ 45 years of age	Total	P
n (%)	417(40.7)	422(41.2)	122(12)	64(6.1)	1025	-
Smoking status, n (%)	31(7.4) *	52(12.3)	14(11.5)	9(14.1)	106(10.3)	0.082
Having diabetes, n (%)	5(1.2)	6(1.4)	10(8.2)	4(6.2)	25(2.4)	0.0001
Body mass index <18.5 (Underweight)	6(1.4)	6(1.4)	1(0.8)	1(1.6)	14(1.4)	0.0001
Body mass index 18.5 – 24.9 (Healthy weight)	272(65.2)	227(53.8)	51(41.8)	25(39.1)	575(56.1)	
Body mass index 25.0 – 29.9 (Overweight)	130(39.8)	168(42.6)	52(54.7)	65(37.6)	385(31.2)	
Body mass index ≥ 30 (Obese)	9(2.2)	21(5.0)	18(14.1)	3(4.7)	51(5.0)	
Body mass index (kg/m ²)	24.25 \pm 2.82	24.88 \pm 2.91	26.47 \pm 3.61	25.88 \pm 2.82	24.88 \pm 3.04	0.0001
SBP (mmHg)	119.20 \pm 3.10	119.25 \pm 5.30	119.59 \pm 15.41	122.58 \pm 9.70	119.48 \pm 7.10	0.004
DBP (mmHg)	79.21 \pm 3.36	79.39 \pm 3.02	80.49 \pm 4.04	80.93 \pm 4.60	77.54 \pm 3.25	0.0001
FPG (mg/dl)	90.98 \pm 11.67	91.74 \pm 13.37	97.43 \pm 22.44	98.75 \pm 22.21	92.55 \pm 15.01	0.0001
HDL-c (mg/dl)	42.87 \pm 8.22	42.57 \pm 8.00	42.70 \pm 9.44	40.23 \pm 7.68	42.56 \pm 8.26	0.133
LDL-c (mg/dl)	106.72 \pm 34.16	109.74 \pm 36.24	113.36 \pm 43.45	121.57 \pm 36.72	109.68 \pm 36.53	0.012
TC (mg/dl)	172.52 \pm 48.74	185.78 \pm 78.55	185.25 \pm 41.97	202.27 \pm 44.58	181.35 \pm 62.46	0.0001
TG (mg/dl)	122.38 \pm 66.47	149.79 \pm 96.10	172.01 \pm 113.43	176.70 \pm 100.43	142.96 \pm 89.98	0.0001
FPG>100 (mg/dl)	47(11.3)	47(11.1)	24(19.7)	17(26.6)	135(13.2)	0.001
HDL-c<40 (mg/dl)	146(35.0)	151(35.8)	47(35.8)	29(45.3)	373(36.4)	0.441
LDL-c> 100 (mg/dl)	222(53.2)	246(58.3)	75(61.5)	46(71.9)	589(57.5)	0.02
TC .200(mg/dl)	98(23.5)	137(32.5)	41(33.6)	32(50.0)	308(30.0)	0.0001
TG>150 (mg/dl)	105(25.2)	158(37.5)	57(46.7)	34(53.1)	354(34.6)	0.0001
BP \geq 140/90 mmHg	0(0)	4(0.9)	12(9.8)	8 (12.5)	24(2.3)	0.0001

*The denominator of the fraction is the number of people in each age group.

FPG, Fasting plasma glucose; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; TC, Total cholesterol; HDL-c, High-density lipoprotein-cholesterol; LDL-c, Low-density lipoprotein-cholesterol; BP, Blood pressure; P-value < 0.05 considered as significant.

Table 2. Characteristics of the study population according to FRS Status (Only in participants aged >30 years of old, n= 608)

Variables	Total	FRS		
		Low (< 10%)	Intermediate (10–19%)	High (> 20%)
No. of participants, n (%)	608 (100)	571 (93.9)	34 (5.6)	3 (0.5)
Age (year)	36.30 ± 5.51	35.80±5.25	44.12±3.00	44.67±2.31
Body mass index (kg/m ²)	25.30 ± 3.12	25.18±3.04	27.04±3.87	28.73±0.89
Body mass index <18.5 (Underweight)	8 (1.3)	7 (1.2)	1 (2.9)	0 (0)
Body mass index 18.5 – 24.9 (Healthy weight)	303 (49.8)	291 (51.0)	12 (35.3)	0 (0)
Body mass index 25.0 – 29.9 (Overweight)	255 (41.9)	238 (41.7)	14 (41.2)	3 (100)
Body mass index ≥30 (Obese)	42 (6.9)	35 (6.1)	7 (20.6)	0(0)
Smoking status, n (%)	75 (12.3)	58 (10.2)	15 (44.1)	2 (66.7)
Having diabetes, n (%)	20 (3.3)	9 (1.6)	10 (29.4)	1 (33.3)
SBP (mmHg)	119.67 ±8.84	119.14±4.97	126.59±10.4	146.58±11.54
DBP (mmHg)	79.65 ± 3.71	79.43±3.49	82.35±4.31	90.00±10.00
FPG (mg/dl)	93.61 ± 16.84	92.45±13.79	111.13±36.81	118.67±54.88
HDL (mg/dl)	42.35 ± 8.29	42.84±8.10	35.15±7.70	30.33±4.04
LDL (mg/dl)	111.71 ± 37.95	109.04±34.87	150.51±57.78	180.07±33.27
TC (mg/dl)	187.40 ± 69.73	184.69±70.07	227.74±49.24	248.00±36.39
TG (mg/dl)	157.08 ± 19.69	151.61±19.11	240.00±22.06	259.00±24.79
FPG >100 (mg/dl)	88(14.5)	74(13.0)	13(38.2)	1(33.3)
HDL-c <40 (mg/dl)	227(37.3)	201(35.2)	23(67.6)	3(100.0)
LDL-c > 100 (mg/dl)	367(60.4)	334(58.5)	30(88.2)	3(100.0)
TC > 200(mg/dl)	210(34.5)	185(32.4)	22(64.7)	3(100.0)
TG >150 (mg/dl)	249(41.0)	220(38.6)	28(82.4)	1(33.3)
BP ≥ 140/90 mmHg	24(2.3)	14(2.5)	7(20.6)	3(100)

FRS, Framingham risk score; FPG, Fasting plasma glucose; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; TC, Total cholesterol; HDL-c, High-density lipoprotein-cholesterol; LDL-c, Low-density lipoprotein-cholesterol; BP, Blood pressure

DISCUSSION

The findings of the present study indicate that the status of cardiovascular disease risk factors in the studied military population is not favorable, as it is in the general population. Based on the results,

the most common CVD risk factors in the studied population were overweight and dyslipidemia. This result may be due to the increasing trend of obesity and overweight in the Iranian general population. The majority of the participants were young (mean age 32) and only 6% were over 45 years old. More than a third of people were overweight (31.2%) or obese (5%). Among the younger participants, 2.2 percent were obese. However, more than 65% of the study population had a normal BMI. Our results are consistent with a results of a meta-analysis that estimated the prevalence of overweight among Iranian military personnel to be 41%.¹³ More than 10% of the participants were current smokers, which is consistent with the value reported for the Iranian general population (about 10%),¹⁴ although higher than that previously reported in Iranian military personnel by Parastuei et al.¹⁵ but it is much lower than the value reported in the Saudi Arabian military (35%).¹⁶ Because smoking is a strong predictor of the occurrence of CVD¹⁷ lifestyle modification should be the first line of disease control measures in this population. The proportion of subject with diabetes was relatively low (2.4%). Nevertheless, among 40-45-year-olds, its prevalence reached 8.2%, which is higher than what was previously reported in Iranian military personnel by Parastuei et al.¹⁵ but lower than the value reported in the general population of Iran¹⁸ and also Persian Gulf region (which is between 25 and 33 percent in the adult population).¹⁹ The level of FPG among 13.2 participants as well as more than a quarter of people over 45 years exceeded 100 mg/dL. The low rate of diabetes in the current study may be due to selection standards for military enlistment, where diabetes is a disqualifying disease.

The present study showed high LDL-c in 57.5% and high TG in 34.6% of the participants. Heydari et al.²⁰ reported a 30.5% prevalence of hypertriglyceridemia among Iranian military personnel, and Khoshdel et al.²¹ in 2012 reported a 24% prevalence of hypertriglyceridemia among Iranian military paratroopers. These results are consistent to studies from other countries showing a high prevalence of CVD risk factors among military community. Gielerak et al.²² in 2013 reported the prevalence of dyslipidemia in military personnel as 51%. A Polish study²³ found dyslipidemia in more than 70% of pilots. Gielerak et al. in 2020 revealed high LDL-c, hypertriglyceridemia and hypercholesterolemia in 60%, 36%, and 52% of polish military personnel respectively. A study in 2018²⁴ in the United States reported that between 2007 and 2016, 18% of armed forces had at least one disorder of abnormal FPG, hyperlipidemia, obesity, or hypertension. In our study population, the prevalence of hypertension increased with age, and 2.3% of all participants had abnormal blood pressure. Heydari et al.,²⁰ found the prevalence of hypertension to be 8.8%. Although 2.3% is lower than that of the general Iranian population²⁵ which is about 25%, it is not surprising that this rate is lower among military personnel, as the military lifestyle could lead to an increase in physical fitness and consequently a reduction in obesity which this factors have beneficial effects on blood pressure.²⁶ Based on the results, 93.9%, 5.6%, and 0.5% of the participants who were over 30 years old had FRS less than 10%, (10–19%) and above 20% respectively. Accordingly, the study by Parastuei et al. 96.5% of the military personnel had less than 10% FRS.¹⁵ Our results are also consistent with Al-Dahi et al. in Saudi Arabia which showed that more than 10% of military personnel had a risk lower than 10%¹⁶ as well as Mullie et al. on Belgian military men which showed that more than 91 % of the military personals had a risk of CVD lower than 5%.²⁷ However, the results of a study among 250 Hungarian pilots were not in line with the above studies and they revealed that about 50% of the military personnel's had a risk above 2.5%.²⁸ Smoking could significantly increase risk of CVD.¹⁷ The proportion of smokers in the currents study was 10.3%.

However, in the Hungarian study the prevalence of smoking was around 31.7% , therefore the risk of CVD was higher compared to our results.²⁸

Strengths and limitations

Our study had some limitations. First, its cross-sectional design, which limits the assessment of causality. Second, the unisex nature of the study due to the small percentage of women in the population of Iranian military personnel. Also, due to some military restrictions, there are limitations to collect more detailed information such as physical activity and dietary intake.

CONCLUSION

The finding of present study showed that despite the low 10-year risk of cardiovascular diseases in a high proportion of military personnel, the high prevalence of overweight and Dyslipidemia requires special attention for this occupational group. Follow-up of participants with identified CVD risk and interventions specifically targeted at reducing smoking and BMI as well as improving lipid profile is recommended.

ACKNOWLEDGMENT

The authors would like to acknowledge the guidance and advice received from the Clinical Research Development Unit of Baqiyatallah Hospital.

Author contributions

Conceptualization: Mojtaba Sepandi, Yousef Alimohamadi, and Sima Afrashteh; Methodology: Esmail Samadipour, Mojtaba Sepandi, and Sima Afrashteh; Formal analysis and investigation: Yousef Alimohamadi and Esmail Samadipour; Writing—original draft preparation: Jatta Salmela and Noora Amanda Heinonen; Writing—review and editing: Mojtaba Sepandi, Yousef Alimohamadi, Esmail Samadipour and Sima Afrashteh.. All authors read and approved the final manuscript.

Funding

This study has not received any fund.

Data availability

The data cannot be made publicly available due to strict data protection laws and regulations.

Declarations

Conflict of interest

The authors declare no competing interests.

Ethical approval

The Study protocol has been approved by the ethics committees of the (IR.BMSU.BAQ.REC.1402.059).

Consent to participate

All participants of this study gave their informed consent to participate.

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