



Hypertension and associated factors in military police anthropometric, sleep, and lifestyle indicators

Hipertensión y factores asociados en la policía militar: indicadores antropométricos, del sueño y del estilo de vida

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Abstract

Objective: To analyze and compare health indicators, body composition, blood pressure, sleep, and physical activity between hypertensive and non-hypertensive military personnel from the Shock Company of the Special Missions Battalion of the Military Police of Espírito Santo.

Methods: A total of 41 military personnel were evaluated, including 25 diagnosed with arterial hypertension and 16 non-hypertensive individuals. The analyzed variables included age, years of service, body composition, anthropometry, health indices, diastolic blood pressure, heart rate, hours of sleep, and weekly minutes of physical activity.

Results: Hypertensive individuals showed significantly higher values for body mass, BMI, waist circumference, body fat percentage, waist-to-height ratio, systolic and diastolic blood pressure compared to non-hypertensive individuals. Additionally, hypertensive military personnel exhibited fewer hours of sleep and similar levels of weekly physical activity.

Conclusion: Anthropometric indicators, sleep patterns, and lifestyle behaviors were associated with the presence of hypertension in military police officers. These findings highlight the importance of preventive strategies focusing on body composition, sleep quality, and physical activity to promote health and operational readiness in this population.

Keywords

Hypertension, military personnel, body composition, sleep duration and cardiovascular health.

Resumen

Objetivo: Analizar y comparar indicadores de salud, composición corporal, presión arterial, sueño y actividad física entre personal militar hipertenso y no hipertenso de la Compañía de Choque del Batallón de Misiones Especiales de la Policía Militar de Espírito Santo.

Métodos: Se evaluó a un total de 41 militares, incluidos 25 diagnosticados con hipertensión arterial y 16 individuos no hipertensos. Las variables analizadas incluyeron edad, años de servicio, composición corporal, antropometría, índices de salud, presión arterial sistólica, presión arterial diastólica, frecuencia cardíaca, horas de sueño y minutos semanales de actividad física.

Resultados: Los individuos hipertenso mostraron valores significativamente más altos en masa corporal, IMC, circunferencia de cintura, porcentaje de grasa corporal, relación cintura-estatura y presión arterial sistólica y diastólica en comparación con los individuos no hipertensos. Además, el personal militar hipertenso presentó menos horas de sueño y similares niveles de actividad física semanal.

Conclusión: Los indicadores antropométricos, los patrones de sueño y los hábitos de estilo de vida fueron asociados con la presencia de hipertensión en los policías militares. Estos hallazgos destacan la importancia de implementar estrategias preventivas centradas en la composición corporal, la calidad del sueño y la actividad física para promover la salud y la preparación operativa en esta población.

Palabras clave

Hipertensión, personal militar, composición corporal, duración del sueño y salud cardiovascular.

Introduction

Cardiovascular diseases (CVD) are the leading cause of mortality worldwide (WHO 2020). In Brazil, approximately 400,000 deaths are related to cardiovascular diseases (Brandão et al. 2025). Hypertension, the main modifiable risk factor for CVD, affects approximately 22% of the adult Brazilian population and is even more prevalent among younger populations when associated with adverse occupational conditions (Brandão et al. 2025).

Among public security professionals, military police officers present a cardiovascular risk profile distinct from that of the general population. Brazilian studies have reported a prevalence of SAH ranging from 5.3% in young police officers from the interior of São Paulo (Calamita et al. 2010) to 22% among Brazilian Air Force personnel aged 19 to 35 years (Wenzel et al. 2009). In the state of Mato Grosso, a survey involving 1,742 military police officers identified an overall prevalence of 14.75%, with 87.5% of hypertensive individuals being overweight or obese (Cerqueira 2013).

Regarding obesity, previous studies have reported both high (Alghamdi et al., 2017) and low (Heinrich et al., 2008) prevalence rates among police officers. Additionally, central obesity measures, including waist circumference, have been shown to discriminate elevated coronary risk better than body mass index (BMI) for cardiometabolic risk (Pitanga, Lessa 2005) in this population, while poor sleep quality and chronic occupational stress act as independent determinants of increased blood pressure (Magnavita et al. 2022).

Among special operations police officers, the evidence suggests a paradoxical scenario. A comparative study between the Special Police Operations Battalion (SPOB) and conventional units of the Military Police of Rio de Janeiro revealed that, although SPOB officers had longer service time, higher income, and apparently better physical conditioning, they paradoxically exhibited a higher prevalence of hypertension (15.1% vs. 6.5%), higher total cholesterol levels (229.7 vs. 209.7 mg/dL), and greater waist circumference (97.0 vs. 95.8 cm) compared to officers from conventional units (Marçolla et al. 2024). These findings suggest that even within an elite force, theoretically more trained and selectively recruited, occupational stressors, including irregular shifts, sleep deprivation, chronic exposure to high-risk situations, and the potential use of ergogenic resources may offset or even outweigh the expected benefits of rigorous physical training, resulting in poorer cardiometabolic indicators.

Despite this evidence, few studies have comprehensively compared different health indicators, including not only blood pressure (Hussain, Ajuwon 2020), but also anthropometric measures of central adiposity (Wenzel et al. 2009), sleep duration and quality (Velazquez-Kronen et al. 2022), level of physical activity (Zampero et al. 2026), and medication use among hypertensive and non-hypertensive military personnel within the same special operations unit. Such comparisons are important to identify the factors that distinguish elite officers who maintain adequate blood pressure levels from those with SAH, thereby enabling more targeted prevention and intervention strategies.

Therefore, the aim of this study was to analyze and compare health indicators, including systemic blood pressure, sleep duration, anthropometric measures, and physical activity levels, between hypertensive and non-hypertensive military personnel from the Shock Company of the Special Missions Battalion of the Military Police of Espírito Santo, Brazil.

Method

General characteristics and sample selection

This study was designed as a descriptive, cross-sectional, analytical investigation conducted using questionnaire-based instruments and anthropometric assessments. After approval by the Human Research Ethics Committee of the Federal University of Espírito Santo (CAAE: 70736323.2.0000.5542/2023), military police officers from the Shock Operations Company of the Special Missions Battalion (SOCSMB), located in the Jardim América district, municipality of Cariacica, Espírito Santo, Brazil, were invited to voluntarily participate in the study. After agreeing to participate, all subjects signed an Informed Consent Form, in accordance with the guidelines established by Resolution No. 466/2012 of the Brazilian National Health Council. Invitations were conducted through

direct contact between researchers and officers, as well as through verbal and digital dissemination strategies.

Adult military police officers of both sexes, actively engaged in occupational duties, were included in the study. Exclusion criteria included officers on leave for any reason during the study period and those who did not sign the informed consent form. Additionally, participants who did not complete all study procedures and assessments were excluded. After applying inclusion and exclusion criteria, the final sample consisted of 41 military police officers from the Shock Operations Company (SOC), distributed in two groups: normotensive ($n = 16$) and hypertensive ($n = 25$), representing 20% of Special Missions Battalion and 59% of SOCSMB.

Experimental design

The SOCSMB is an elite unit of the Military Police of the State of Espírito Santo, employing specialized tactics and techniques in situations requiring advanced operational performance, such as civil disturbance control, explosive ordnance incidents, and high-complexity hostage situations. The unit currently comprises approximately 200 officers and is considered the last operational resource of the corporation, characterized by highly refined technical training, continuous preparation, loyalty, and strong commitment to duty. In general, SOCSMB officers are trained in explosive ordnance disposal, chemical agent response, high-angle rescue operations, aquatic operations, prison interventions, tactical entries, riot control, crisis management, hostage negotiation, and precision shooting.

Data collection was conducted in the workplace during duty days, according to participant availability. Participants completed questionnaires after a full explanation of the study procedures. The evaluation sequence included: signing the informed consent form, assessment of sociodemographic parameters, evaluation of physical activity level (IPAQ), and anthropometric assessment while wearing standard physical training uniforms.

Evaluated parameters

Blood pressure

Systolic and diastolic blood pressure were measured twice on the left arm, positioned at heart level, with the participant seated and legs uncrossed, following previous protocols (Brandão et al. 2025). Briefly, all participants remained at rest for at least 5 minutes in a quiet environment, seated with their back supported, legs uncrossed, and feet flat on the floor. The arm was bare, supported at heart level, with the palm facing upward. Three measurements were obtained at one-minute intervals, and the mean of the last two measurements was used for analysis. When a difference greater than 10 mmHg was observed between measurements, additional measurements were performed. The cuff was selected according to arm circumference and appropriately positioned 2–3 cm above the antecubital fossa.

The data collection team (researchers and students) was previously trained to ensure data reliability. All equipment was properly calibrated, maintained, and transported. Blood pressure was measured using an Omron Model HEM-705CP device (Omron, Texas, USA), with cuff size appropriate for arm circumference. For analytical purposes, participants were classified as hypertensive if systolic blood pressure (SBP) > 140 mmHg or diastolic blood pressure (DBP) > 90 mmHg and normotensive systolic blood pressure (SBP) < 120 mmHg and diastolic blood pressure (DBP) < 80 mmHg according to Brandão et al. (2025).

Health, occupational indicators, and sleep duration

To assess general health perception, occupational characteristics, and sleep duration, structured questionnaires were administered. Each question included predefined response options, with the possibility of additional responses when applicable.

Open-ended questions were used to assess smoking habits, alcohol consumption, awareness of chronic disease diagnoses, medication use, self-rated health status, and sleep duration. Sleep duration was classified as adequate when reported between 7 and 8 hours, and inadequate when less than 7 hours, according to the National Institutes of Health guidelines (2007) and previous studies from our research group (Oliveira et al. 2024).

Anthropometric measures and cardiovascular risk

Anthropometric assessments followed standardized procedures from previous studies (Esparza-Ros et al. 2019, Oliveira et al. 2023, Oliveira et al. 2024). Body mass was measured using a digital scale (Marte Scientific, L200, SP) with 0.1 kg precision, and height was measured using a stadiometer (Cardiomed WCS) with 0.1 cm precision. Body mass index (BMI) was calculated as body mass divided by height squared. The following BMI classification was used: normal weight ($BMI \geq 18.5$ and $< 25.0 \text{ kg/m}^2$), overweight ($BMI \geq 25.0$ and $< 30.0 \text{ kg/m}^2$), and obesity ($BMI \geq 30.0 \text{ kg/m}^2$).

Waist circumference (WC) was measured using a non-elastic measuring tape at the midpoint between the lower rib margin and the iliac crest. Cardiovascular risk classification followed standard cutoffs: increased risk (men $\geq 94 \text{ cm}$; women $\geq 80 \text{ cm}$) and substantially increased risk (men $\geq 102 \text{ cm}$; women $\geq 88 \text{ cm}$).

Body composition was estimated using a double indirect method through skinfold thickness measurements (biceps, triceps, subscapular, and suprailiac) using a skinfold caliper (Mitutoyo Cescorf, Porto Alegre, Brazil). Body fat percentage (%BF) was calculated according to the Durnin and Womersley (1974) equation and classified according to previous publications (Choi et al. 2016, Heinrich et al. 2008) as: normal ($< 18\%$), overweight ($18\text{--}24.9\%$), and obese ($> 25\%$).

The waist-to-height ratio (WHtR) was calculated by dividing waist circumference by height (both in cm), with a cutoff point of 0.50 to classify low versus increased health risk, according to Corrêa et al. (2019).

The Conicity Index (C Index) was calculated based on the assumption that central fat accumulation results in a body shape resembling a double cone. The formula used was: $C \text{ Index} = \text{waist circumference (m)} / [0.109 \times \sqrt{(\text{body mass (kg)} / \text{height (m)})}]$. Values ≥ 1.25 were considered indicative of increased coronary risk, while values < 1.25 indicated lower risk, according to previous studies (Pitanga, Lessa 2004, Oliveira et al. 2024).

Physical activity level

Total physical activity time and activity level were assessed using the International Physical Activity Questionnaire (IPAQ), as in previous studies (Ferraz et al. 2020, Oliveira et al. 2024). The questionnaire evaluated weekly physical activity, including walking, moderate activity, and vigorous exercise. Participants were classified as physically active if they achieved at least 150 minutes of physical activity per week, in accordance with World Health Organization guidelines. Those who did not meet this threshold were classified as inactive.

Data analysis

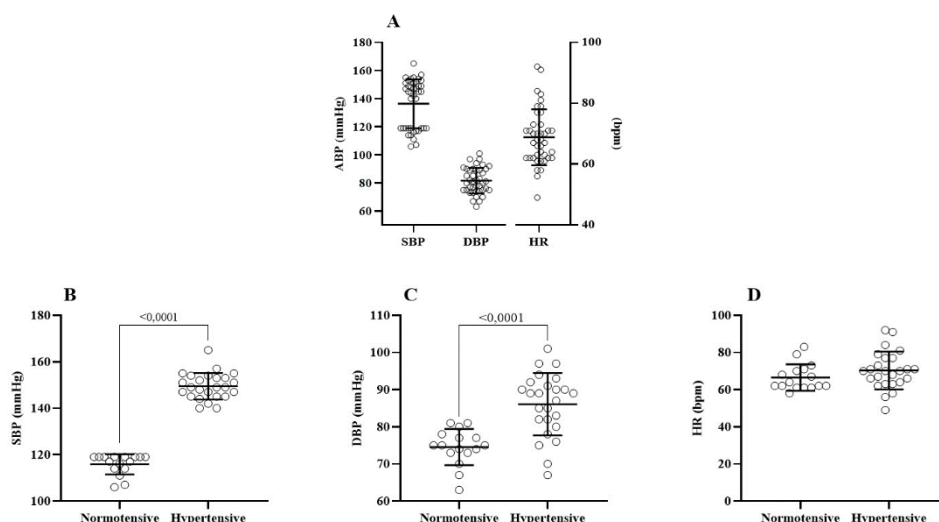
Data are presented as absolute (n) and relative (%) frequencies for qualitative variables, and as mean $\pm$ standard deviation, coefficient of variation (CV), and 95% confidence interval (95% CI) for quantitative variables. Normality was assessed using the D'Agostino-Pearson test. Comparisons between groups (normotensive vs. hypertensive subjects) were performed using the chi-square test for categorical variables and the unpaired t-test for continuous variables. Pearson's correlation test was used to evaluate the strength and direction of associations between anthropometric variables, working time, and sleep duration. Correlation strength was classified as: weak ($r = 0.10 - 0.39$), moderate ($r = 0.40 - 0.69$), and strong ($r = 0.70 - 1.00$). Statistical analyses were conducted using GraphPad Prism version 6.00 for Windows (GraphPad Software, La Jolla, CA, USA), with a significance level set at $p < 0.05$.

Results

The mean age of the shock unit officers was 36 ± 6.8 years (CV: 18.64%), with a mean length of service of 12.23 ± 5.54 years (CV: 45.33%). The prevalence of hypertension was 25 cases (60.98%) among the officers. After stratifying participants according to hypertension diagnosis, no significant differences were observed in age (Normotensive: 37.50 ± 7.43 , CV: 19.81%; Hypertensive: 36.48 ± 7.13 , CV: 19.55%; MD: 1.02, 95% CI: -3.04 to 5.71, $p = 0.6626$) or length of service (Normotensive: 12.63 ± 4.84 , CV: 38.36%; Hypertensive: 11.92 ± 6.31 , CV: 53.00%; MD: 0.70, 95% CI: -3.04 to 4.45, $p = 0.7060$) between groups.

Figure 1A presents the overall values for systolic blood pressure (SBP: 136.50 ± 17.38 , CV: 12.75%), diastolic blood pressure (DBP: 81.59 ± 9.14 , CV: 11.21%), and heart rate (HR: 68.85 ± 9.15 , CV: 13.30%). However, significant differences were observed between groups for SBP (Normotensive: 115.90 ± 4.38 , CV: 3.78%; Hypertensive: 149.50 ± 5.70 , CV: 3.81%; MD: 33.61; 95% CI: 30.21 to 37.00; $p < 0.0001$) and DBP (Normotensive: 75.56 ± 4.85 , CV: 6.51%; Hypertensive: 86.08 ± 8.41 , CV: 9.77%; MD: 11.52; 95% CI: 6.82 to 16.21; $p < 0.0001$). No significant differences were observed for heart rate (Normotensive: 66.50 ± 7.09 , CV: 10.68%; Hypertensive: 70.36 ± 8.41 , CV: 14.37%; MD: 3.86; 95% CI: -2.01 to 9.37; $p = 0.8191$).

Figure 1. Values are expressed as mean $\pm$ standard deviation. SBP: systolic blood pressure; DBP: diastolic blood pressure; HR: heart rate.



Anthropometric parameters, sleep duration, and physical activity levels are presented in Table 1. Overall, the sample exhibited elevated body mass index (BMI), body fat percentage, and cardiovascular risk indicators, along with high levels of physical activity.

Table 1. Anthropometric characteristics, sleep duration, and physical activity time of military police officers.

Parameters	Overall	Normotensive	Hypertensive	MD (95% CI)	p
Body mass (kg)	86.63 $\pm$ 12.15 (14.03%)	81.19 $\pm$ 14.39 (17.72%)	90.11 $\pm$ 9.17 (10.18%)	8.92 (16.33 to 1.50)	= 0.0197
Height (m)	1.76 $\pm$ 0.07 (4.13%)	1.75 $\pm$ 0.09 (5.40%)	1.77 $\pm$ 0.05 (3.18%)	0.01 (-0.05 - 0.03)	= 0.5873
BMI (kg/m ²)	27.76 $\pm$ 3.23 (11.66%)	26.16 $\pm$ 3.28 (12.55%)	28.78 $\pm$ 2.81 (9.79%)	2.61 (-4.56 - -0.66)	= 0.0098
Body fat (%)	22.22 $\pm$ 6.72 (30.25%)	18.31 $\pm$ 5.05 (27.62)	24.72 $\pm$ 6.52 (26.38%)	6.41 (-10.30 - -2.52)	= 0.0019
Fat mass (kg)	19.56 $\pm$ 7.20 (36.85%)	15.09 $\pm$ 5.99 (39.70%)	22.42 $\pm$ 6.50 (29.02%)	7.32 (-11.41 - -3.23)	= 0.0008
Fat-free mass (kg)	67.07 $\pm$ 9.05 (13.50%)	66.09 $\pm$ 10.81 (16.36%)	67.69 $\pm$ 7.91 (11.69%)	1.59 (-7.51 - 4.31)	= 0.5878
Waist circumference (cm)	90.01 $\pm$ 9.31 (10.352%)	85.75 $\pm$ 10.16 (11.84%)	92.74 $\pm$ 7.76 (8.37%)	6.99 (-12.66 - -1.31)	= 0.0171
WHR	0.51 $\pm$ 0.05 (10.12%)	0.48 $\pm$ 0.05 (10.51%)	0.52 $\pm$ 0.04 (9.11%)	0.03 (-0.06 - -0.00)	= 0.0293
C index	1.40 $\pm$ 0.08 (5.71%)	1.37 $\pm$ 0.07 (5.53%)	1.41 $\pm$ 0.08 (5.65%)	0.03 (-0.09 - 0.01)	= 0.1267
Sleep	6.78 $\pm$ 1.08 (15.99%)	7.68 $\pm$ 0.47 (6.22%)	6.20 $\pm$ 0.95 (15.44%)	1.48 (0.96 - 2.01)	< 0.0001
PA level time (min)	171.10 $\pm$ 185.00 (108.10%)	138.80 $\pm$ 124.80 (89.97%)	191.80 $\pm$ 214.90 (112.00%)	53.09 (-173.20 - 67.02)	= 0.3768
PA moderate time (min)	200.60 $\pm$ 132.10 (65.85%)	195.60 $\pm$ 122.10 (62.42%)	203.80 $\pm$ 140.50 (68.95%)	8.17 (-94.78 - 78.43)	= 0.5332
PA intense time (min)	161.50 $\pm$ 328.80 (73.99%)	162.20 $\pm$ 122.60 (75.61%)	161.10 $\pm$ 119.10 (74.50%)	1.18 (-77.16 - 79.53)	= 0.9757
PA week time (min)	533.20 $\pm$ 328.80	496.60 $\pm$ 322.90	556.60 $\pm$ 337.00	60.08	= 0.5748

(61.67%) (65.03%) (60.54%) (-274.90 – 154.70)

Values are expressed as mean $\pm$ standard deviation (coefficient of variation), MD (mean difference), 95% CI (confidence interval), BMI (body mass index), waist-to-height ratio (WHtR) and PA (physical activity).

Significant differences between normotensive and hypertensive groups were observed for body mass, BMI, body fat percentage, fat mass, waist circumference, waist-to-height ratio (WHtR), and sleep duration. No significant differences were found for fat-free mass or for time spent in walking, moderate physical activity, vigorous physical activity, or total weekly physical activity.

As shown in Table 2, smoking was generally infrequent, reported by 33 participants (80%) as non-smokers. However, alcohol consumption was prevalent among the evaluated military police officers, with 17 individuals (41%) reporting alcohol use. Regarding the presence of non-communicable chronic diseases, only 4 participants (8%) reported having such conditions. Considering all participants, 1 (2%) reported a diagnosis of hypothyroidism, 4 (8%) reported anxiety and depression, 1 (2%) reported gastritis and reflux, and 2 (4%) reported rhinitis.

Table 2. Daily habits and general health conditions of military police officers.

Parameters	Overall N (%)	Normotensive N (%)	Hypertensive N (%)	p
Smoking				
Yes	8 (20)	0 (0)	8 (32)	= 0,0001
No	33 (80)	16 (100)	17 (68)	
Alcohol consumption				
Yes	17 (41)	0 (0)	17 (68)	= 0,0117
No	24 (58)	16 (100)	8 (32)	
Pre-existing diseases				
Yes	4 (10)	0 (0)	4 (16)	= 0,0001
No	37 (90)	16 (100)	21 (84)	
Diagnosed diseases				
Hypothyroidism	1 (2)	0 (0)	1 (4)	= 0,6644
Anxiety and depression	4 (10)	0 (0)	4 (17)	
Gastritis and reflux	1 (2)	0 (0)	1 (4)	
Rhinitis	2 (5)	0 (0)	2 (8)	
General medication use				
Yes	10 (25)	0 (0)	10 (40)	= 0,0036
No	31 (75)	16 (100)	15 (60)	

N: number of cases

A high prevalence of physical activity was observed, with 39 participants (95%) classified as physically active. Adequate sleep duration was reported by 24 individuals (58%). Based on BMI classification, 16 participants (40%) were classified as overweight. Abdominal obesity, assessed by waist circumference, was observed in 9 individuals (23%). A total of 12 participants (28%) presented elevated body fat percentage, while 26 (63%) showed increased risk for coronary artery disease based on waist-to-height ratio (WHtR). In contrast, 40 participants (99%) were classified as having no risk according to the Conicity Index (Table 3).

Differences between normotensive and hypertensive groups were identified for smoking, alcohol consumption, and medication use, but not for the presence of diagnosed chronic diseases (Table 3). It is noteworthy that in the hypertensive group, reported conditions included hypothyroidism (1 [4%]), anxiety and depression (4 [16%]), gastritis and reflux (1 [4%]), and rhinitis (2 [8%]). Interestingly, no officer reported the use of antihypertensive medications.

Associations between hypertensive and normotensive groups regarding physical activity level, sleep duration, and anthropometric parameters are presented in Table 3. Significant associations were observed only for sleep duration ($p < 0.0001$), body fat percentage ($p = 0.0004$), waist-to-height ratio ($p = 0.0002$) and C index ($p < 0.0001$).

Table 3. Classification of physical activity level and anthropometric parameters of military police officers.

Parameters	Overall N (%)	Normotensive N (%)	Hypertensive N (%)	p
Physical activity				
Active	39 (95)	16 (100)	23 (92)	= 0.2460
Inactive	2 (5)	0 (0)	2 (8)	
Sleep time				
Adequate	24 (58)	16 (100)	8 (32)	< 0,0001
Inadequate	17 (42)	0 (0)	17 (68)	
BMI classification				
Normal	24 (59)	11 (68)	13 (52)	= 0.4691
Overweight	16 (40)	5 (32)	11 (44)	
Obesity	1 (1)	0 (0)	1 (4)	
Body fat %				
Normal	13 (32)	10 (62)	3 (12)	= 0.0004
Overweight	16 (40)	6 (38)	10 (40)	
Obesity	12 (28)	0 (0)	12 (48)	
WC classification				
Adequate	31 (76)	16 (100)	15 (60)	= 0.0145
Increased	9 (23)	0 (0)	9 (36)	
Substantially increased	1 (1)	0 (0)	1 (4)	
WHtR				
Non risk	21 (51)	14 (87)	7 (28)	= 0.0002
With risk	20 (49)	2 (13)	18 (72)	
C index				
Non risk	16 (39)	16 (100)	0 (0)	< 0.0001
With risk	25 (61)	0 (0)	25 (100)	

N: number of cases; BMI: body mass index; %BF: body fat percentage; WC: waist circumference; WHtR: waist-to-height ratio

Table 4 presents the correlation values between anthropometric parameters, sleep duration, and time spent in different physical activity domains. On the other hand, a correlations was observed between body mass, BMI, body fat percentage, fat mass, waist-to-height ratio and sleep duration with SBP, however, to DBP just fat mass, body fat and sleep duration indicate significant correlation.

Table 4. Correlation between anthropometric parameters, sleep duration, and physical activity with systolic and diastolic blood pressure in military police officers.

Parameters	Systolic blood pressure (mmHg)			Diastolic blood pressure (mmHg)		
	r	CI 95%	p	r	CI 95%	p
Age (years)	-0.1396	-0.4288 - 0.1756	= 0.3841	-0.0620	-0.3592 - 0.2466	= 0.6964
Service time (years)	-0.0654	-0.3657 - 0.2472	= 0.6843	-0.0352	-0.3356 - 0.2771	= 0.8248
Body mass (kg)	0.3762	0.0775 - 0.6129	= 0.0153	0.1371	-0.1741 - 0.2202	= 0.3867
Height (m)	0.1472	-0.1681 - 0.4351	= 0.3584	-0.0897	-0.3832 - 0.2202	= 0.5720
BMI (kg/m ²)	0.3779	0.0794 - 0.6141	= 0.0149	0.2420	-0.0663 - 0.5089	= 0.1218
Body fat (%)	0.4826	0.2055 - 0.6881	= 0.0014	0.3472	-0.0483 - 0.5890	= 0.0243
Fat mass (kg)	0.5169	0.2488 - 0.7114	= 0.0005	0.3439	0.0446 - 0.5864	= 0.0258
Fat-free mass (kg)	0.0932	-0.2207 - 0.3897	= 0.5619	-0.0900	-0.3834 - 0.2199	= 0.5708
Waist circumference (cm)	0.3663	0.0661 - 0.6057	= 0.0185	0.1444	-0.1368 - 0.4552	= 0.2694
WHtR	0.3104	0.0030 - 0.5642	= 0.0482	0.2218	-0.0811 - 0.4925	= 0.1581
C index	0.2373	-0.0759 - 0.5079	= 0.0563	0.1084	-0.2022 - 0.3992	= 0.4943
Sleep (hours)	-0.6999	-0.8291 - -0.5000	< 0.0001	-0.4624	-0.6719 - -0.1844	= 0.0020
PA level time (min)	0.2565	-0.0556 - 0.5229	= 0.1055	0.1216	-0.1894 - 0.4103	= 0.4431
PA moderate time (min)	0.0414	-0.2696 - 0.3447	= 0.7968	-0.1789	-0.4579 - 0.1323	= 0.2770
PA intense time (min)	0.0065	-0.3017 - 0.3136	= 0.9676	-0.1183	-0.4075 - 0.1926	= 0.4557
PA week time (min)	0.1633	-0.1519 - 0.4485	= 0.3075	-0.0488	-0.3477 - 0.2589	= 0.7585

95% CI (confidence interval), BMI (body mass index), waist-to-height ratio (WHtR) and PA (physical activity).

Discussion

The present study demonstrated that hypertensive military police officers from the Shock Company of the Special Missions Battalion of Espírito Santo exhibit, compared to normotensive counterparts, shorter sleep duration, greater central adiposity, higher body fat percentage, and a higher prevalence of alcohol consumption and smoking. Additionally, no differences were observed in physical activity levels between groups. Inadequate sleep was strongly correlated with increased blood pressure, highlighting it as a potential priority target for interventions in this population.

The prevalence of hypertension observed was higher than that reported in other studies involving Brazilian military personnel: 22% in the Brazilian Air Force, 14.8% among military police officers in

Mato Grosso (Cerqueira 2013), and 15.1% in BOPE officers from Rio de Janeiro (Marçolla et al. 2024). This discrepancy may be attributed to multiple factors, including sample-specific characteristics such as elite operational demands, diagnostic criteria (direct workplace assessment), and the high levels of stress and sleep deprivation to which these professionals are exposed. Notably, no age differences were found between groups, reinforcing the role of occupational and behavioral factors rather than chronological age. Compared with VIGITEL 2023 data for Espírito Santo, the prevalence of hypertension in our sample was markedly higher. However, this comparison should be interpreted with caution, as VIGITEL relies on self-reported medical diagnoses, whereas our study used direct blood pressure measurements, a more sensitive method capable of identifying undiagnosed and untreated cases.

Our findings revealed a strong inverse correlation between sleep duration and systolic blood pressure, with hypertensive individuals sleeping, on average, 1.48 hours less than normotensive individuals. This is consistent with literature identifying sleep deprivation as a trigger for sympathetic hyperactivity, increased cortisol levels, reduced nocturnal blood pressure dipping, and increased blood pressure variability (Spiegel et al. 2004, Battisha et al. 2025). Furthermore, moderate correlations were observed between sleep duration and both body fat percentage and fat mass. Although leptin and ghrelin were not measured, classical studies demonstrate that sleep restriction reduces levels of the anorexigenic hormone leptin and increases levels of the orexigenic hormone ghrelin, promoting increased appetite and preference for calorie-dense foods (dos Santos et al. 2021). Thus, it is plausible that sleep deprivation contributes not only directly to elevated blood pressure but also indirectly through increased central adiposity.

Hypertensive officers also presented higher BMI, greater body fat percentage, and increased waist circumference, with no differences in fat-free mass. This pattern—excess adiposity with preserved lean mass—has been described in physically active populations with positive energy balance and has been previously reported in Brazilian military police (Filho, D'Oliveira Junior 2004, dos Santos et al. 2021). The waist-to-height ratio (WHtR) was also significantly higher in hypertensive, exceeding the risk threshold (≥ 0.50) exclusively in this group. This indicator has been considered superior to BMI alone for predicting cardiometabolic risk in populations with high muscle mass (Tanasescu et al. 2025), supporting its routine use in periodic evaluations of elite police officers.

An important and seemingly paradoxical finding was the absence of differences in physical activity levels between hypertensive and normotensive groups. Both groups reported high weekly physical activity (~520–560 min/week), far exceeding World Health Organization recommendations (150 min/week). However, hypertensive individuals exhibited more than triple the prevalence of alcohol consumption and exclusive smoking compared to normotensive individuals. Similar findings have been reported by Marçolla et al. (2024) in BOPE officers from Rio de Janeiro, suggesting that the cardiovascular benefits of physical activity may be attenuated by the combined effects of chronic occupational stress, sleep deprivation, excessive alcohol consumption, and smoking (Holtermann et al. 2018). Indeed, being physically active does not confer metabolic protection when multiple risk factors are present. This finding has important implications for health promotion programs, which should not focus exclusively on physical activity at the expense of interventions targeting sleep, nutrition, and stress management.

The high prevalence of alcohol consumption among hypertensive individuals is consistent with previous findings in military police populations (Ferreira et al. 2011, Fonseca et al. 2021), reinforcing the hypothesis that alcohol use may function as a coping mechanism for occupational stress and chronic exposure to high-risk situations. In contrast, smoking, present in 32% of hypertensive individuals, was absent in the normotensive group. These findings differ from studies in police officers from other regions³⁻⁵, and the absence of smokers in the normotensive group may reflect greater health awareness or lower exposure to stressors.

Regarding medication use, 40% of hypertensive individuals reported regular use of general medicaments, indicating that a substantial proportion was under treatment. No normotensive individuals reported such use, reducing the likelihood of misclassification of the control group due to pharmacological effects. However, treatment adherence and blood pressure control levels were not assessed, representing important aspects for future research.

Despite its relevant findings, this study has limitations that should be considered. First, the relatively small sample size ($n = 41$) and restriction to a single BME unit limit the generalizability of the results. Second, the absence of female participants precludes sex-based analyses, an important consideration given the increasing number of women in military police forces. Additionally, sleep and dietary assessments were based on self-report, which is subject to recall and social desirability bias, without objective confirmation through methods such as actigraphy or detailed dietary records. Furthermore, potentially relevant variables, such as sleep quality (e.g., Pittsburgh Sleep Quality Index), obstructive sleep apnea, occupational stress (e.g., salivary cortisol or validated scales), and detailed dietary intake were not measured. Finally, blood pressure was assessed during only two occasions, without confirmation through ambulatory (ABPM) or home blood pressure monitoring (HBPM), which may have overestimated hypertension prevalence due to situational elevations (white-coat effect).

Despite these limitations, the present findings provide practical implications for occupational health in military police forces. First, systematic assessment of sleep should be incorporated into routine health evaluations, given its strong association with blood pressure levels. This may be achieved through simple screening questions, with referral for further evaluation (e.g., polysomnography) in suspected cases of obstructive sleep apnea. Second, the replacement or complement of BMI with waist circumference and waist-to-height ratio is recommended, as these measures were more sensitive in identifying cardiovascular risk differences between groups. Third, the findings indicate that health promotion programs focusing exclusively on physical activity are insufficient to control hypertension in this population; multidisciplinary interventions addressing sleep hygiene, stress management, alcohol reduction, and smoking cessation are necessary. Fourth, targeted educational strategies for hypertensive officers should emphasize the detrimental effects of alcohol and tobacco on blood pressure control and the importance of treatment adherence.

Finally, the results highlight the need to review work schedules and organizational conditions that negatively impact sleep, such as shifts and excessive workloads without adequate rest periods. Institutional implementation of such measures may improve individual health, preserve operational readiness, and reduce long-term healthcare and retirement costs associated with cardiovascular diseases.

Conclusions

In conclusion, hypertensive military police officers from the Shock Operations Company of the Special Missions Battalion exhibited a less favorable health profile than their normotensive counterparts, characterized by shorter sleep duration, greater central adiposity, higher body fat percentage, and a higher prevalence of alcohol consumption and smoking, irrespective of age and physical activity levels. Notably, inadequate sleep was strongly associated with elevated blood pressure, underscoring the potential relevance of sleep duration as an important factor in cardiovascular risk among this occupational population. Furthermore, the absence of significant differences in physical activity levels suggests that regular engagement in physical activity alone may not fully counterbalance the adverse effects associated with unfavorable sleep patterns, excess adiposity, and health-related behaviors. These findings reinforce the importance of a comprehensive approach to cardiovascular health in military police personnel, incorporating not only physical activity but also adequate sleep, body composition management, and the reduction of modifiable lifestyle risk factors.

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