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Original Article

Cardiovascular disease risk factor prevalence among police officials: findings from a cross-sectional study in Kerala, India

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Abstract

Objectives: Police officials' stressful and physically demanding activities reportedly increase the risk of cardiovascular disease (CVD). This study explored the prevalence of CVD risk factors such as hypertension, diabetes, tobacco use, alcohol consumption, and overweight among police officials in Kerala, India.
Methods: A cross-sectional study was conducted among 255 police officials in selected police stations in the Thiruvananthapuram district, Kerala. The World Health Organization STEPs questionnaire for noncommunicable disease risk factor surveillance was used to collect information. We collected STEP 1 (demographics, tobacco use, alcohol consumption, physical activity, and diet) and STEP 2 (weight, height, and blood pressure) data. Multivariable analysis was done to identify factors associated with hypertension.
Results: The mean age of participants was 42 years (range: 30-55 years) and the majority were men (83.5%). Current use of tobacco or alcohol was reported by 22.7% of the participants. The prevalence of overweight was 64.7% and physical inactivity was 35.1%. Self-reported prevalence of diabetes was 7.5% and of hyperlipidemia was 11.4%. Hypertension prevalence was 40.4%. Among hypertensives, 35.9% were aware, 20.4% were treated, and 5.8% had controlled blood pressure. The control rate was 28.6% among treated hypertensives. When controlling for age, diabetes (odds ratio [OR]: 3.57; 95% CI: 1.16-10.90), and overweight (OR: 1.88; 95% CI: 1.06-3.35) participants were more likely to have hypertension compared with their counterparts.
Conclusions: Police officers have a high prevalence of significant CVD risk factors such as hypertension, physical inactivity, and being overweight. These findings reinforce the need for interventions addressing the above risk factors to prevent CVD in this population.

Key points

- **What is already known on this topic**

Research has shown that police officials are at a higher risk of developing cardiovascular diseases (CVDs) compared with the general population. Police officials are at higher risk of stress-related physical and psychological issues such as heart disease, depression, and substance abuse due to the demanding nature of their job, organizational risk factors, and occupation-related demands. However, comprehensive evidence on this issue in the Indian context is very limited.

- **What this study adds**

A considerable number of police officers have a high prevalence of risk factors for cardiovascular disease including hypertension, physical inactivity, and obesity. Our study was conducted among police officials in the Kerala state of India, where overall health indicators are better than in other states of the country. The study emphasizes the need for interventions to address cardiovascular risk factors in police officials in India. Regular awareness and assessment of CVD risk factors are necessary.

- **How this study might affect research, practice, or policy**

Our group is currently working on a feasibility study aimed at testing whether a behavioral intervention can help reduce the modifiable risk factors of CVD in the population of India through psychological and behavioral changes.

Keywords: cardiovascular diseases; hypertension; police officials; Kerala; India.

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Introduction

Cardiovascular disease (CVD) is the leading cause of mortality in India. [1]Work-related risk factors are significantly associated with CVDs.[2] Exposure to work strain, including psychological stress at work, is associated with CVDs,[2,3] and this link is mostly through modifiable risk factors.[4] Law enforcement, one of the most stressful occupations, has been related to increased stress-related health risks.[5] Police officials are supposed to be physically and psychologically healthy in order to perform their duties. However, studies have shown that risk factors for CVD are common in police officials and that they are at a greater risk of developing CVDs compared with the general population. A number of studies have reported that police officials are at increased risk of stress-related physical diseases like heart disease,[6] and psychological complications like depression and substance abuse,[7,8] compared with other occupational groups. Also, organizational risk factors and occupation-related demands[9,10] as well as personal factors like coping strategies, which arise due to stressful work,[11] are significantly linked to police officials' physical and psychological risk factors. In the United States the prevalence of metabolic syndrome was reported to be 27% in police officials, compared with 19% in other employed populations.[12] Police officials' stressful and physically demanding activities were associated with an increased risk of sudden cardiac death compared with other routine or nonemergency activities.[13] Furthermore, some research in India and other countries reported that occupational risk factors, such as long working hours, irregular eating habits, inadequate sleep-in shift duties, and dealing with stressful situations, contribute to increased disease vulnerability, including high blood pressure, diabetes, overweight, joint pains, and heart attacks among police officials.[14-16] However, in the Indian setting, the occupational class differential for CVD risk has not been well explored, especially among police officials.

Globally, there is a clear gender difference in CVD risk factors that is not favorable to men.[17] Also, stress coping strategies are less adaptive among men physiologically, behaviorally, and emotionally, contributing to an increased risk of coronary heart disease.[17] This is an important consideration when working in male-dominated professions such as law enforcement. It was evidenced that hypertension is the strongest risk factor for CVDs.[18] High rates of CVD[19] and its risk factors such as diabetes (34%) and hypertension (31%), abdominal obesity (72%), overweight (52%), and moderate or high stress (70%)[20] among police officials were reported from India. Most of the studies on CVD risk factors among police officials from India are based on small samples.[21-23] We considered cardiovascular risk factors modifiable at the individual level, and the occupational factors related to cardiovascular health among police officials. Our findings will be used to design behavioral interventions for cardiovascular risk factor reduction in this community. This study evaluated CVD risk factors such as hypertension, diabetes, tobacco use, alcohol consumption, and overweight among police officials in Kerala, India. We specifically explored the prevalence, awareness, treatment, and control of hypertension and the factors associated with hypertension in this population.

Methods

A cross-sectional study was conducted among police officials in selected police stations in the Thiruvananthapuram district of Kerala in 2021. There are nearly 50 000 police officials in the state of Kerala, spread among 545 police stations. Thiruvananthapuram, the capital district of the state, has both rural ($n = 40$) and urban ($n = 26$) police stations with an approximate strength of 3900 police officials. Based on the hypertension prevalence of 30.4% from a prior study in the state[24] the sample size was calculated as 127, with a precision of 8. Because the sample selection procedure was cluster sampling (police stations as clusters), a design effect of 2 was used and the estimated final sample size was 254, which is rounded off to 255. Sampling was done for rural and urban areas in order to get representative data from the whole study area. Both from rural and urban areas, we randomly selected 7 police stations, and finally we surveyed police officials from the selected 14 police stations in the district. Among the selected police stations, we surveyed police officials aged 30-55 years who were willing to participate in the study. A total of 282 eligible police officials were approached, of whom 255 consented and participated in the study providing a response rate of 90.4%. The nonresponse was mainly due to their emergency duty schedule during the data collection in the coronavirus disease-2019 (COVID-19) pandemic period.

The World Health Organization (WHO) stepwise surveillance of noncommunicable disease (NCD) risk factors questionnaire was used for the study.[25] We collected STEP 1 (demographics, tobacco use, alcohol consumption, physical activity, and diet) and STEP 2 (weight, height, and blood pressure) data. We followed the WHO STEPwise protocol to measure blood pressure, weight, and height.[25] Blood pressure was measured using OMRON blood pressure devices (OMRON HEM-907; OMRON Healthcare Company, Kyoto, Japan). Height was measured using a portable stadiometer, weight using a SECA scale, and waist and hip circumferences were measured by constant tension tape. Briefly, 3 readings of blood pressure were taken and the average of the last 2 readings was used for further analysis. Weight was measured in kilograms and height in centimeters. Waist circumference could not be measured for all participants because the participants were in police uniforms and were not comfortable with measuring their waist circumference at the police station premises. All the interviews were conducted by one of the authors, who is a trained public health nurse (J.G), in Malayalam (local language), and all the measurements were taken by trained personnel.

Current tobacco use was defined as the use of any form of tobacco during the last month prior to the survey. Those who consumed at least 1 alcoholic drink within the past month were defined as current users of alcohol. Insufficient physical activity (physical inactivity) was defined as not meeting the WHO recommendation of at least 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity or an equivalent combination of moderate- and vigorous-intensity physical activity achieving at least 600 MET (metabolic equivalent task) minutes per week. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Overweight was defined as BMI 25-29 kg/m^2, and obesity as BMI ^{3}30 kg/m^2. Consumption of less than 5 servings of fruits and vegetables per day was considered as an unhealthy diet. Hypertension was defined as systolic blood pressure (SBP) >=140 mmHg or diastolic blood pressure (DBP) >=90 mmHg or on self-reported medication for high blood pressure.[26] Controlled hypertension was defined as SBP <140 and DBP <90 mmHg. Diabetes and hyperlipidemia were defined based on self-reported diagnosis by a physician. Extra salt use was assessed by questions on salt intake behavior to capture high salt intake similar to that reported earlier.[27] We used 3 questions: "Do you add salt or a salty sauce such as soy sauce to food right before eating?" or "during cooking?" and "Do you eat processed food high in salt?" Extra salt use was assessed if the participants answered positively to at least 2 of

the above salt-related questions. We gathered information related to the job, such as the number of years of experience, perceived stress related to the job, details of working hours, shift duty, and job satisfaction. Shift work was defined as working at night in addition to the normal working hours. We assessed perceived stress by asking the question, "Do you feel any stress related to your work?" We also asked whether they were satisfied with their profession. Additionally, we collected subjective assessments of inadequate sleep.

Ethical clearance for the study was obtained from the Institutional Ethics Committee (IEC) of Ananthapuri Hospitals and Research Institute, Thiruvananthapuram (IEC number: AHRI/EC/110/Jun/2021 dated June 21, 2021). A participant information sheet was given to all participants. Written informed consent was obtained from all the participants. All the statistical analyses were done using IBM SPSS Statistics V.21 software for Windows. Univariate, bivariate, and multivariate analyses were done. Categorical variables were compared using the chi-square test. Multivariate analysis using logistic regression models was used to explore factors associated with hypertension. Statistical significance was fixed as $P \leq .05$.

Results

The sociodemographic and occupational characteristics and details of CVD risk factors of the study participants are shown in Table 1. The majority of them (84%) were men, and the mean (SD) age was 42 (6) years (range: 30-55 years). Finally, we obtained a total sample of 119 (46.7%) from rural and 136 (53.3%) from urban police stations. Nearly three-fourths of the participants were living in rural areas. Around 18% of the participants had high school or higher secondary education, 68% were graduates, and 14% were postgraduates. The majority of them were currently married (98%), 5 persons were single, and 1 person was separated. At the time of the survey, nearly 2% were gazetted police officers (executive-level ranked government officers), 84% were nongazetted civil police officers, and the remainder were other officers including administrators and subdivisional officers. Around 49% had a shift-work pattern, and 70% worked more than 8 hours per day. More than half of them reported very rare weekends off, and 68% reported being satisfied or very satisfied with their present job. Work-related stress was reported by 73% of the study population, and inadequate sleep was reported by 26%. Years of experience varied from 1 year to 34 years, with nearly half of the participants (49%) having $\geq$15 years of experience as police officials.

The overall prevalence of current smoking and smokeless tobacco use was reported only by male participants. Nine men (4.3%) reported current smoking and 1 man reported current smokeless tobacco use. Of the 9 smokers, 7 were from rural areas and aged 40 years or more. Current alcohol use was reported by men only (26.1%); 72% of these were from rural areas and 60% were aged 40 years and above. Poor dietary habit was reported by most of the participants (92.1%). Physical inactivity was reported by 35.1% of participants (men: 36.1%, women: 25.0%).

Five participants (2.0%) reported a history of heart disease and among them, 4 were under treatment. Respiratory disease was reported by 2.7%, kidney disease by 3 participants (1.3%), diabetes by 7.5%, hyperlipidemia by 11.4%, and hypertension by 9.4%. Nearly 84% of the diabetic participants and 17.2% of those with hyperlipidemia were under treatment.

Extra salt use was reported by 58% of the respondents. Poor dietary habits were significantly higher among the lower age group of 30-39 years old compared with their older counterparts of 40-55 years old (96.9% vs 88.5%; $P < .05$). No difference in poor dietary habits was found between urban and rural residents. Prevalence of inactivity was slightly higher among older age groups (35.6%) compared with younger age group participants (34.5%), and higher among participants from urban police stations compared with rural police stations (42.9% vs 26.2%). However, these results are not statistically significant. Self-reported diabetes was reported by men only (8.9%). Diabetes prevalence was slightly higher among rural residents compared with urban residents (7.6% vs 7.0%), and significantly higher among older age groups (12.2% in the age group of 40 years and above and 0.9% among 30-39 years; $P < .001$). Table 2 presents the selected CVD risk factors by sociodemographic and occupational characteristics.

The mean (SD) systolic and diastolic blood pressures were 134 (14) mmHg and 83 (9) mmHg, respectively. The mean (SD) BMI was 26.3 (3.1) kg/m^2. The prevalence of overweight or obesity was 64.7% (95% CI 58.5-70.5) (overweight: 51.4%, and obesity: 13.3%). The prevalence of hypertension was 40.4% (95% CI: 34.3-46.6). Among hypertensives, 36% were aware of their condition, 20% were treated, and 6% were controlled. The control rate was 29% among treated hypertensives. The prevalence of hypertension was higher among higher age group participants, men, lower educated, and urban residents. A higher prevalence of hypertension was seen among participants with 15 years or more experience as police officials, among those who were having job-related stress, were unsatisfied with their current job, or had inadequate sleep compared with their counterparts. Figure 1 shows the prevalence

Table 1. Sociodemographic and occupational characteristics and cardiovascular disease risk factors of the study participants (N = 255).

Variables	Total, [a] n (%)
Age group	
30-39 y	108 (42.4)
40-55 y	147 (57.6)
Sex	
Men	213 (83.5)
Women	42 (16.5)
Education	
High school/higher secondary level	45 (17.6)
Graduation and above	210 (82.4)
Job experience	
<15 y	131 (51.4)
≥15 y	124 (48.6)
Had perceived job-related stress	186 (72.9)
Working hours per day (n = 243)	
≤8 h	73 (30.0)
>8 h	170 (70.0)
Had shift work (n = 251)	123 (49.0)
Satisfied with the present job	174 (68.2)
Reported inadequate sleep	66 (25.9)
CVD risk factors	
Current use of tobacco and/or alcohol (n = 172)	39 (22.7)
Poor dietary habits (n = 228)	210 (92.1)
Physically inactive (n = 131)	46 (35.1)
Overweight/obesity	165 (64.7)
Diabetes [b]	19 (7.5)
Hypertension	103 (40.4)
Hyperlipidemia [b] **(n = 254)**	29 (11.4)

[a]Percentages presented are column percentages. [b]Self-reported.

Table 2. Description of selected cardiovascular disease risk factors by background characteristics.[a]

Characteristics	Tobacco or alcohol (N = 172), n (%)	Poor dietary habits (N = 228), n (%)	Physical inactivity (N = 131), n (%)	Overweight (N = 255), n (%)
Age group		*		
30-39 y	14 (19.7)	94 (96.9)	20 (34.5)	66 (66.1)
40-55 y	25 (24.8)	116 (88.5)	26 (35.6)	99 (67.3)
Sex	*			
Men	39 (25.0)	177 (92.2)	43 (36.1)	135 (63.4)
Women	0 (00.0)	33 (91.7)	3 (25.0)	30 (71.4)
Education				
School education	6 (17.1)	40 (90.9)	8 (34.8)	30 (66.7)
Graduates	33 (24.1)	170 (92.4)	38 (35.2)	135 (64.3)
Place of residence				*
Rural	28 (23.1)	149 (92.0)	28 (30.8)	112 (60.9)
Urban	11 (21.6)	61 (92.4)	18 (45.0)	53 (74.6)
Occupational variables				
Years of service		**		
<15	17 (20.5)	114 (97.4)	25 (35.2)	84 (64.1)
≥15	22 (24.7)	96 (86.5)	21 (35.0)	81 (65.3)
Perceived job-related stress				
No	8 (20.0)	55 (94.8)	11 (33.3)	49 (71.0)
Yes	31 (23.5)	155 (91.2)	35 (35.7)	116 (62.4)
Working hours per day [b]				
£8	7 (17.1)	60 (93.8)	17 (42.5)	51 (69.9)
>8	28 (23.0)	142 (91.0)	27 (30.7)	106 (62.4)
Had shift work [c]				
Yes	20 (23.8)	104 (92.9)	17 (28.3)	76 (61.8)
No	19 (22.4)	103 (91.2)	27 (39.1)	87 (68.0)
Job satisfaction				
Satisfied	26 (22.2)	143 (91.7)	34 (36.6)	115 (66.1)
Unsatisfied	13 (23.6)	67 (93.1)	12 (31.6)	50 (61.7)
Inadequate sleep				
Yes	9 (20.9)	51 (87.9)	14 (45.2)	39 (59.1)
No	30 (23.3)	159 (93.5)	32 (32.0)	126 (66.7)

*$P < .05$; ** $P < .001$. [a]Percentages presented are row percentages. [b]Missing = 12. [c]Missing = 4.

of co-occurrence of 4 different cardiovascular risk factors: hypertension, diabetes, overweight or obesity, and physical inactivity. Among those with hypertension and diabetes, the most co-occurring risk factor is physical inactivity. Being overweight was the main risk factor that co-occurred with other risk factors like hypertension, diabetes, and physical inactivity. In the multivariate analysis, we included variables significantly associated with hypertension in bivariate analysis. Table 3 shows the results of the multiple logistic regression model adjusted for age and rural/urban areas. Participants with diabetes (odds ratio [OR]: 3.57; 95% CI: 1.16-10.90) and overweight (OR: 1.88; 95% CI: 1.06-3.35) were more likely to have hypertension compared with their counterparts.

Table 3. Risk factors for hypertension: results of multiple logistic regression model[a].

Variables	Adjusted OR	95% CI	*P* value [b]
Education			
Graduates	Reference		
School education	1.68	0.82-3.43	.152
Perceived job-related stress			
No	Reference		
Yes	1.10	0.60-2.02	.741
Overweight			
No	Reference		
Yes	1.88	1.06-3.35	**.031**
Diabetes			
No	Reference		
Yes	3.57	1.16-10.90	**.024**

Abbreviation: OR, odds ratio. [a]Adjusted for age and rural/urban areas. [b]Bold *P* value denotes statistical significance ($P < .05$).

Discussion

This study comprehensively assesses CVD risk factors among police officials in Kerala state, India. The study shows a high prevalence of CVD risk factors among police officials. The prevalence of hypertension among police officials in this study was 40.4%, which is higher than that reported in the general population in the state (30.4%).[24] An earlier study among male police officials in Kerala reported a hypertension prevalence of 41.4% with a cutoff point of SBP ≥130 or DBP ≥85 mmHg.[28] This might be similar to our finding, considering that we used a cutoff point of SBP ≥140 or DBP ≥90 mmHg. The prevalence of hypertension reported in our study was higher than that reported among policemen in other parts of India, such as the 30.5% reported among policemen aged 20-59 years in Puducherry.[20] However, police officials in the Madhya Pradesh state of India (67.9%)[29] and 85 male police officials in Delhi (63.6%)[30] reportedly had a comparatively higher prevalence of hypertension. A lower prevalence of hypertension was reported among police officials in the United States (28%).[31]

Similar to the previous Kerala study carried out among police officials,[28] the prevalence of overweight in our study was 65%, which is higher compared with the general population in the

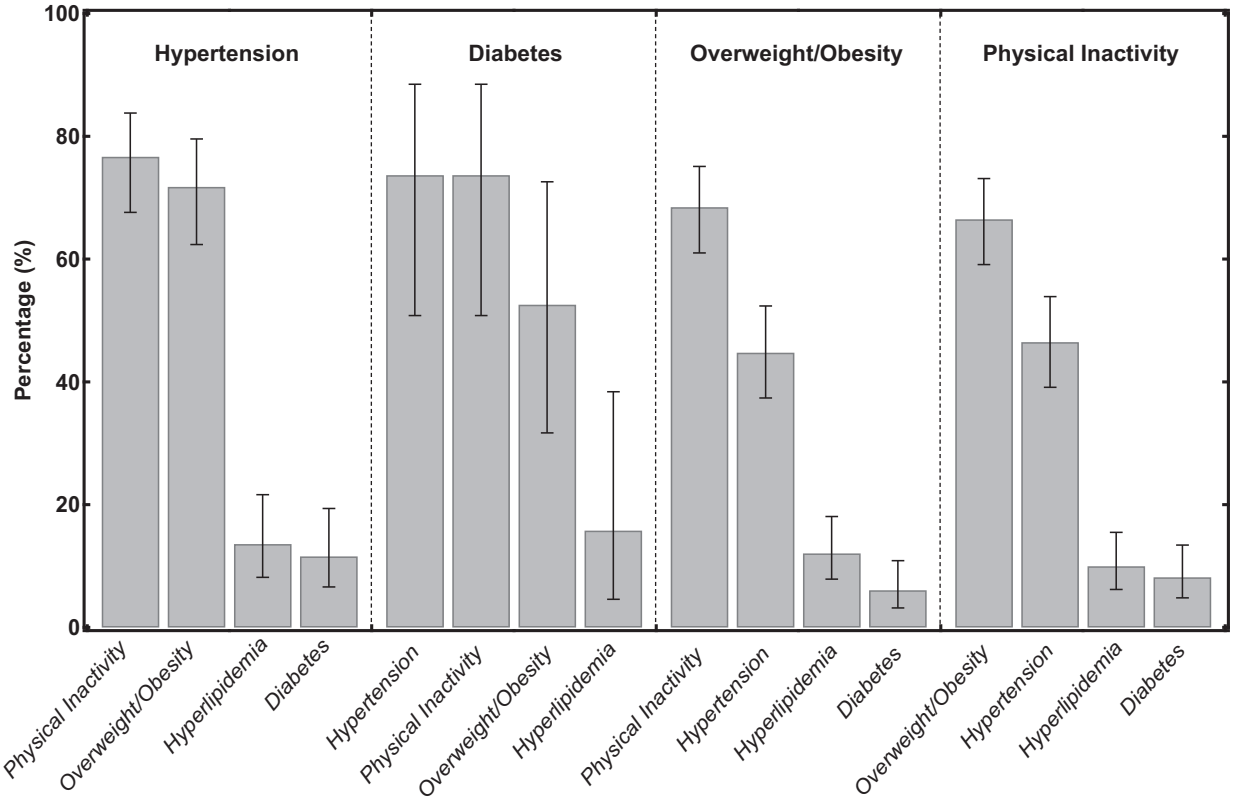


Figure 1. Prevalence of co-occurrence of different cardiovascular risk factors.

state.[24] A comparatively lower prevalence (51.6%) of overweight was reported among police officials in Puducherry[20] and a higher prevalence (71.8%) among police constables in Delhi, India.[30] A higher prevalence of overweight was also reported among police officials (80%)[31] in the United States. Our finding of a robust association between overweight and hypertension is consistent with results from other studies.[32]

The proportion of physical inactivity (35%) among the study population is a matter of important concern, especially since police officials are perceived to be a physically fit group. At the time of recruitment for their job, physical fitness is one of the main selection criteria. However, according to our findings, a high proportion of them became physically inactive over time, highlighting the need to implement appropriate strategies to maintain their physical fitness. Because physical activity details were not available for all participants, the association of physical inactivity with the higher proportion of overweight and hypertension could not be established.

One-fourth of the study participants reported inadequate sleep, which is a major problem to be addressed because poor sleep quality among law enforcement professionals was found to be associated with mental health issues.[33] Poor sleep was associated with a higher incidence of CVDs among civilians[34] and law enforcement officers.[35]

The prevalences of smoking and alcohol consumption reported among policemen in the present study (5.6% and 22.9%, respectively) were lower than those reported among policemen in Puducherry (23% and 45.7%, respectively), India.[20] In our study, current consumption of alcohol and tobacco use were lower than reported in the general adult population from Kerala.[24] Tobacco use among other occupational groups in Kerala state was lower; for example, one study found that the prevalence of alcohol use among male school teachers was as low as 0.8%.[36] The true prevalence of tobacco and alcohol might be masked because the interviews were conducted on the police station premises.

The incidences of metabolic syndrome and coronary heart disease have been found to be higher among police officials.[37] A study from West Bengal state, India, showed that, compared with other occupational groups, police officers were found to be at higher risk of metabolic parameters such as impaired fasting glucose and impaired glucose tolerance.[22] Self-reported prevalence of diabetes (7.5%) in our study was lower than the diabetes prevalence of 19% among the general population in Kerala.[24] The co-occurrence of CVD risk factors in this population is a matter of concern because the clustering of metabolic risk factors doubles the likelihood of CVD deaths.[38]

Nearly three out of four participants in our study reported work-related stress. It is important to address this issue because stress was reported as a predictor of metabolic syndrome among police officials in different settings, including China[39] and the United States.[12] Additionally, stress was reported as an important predictor of hypertension among police personnel in Puducherry, south India.[20]

Our study has several limitations. First, data collection was conducted during the COVID-19 pandemic, which might have affected key features such as shift work and diet patterns. Second, although we anticipated measuring waist and hip circumference from all study participants, we could measure these only in a subsample of participants. Third, due to budget and logistical constraints, we were not able to apply WHO-STEP-3 (biochemical measurements). Finally, we relied on self-reports for some measures of CVD risk factors. The very high prevalence of poor

dietary habits reported in this study needs to be explored further. Participants were surveyed during the COVID-19 pandemic, which might have influenced their dietary habits. The food choices during the survey period were very limited because food shops were not fully functional at the time. Examining data by gender is limited because of the small sample size of women police officials in the study; however, the proportion of women in this type of work in India is very low.[40]

Conclusion

Our study conducted among police officials in Kerala state, India, where overall health indicators are much better than in other states of the country, reported a high prevalence of hypertension and other CVD risk factors such as overweight and physical inactivity. The findings of this study highlight the need to implement interventions to address cardiovascular risk factors in police officials. Increasing awareness and regular assessment of CVD risk factors are warranted among police officials in India. In response to this need, our group is currently conducting behavioral and psychological interventions for the reduction of modifiable risk factors of CVD in this population in India, supported by the Lown Scholar's Program from the TH Chan School of Public Health, Harvard University.[41]

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Author contributions

J.G contributed to the conception, design, acquisition of data, and writing of the first draft of the manuscript; M.P. and V.I. contributed to the analysis and interpretation of data and revision of the manuscript with a critical contribution for intellectual content; G.K.M. contributed to the conception, design, analysis, and interpretation of data and revision of the manuscript with a critical contribution for intellectual content, and also approved the final draft of the version to be published.

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Conflicts of interest

The authors declare no conflicts of interest for this article.

Data availability

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

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