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Cardiovascular risk factors in military personnel of the brazilian airforce at Alcântara (MA)

Fatores de risco cardiovascular em militares da força aérea brasileira em Alcântara (MA)

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Abstract
***Objective**: to investigate the frequency of cardiovascular risk factors in military personnel of the Brazilian Air Force in Alcântara, Brazil. **Methodology**: a retrospective cross-sectional study was conducted with clinical records of 240 active military personnel from the Medical and Statistical Archives Service and nutritional assessment from the Nutrition Subsection Sector. The modifiable (diabetes mellitus – DM, systemic arterial hypertension – SAH, generalized obesity, abdominal obesity, hypercholesterolemia, hypertriglyceridemia, sedentarism, smoking, and alcoholism) and non-modifiable (gender and age) cardiovascular risk factors, anthropometric data, and cardiovascular diseases (CVD) were extracted. Descriptive statistics and chi-square test was applied (a=5%). **Results**: the sample was predominantly male (55.8%) and with a mean age of 33 (±8.4) years. The most prevalent risk factors were overweight (43.8%), abdominal obesity (42.9%), generalized obesity (21.3%), alcoholism (34.6%), and sedentary lifestyle (31.3%). Regarding the distribution of cardiovascular risk factors in relation to gender, a significant association was found with SAH, sedentarism, abdominal obesity and nutritional status (p=0.004, p=0.027, p=0.040 and p=0.018, respectively). For the sample studied, 2.7% had CVD. **Conclusion**: the predominant cardiovascular risk factors were overweight, abdominal obesity, generalized obesity, alcoholism and sedentary lifestyle. In men, hypertension and overweight were predominant, and in women, sedentarism and abdominal obesity.*
***Keywords:** Cardiovascular diseases; military health; air force personnel; obesity*

Resumo
Objetivo: investigar a frequência de fatores de risco cardiovascular em militares da Força Aérea Brasileira em Alcântara, Brasil. **Metodologia**: estudo transversal retrospectivo foi realizado com registros clínicos de 240 militares ativos e oriundos de prontuários do Serviço de Arquivo Médico e Estatístico, e de avaliação nutricional do Setor de Subseção de Nutrição. Foram extraídos os fatores de risco cardiovascular modificáveis (diabetes mellitus – DM, hipertensão arterial sistêmica – HAS, obesidade geral, obesidade abdominal, hipercolesterolemia, hipertrigliceridemia, sedentarismo, tabagismo e etilismo) e não modificáveis (sexo e idade), dados antropométricos e de doenças cardiovasculares (DCV). Estatística descritiva e teste qui-quadrado foi aplicado (a=5%). **Resultados**: a amostra foi predominantemente de homens (55,8%) e com média de idade de 33 (±8,4) anos. Os fatores de risco mais prevalentes foram sobrepeso (43,8%), obesidade abdominal (42,9%), obesidade geral (21,3%), etilismo (34,6%) e sedentarismo (31,3%). Quanto a distribuição dos fatores de risco cardiovascular em relação ao gênero, foi constatada associação significativa com HAS, sedentarismo, obesidade abdominal e estado nutricional (p=0,004, p=0,027, p=0,040 e p=0,018, respectivamente). Para a amostra, 2,7% apresentavam DCV. **Conclusão**: os fatores de risco cardiovascular predominantes foram sobrepeso, obesidade abdominal, obesidade geral, etilismo e sedentarismo. Nos homens foi predominante a hipertensão e o excesso de peso e nas mulheres, o sendentarismo e a obesidade abdominal.
Palavras-chave: Risco cardiovascular; saúde militar; pessoal da força aérea; obesidade

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INTRODUCTION

Among the chronic non-communicable diseases, cardiovascular disease (CVD) is the leading cause of death

worldwide. More than 17 million people die worldwide from cardiovascular diseases (CVDs) per year, making them the leading cause of death globally[1]. In Brazil, approximately 350,000 people die each year from CVD, which represents 27% of all deaths, and is the leading cause[2].

Cardiovascular risk factors (CVRFs) are classified as non-modifiable, such as: age, ethnicity, and family history of CVD, and modifiable, such as: systemic arterial hypertension (SAH), diabetes mellitus (DM), dyslipidemia (DLP), generalized obesity (specifically abdominal obesity), sedentary lifestyle, smoking, and alcohol consumption. Diet and sedentarism are considered the primary risk factors for CVD and contribute to other risk factors such as hypertension, DM, and DLP[3].

The CVRFs with the greatest impact on morbidity and mortality rates were hypertension, DM, DLP, and smoking. Being overweight contributes to the increased prevalence of SAH, DM, and DLP, with a consequent increase in the incidence of negative cardiovascular outcomes, such as sudden death, stroke, acute myocardial infarction, heart failure, peripheral arterial disease, and chronic kidney disease[4].

For military personnel, work activities often involve overload and a high level of stress, which predisposes them to a higher risk of developing CVRF[5]. Evaluating these factors in military personnel, a systematic review focusing on policemen determined that the most have a sedentary lifestyle, metabolic syndrome, and cardiovascular risks that contribute to the development of cardiometabolic diseases[6]. Among these risk factors, overweight and obesity are the main factors that threaten the health of the workers. The increased incidence of these factors is a serious challenge for military organizations Baygi et al[7]. (2020). Concurrently, smoking and alcohol consumption are common among military personnel Baygi et al.[7] (2020).

Military personnel undergo a series of examinations, including cardiovascular risk screening at the time of admission and at annual health checks. However, information about the diagnosis and need for lifestyle modifications to reduce CVRFs is poorly disseminated. Thus, health education is essential to explain the importance of CVRFs and prevention to reduce cardiovascular risk, the occurrence of CVD, and its complications.

As intense and stressful work activities of military personnel can lead to CVDs, the establishment of strategic programs with Brazilian military organizations is essential for the early diagnosis and control of CVRFs, which can help reduce mortality from these diseases.

METHODOLOGY

A retrospective cross-sectional study was conducted with clinical records of active military personnel from the Medical and Statistical Archives Service and nutritional assessment from the Nutrition Subsection Sector, Alcântara Air Force Polyclinic, located in Alcântara and in an annex in São Luís, Maranhão (Brazil), between January 2017 and December 2020.

The research was approved by the Research Ethics Committee of CEUMA University (number: 3,948,820/2020). Data collection was authorized by the Military Institution in letter no. 056/PROP/2019 and in letter no. 1/SCI/11184.

To participate in the study, military personnel had to be on active duty, aged between 18 and 59 years, receive nutritional care and/or monitoring, and have complete medical records. Military personnel who were removed from administrative and operational activities and were considered unsuitable by the Medical Board of Health were excluded from the study.

A sample calculation was performed to estimate the frequency of being categorized as overweight among the military personnel. The 55% prevalence of being categorized as overweight Gielerak et al.[8] (2020), 95% confidence level, and 5% estimation error were considered for the calculation. The initial sample size (n) was 380 participants. After adjusting for a finite population (1215 active military personnel), the final sample size was 289.

Modifiable cardiovascular risk factors (DM: glycemia above 126 mg/dl; SAH: 140 mmHg x 90 mmHg; hypercholesterolemia: low-density lipoprotein cholesterol ≥ 160 mg/dL; hypertriglyceridemia: triglycerides ≥ 150 mg/dL; sedentary lifestyle: less than 150 minutes of moderate physical activity per week; alcoholism: daily alcohol intake above 50 grams for women and 70 grams for men; smoking: consumption of cigarettes or other products containing tobacco; generalized obesity; and abdominal obesity) and non-modifiable risk factors (gender and age), anthropometric indicators (weight, height, and waist circumference [WC]), and CVD were investigated in this study. DM, SAH, hypercholesterolemia, hypertriglyceridemia, sedentary lifestyle, alcoholism, smoking, and abdominal obesity were categorized into No e Yes.

Abdominal obesity (central obesity) was assessed using the WC. The global nutritional status of adults was obtained by the body mass index (BMI), dividing body weight in kilograms (kg) by height in meters (m) squared: weight (kg) / height (m)^2 and being categorized as low weight (BMI < 18.5 kg/m^2), eutrophic (BMI ≥ 18.5 and ≤ 24.9 kg/m^2), overweight (BMI between 25 and 29.9 kg/m^2), and general obesity (BMI ≥ 30 kg/m^2) (WHO 2000).[9]

RESULTS

The survey response rate was 83%, with 240 clinical records of military personnel. The losses were related to incomplete medical records (49 records). The sample was predominantly men (55.8%) with a mean age of 33 (8.4) years. Most of the participants were married (54.6%) or single (43.8%). The most frequent military ranks and grades were sergeants (27.9%), officers (26.3%), and non-commissioned officers (17.5%) (Table 1).

Table 1- *Distribution of military personnel seen at the Alcântara (Maranhão, Brazil) Air Force Polyclinic of the Brazilian Air Force, according to gender, age group, marital status and military hierarchy. 2017- 2020 (n=240)*

Variables	n (%)
Gender	
Men	134 (55.8)
Women	106 (44.2)
Age group	
18 to 28 years	82 (34.2)
29 to 39 years	97 (40.4)
40 to 50 years	55 (22.9)
51 to 59 years	6 (2.5)
Marital status	
Married/ stable unite	133 (55.4)
Sole	105 (43.8)
Divorced	2 (0.8)
Military Hierarchy	
Colonel	4 (1.7)
Major	1 (0.4)
Captain	5 (2.1)
Officer	63 (26.3)
Sub-office	42 (17.5)
Sergeant	67 (27.9)
Cabo	20 (8.3)
Sodier	20 (8.3)

Source: Authors

The most prevalent CVFRs included abdominal obesity (49.2%), overweight (43.8%), alcohol consumption (34.6%), sedentary lifestyle (31.3%), and generalized obesity (21.3%). Hypertension and overweight predominated in men; sedentarism and abdominal obesity predominated in women. SAH, sedentarism, abdominal obesity, and nutritional status were significantly associated with sex (p=0.004, p=0.027, p=0.040, and p=0.018, respectively). (Table 2). In the study sample, 2.7% of the patients had CVD.

Table 2 – *Frequency of modifiable cardiovascular risk factors and their distribution in relation to gender of military personnel seen at the Alcântara Aeronautics Polyclinic (Maranhão, Brazil), 2017-2020. (n=240)*

Cardiovascular risk factors modifiable	Total n (%)	Men n (%)	Women n (%)	*p*-value
Diabetes				
Not	225 (93.7)	125 (93.3)	100 (94.3)	0.737*
Yes	15 (6.3)	9 (6.7)	6 (5.7)	
Hypertension				
Not	217 (90.4)	115 (85.8)	102 (96.2)	0.004**
Yes	23 (9.6)	19 (14.2)	4 (3.8)	
Hypercholesterolemia				
Not	207 (86.3)	116 (86.6)	91 (85.8)	0.873*
Yes	33 (13.7)	18 (13.4)	15 (14.2)	
Hypertriglyceridemia				
No	207 (86.3)	115 (85.8)	92 (86.8)	0.828*
Yes	33 (13.7)	19 (14.2)	14 (13.2)	
Sedentary lifestyle				
No	165 (68.8)	100 (74.6)	65 (61.3)	0.027*
Yes	75 (31.2)	34 (25.4)	41 (38.7)	
Alcoholism				
Not	157 (65.4)	90 (67.2)	67 (63.2)	0.522*
Yes	83 (34.6)	44 (32.8)	39 (36.8)	
Smoking				
Not	236 (98.3)	131 (97.8)	105 (99.1)	0.436**
Yes	4 (1.7)	3 (2.2)	1 (0.9)	
Abdominal obesity				
Not	122 (50.8)	76 (56.7)	46 (43.4)	0.040*
Yes	118 (49.2)	58 (43.3)	60 (56.6)	
Nutritional status				
Low weight and/or eutrophic	84 (35.0)	37 (27.6)	47 (44.3)	
Overweight	105 (43.8)	65 (48.5)	40 (37.7)	0.018***
General obesity	51 (21.3)	32 (23.9)	19 (17.9)	

** Chi-square test; ** Fisher's exact test; *** c^2 Linear Trend; Nutritional status: the category "Low weight" (1 case) was joined to the category "Eutrophic". Low weight (BMI<18.5 kg/m²), eutrophic (BMI ≥ 18.5 and ≤ 24.9 kg/m²), overweight (BMI = 25-29.9 kg/m²), and general obesity (BMI ≥ 30kg/m²)*

Regarding the classification of CVD risk according to WC in service men, 14.18% (n=19) were at increased risk (WC ≥ 94 cm), 22.39% (n=30) were at highly increased risk (WC ≥ 102 cm), and 63.43% (n=85) were not at risk. Regarding WC of service women, 25.47% (n=27) were at increased risk (WC ≥ 80 cm), 25.47% (n=27) were at very high risk (WC ≥ 88 cm), and 49.06% (n=52) were at no risk.

DISCUSSION

The most prevalent modifiable CVRFs were abdominal obesity, overweight, alcohol consumption, sedentary lifestyle, and generalized obesity. SAH and overweight were more frequent in men, and a sedentary lifestyle and abdominal obesity were more frequent in women.

The distribution of modifiable risk factors in this study was similar to those reported in other studies. Gielerak et al[8]. (2020) observed that 55% of military personnel were overweight and almost 30% reported a sedentary lifestyle. In a systematic review investigating the overall prevalence of cardiometabolic risk factors in military personnel, being overweight the most prevalent risk factor (35%) Baygi et al[7]. (2020). Payab et al[11]. (2017) found that 48% of the Iranian military personnel were overweight.

A high frequency of these risk factors was also reported by Mariano Júnior, Paula[12] (2018). Sixty-six percent of military police officers interviewed were sedentary. They also reported that 80% of patients had a BMI above normal, in addition to the fact that 62% had a high abdominal circumference.

The majority of participants in our sample were men, which is similar to the samples in the studies by Gielerak et al[8]. (2020) and Bell Ngan et al[13]. (2020); 97% and 81.3% of their participants were men, respectively. Mandatory military enlistment explains this finding.

Sixty-five percent of the individuals in the study had a BMI greater than or equal to 25, which characterizes

overweight (43.8%) or obesity (21.3%). This indicator is a practical method widely used by health professionals to diagnose obesity. However, this parameter is limited because it does not consider the distribution of body fat and does not differentiate between lean mass and fat mass. Thus, its use in association with other anthropometric parameters of body fat distribution is required to establish a more accurate method to assess the risk for developing CVD Barroso et al[14]. (2017).

The main cause of the unreliability of BMI in determining the distribution of body fat is that it can be normal in individuals with central obesity, as determined by WC or with increased muscle mass Xia, Lloyd-Jones, Khan[15] (2019). Thus, an additional evaluation of abdominal obesity is essential because it reflects the adiposity of this part of the body. These measures, compared with other anthropometric indicators, are considered more appropriate for predicting the risk of CVD in the general population because they are markers that indirectly reflect cardiometabolic risk Hsie et al[16]. (2019).

In the present study, it was evident that more than half of the military personnel in our sample were not at risk for CVD based on WC. Of those who presented with risk for CVD, women had similar "increased risk" and "highly increased risk 'and men showed a predominance for the "highly increased risk'. Although women had a lower waist circumference, they were at a higher risk.

In a study by Martins-Silva, Mola Vaz, Tovo-Rodrigues[17] (2018), where abdominal obesity was measured using the WC indicator, a higher prevalence was found in women than in men, which corroborates the present study. Similar results were also observed in a study by Domingos Júnior et al[18]. (2020), where they detected a significantly higher prevalence of excess abdominal adiposity in women. The predominance of abdominal obesity in women reflects the higher concentration of body fat due to hormonal oscillations that occur in the body during life Barroso et al[14]. (2017).

It is noteworthy that the prevalence of abdominal obesity has increased in recent years and is higher than generalized obesity Barroso et al.[14] (2017). This was observed in the present study, the prevalence of generalized obesity was 21.3%, and that of abdominal obesity was 49.2%. These findings confirm the study by Sasaki et al[19]. (2021), with 50 individuals aged between 18 and 50 years in a city in the northwest of Paraná state. In their study, the prevalence rates of generalized obesity and abdominal obesity were 34% and 58%, respectively.

The accumulation of fat in the abdominal region implies an increase in inflammatory adipokines, which in turn may elevate the risk of insulin resistance and consequently increase the risk of CVD Anderson[20] (2017).

Although risk factors are similar in all countries, their distribution is variable. A simple example is the incidence of SAH as a CVRF in Brazil and the United States. In Brazil, SAH is the main risk factor for CVD, whereas in the United States, dyslipidemia is the main risk factor. In the present study we found a higher number of cases (total of 9 cases) of SAH in the 29 to 39 age group, which represents 40.4% of the sample. One of the factors that could explain the frequency of cases for this age group is the food offered in the restaurants of the military organization, such as foods with high sodium content and preservatives (sodium nitrite and sodium nitrate), sweeteners (sodium cyclamate and sodium saccharin), ferments (sodium bicarbonate) and flavor enhancers (monosodium glutamate).

In the present study, the prevalence of excessive consumption of alcoholic beverages was 34.6%, while in a study conducted by Bell Ngan et al[13]. (2020), 61.7% of the military consumed alcoholic beverages excessively. It is noteworthy that excessive ingestion of alcoholic beverages can cause dozens of physiological disorders, especially psychosocial disorders, because alcohol is a psychotropic drug with a high affinity for the central nervous system. Thus, it is concerning that excessive alcohol consumption among military personnel is prevalent as it can affect technical and military performance Carvalho et al[21]. (2019).

Smoking, diabetes, and hypertension were less prevalent in our sample. The lower prevalence of these factors can be explained by periodic nutritional monitoring through nutritional support services for the prevention of these diseases. The same was the case for hypercholesterolemia and hypertriglyceridemia This finding differs from the findings of Krzowski et al[22]. (2018), where 50% of Polish participants had hypercholesterolemia, 72% had high LDL-C, and 29% had hypertriglyceridemia.

The findings for smoking contrast with those of the results of Gielerak et al[8]. (2020), who detected a high percentage of smokers (46%) among Polish military personnel. However, the findings of the research of Escócio et al[23]. (2020) were similar to those of the present study, with only 4% of the participants being smokers. The low prevalence of smoking stems from a local corporate policy in which the military is warned about the risks to the health and safety of their families.

Considering the differences in modifiable CVRFs by gender, we found that a sedentary lifestyle was more prevalent in women; in contrast, SAH was more prevalent in men. The findings of the greater prevalence of sedentary lifestyle in women are in agreement with Domingos Júnior et al[18]. (2020), who also found a greater prevalence in women (54.5%). The findings of SAH corroborates the findings of the study by Bell Ngan et al[13]. (2020), which detected SAH in 23% of male military personnel.

Although in the present study 68.8% of the military men participated in physical activity, the nutritional status of the men revealed that 48.5% were overweight and 23.9% were obese. The high prevalence of being overweight or obese in the present study may explain the demand of the nutrition sector by the military to adjust the dietary base and establish changes in eating habits. This highlights the need to implement intervention programs to improve the nutritional status of the military and, consequently, their overall health. It is known from tests

and genetics that obesity and excess body fat, especially abdominal fat or visceral adipose tissue, are related to major cardiometabolic problems ranging from type 2 diabetes and hypertension to cardiovascular diseases and several types of cancer Kantar[24] (2020), Sattar, McInnes, McMurray[25] (2020).

For military personnel, physical activity is intrinsic to the profession, and this connection is explicitly evident during the stages of public competition for entry into the career or in the selection of paid temporary reserve forces. Therefore, to join military forces, the individual is required to pass a series of eliminatory physical tests and complete a training course or adaptation period. During this period, an intense daily routine of physical activity is performed to indoctrinate the body and maintain physical fitness for the demands inherent to the profession.

After military training, physical conditioning of those on active duty or reserve forces is required annually through a physical conditioning evaluation test (PTAS). Prolonged and regular physical activity has promoted beneficial physiological effects in the prevention of cardiovascular events; however, this is insufficient and requires a series of joint measures for prevention to be effective.

The limitations of this study are related to its cross-sectional design, which prevents the establishment of a causal relationship, and its retrospective nature, which may introduce an observation bias as the recorded data may contain errors. We used BMI as an indicator of nutritional status; however, BMI cannot be used to distinguish between fat and lean mass. Thus, abdominal obesity was assessed to minimize the effects of this limitation.

This research consolidates important information that can serve as a basis for reflecting on the work processes and health of military personnel. Considering eating habits and lifestyle changes over time, CVRFs also need to be reevaluated, which will help establish new strategies for CVD prevention and related health promotion.

The results emphasize the importance of health policies that encourage lifestyle changes at and outside the workplace, which can impact the physical and mental health of workers. Workers' health is going through a new moment, focusing on prevention and promotion. Thus, future interventions by military organizations are recommended to establish a program encompassing healthy eating and greater adherence to physical exercise. Such interventions will contribute to the prevention and/or reduction of the factors that contribute to the onset of CVD, and thus meet the standards of excellence of body composition expected in military personnel. However, for these objectives to be achieved, strategic planning to produce indicators and support an interdisciplinary approach is necessary, aligning all work sectors to act together and complementarily for a common good.

Based on the results of this study, educational material was prepared and disseminated through the Alcântara (MA) air force's website, in order to clarify the military about the modifiable risk factors related to CVDs.

CONCLUSION

Modifiable factors such as: hypertension, overweight, generalized obesity, sedentarism and abdominal obesity are more frequent in military personnel of the Brazilian Airforce. These findings also highlight the need to adopt strategies aimed at the prevention and control of cardiovascular risk factors among this category of workers.

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