Original Article

Metabolic Syndrome and Other Cardiovascular Risk Factors Among Police Officers

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Abstract

Background: Police force constitutes a special occupational group. They have been shown to be at high risk for the development of cardiovascular diseases. A multitude of factors may be responsible for this. There is very limited documentation of their health status and health surveillance activities are inadequate. **Aim:** The present study was designed to measure the prevalence of metabolic syndrome and other cardiovascular risk factors among police officers. **Materials and Methods:** The design was cross-sectional and spanned 900 policemen (n = 900). A pre-tested questionnaire was used for collecting historical data. Anthropometric and biochemical measurements were carried out using standard techniques. MS was diagnosed using the National Cholesterol Education Program—Adult Treatment Panel III criteria. Statistical analysis was performed using the SPSS 16.0 software. **Results:** MS was observed in 16.8% of the study population. High blood pressure and hyper-triglyceridemia were the commonest abnormalities. The prevalence of other cardiovascular risk factors were high body mass index (65.6%), hypertension (37.7%), diabetes (7%), smoking (10%), and alcohol use (48%). **Conclusion:** Our study identified police officers as a high-risk group for developing CVDs. The findings underscore the need for regular surveillance and lifestyle interventions in this important occupational group.

Keywords: Diabetes, Hypertension, Metabolic syndrome, Obesity, Police

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Introduction

Police personnel play a pivotal role in any society by ensuring security and stability. They constitute a special occupational group with exposure to violence at work, which directly and indirectly affects their health. Currently employed police personnel have also been shown to have a high prevalence of cardiovascular risk factors, including metabolic syndrome (MS) [Table 1], hypertension, hyperlipidemia, cigarette smoking, and a sedentary lifestyle.[1,2] In fact, job as a law enforcement personnel has been proven to be a long-term predictor for adverse cardiovascular events.[3]

MS is a cluster of anthropological and biochemical abnormalities that predispose an individual to coronary artery disease.[4] It is considered a prominent

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Table 1: Modified national cholesterol education program: Adult treatment panel III criterion for diagnosing MS. MS is diagnosed if at least three of the following five factors are positive

Variable	Condition
Waist circumference	>90 cm in males, >80 cm in females
Blood pressure	SBP≥130 and/or DBP≥85 or treatment for previously diagnosed hypertension
Triglycerides	≥150 mg/dl or drug treatment for elevated triglycerides
HDL	<40 mg/dl in males, < 50 mg/dl in females or drug treatment for low HDL
Glucose	>110 mg/dl or treatment for previously diagnosed diabetes

HDL: High-density lipoprotein; TG: Triglycerides

cardiovascular risk factor due to its high predictive ability for the development of cardiovascular diseases (CVDs). Two recent prospective population-based studies confirmed that MS identified a high-risk group of persons who would have been missed by only consideration of the conventional risk factors.[5] A study also revealed significantly increased healthcare expenditure for those with MS.[6] This in addition to direct health problems like injuries adds to the stress of a policeman and might lower his job satisfaction. Looking at various studies around the world, which included population samples, aged 20-25 and upwards, the prevalence of MS in the general population varies from 8% (India) to 24% (USA) in men.[7] Even within the same ethnic population significant differences can exist in the prevalence of MS and its components.[8,9] This is because of the influence of extent of urbanization, lifestyle patterns, and socioeconomic/cultural factors. Asian Indians have traditionally been considered a high-risk population with respect to diabetes and CVD, and the numbers are consistently on the rise.[10] Reasons cited for high prevalence of CVDs among policemen include job stress, irregular food habits, lack of regular exercise, inadequate sleep, and unhealthy habits like smoking and drinking.[3,11,12] Therefore, the study was planned to investigate the cardiovascular risk factors among police personnel and to estimate the prevalence of MS, which is a good predictor for cardiovascular morbidity. Workplace programs to promote the health and fitness of police officers are commonly lacking, but can be an effective means for reducing cardiovascular risk. It is hoped that the present study would guide the implementation of interventions for addressing the health concerns for this important occupational group.

Materials and Methods

Study design

The study was conducted in a cross-sectional design with the aim of covering all police officers of the district.

Project process

The project proposal was approved after two rounds of discussions by the investigators with the police commissioner. The structured questionnaire for data collection was prepared by epidemiologists. Pre-testing was done among 30 police officers in one of the selected police stations and necessary modifications were done. The questionnaire included details about socio-demographic characteristics, anthropometric and biochemical parameters, medical history, brief dietary details, regular physical exercise, and smoking and alcohol status. The officers were questioned about habits of ever consuming alcohol or smoking. The frequency of alcohol consumption was marked as weekly, monthly, or occasionally (less than once a month). With regard to smoking, the number of cigarettes consumed/day was elicited. Only the current status of smoking and drinking (not past consumption) was used in the statistical analysis. 'Regular physical exercise' was defined as regular recreational physical activity other than occupational, carried out for greater than 30 min on at least 5 days a week.

Arrangement for blood investigations and laboratory examinations was done at the public health laboratory of district general hospital. Arrangements were made for conducting weekly screening programs at the same hospital. The multi-disciplinary screening team included physicians, epidemiologists, nurses, lab technicians, and electrocardiography (ECG) technicians. Training was given for the persons involved in data collection.

The study period extended for 8 weeks. Each week, 120 police officers were selected and instructed to report at the hospital on prescribed days from Monday to Saturday (20 persons × 6 days). They were asked to report at 8 a.m. on empty stomach (12-h overnight fasting) and underwent blood investigations. The same policemen were given appointments for screening and counseling on the following Sunday.

Screening camps

Five stations were organized

First station: The questionnaire was given and after briefing, personal information was self-administered and cross-checked.

Second station: Dietary history, personal habits, and addiction details were collected through direct interview.

Third station: Blood pressure and anthropometric measurements were done.

Forth station: Detailed morbidity history was taken. After medical examination by doctors, required counseling, prescriptions, and references were given. Follow-up visits were arranged at the same hospital.

The recorded information was cross-checked for any disparity/personal errors and corrections were made. The data were coded and entered into Microsoft excel 2007 by trained data entry operator under the supervision of an epidemiologist.

Data collection

Anthropometric measurements

Standing body height was measured with a commercial stadiometer in cm (to the nearest 0.5 cm). A digital scale, with an accuracy of ±100 g, was used to measure body weight and was recorded in kg. Waist circumference

was measured in a horizontal plane, midway between the inferior margin of the ribs and the superior border of the iliac crest, using a standard inelastic measuring tape. Measurements were taken thrice and the mean was taken in all cases. All instruments used for measurement were calibrated twice weekly. Body mass index (BMI) (kg/m^2) was calculated by dividing weight (in kg) by the square of height (in m). Systolic and diastolic blood pressures were measured using a standard sphygmomanometer with adult cuffs and recorded in mmHg. The measurements were repeated twice at an interval of 3 min in the sitting position and the mean was taken.

Biochemical measurements

Blood samples (3 ml) were drawn from the mid-cubital vein after 12-h overnight fasting for measurement of lipid profile (total cholesterol (TC), high-density lipoprotein (HDL), cholesterol, and triglycerides) and fasting plasma glucose levels. Plasma glucose was measured using the glucose oxidase peroxidase method; serum TC and triglycerides by standard enzymatic procedures; and HDL cholesterol by direct assay method. They were recorded in mg/dl.

Operational definition of MS

MS was diagnosed using the modified National Cholesterol Education Program—Adult Treatment Panel III (NCEP-ATPIII) criterion, which considers ethnic differences in central obesity.[4] The modification was lowering the cut-off for waist circumference from 102 cm to 90 cm.[13] A standard criterion to diagnose MS is still lacking. However, the above criterion is used widely used as it incorporates ethnic variation and for its good predictive ability for adverse cardiac events[6,7] [Table 1].

Statistical analysis

Statistical analysis was performed using the SPSS 16.0 program (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL, USA) for Windows 7. Mean and standard deviations were derived for numerical data. Prevalences are reported in percentages. Multivariate logistic regression was done to measure the association of conventional cardiovascular risk factors (independent variables) with MS (dependent variable). Significance level was defined as $P < 0.05$.

Results

Twenty-five police stations covered in our study had a combined police force of 1200. Nine hundred officers attended the study (response rate 75%). There were 823 men and 77 women. Analysis of male police officers' data is included in this paper. The age of the study population ranged from 26 to 58 years. They were predominantly middle-aged, with 85% belonging to the age group of 30-50 (mean 41.3 years ± 6.8 years). They had spent on an average 15.3 (±7.6) years in service.

Basic physical and biochemical parameters are represented in Table 2. Forty-eight men (5.8%) were identified as known hypertensives or individuals prescribed drug therapy. According to our measurements 395 (48%) were in the pre-hypertensive stage and 341 (41.4%) in the hypertensive range. Abnormal lipid profile and blood glucose levels were found in 619 (75.2%) and 113 (13.7%) officers, respectively (abnormal lipid profile: Triglycerides ≥ 150 mg/dl or HDL < 50 mg/dl or TC ≥ 200 mg/dl; abnormal glucose: Fasting glucose ≥ 110 mg/dl or known diabetic).

Metabolic syndrome

One hundred and thirty-eight (16.8%) officers were observed to have MS. The prevalence of various components of MS and cardiovascular risk factors in subjects with MS were compared to that of the total study population [Table 3a] and those without MS [Table 3b]. Abnormal blood pressure was the commonest component of MS (119, 86.2%) and triglyceride levels had the highest odds for coexisting with MS (odds ratio, 8.1; confidence interval (CI), 5.4-12.3). Abnormal glucose control (fasting glucose ≥ 110 mg/dl or diabetes) was also common among those with MS (38.4%). Its prevalence was only 8.8% among those without MS.

Prevalences of behavioral factors are shown in Table 3b. Smoking was significantly higher among those with MS (15.2% versus 9.6%, *P*-value = 0.05). Half of the studied policemen admitted to consuming alcohol. While the majority (70%) consumed it only occasionally (less than

Table 2: General characteristics of the study population

Characteristics	*N*	Range	Mean (SD)
Age (years)	823	26-58	41.3 (6.8)
Service years	823	1-34	15.3 (7.6)
Anthropometric and physical parameters			
Height (m)	823	150-197	172.6 (5.2)
Weight (kg)	823	49-105	71.3 (8.4)
BMI (kg/m^2)	823	17.0-36.3	23.9 (2.5)
SBP (mm Hg)	823	90-190	125.2 (13.4)
DBP (mm Hg)	823	60-130	82.0 (9.0)
Waist circumference (cm)	823	64-115	85.9 (11.9)
Biochemical			
Triglyceride (mg/dl)	823	40-473	143.0 (56.9)
LDL (mg/dl)	800	33-332	129.0 (38.3)
HDL (mg/dl)	823	18-92	49.1 (11.3)
Total cholesterol (mg/dl)	817	70-406	207.2 (40.2)
Fasting glucose (mg/dl)	822	48-253	90.5 (23.6)

BMI: Body mass index; DBP: Diastolic blood pressure; HDL: High-density lipoprotein; LDL: Low-density lipoprotein; SBP: Systolic blood pressure

once a month), 19% admitted to doing it weekly, but the difference for the drinking status was not significant between the two groups (*P*-value = 0.5). Officers with MS consumed alcohol more frequently than those healthy (24.7% consuming weekly versus 17.9%).

Discussion

Law enforcement officers (LEOs) suffer higher morbidity and mortality rates from all causes than the general population. CVD accounts for a significant portion of the excess illness, with a reported prevalence as high as twice that of the general population.[2] A study revealed that occupational status as LEOs compared with that of non-LEOs predicted higher levels of C-reactive protein, systolic blood pressure, body mass index, and waist circumference.[3] Although limited in number, studies from India also have reported similar findings.[12,14]

Our study revealed the prevalence of MS to be 16.8%.

Table 3a: Comparison of components of MS in the group with MS and the total study population

Components of MS	With MS (*N*=138)		Total study population (*N*=823)	
	n	%	*n*	%
Blood pressure: SBP≥ 130 mm Hg/DBP≥ 85 mmHg or treatment for previously diagnosed hypertension	119	86.2	448	54.4
TG≥150 mg/dl or drug treatment for elevated triglycerides	114	82.6	304	36.9
Waist circumference: >90 cm for males, >80 cm for females	98	71	259	31.5
Low HDL: <40 for males, <50 for females	57	41.3	137	16.6
FBG>110 mg/dl or treatment for previously diagnosed diabetes	53	38.4	113	13.7

DBP: Diastolic blood pressure; FBG: Fasting blood glucose; HDL: High-density lipoprotein; MS: Metabolic syndrome; SBP: Systolic blood pressure

An appropriate group for comparison of MS from this part of India (Kerala state) could not be retrieved from literature search. Studies to assess the prevalence of MS in the rest of India have given varied results, probably due to diversity of ethnicity and lifestyle. Absence of a standard criterion for diagnosing MS is also a problem. In our study, the modified NCEP ATP III criterion was used, which has been shown to be reliable in predicting adverse cardiovascular outcomes.[13,15] The reported prevalence varies from 8% among the males constituting the rural population[16] to 25%-40% among urban males.[17,13] In the Chennai Urban Population Study (CUPS),[18] the prevalence of MS as defined by the European Group of Insulin Resistance (EGIR) was found to be 11.2%. Using the International Diabetic Federation (IDF) criteria, a 57% prevalence was reported among the Chennai policemen.[14] It should be kept in mind that the prevalence calculated using the IDF criteria tends to be higher as compared with that using the NCEP criteria due to the use of a lower cut-off for fasting glucose.[19] Also, some studies could have falsely reported high prevalence due to the fact the data were collected from cohorts enrolled into CVD-related studies[13] or who attended CVD camps.[17]

Among the cardiovascular risk factors, the prevalences of general and abdominal obesity, hypertension, hyper-triglyceridemia, and alcohol use were found to be more than in the general population of Kerala state.[20,21] High BMI (*P*-value < 0.001) contributed significantly toward the development of MS. BMI was in the overweight-obesity range for 65.6% of the officers we studied (mean 23.9 ± 2.5 kg/m^2), which is higher than the prevalence reported for the general population (47.2%).[21] In a Western study, among police officers the average BMI was 28.6 (±4.9 kg/m^2) with 80% overweight or obese.[22] The development of obesity, or more specifically an increase in abdominal fat, is thought to be the primary event in the progression of MS, and Asian Indians have been shown to have a tendency to develop

Table 3b: Comparison of various cardiovascular risk factors in the groups with and without MS along with the total study population

Cardiovascular risk factors	MS (*N*=138)		Non-MS (*N*=685)		Total study population (*N*=823)		Odds ratio	CI		*P* value
								Lower	Upper	
	n	%	*n*	%	*n*	%				
High BMI (kg/m^2)*	118	85.5	422	61.6	540	65.6	3.1	2.0	4.9	<0.0001
Hypertension	87	63	254	37.1	341	41.4	2.3	1.6	3.1	<0.0001
Smoking	21	15.2	66	9.6	87	10.6	1.6	1.1	3.0	0.05
Exercise	70	50.7	409	59.7	479	58.2	1.2	1.0	1.5	0.06
Family history of hypertension or diabetes	79	57.2	366	53.4	445	54.1	1.2	0.8	1.7	0.45
Alcohol	73	52.9	347	50.7	420	51	1.1	0.8	1.7	0.51
Non-vegetarian diet	135	97.8	667	97.4	802	97.4	1.0	0.97	1.03	1.0

BM: Body mass index; CI: Confidence interval; *High BMI; >23 kg/m^2

central obesity.[17,23] In our study, abdominal obesity (waist circumference > 90 cm) was reported in one-third of the policemen, which exceeded the general prevalence.[20]

Hypertension was observed in 41.4% of the policemen. This was midway between the prevalence among Nagpur and Chennai policemen (22.5% and 59%, respectively)[12,14] and higher than that reported in the general population.[20] Although the high percentage could have been a manifestation of white collar hypertension, this issue should not be overlooked. Six percent of the policemen with measurements in the hypertensive range were aware of their condition reflecting inadequate control. High blood levels of bad lipids were another disconcerting factor and could be related to central obesity.[17] Prevalence of hyper-triglyceridemia and mean levels of triglycerides were more than in the general population.[20] Fifty-three policemen (6.4%) had fasting glucose in the diabetic range (fasting glucose ≥ 126 mg/dl) of whom one-third (33%) were aware of their condition indicating inadequate control.

Prevalence of smoking was low as compared with other studies on Indian policemen.[12,14] The analysis however revealed smoking to contribute significantly to the development of MS (*P*-value = 0.05). Although most policemen did not smoke, more than half of them consumed alcohol. This was higher than the rate reported in other studies[12,14] and from the state.[20] The frequency of consumption was found to be high among those with MS. Although majority of the policemen admitted to drinking only occasionally, it is probable that they were binge-drinking episodes (heavy episodic drinking). Kerala state, where the study was conducted, has the highest per capita alcohol consumption in the country of over 8 l (1.76 gallons) per person a year[24] and the drinking habit is characterized by binge drinking. The involvement in regular physical exercises was also low among the officers. Other studies have also revealed similar findings.[12,14] Even though involvement was not significantly different in the two groups (*P*-value = 0.06), it could be argued that the intensity of exercise was probably different, with the non-MS group involving in a more exhaustive workout.

Our findings challenge the general conception that police personnel constitute a physically fit population. The remarkable fitness on the basis of which they are selected is not maintained subsequently as reflected in the low number of people engaging in regular exercise and increased drinking. The risk factors that contribute to MS are often affected by such poor lifestyle choices. Job stress and a low level of satisfaction could be some of the factors leading to the development of these habits. However, both these factors were found to be within satisfactory limits in our study and could not be correlated directly to any of the cardiovascular risk factors.

Conclusion

LEOs constitute an occupational group that is prone to increased prevalence and incidence of CVDs.[11] The nature of the work and lack of awareness contribute to this situation. It is unfortunate that a group selected for remarkable physical fitness at the entry stage fail to maintain it and succumb to lifestyle diseases that are very much preventable. Similar results from other parts of India and the world calls for attention from policy makers to introduce effective policies for taking care of this issue. The facts that only 5% of those with hypertension were aware of it and that none of the known diabetic patients had adequate glucose control are really concerning and reflect the inadequacy of healthcare activities among policemen. Workplace programs to promote the health and fitness of police officers are commonly lacking, but can be an effective means for reducing cardiovascular risk.[1] Regular screening and health education programs need to be implemented. Counseling related to lifestyle modification, addiction control, and stress management should be an integral component of these health-related activities.

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