



## The Prevalence of Cardiovascular Disease Risk Factors, and Metabolic Syndrome among Iranian Military Parachutists

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### ABSTRACT

**Background:** The incidence of cardiovascular disease (CVD) is rapidly increasing worldwide. Occupation-related stress such as military parachuting has been considered to be a potentially important cardiovascular risk factor. The present study was performed to determine the prevalence of cardiovascular risk factors and metabolic syndrome among military parachutists which provides a guideline to prevent catastrophic cardiovascular events.

**Methods:** This is a cross-sectional study among 96 military parachutists in southern IR Iran; who were evaluated in the military clinic in Shiraz, Southern IR Iran. Information regarding demographic and life style were obtained from each subject. Arterial blood pressure, weight, height, body mass index (BMI), waist circumference (WC) and hip circumference (HC), fasting blood glucose, lipid profile consisting of total cholesterol, LDL, HDL and triglyceride were measured by standard methods.

**Results:** The mean age of participants was  $37.4 \pm 6.4$  years. There were 5 (5.2%) cases under treatment for cardiovascular diseases, 4 (4.2%) participants were pre-diabetics and 5 (5.2%) suffered from diabetes mellitus. Hypertriglyceridemia and hypercholesterolemia were seen in 23 (24%) and 46 (47%) military parachutists respectively.

**Conclusions:** Although war-related stressors and high intensity physical activities are associated with both acute cardiac events and cardiac risk factors, our data is in favor of lower frequency of cardiovascular risk factors among military parachutists. However, routine monitoring of military parachutists is necessary to find the cardiovascular risk factors.

### ► Implication for health policy/practice/research/medical education:

Although having healthy life, military parachutists are susceptibility to acute and chronic cardiac events, so routine screening for the cardiovascular risk factors seems to be necessary. This article wants to attract the attentions to this crucial issue.

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### Introduction

The incidence of cardiovascular disease (CVD) is rapidly increasing worldwide (1, 2). Several biological risk factors, such as maleness, high blood pressure, dyslipidemia, smoking, abdominal obesity, glucose abnormalities, insulin resistance and behavioral risk factors, such as

smoking, personality trait, stress and sedentary life style are associated with the development of cardiovascular diseases (3, 4). The recent population based studies show the increasing rate of all cardiovascular risk factors (2, 5). Occupation-related stress has been considered to be a potentially important cardiovascular risk factor (6). Military-related stressors such as parachuting are associated with both acute cardiac events and cardiac risk factors (4, 7). On the other hand, despite the known benefits of regular

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exercise training, an enhanced risk of undesirable events such as sudden death has been described in individuals who participate in mainly high intensity physical activities, with incidence range of 1:15,000 to 1:50,000 (8-10).

In the past decade a clinical condition, metabolic syndrome, has drawn attention; which can be defined as a complex disorder represented by a set of cardiovascular risk factors, usually related to central accumulation of fat and insulin resistance, which significantly increase morbidity and other entities, especially CVD (11, 12).

It is important to provide primary prevention to hinder the progression of CVD (4, 13). The present study was performed to determine the prevalence of cardiovascular risk factors and metabolic syndrome among military parachutists and provide a guideline to prevent catastrophic cardiovascular events.

### Materials and Methods

This cross-sectional study was conducted from September 2010 to December 2011 among Iranian military parachutists with more than 5 years of parachuting experience and more than 50 successful diving, to assess frequency of different cardiovascular risk factors, along metabolic syndrome. This survey was approved by the committee of research ethics of AJA University. A total of 96 male military parachutists were selected by random sampling after clustering the military parachutists according to their military ranks.

After signing an informed consent, the participants were called to the survey center for risk factor measurement and clinical examinations. The field examinations were done by trained health care providers for this study.

Parachutists were asked to sit in a silent room for 5 minutes before their arterial blood pressure were measured twice in the right arm, by a zero-calibrated sphygmomanometers with appropriate size cuff. The readings at the first and the fifth Korotkoff phase were taken as systolic and diastolic BP (SBP and DBP), respectively. The average of the two BP measurements was recorded (14, 15). After measuring BP, Anthropometric features including; weight, height, body mass index(BMI), waist circumference (WC) and hip circumference (HC) were then measured by standard methods. Height was measured to the nearest 0.5 cm using a secured metalruler; weight was measured in light clothing using calibrated scales. Body mass index (BMI) was calculated as  $\text{weight}/\text{height}^2$  ( $\text{kg}/\text{m}^2$ ). The waist/hip ratio (WHR) was calculated using waist circumference (WC) measured at a level midway between the lower rib margin and the iliac crest to the nearest 0.5 cm and hip circumference at the level of the greater trochanter. On the same day, 5cc of venous fasting blood was taken from antecubital area of the participants. The blood samples, were transferred under refrigeration ( $-5\text{ }^{\circ}\text{C}$ ) directly to the laboratory to determine fasting blood glucose, and total cholesterol, LDL, HDL and triglyceride serum levels.

Obesity was defined as  $\text{BMI} \geq 30\text{ kg}/\text{m}^2$ . Abdominal obesity was defined as  $\text{WC} \geq 102\text{ cm}$  for men and  $\geq 88\text{ cm}$  for women. Gender specific cut-off points of  $\geq 0.95$  and  $\geq 0.80$  for WHR were used for men and women respectively (2, 15, 16).

The cut-off values to include abnormalities were set at

$<40\text{ mg}/\text{dl}$  for HDL,  $\geq 150\text{ mg}/\text{dl}$  for triglycerides,  $\geq 126\text{ mg}/\text{dl}$  for diabetes mellitus, plasma glucose range,  $110\text{--}125\text{ mg}/\text{dl}$  for impaired fasting glucose(IFG),  $\geq 200\text{ mg}/\text{dl}$  for total cholesterol and  $\geq 140/90\text{ mmHg}$  for hypertension and  $(120\text{--}139)/(80\text{--}89)$  for pre-hypertension (2).

Current smoking was defined as smoking regularly more than once a day on average for  $\geq 1$  year and smoking during the preceding month. In this connection, the parachutists were divided into non-smoker, active and passive smoker groups.

There are different definitions for the metabolic syndrome; current National Cholesterol Education Program( ATP III) criteria defines the metabolic syndrome as the presence of any three of the following five traits: Abdominal obesity (waist circumference in men  $>102\text{ cm}$  (40 in) and in women  $>88\text{ cm}$  (35 in)), serum triglycerides  $\geq 150\text{ mg}/\text{dL}$  or drug treatment for elevated triglycerides, serum HDL cholesterol  $<40\text{ mg}/\text{dL}$  in men and  $<50\text{ mg}/\text{dL}$  in women or drug treatment for low HDL-C, blood pressure  $\geq 130/85\text{ mmHg}$  or drug treatment for elevated blood pressure, fasting plasma glucose (FPG)  $\geq 100\text{ mg}/\text{dL}$  or drug treatment for elevated blood glucose.(17, 18)

Metabolic syndrome was defined according to International Diabetes Federation (IDF) as the presence of central obesity (being an essential element), plus any two of the following: Triglycerides  $>150\text{ mg}/\text{dL}$  or treatment for elevated triglycerides, HDL cholesterol  $<40\text{ mg}/\text{dL}$  in men or  $<50\text{ mg}/\text{dL}$  in women, or treatment for low HDL, systolic blood pressure  $>130$ , diastolic blood pressure  $>85$  or treatment for hypertension, fasting plasma glucose  $>100\text{ mg}/\text{dL}$ , or previously diagnosed type 2 diabetes(19).

### Statistical Analysis

Data were collected, analyzed and reported as mean  $\pm$  SD. Statistical comparisons between groups were carried out by using SPSS 19.0 software. ANOVA test and Duncan post hoc test were applied to identify relationship between cardiovascular risk factors and demographic data. P less than 0.05 was considered as statistically significant

### Result

The participants aged from 20.0 to 50.0 years with mean age  $37.4 \pm 6.4$  years, and mean of  $166.8 \pm 21.3$  successful parachuting experiences. Prevalence of cardiovascular risk factors among the parachutists is demonstrated in Table 1.

Five cases (5.2%) were under treatment for cardiovascular diseases and gave no history of major clinical illnesses including malignancy, renal failure, liver insufficiency, metabolic and hormonal disorders. Laboratory investigations showed that 4 (4.2%) participants were pre-diabetics and 5 (5.2%) suffered from diabetes mellitus. Hypertriglyceridemia and hypercholesterolemia were seen in 23 (24%) and 46 (47%) military parachutists. Criteria of hypertension were found in 24 (25%) parachutists while 36 (37.5%) exhibited blood pressure in the range of pre-hypertension. Diastolic blood pressure, BMI, WC, WHR, and total cholesterol (TC) Serum Level ( $P=0.038$ ,  $P=0.001$ ,  $P=0.025$ ,  $P=0.043$  and  $P=0.04$  respectively) increased significantly with advancing age (Table 2).

The relationship between numbers of parachuting with

**Table 1.** The prevalence of cardiovascular risk factors among parachutists

Risk Factor	No (Percent)
<b>Smoking</b>	Non-smoker 65 (67.7%)
	Passive-smoker 6 (6.3%)
	Active-smoker 25 (26.0%)
<b>History of Diabetes Mellitus</b>	No 93 (96.9%)
	Yes 3 (3.1%)
<b>BMI</b>	Underweight 2 (2.1%)
	Normal 39 (40.6%)
	Overweight 45 (46.9%)
<b>Waist Circumference</b>	Obese 10 (10.4%)
	Normal 68 (70.8%)
	Centrally Obese 28 (29.2%)
<b>WHR</b>	Normal 68 (70.8%)
	Truncal obesity 28 (29.2%)
<b>Blood Pressure</b>	Normal Blood Pressure 36 (37.5%)
	Prehypertension 36 (37.5%)
	Hypertension Stage1 13 (13.5%)
	Hypertension Stage2 11 (11.5%)
<b>TG Serum Level</b>	<150 73 (76.0%)
	≥150 23 (24.0%)
<b>TC Serum Level</b>	<200 50 (52.1%)
	≥200 46 (47.9%)
<b>LDL Serum Level</b>	<160 91 (94.8%)
	≥160 5 (5.2%)
<b>HDL Serum Level</b>	<40 34 (35.4%)
	≥40 62 (64.6%)
<b>FBS Serum Level</b>	Normal 87 (90.6%)
	IFG 4 (4.2%)
	DM 5 (5.2%)
<b>Metabolic Syndrome (ATP IIICriteria)</b>	NO 91 (94.8%)
	YES 5 (5.2%)
<b>Metabolic Syndrome (IDF Criteria)</b>	NO 83 (86.5%)
	YES 13 (13.5%)

cardiovascular risk factors is demonstrated in Table 3. Metabolic syndrome with ATP III criteria was present in 5 (5.2%) parachutists, while 13(13.5%) fulfilled IDF criteria of metabolic syndrome.

**Discussion**

Identification of risk factors of cardiovascular events, which cause morbidity and mortality in the world, has always been a real concern for the medical community (20). There are limited reports on the prevalence of cardiovascular risk factors among military parachutists and to the best of our knowledge this is the first study which shows the status of cardiovascular risk factors among Iranian military parachutists.

It is well known that CVD risk increases with age, and hypertension and dyslipidemia are major CV risk factors (3), and significant reductions in LDL-C and triglycerides and significant improvement in HDL-C similarly resulted in a 37% reduction in risk of coronary artery events (21, 22). BMI is the most commonly used indicator of obesity in population studies, and is associated with a variety of metabolic disorders and increased cardiovascular mortality (4, 16).

In a recently published national survey for risk factors of

**Table 2.** Correlation of age with metabolic syndrome criteria

	Age	No.	Mean± SD	P value
<b>Systolic Blood Pressure</b>	<30	14	110.0± 9.6	0.108
	30-40	41	118.3±13.4	
	>40	41	118.8±15.4	
<b>Diastolic Blood Pressure</b>	Total	96	117.3±14.0	0.038
	<30	14	74.0±6.2	
	30-40	41	81.5±10.7	
<b>Waist Circumference</b>	>40	41	83.7±14.7	0.043
	Total	96	81.3±12.4	
	<30	14	90.3±9.6	
<b>Waist Hip ratio</b>	30-40	41	97.2±8.9	0.025
	>40	41	94.2±8.8	
	Total	96	94.9±9.2	
<b>TG Serum Level</b>	<30	14	0.88±0.04	0.007
	30-40	41	0.92±.005	
	>40	41	0.93±0.05	
<b>HDL Serum Level</b>	Total	96	0.92±0.05	0.534
	<30	14	91.1±36.6	
	30-40	41	144.4±64.6	
<b>FBS Serum Level</b>	>40	41	124.9±46.6	0.477
	Total	96	128.3±56.4	
	<30	14	44.0±8.5	
<b>Metabolic Syndrome (ATP III Criteria)</b>	30-40	41	44.4±13.7	0.007
	>40	41	47.6±15.9	
	Total	96	45.7±14.1	
<b>Metabolic Syndrome (IDF Criteria)</b>	<30	14	90.1±13.8	0.025
	30-40	41	95.3±21.2	
	>40	41	98.9±28.7	
<b>Metabolic Syndrome (ATP III Criteria)</b>	Total	96	96.1±23.9	0.477
	<30	14	90.1±13.8	
	30-40	41	95.3±21.2	
<b>Metabolic Syndrome (IDF Criteria)</b>	>40	41	98.9±28.7	0.477
	Total	96	96.1±23.9	
	<30	14	90.1±13.8	

non-communicable disorders, the prevalence of diabetes, hypertension, obesity, and central obesity was reported to be 8.7%, 26.6%, 22.3% and 53.6% (24).

Hypertension in 29.5%, hypertriglyceridemia in 24%, low HDL in 20.3%, BMI greater than 25 kg/m<sup>2</sup> in 60%, glucose abnormalities in 3.2% of US military personnel were reported by Leigh, et al (4) Heydari, et al (2) found the prevalence of 8.8%, and 30.5% for HTN, hypertriglyceridemia among Iranian military personnel.

In comparison to Iranian normal population the data of our investigation indicated a lower frequency for cardiovascular risk factors which could be due to specific occupation-related life style, as constant physical activity and prohibition from smoking and opium ingestion is strictly observed by the members of armed forces.

Metabolic syndrome is a cluster of metabolic abnormalities (2), which is clearly connected with insulin resistance. In fact, insulin resistance increases with the appearance of metabolic syndrome criteria and close correlations exists between insulin level, BMI, blood pressure and waist size. Cardiovascular complications and diabetes mellitus are related to metabolic syndrome(23, 24). The prevalence of metabolic syndrome in different societies was reported to be 24% to 35% due to ATP III criteria, and 39% to 48% owing to IDF criteria. Based on ATP III criteria, the prevalence of this syndrome was more than IDF definition in the Iranian population (12). The prevalence of metabolic syndrome for Iranian population

**Table 3.** Correlation of numbers of parachuting with metabolic syndrome criteria

	No. of parachuting	No. of parachutists	Mean±SD	P value
Systolic Blood Pressure	<50	27	114.8±12.8	0.295
	50-100	31	116.1±13.0	
	100<	38	120.0±15.5	
	Total	96	117.3±14.0	
Diastolic Blood Pressure	<50	27	77.8±9.6	0.142
	50-100	31	81.1±12.0	
	100<	38	83.9±14.0	
	Total	96	81.3±12.4	
Waist Circumference	<50	27	92.8±9.8	0.045
	50-100	31	98.3±9.1	
	100<	38	93.7±8.4	
	Total	96	94.9±9.2	
Waist Hip ratio	<50	27	0.89±0.05	0.001>
	50-100	31	0.95±0.06	
	100<	38	0.90±0.04	
	Total	96	0.92±0.05	
TG Serum Level	<50	27	100.3±35.6	0.002
	50-100	31	151.9±56.7	
	100<	38	129.0±60.2	
	Total	96	128.3±56.4	
HDL Serum Level	<50	27	45.1±10.7	0.548
	50-100	31	47.9±13.1	
	100<	38	44.2±16.8	
	Total	96	45.7±14.1	
FBS Serum Level	<50	27	93.1±20.2	0.671
	50-100	31	98.7±28.8	
	100<	38	96.0±22.1	
	Total	96	96.1±23.8	

vary from 23.1% to 50.3% in different surveys (25-28).

The analysis of the pattern of combination evidenced that 20.9% of the subjects studied showed no risk factor for metabolic syndrome, whereas 38.5% of the subjects had at least two risk factors, and metabolic syndrome with ATP III and IDF criteria were found among 5.2% and 13.5% of Iranian military parachutists respectively.

As the prevalence of cardiovascular risk factors varies significantly across the world (29), and despite association of war-related stressors, and high intensity physical activities with both acute cardiac events and cardiac risk factors, the available data on military personnel is in favor of lower frequency of cardiovascular risk factors among the military personnel, the findings comparable with the results of our study (4, 29).

Although having healthy life, it is recommended to carry out routine screening for the cardiovascular risk factors among military parachutists because of susceptibility to acute and chronic cardiac events.

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