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Original Article

Prevalence of cardiovascular disease (CVD) risk factors

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Background: Various studies conducted across the country have shown a high prevalence of known risk factors of cardiovascular disease (CVD) (like mean body mass index (BMI), systolic BP and raised cholesterol levels) but no exhaustive data is available pertaining to armed forces personnel.

This study was conducted to assess the prevalence of raised BMI, blood pressure, cholesterol and blood sugar among serving armed forces personnel ≥35 yrs of age.

Methods: The study was carried out between Jan 2013–Jun 2013. The study included all individuals ≥35 yrs of age deployed/posted in specific districts of northern part of the country ($N = 5143$) instead of a limited sample size.

Results: In this study, obesity was observed in 3.42% (95% CI: 2.96%–3.95%), raised BP in 14.07% (95% CI: 13.15%–15.05%) and raised blood sugar levels in 1.71% (95% CI: 1.39%–2.10%). Additionally, 67.72% (95% CI: 66.43%–68.99%) were pre-obese and 82.65% (95% CI: 81.60%–83.67%) were pre-hypertensives.

Conclusion: Lower prevalence of hypertension, hyperglycemia and dyslipidemia was observed in armed forces personnel in comparison to country specific data. However, high prevalence of pre-obese and pre-hypertension suggests a need for concerted efforts towards preventive activities in this field.

Introduction

The incidence of cardiovascular diseases (CVDs) is rapidly increasing worldwide and is currently considered to be the leading cause of death in both developing and developed countries.[1,2] The rapid economic development and increasing westernized lifestyle of the past few decades has led to increased prevalence of these diseases and has attained alarming proportions among Indians in the recent years.[3] Behavioural risk factors like unhealthy diet (rich in salt, fat and sugars), physical inactivity, harmful use of alcohol and tobacco, raised body mass index, waist hip ratio and metabolic risk factors like hyperglycaemia, hyperlipidaemia and raised blood pressure are well known causes of CVDs.[4]

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The armed forces personnel lead a healthy lifestyle which includes regular physical exercise, good nutrition and an easy access to preventive healthcare and are thus expected to be healthier than the native population. However, military service is also inherently associated with long hours of work, strong disciplinary mechanisms, stress of separation from family, uncongenial climatic and terrain conditions and an impending fear of enemy action leading to increased risk of CVDs. A cross-sectional study among military personnel in southern Iran showed 20.8% were smokers, 62.75% had BMI > 25 and physical activity of less than 30 min per day was performed by 7.03%.[5] Alarming levels of behavioural and metabolic risk factors (Smoking – 17.9%, harmful use of alcohol – 2.3%, daily use of butter and ghee – 73.1%, use of added salt or pickles daily – 40.1%, No physical activity – 7.9%, BMI > 23–29.9% and pre-hypertension – 79.8%) were shown by a study among armed forces personnel from India.[6]

This study was conducted with an aim to assess the prevalence of metabolic cardiovascular disease risk factors amongst the troops and recommend preventive measures for CVDs.

Materials & Method

This study was conducted in an operational area among apparently healthy armed forces personnel between Jan 2013–Jun 2013. All personnel ≥35 yrs of age deployed in an operationally committed formation participated in the study (N = 5143). All subjects currently on anti-hypertensive or hypoglycaemic medications or having written prescriptions of anti-hypertensive or hypoglycaemic drugs were classified as ''hypertensive'' or ''diabetics'', irrespective of their current blood pressure or blood sugar reading. Data regarding behavioural risk factors like smoking, family history of cardiovascular diseases, anthropometric profile, blood pressure measurement and fasting blood samples was collected by trained healthcare workers using pre-tested questionnaire. The refresher training of investigators was carried out in anthropometric measurements, blood pressure measurement and blood sample collection. The study participants were educated regarding the importance of a fasting blood sample prior to the day of collection of the sample.

Calibration of all the instruments used in the study was carried out prior to the commencement of the study. Body weight to nearest 0.5 kg and height to nearest 0.5 cm was measured using standardized techniques with an automated balance and a wall mounted stadiometer. The blood samples were transported to the hospital laboratories maintaining all precautions to prevent haemolysis. Fasting blood sugar and cholesterol levels were determined using a semi-auto analyzer. BMI was calculated as Quetlet's index [Weight in Kg/(Height in m)^2]. Blood pressure (BP) was measured on right arm in sitting position using mercury sphygmomanometer after 5 min of rest and ensuring that study participant had not smoked or consumed coffee in previous 30 min. Hypertension was diagnosed according to JNC 7 criteria 5[7] (Table 1). Obesity and overweight were classified as per the criteria for Asians[8] (Overweight was defined as BMI ≥ 23 kg/m^2 and obesity as BMI of ≥27.5 kg/m^2). Impaired fasting glucose was defined as fasting blood sugar levels between 110 and 125 mg/dl and diabetes mellitus as fasting blood sugar levels ≥ 126 mg/dl.[9] Hypercholesterolaemia was defined as serum cholesterol level > 200 mg/dl.[10]

Table 1 – JNC criteria for hypertension.

Category	Systolic BP (mm of Hg)	Diastolic BP (mm of Hg)
Normal	<120	<80
Pre-hypertension	≥120–139	≥80–89
Hypertension	≥140	≥90

Results

A total of 5143 armed forces personnel participated in this study. The mean age of study participants was 39.29 ± 4.24 yrs. The characteristics of study participants are given in Table 2. 9.70% (95% CI: 8.92%–10.54%) of the study participants were smoking tobacco and only 3.73% (95% CI: 3.25%–4.29%) were having family history of CVDs. The risk factor profile for CVDs was assessed as shown in Table 3. 14.07% (95% CI: 13.15%–15.05%) of the study participants were suspected of suffering from raised blood pressure (≥140/90 mm of Hg). Only 88 (1.71%) (95% CI: 1.39%–2.10%) of the study participants have raised fasting blood sugar levels and amongst them 62 had impaired fasting glucose (IFG) and 26 had diabetes mellitus. Hypercholesterolaemia was observed among 3.60% study participants (95% CI: 3.09%–4.11%).

Estimation of overweight and obesity using the criteria for Asians revealed alarming proportion (67.72%) (95% CI: 66.43%–68.99%) of study participants in pre-obese state but only 3.42% (95% CI: 2.96%–3.95%) were obese. The individuals with pre-hypertension are more vulnerable to develop hypertension with increasing age. A very large proportion i.e. 82.65% (95% CI: 81.60%–83.67%) of the study participants were pre-hypertensives. The age wise distribution of study participants with respect to risk factors is given in Table 4.

Discussion

This study revealed a lower prevalence of risk factors of CVDs in comparison to previous studies. The prevalence of obesity was higher (3.42% vs 1.30%) than the World Health Statistics for India as revealed by WHO in 2012[11] and quite low in

Table 2 – Characteristics of study participants (N = 5143).

Characteristic	Mean ± SD
Age (yrs)	39.29 ± 4.24
Height (m)	1.71 ± 0.12
Weight (Kg)	70.19 ± 6.49
BMI	25.34 ± 6.06
Systolic BP (mm Hg)	124.52 ± 8.84
Diastolic BP (mm Hg)	81.28 ± 6.40
Fasting blood sugar (mg/dl)	84.74 ± 13.10
Serum cholesterol (mg/dl)	177.37 ± 26.15

Table 3 – CVD risk factor profile of study participants (N = 5143).

BMI (Kg/m^2)	18.50–23.00 (%)	23.01–27.50 (%)	27.51–32.50 (%)	>32.50 (%)
	1484 (28.86%)	3483 (67.72%)	176 (3.42%)	–
Systolic BP (mm Hg)	70–119 (%)	120–139 (%)	140–159 (%)	≥160 (%)
	1130 (21.97%)	3763 (73.17%)	227 (4.41%)	23 (0.45%)
Diastolic BP (mm Hg)	50–79 (%)	80–89 (%)	90–99 (%)	≥100 (%)
	1495 (29.07%)	3005 (58.43%)	600 (11.67%)	43 (0.83%)
Fasting blood sugar (mg/dl)	60–109 (%)	110–126 (%)	127–200 (%)	>200 (%)
	5015 (97.51%)	62 (1.20%)	26 (0.51%)	–
Serum cholesterol (mg/dl)	150–200 (%)	201–250 (%)	251–300 (%)	>300 (%)
	4958 (96.40%)	157 (3.05%)	28 (0.55%)	–

comparison to Israel army[5] (*P* value – highly statistically significant). Similarly, prevalence of raised BP was also lower (14.07% vs 26.00%) in comparison to World Health Statistics for India.[11] Raised blood sugar level prevalence was much lower (1.71% vs 23.10%) than estimates available from World Health Statistics, Israel Army (1.71% vs 8.80%) (*P* value – statistically significant) and police personnel in West Bengal[12] (1.71% vs 42.20%) (*P* value – highly statistically significant) (Table 5). Wide variations from WHO data and police personnel of West Bengal can probably be explained on the basis of regular physical activity and healthy lifestyle followed by military personnel. The estimates in various regional studies across the country have found statistically significant higher prevalence of hypertension among males in rural areas of Southern India (Davangere, Karnataka),[13] Central India (Surat, Gujarat)[14] and Eastern India (Malda, West Bengal)[15] 19.1%, 30.4% and 24.9% respectively compared to this study (Table 5). The various ethnic groups have different prevalence of CVD risk factors due to genetic, socio-cultural and dietary habits and armed forces comprises of a heterogeneous group of persons of all ethnic groups from across the country and might be considered more reliable data. However, nationwide statistics available from National Programme for Control of Diabetes, Cardiovascular diseases, Cancer and Stroke (NPCDCS) reveal a lower prevalence of raised blood pressure but a higher prevalence of raised blood sugar levels among adults aged >30 yrs[16] (Table 5). The differences can be attributed to the younger age group studied, the larger sample size and no separate male and female data availability.

Indian army personnel data from southern part of nation revealed high prevalence of CVD risk factors like: smoking – 17.9%, pre-obesity – 29.9% and pre-hypertension – 79.9%.[6] The reason for lesser prevalence with respect to pre-obesity and pre-hypertension compared to the present study might have occurred as different age groups have been studied in both research works. Our study also indicates a high prevalence of pre-obese and pre-hypertensives among military personnel ≥35 yrs of age. Varma et al. study[17] conducted among healthy army personnel revealed higher proportions of hypercholesterolaemia, diabetes and lower levels of pre-hypertension and hypertension compared to the present study.

CVDs are both a life-course and lifestyle disease. Approximately 1/3rd of individuals serving in the armed forces are in

Table 4 – Age wise distribution of CVD risk factors (N = 5143).

Cardiovascular disease risk factor	Age (yrs)				*P* Value
	35–39	40–44	45–49	≥50	
BMI					
Normal	997	358	122	7	0.000001
Pre-obese	2107	901	451	24	
Obese	97	50	24	4	
Systolic BP					
Normal	789	239	99	3	0.000001
Pre-hypertension	2264	1012	459	28	
Hypertension	148	459	40	4	
Diastolic BP					
Normal	1056	308	143	7	0.000001
Pre-hypertension	2059	962	425	26	
Hypertension	86	39	30	2	
Blood Sugar					
Normal	3154	1286	580	35	Could not be calculated
Impaired fasting glucose	30	18	14	–	as expected values <1
Diabetes mellitus	17	5	4	–	

Table 5 – Comparison of CVD risk factors with data available from previous studies.

Variable	Present study (N = 5143)	PP Varma et al. study[17] (N = 1920)	Ray S et al. study[6] (N = 727)	Davengere study[13] (N = 1900)	Surat Study[14] (N = 1493)	Israel army Study[5] (N = 341)	West Bengal police study[12] (N = 1817)	NPCDS data (N = 1, 32, 59, 143)	World health statistics (N = Not mentioned)
Pre-obesity	67.72%	34.38%***	29.90%***	–	–	–	–	–	–
Obesity	3.42%	16.51%***	–	–	–	–	25.70%***	–	1.30%^
Pre-hypertension	82.65%	–	79.80%*	–	34.50%***	32.90%***	–	–	–
Hypertension	14.07%	8.49%***	–	19.10%***	30.50%***	8.80%**	57.60%***	6.80%***	26.00%
Smoking	9.70%	–	17.90%***	–	–	–	–	–	11.10%^
Hyper cholesterolaemia	3.60%	9.84%***	21.90%***	–	–	33.40%***	–	–	–
Diabetes	0.50%	1.09%*	–	–	–	1.80%**	9.00%***	7.47%***	23.10%^

*P value not significant, **P value significant, ***P value highly significant, ^P value could not be calculated.

age group at higher risk (>35 yrs) of developing CVDs and a large proportion of our study participants in the same age group were found suffering and from pre-obese and pre-hypertensive state. In Indian populace, the risk of CVDs occurs at lower levels of BMI and has been attributed to body fat distribution with more visceral body fat leading to insulin resistance. The high burden of pre-obese state among healthy armed forces personnel highlights that 'ideal weight for age' criteria used in armed forces has become redundant and requires a re-look as even Govt. of India has already implemented the BMI standards suggested for Asians for defining obesity. The large proportion of pre-obese individuals if not detected early would present a formidable challenge to our healthcare system coupled with enormous burden of pre-hypertension. Though, the existing system of healthy lifestyle in armed forces is in place but the considerable burden of CVD risk factors as evident from our study points towards priority based public health approach. Majority of these diseases remain hidden and not detected till a catastrophic event like acute coronary syndrome, stroke etc occur. Instead of opportunistic screening, the enormous burden of CVD risk warrants a regular public health surveillance of CVD risk factors.

Conclusion

The lower levels of established CVD risk factors in our study imply success of primary prevention activities. However, conditions like pre-obesity and pre-hypertension among military personnel requires an insight into the standards followed for medical examination in view of revised guidelines for obesity and hypertension to nip the evil in the bud. Further, multi-centric studies can be conducted to frame the guidelines for obtaining these standards.

Limitations

The study has been carried out in a specific area where local stress factors might have played a role in CVD risk and thus findings are to be generalized with a caution.

Conflicts of interest

The authors have none to declare.

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IMPORTANT

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