Study of risk factors causing coronary heart disease among army personnel of the rank non-commissioned officers and below in the age group of 20–50 years and its association with prehypertension

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ABSTRACT

Background: Coronary heart disease (CHD) is an acute public health problem both in developed and in developing countries, like India. Assessing the prevalence of CHD in the community is equivalent to assessing the tip of the iceberg. Hypertension is a major risk factor for CHD and hypertension disease prevalence tip of the iceberg in the community is much more obscure. **Objective:** The objective of the study was to carry out a cross-sectional study among serving Army personnel, comprising healthy non-commissioned officers and other rank personnel to successfully assess the risk factors for CHD and their association with prehypertension. **Materials and Methods:** Screening of risk factors for CHD among 200 randomly selected participants was carried out. Blood pressure, height, weight, serum total cholesterol, serum triglycerides, serum high-density lipoprotein (HDL), random blood sugar levels, and smoking status were the major risk factors screened. **Results:** Nearly 63% of Army personnel were found to be having blood pressure commensurate to the range of prehypertension. About 15% were detected to be overweight, 22% had hypercholesterolemia, 5.4% had impaired glucose tolerance (IGT), and 19.2% were current smokers. Higher age, body mass index, high serum triglycerides, low serum HDL, and IGT were found to be independently associated with increased prevalence of prehypertension in multiple logistic regression analysis. **Conclusion:** Our findings recommend the constant monitoring of CHD risk factors and the formulation of effective preventive strategies for adequate control of alarming incidence.

KEY WORDS: Coronary Heart Disease; Prehypertension; Impaired Glucose Tolerance; Body Mass Index; Non-Commissioned Officers

INTRODUCTION

Coronary heart disease (CHD) is an acute public health problem both in developed and in developing countries, like India. As per background information, CHD is now on the increase in India, possibly due to the changing lifestyle, and is causing grave concern. CHD will be the most important cause of mortality in India by the year 2015 as per futuristic predictions.[1] CHD causes more deaths annually than any other disease in the world. For CHD and stroke, unhealthy diet, physical inactivity, tobacco use, and harmful use of alcohol are the leading behavioral risk factors. For about 80% of CHD and cerebrovascular disease, behavioral risk factors are mainly the culprit for causation.[2]

Hypertension is a huge public health problem because it is frequent and an important contributor) to the epidemic of CHD, together with other risk factors including cholesterol,

diabetes, and obesity, but it is modifiable.[3] Those individuals having a systolic blood pressure in the range of 120–139 mm Hg or diastolic blood pressure in the range of 80–89 mm Hg should be considered as prehypertensive, thus requiring proactive health-promoting lifestyle modifications to prevent CHD.[4] In the vast majority of populations studied, CHD is higher in people with diabetes than in those without. Lesser forms of glucose intolerance, such as impaired glucose tolerance, are also associated with higher rates of IHD.[3] Individuals suffering from impaired glucose tolerance (IGT) and/or impaired fasting glucose have a very high risk of developing diabetes mellitus and are also susceptible to experience an adverse cardiovascular event (Myocardial Infarction, Stroke, CHD death) later in life.[5]

The main objective of the present research study is to assess the prevalence of CHD risk factors among Army personnel of the rank non-commissioned officers (NCOs) and below in the age group of 20–50 years and its association with prehypertension.

MATERIALS AND METHODS

A health awareness and screening camp were organized for Army personnel by Department of Community Medicine, Army College of Medical Sciences (ACMS), Delhi Cantonment on September 29, 2010, as observation of World Heart Day at Auditorium of ACMS and Base Hospital, Delhi Cantonment for next 2 consecutive days. In Army, there is a welfare organization, called Army Wives Welfare Association which constantly monitors and supervises optimal health care of all Army families and their husbands who are serving in the Army. Periodically, health promotion, specific protection, and screening programs are conducted to ensure the optimal health status of all soldiers. Uniform instructions for screening were given from the medical branch of Delhi Area Headquarters after obtaining requisite go-ahead (Ethical Approval and concurrence) from the wife of Delhi Area Commander. Army personnel of the rank NCO and below in the age group of 20–50 years were included in the study. All eligible individuals were interviewed after obtaining informed consent to suffice the requirement of Ethical Approval. Information about their age in completed years, education, occupation, tobacco use, pattern of alcohol consumptionm and daily physical activity were recorded in a pre-tested pro forma. Individuals having CHD, hypertension, and diabetes were excluded at the inception stage of the research study to avoid distortion in results; however, simultaneously, it was adequately ensured that all such ailing individuals were under required therapeutic management, thus further ensuring impugning of ethical criteria in the present research study.

Assuming the prevalence of CHD to be 7%,[6] with 95% level of confidence and 5% absolute error and assuming the design effect of 1.5 for the systematic sampling with 10%

non-response rate, the sample size was calculated to be 172. During this period, 634 eligible participants attended the camp and out of these 200 personnel were subjected to screening for various risk factors of CHD.

The blood pressure of eligible participants was measured in the lying position after giving them a rest of 5 min. Prehypertension was labeled when the systolic blood pressure was found to be in the range of 120–139 mmHg or the diastolic blood pressure was found to be in the range of 80–89 mmHg, following the guidelines prescribed by "The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood Pressure."[4]

Body weight of eligible participants was measured on a weighing scale (calibrated to measure accurately up to 100 gms) with individual standing without footwear on the weighing scale with feet about 15 cm apart, thus equally distributing weight on both lower limbs. Anthropometric rod was used to measure the height of eligible participants, with their head positioned straight in standing position, so that the top of the external auditory meatus of both the ears was level with the inferior margin of both the bony orbits of eyes. The body mass index (BMI) was calculated by dividing the weight of the individual in kgs by the square of the height of the individual in meters. The individual was labeled overweight when BMI was ≥ 23 Kg/m^2.[7] Waist circumference was measured at the level of umbilicus up to the nearest 0.1 cm. Hip circumference was measured to the nearest 0.1 cm at bilateral greater trochanter level. As a moderate-intensity aerobic activity of at least 150 min a week (2 h and 30 min), lowers the risk for these diseases, details of physical activity of the individual in his daily routine life were also enquired.[8]

When total cholesterol was >200 mg%, the individual was labeled to be having hypercholesterolemia and when triglycerides were >150 mg%, then the individual was labeled to be having hypertriglyceridemia. Low high-density lipoprotein (HDL) was labeled when HDL was <40 mg %.[9]

Random Blood Sugar (RBS) level of 8–<11 mmol/L was classified as IGT, while RBS of $\geq$ 11 mmol/L was labeled as diabetic.[10] All eligible participants with an RBS of $\geq$8 mmol/L were labeled to be having an undesirable blood sugar level and were referred for further detailed investigations and required necessary treatment.

Data were entered and coded in MS Excel 2007 and presented in percentage. Descriptive statistics such as mean, Standard Deviation (SD) were used to check the nature of data. Student's *t*-test and Chi-square test were applied to check the statistical significance. $P < 0.05$ was taken as the significance level. Further multiple logistic regression analysis was employed to determine the relationship between prehypertension and risk factors of CHD. SPSS version 18 was used to conduct the required statistical analysis.

RESULTS

The study population comprised 200 participants of the rank NCOs and below. The average age of 200 participants was 34.6 ± 7.8 years (mean ± SD).

Table 1 depicts mean and SD of understudy risk factors. The average systolic blood pressure of the study population was 128.0 ± 9.0 mm Hg which was in the prehypertensive range whereas the average values of BMI (kg/m^2) (22.7 ± 2.8), total cholesterol (mg/dl) (193.7 ± 14.8), serum triglycerides (mg/dl) (145.1 ± 7.8), and blood sugar (mg/dl) (119.3 ± 9.8) were below the standard cutoff values.

Table 2 depicts the prevalence of various CHD risk factors among army personnel of the rank NCOs and below. Prevalence of prehypertension was about 63.0% (95% confidence interval [CI]: 56.3–69.7). HDL levels of <40 mg/dl were found in 68% of the total group, but still, a prevalence of raised total cholesterol and triglycerides was found to be 22% and 15.3%, respectively. The prevalence of IGT was seen in 5.4% of individuals. 19.2% of the eligible participants were smoking concurrently and 3.4% were consuming alcohol to the extent of 3 pegs/week. Most of the eligible participants

indulged into moderate or heavy exercise except for 7.6% who only indulged into light exercising.

Statistical analysis with the help of multiple logistic regression analysis showed the association of prehypertension with BMI > 23 kg/m^2 (odds ratio [OR] 1.76, 95% CI:1.12–2.91, $P = 0.044$), serum HDL cholesterol < 40 mg/dl (OR 1.58, 95% CI:1.08–3.21, $P = 0.047$), serum triglyceride > 150 mg/dl (OR 2.83, 95% CI:1.98–6.11, $P = 0.024$), for age group 30–40; (OR = 2.67, 95% CI: 1.54–4.22, $P < 0.001$) and for age group 40–50; (OR = 4.12, 95% CI: 2.89–5.43, $P < 0.001$), and RBS 126–180 mg/dl (OR = 2.59; CI = 1.87–6.32, $P = 0.03$) [Table 3].

DISCUSSION

The research study found a high prevalence of prehypertension in serving Army personnel, comprising healthy NCOs and other rank personnel which is a serious cause for concern as these individuals stand a high risk of developing hypertension and CHD in later life. Statistical analysis with the help of multiple logistic regression analysis showed the association of prehypertension with BMI > 23 kg/m^2, serum HDL cholesterol < 40 mg/dl, serum triglyceride > 150 mg/dl, and RBS 126–180 mg/dl.

The prevalence of prehypertension observed in this research study was much higher than the estimates reported by other studies. Yadav *et al.* in their study conducted in an affluent North Indian population found the prevalence of prehypertension to be 36% in males.[11] Singh *et al.* found a prevalence of prehypertension among males to be in a range of 23.5–35.1% in their research study conducted concurrently in five different cities of India.[12] Shanthirani *et al.* reported a 47% prevalence of prehypertension among urban residents in Chennai who were >18 years,[13] while in a survey in an industrial population, Prabhakaran *et al.* reported prehypertension in 44%.[14] Prevalence of prehypertension was 41.44% in the study by Sansanayudh *et al.* among Thai Army personnel[15] and 32.9% in the study by Heydari *et al.*

Table 1: Age, clinical, and laboratory test findings of the study population

Background characteristics (*n*=200)	Mean±SD	95% CI
Age (in years)	34.6±7.8	33.5–35.7
BMI (kg/m^2)	22.7±2.8	22.3–23.1
Waist hip ratio	0.85±0.05	0.84–0.86
Systolic BP (mm Hg)	128.0±9.0	126.8–129.3
Diastolic BP (mm Hg)	80.0±8.0	78.9–81.1
Total cholesterol (mg/dl)	193.7±14.8	191.6–195.7
Serum HDL (mg/dl)	38.8±3.7	38.3–39.3
Serum triglycerides (mg/dl)	145.1±7.8	144.0–146.2
Blood sugar (mg/dl)	119.3±9.8	117.9–120.6

HDL: High-density lipoprotein, BMI: Body mass index, CI: Confidence interval

Table 2: Distribution of behavioral and clinical parameters as a risk factor

Parameters	*n* (%)	95% CI	
		Lower limit	Upper limit
Prehypertension	126 (63.0)	56.3	69.7
Serum cholesterol >200 mg/dl	44 (22.0)	16.3	27.8
HDL <40 mg/dl	136 (67.8)	61.3	74.3
Serum triglycerides >150 mg/dl	31 (15.3)	10.3	20.3
RBS 126–200 mg/dl	11 (5.4)	2.3	8.5
BMI >23 Kg/m^2	31 (15.4)	10.4	20.3
Current smoking	38 (19.2)	13.8	24.7
Alcohol (> 3 pegs/week)	7 (3.4)	0.9	6.0
No moderate/heavy exercise	14 (7.0)	3.5	10.5

HDL: High-density lipoprotein, BMI: Body mass index, RBS: Random blood sugar, CI: Confidence interval

Table 3: Relationship between prehypertension and various risk factors by multiple logistic regression analysis

Variables	Prehypertension		
	Risk Ratio	95% CI	*P*-value
Age group (in years)			
20–30	1 (Ref)		
30–40	2.67**	1.54-4.22	0.001
40–50	4.12**	2.89-5.43	0.001
BMI			
<23 kg/m²	1 (Ref)		
>23 kg/m²	1.76*	1.12-2.91	0.044
Serum triglycerides			
<150 mg/dl	1 (Ref)		
>150 mg/dl	2.83*	1.98-6.11	0.024
Total cholesterol			
<200 mg/dl	1 (Ref)		
>200 mg/dl	0.47	0.11-4.32	0.345
Serum HDL			
>40 mg/dl	1 (Ref)		
<40 mg/dl	1.58*	1.08-3.21	0.047
RBS			
<126 mg/dl	1 (Ref)		
126–180 mg/dl	2.59*	1.87-6.32	0.03

*$P<0.05$, **$P<0.01$. HDL: High-density lipoprotein, BMI: Body mass index, CI: Confidence interval

among military personnel in Southern Iran.[16] Datta *et al.* found the prevalence of hypertension to be 32.5% in 916 men (policemen = 507, civilian = 409), randomly selected from different regions of central Kolkata which was significantly higher when compared with the civilians. Behavioral habits and obesity indices were also higher among the policemen. Regression analysis identified age, BMI, SBP, history of parental hypertension, and consumption of smokeless tobacco as the risk factors of hypertension.[17] Abeetha *et al.* found the prevalence of prehypertension highest (55.6%) among medical students out of a total of 323 students from various courses such as medicine, engineering, and arts from a deemed university in Chennai. The prevalence of prehypertension was 1.42 times more among people with high stress, 1.8 times more among people with anxiety, and 1.5 times more among medical students which were found statistically significant.[18]

Sedentary lifestyle and obesity are important modifiable risk factors for hypertension.[11] Among behavioral risk factors for CHD the prevalence of smoking, alcohol consumption, and sedentary lifestyle were 19.2%, 3.4%, and 7.0%, respectively. Statistical analysis with the help of multiple logistic regression analysis showed the association of prehypertension with BMI > 23 kg/m² (OR 1.76, 95% CI: 1.12- 2.91, $P = 0.044$). Raju *et al.* in a cross-sectional observational study conducted on 245 police personnel working at Provincial Armed Constabulary, Sitapur, found that 77.14% of individuals

were having generalized obesity and 82.04% were having abdominal obesity (AO). According to the duration of service, the majority of the individuals were obese and their association with AO was highly significant ($P = 0.004$). Nature of job showed that 82.31% of individuals having AO related to field or shift, but the association was not found to be significant.[19] The prevalence of current smoking and alcohol consumption was seen in 25.9% of males in the study by Shivaramakrishna *et al.*[20] whereas Gupta *et al.* in their research study observed smoking to be prevalent in 36.5% of males.[21] Our study indicates the prevalence of IGT to be 5.4% among serving Army personnel, comprising healthy NCOs and other rank personnel. Ramachandran *et al.* in their research study to assess the prevalence of diabetes and IGT, conducted concurrently in six major cities, covering all the regions of our country found the age standardized prevalence of diabetes and IGT to be 12.1% and 14.0%, respectively, with no significant gender difference.[22] In our research study independent association between higher age, BMI, high serum triglycerides, low HDL, and IGT with increased prevalence of prehypertension was adequately revealed with the conduct of required statistical analysis using multiple logistic regression analysis. Sansanayudh *et al.* in their study on the prevalence of prehypertensive state and other CHD risk factors in the First Infantry Regiment, The King's Own Bodyguard, observed above-mentioned factors to be associated with prehypertension.[15] Similar findings were observed by Yadav *et al.* in their study where increasing age, BMI, and IGT were significantly associated with prehypertension.[11]

Strength and Study Limitation

The strength of the study was that we could successfully show the significant frequency of the risk factors in a limited number of serving Army personnel, comprising of healthy NCOs and other rank personnel, who adequately represented the general population of the serving Army personnel.

The elicited history for smoking and alcohol consumption by the eligible participants might have been less in our research study as there might have been hesitancy on the part of serving Army personnel, comprising healthy NCOs and other rank personnel to divulge such behaviors. The eligible participants in our research study were young male serving soldiers with a high level of physical fitness, endurance, and a habit of undertaking regular exercise. Although this may limit the generalization of the results to other subgroups, the present findings are consistent with findings from other studies involving different subgroup of people. In addition, the classification of prehypertension was based on only one measurement of blood pressure and cannot exclude the apprehension caused by a doctor to an unsuspecting healthy individual while examining (white coat phenomenon), which could have resulted in finding a higher prevalence of prehypertension. However, most of the other epidemiological studies used the same method of measurement making the present method justifiable for comparison. By these

results we cannot generalize our conclusion about increasing or decreasing trend of foregoing risk factors among serving Army personnel, comprising of healthy NCOs, and other rank personnel. Therefore, we strongly recommend the conduct of future prospective multicenter investigations to have clear estimates for future interventions and implementation of preventive strategies.

CONCLUSION

Our research study adequately demonstrates that the prevalence of prehypertension and other CHD risk factors are high among serving Army personnel, comprising healthy NCOs and other rank personnel. It is therefore very strongly recommended that all other rank personnel should also be subjected to a detailed medical examination with focus on screening for CHD risk factors. The Army Officers undergo detailed medical examination periodically every five years, subsequent to attaining the age of 35 years Periodic Medical Examination (PME). The Army Junior Commissioned Officers also undergo, PME once within one year of promotion or after attaining the age of 40 years, but before attaining the age of 41 years. Similarly, in the civilian population, everyone should undergo PME, periodically every 5 years, subsequent to attaining the age of 35 years. Further, research studies should be encouraged to assess the effect of lifestyle modification on CHD morbidity and mortality.

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