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Prevalence of arterial hypertension in young military personnel and associated factors

ABSTRACT

OBJECTIVE: To estimate the prevalence of arterial hypertension among young military personnel and associated factors.

METHODS: Cross-sectional study carried out with a sample of 380 male military personnel aged 19 to 35 years of a Brazilian Air Force unit in the city of São Paulo, Southeastern Brazil, in 2000 and 2001. The cut-off points for hypertension were: ≥ 140mmHg for systolic pressure and ≥ 90mmHg for diastolic pressure. The studied variables included risk and protective factors for hypertension, such as behavioral and nutritional characteristics. For association analysis, generalized linear model multiple regression was used, with binomial family and logarithmic link, and prevalence ratios were obtained with 90% confidence interval and hierarchical selection of variables.

RESULTS: Prevalence of hypertension was 22% (90% CI: 21;29). In the final multiple regression model, it was found that the prevalence of hypertension was 68% higher among ex-smokers when compared to non-smokers (90% CI: 1.13; 2.50). Among subjects with overweight (body mass index – BMI of 25 to 29kg/m2) and obesity (BMI> 29kg/m2) the prevalences were, respectively, 75% (90% CI: 1.23;2.50) and 178% (90% CI: 1.82;4.25) higher than among subjects with normal weight. Among those that practiced physical activity regularly, compared to those who did not practice it, the prevalence was 52% lower (90% CI: 0.30;0.90).

CONCLUSIONS: Being an ex-smoker and overweight or obese were risk situations for hypertension, while the regular practice of physical activity was a protective factor in young military personnel.

DESCRIPTORS: Military Personnel. Hypertension, epidemiology. Risk Factors. Socioeconomic Factors. Cross-Sectional Studies.

INTRODUCTION

Arterial hypertension is affecting adults at an increasingly younger age. More than one fourth of the world's adult population is hypertensive and until 2025, the figure will amount to 1.56 billion people or 29%.[11] In the United States, for example, more than 50 million people are hypertensive.[1]

In the Brazilian regions, prevalence of arterial hypertension ranges from 11% to 20%. According to data provided by the Ministry of Health, in 1980, there were approximately 7.7 million (11%) hypertensive individuals aged 20-40 years.[a]

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In 1993, the proportion was of 15%[a] and in 2002, it reached 22% of the adult population in this same age group.[b] Some factors are important in the determination of arterial hypertension, like excess weight, which has been frequently reported in the scientific literature.[10,12] Other factors include: smoking, which causes the activation of the sympathetic nervous system, oxidative stress and vasoconstrictive effect associated with the increase in inflammations related to hypertension;[3] alcohol consumption, which has been associated with an increase in hypertension prevalence, probably due to the fact that it has a direct harmful action on the cardiac muscle.[6] On the other hand, physical activity, at high and regular levels, tends to reduce blood pressure values.[13,14]

The objective of the present study was to estimate the prevalence of arterial hypertension in a young military population and the associated factors.

METHODS

A cross-sectional study was carried out with active military personnel from *Força Aérea Brasileira* (FAB – Brazilian Air Force) who work at São Paulo's Air Base, Southeastern Brazil. We decided to work with this group, active military personnel, because they are young adults who are presumably healthy, as the admission to and permanence at FAB implies periodical submission to many medical and physical examinations.

The total number of military people working at the Air Base was 750. Data were collected during one year, beginning in August 2000, without interruption, by a team formed by trained professionals. Data collection was performed at the outpatient clinic of the hospital of the military unit. Out of 514 military males (aged 19 to 49 years) who attended the outpatient clinic, only the young individuals, aged 19 to 35 years (n=380) were selected to compose the sample. The age group was intentionally selected in order to control for the possible bias of increase in blood pressure at older ages.

The anthropometric measurements were performed twice and the mean was registered. Weight measures were obtained with barefooted individuals wearing light clothes and standing on a Tanita® electronic scale with 200 g precision; height was measured with a portable stadiometer with 1 mm precision. In both cases, the employed techniques followed Lohman et al.[15]

Nutritional status, described by the Body Mass Index (BMI) (weight/height^2), was classified according to the proposal of the World Health Organization[c] (<25 kg/m^2 = eutrophia, 25–29 kg/m^2 = overweight, >29 kg/m^2 = obesity).

Blood pressure was measured with a mercury sphygmomanometer. Two measurements of the blood pressure were taken on the right arm in the sitting position. The mean of the measures was used, as recommended by the III Brazilian Consensus on Arterial Hypertension, 1998.

The adopted arterial hypertension classification was the one recommended by the *Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure,*[5] according to Table 1.

For the analysis, the dichotomous variable arterial hypertension was created, where: 0= normal and pre-hypertension and 1= hypertension stage 1 and 2.

The explanatory variables were: level of schooling (primary/secondary school, technical and higher education), military rank (soldier; corporal/steward/sergeant/sub-officer; officer), period of time working at FAB, per capita income and age (continuous), smoking (non-smoker, smoker and ex-smoker), alcohol consumption (no and yes), physical activity (does not practice it, practices it outside FAB, practices it inside FAB, practices it inside and outside FAB) and BMI.

In the study of arterial hypertension, the hierarchical approach allowed to deal with confounding factors that are typical of epidemiological studies, which present themselves at distinct moments of the outcome determination.[19]

The economic and social variables condition the individuals' lifestyle, but it is believed that they do not have a direct effect on arterial hypertension; thus, they are allocated at the distal level of the model. The lifestyle variables are closer to the outcome, being allocated at the intermediate level. The BMI variable was allocated at the proximal level. It indicates the presence of obesity, which is considered to be an important and more direct factor in the causation of arterial hypertension.

For the analysis of the relationship between arterial hypertension and the explanatory variables, prevalence ratio (PR) was used, initially with simple analyses of the variables and, subsequently, with multiple regression. The variables selected for multiple regression were those which, in the simple analyses, presented descriptive $p<0.20$. In the multiple regression, the variables that remained at each hierarchical level were those which presented $p<0.10$.

For these variables, point estimates of prevalence ratios (PR) were presented, and respective 90% confidence intervals. The utilized statistical model was generalized

[a] Ministério da Saúde. Coordenação de Doenças Cardiovasculares. Doenças cardiovasculares no Brasil: Sistema Único de Saúde. Dados epidemiológicos. Assistência médica. Brasília; 1993.
[b] Ministério da Saúde. Plano de reorganização da atenção à hipertensão arterial e ao diabetes Mellitus. Brasília; 2002.
[c] World Health Organization. Obesity: Preventing and managing the global epidemic. Report of WHO Consultation on Obesity. Geneva;1998.

linear regression with binomial family and logarithmic link, and Poisson regression with robust variance when there was no convergence.

Data keyboarding and verification were performed with the use of the EpiData package. The analyses were carried out by means of the Stata statistical package, version 9.

The study was approved by the Research Ethics Committee of the *Faculdade de Saúde Pública* (School of Public Health) of *Universidade de São Paulo* and is in accordance with the norms of Resolution no. 196/1996 of the National Health Council. All the participants signed a consent document.

RESULTS

The majority of the participants was single, with income up to R$1,000.00, and belonged to the lowest military ranks (soldiers). The largest proportion of individuals (69.5%) was in the age group 20-24 years and had been working at the military unit for up to five years (74%) (Table 2).

The prevalence of arterial hypertension was 22% (CI 90%: 21; 29). Among the obese individuals, prevalence was twice the one verified among overweight individuals and three times that of eutrophic individuals.

The prevalence of arterial hypertension in ex-smokers was 40%, almost twice the one observed among smokers.

As for nutritional status, prevalence of the overweight/obesity set was 36% and prevalence of obesity was 8%. The BMI mean was 24.3kg/m^2.

Table 3 presents the results of the simple analyses and of the multiple regression analysis, with the prevalence ratios and their respective 90% CI.

The variables that remained at the distal level were level of schooling, military rank, period of time working at FAB and income; at the intermediate level: smoking, physical activity and age; and at the proximal level, BMI.

In the final multiple regression model, the prevalence of arterial hypertension was 52% higher among ex-smokers and 18% higher among smokers when compared to the prevalence for non-smokers.

Table 1. Blood pressure classification according to the criteria of the *Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure*.

Blood pressure classification	SBP[a] (mmHg)		DBP[b] (mmHg)
Normal	< 120	and	< 80
Pre-hypertension	120 - 139	or	80 - 89
Hypertension	≥ 140	or	≥ 90
stage 1	140 - 159	or	90 - 99
stage 2	≥160 - 180	or	≥100

[a] SBP: Systolic blood pressure
[b] DBP: Diastolic blood pressure

Table 2. Frequency of arterial hypertension in young male military personnel according to selected variables. City of São Paulo, Southeastern Brazil, 2000-2001.

Variable	n	(%)	Prevalence of arterial hypertension
Level of schooling			
primary education	49	12.9	32.6
secondary, technical and higher education	331	87.1	19.9
Military rank			
soldier	187	49.2	18.2
corporal/stew/serg/sub-officer	179	47.1	24.6
officer	14	3.7	28.6
Period of military work			
≤ 5 years	280	73.9	20.0
6 – 10 years	50	13.2	20.0
11 – 20 years	49	12.9	31.2
Income (Reais)			
≤ 1000	231	60.8	21.2
1000 – 1500	100	26.3	25.0
1501 – 10,000	49	12.9	16.3
Smoking			
Non-smokers	291	76.6	18.6
Smokers	49	12.9	24.4
Ex-smokers	40	10.5	40.0
Alcohol consumption			
no	161	42.4	19.2
yes	219	57.6	23.3
Age (years)			
20 – 24	265	69.4	21.0
25 – 29	70	18.3	17.4
30 – 35	47	12.3	32.0
Physical activity			
Does not practice it	126	33.2	23.0
Practices it outside FAB	123	32.8	28.5
Practices it inside FAB	95	25.0	10.5
Practices it inside and outside FAB	36	9.0	22.2
BMI			
< 25 - eutrophia	243	63.9	14.8
25 – 29 - overweight	107	28.2	28.0
> 29 - obesity	30	7.9	53.3

Prevalence of arterial hypertension tended to increase as the BMI increased. Overweight and obese individuals presented hypertension prevalence, respectively, 75% and 178% higher than eutrophic individuals. When compared to overweight individuals, hypertension prevalence was 78% higher among the obese.

Among the individuals who practiced physical activity on a regular basis, the prevalence of arterial hypertension was 52% lower compared to sedentary individuals.

Table 4 presents comparisons only in the ex-smokers group regarding prevalence of arterial hypertension in overweight ex-smokers and eutrophic ex-smokers. Although there was no significant difference between them, PR increased.

DISCUSSION

Some aspects must be taken into account in the results interpretation. The first refers to the fact that the study was carried out at only one military unit, limiting the extrapolation of the results. Another aspect concerns the cross-sectional outline of the study, which does not ensure the temporal precedence of the anthropometric indexes over the occurrence of arterial hypertension, but there is scientific plausibility in this order.

Table 3. Prevalence ratios and confidence intervals (90%) in the simple and multiple analyses of arterial hypertension according to explanatory variables. City of São Paulo, Southeastern Brazil, 2000-2001.

Variable	Arterial hypertension		
	Crude PR	Adjusted PR	CI 90%
Distal level			
Level of schooling			
Primary education	1	1	
Secondary, technical and higher education	0.61*	0.72	0.50;1.04
Military rank			
Soldier	1		
corporal/steward	1.35*	excluída	
Officer	1.57	excluída	
Period of military work	1.03*	excluída	
Income	1.00*	excluída	
Intermediate level			
Smoking			
Non-smokers	1	1	
Smokers	1.32	1.20	0.76;1.90
Ex-smokers	2.15*	1.68**	1.13;2.50
Alcohol consumption*			
No	1	-	-
Yes	1.21	-	-
Physical activity			
Does not practice it	1	1	
Practices it outside FAB	1.24	1.24	0.88;1.75
Practices it inside FAB	0.46*	0.52**	0.30;0.90
Practices it inside and outside FAB	0.96	0.98	0.54;1.77
Age	1.04*	1.01	0.98;1.05
Proximal Level			
BMI			
< 25 - eutrophia	1	1	
25 – 29 - overweight	1.89*	1.75**	1.23;2.50
> 29 - obesity	3.60*	2.78**	1.82;4.25

* p< 0.20
** p<0.10

Also, the fact that approximately 30% of the military personnel (n=236) did not attend the outpatient clinic for data collection prevented us from obtaining data referring to these individuals. However, we believe that this fact does not affect results interpretation, as the sample was composed of military personnel from all ranks, who developed the different activities inherent in the military career.

Nevertheless, a strong point of the study was the obtention of the anthropometric and blood pressure measures by direct measurement and not by self-report; not to mention the control for confounding variables that are relevant to the estimates of the associations.

To be admitted to the Air Force, the individuals are submitted to a selection process in which some characteristics are required, like minimum limit of height and weight, good health condition, absence of physical or mental disability and aptitude for physical activity. The age mean, 24 years, and the mean permanence time in the air force, five years, indicate that the initial biological and health characteristics, observed in the selection, are probably still prevalent. Therefore, it is a group of individuals with a small probability of presenting serious health problems which could interfere in the associations of some variables with the outcome.

However, the prevalence of 22% of arterial hypertension is high when compared to data provided by the Ministry of Health,[a] which show that the prevalence in the city of São Paulo, in 2003, was 12.7% in the age group 25-39 years. Among Brazil's capitals, in 2003, the highest prevalence was found in Porto Alegre (Southern Brazil), with 15.7% among men,[a] which is still much lower than the prevalence found in the present study. In Brazil, in 2004, the prevalence in 15 capitals and in the Federal District ranged from 7.4% to 15.7% in people aged between 25 and 39 years. In the population older than 40 years, the prevalence was 35%, which represents 17 million hypertensive individuals.[b]

Table 4. Frequency of overweight in ex-smokers, according to the blood pressure of young male military personnel. City of São Paulo, Southeastern Brazil, 2000-2001.

Arterial hypertension	Eutrophic		Overweight	
	n	(%)	n	(%)
Não	15	68.2	9	50.0
Sim	7	31.8	9	50.0

Fisher's exact test: one-tailed p = 0.243
PR = 1.57

In the United States, the prevalence was 7% in individuals aged 18 – 39 years, in 2000.[8] In a study conducted in a city in Korea,[9] in 2001, the general prevalence was 33%, progressively increasing with age, from 14% between 18 and 24 years of age to 71% for people aged 75 years or older. In other countries, researchers found higher prevalence compared to the present one: in China, in 1998, it was 24% among men aged 35-59 years,[20] and in Portugal, in 2003, prevalence in adults aged 20-90 years was 42%, being 26% among those aged 20-35 years.[16]

Prevalence of arterial hypertension in military subjects who practice physical activity inside the military quarters is half of that observed in military subjects who do not practice it. This may be explained by the regularity and intensity with which physical activities are practiced in the military quarters, besides being a directed and supervised activity, characteristics that are necessary in order to produce some effect on blood pressure. This result is coherent with those from another study[2] that used the same cut-off point to classify blood pressure. The practice of physical activity with high intensity and regularity was associated in an inverse way with arterial hypertension. In individuals with regular and intense performance, prevalence of arterial hypertension was 13% lower when compared to individuals who did not practice any kind of physical exercise.

Regarding the habit of smoking, it was observed that the difference between hypertension prevalence in smokers and in ex-smokers is not significant. Being a young population, it is possible that the harmful effects of smoking on health, which manifest themselves in the long term, are still not present in these individuals.

The ex-smokers presented prevalence of arterial hypertension 52% higher than the non-smokers and 28% higher than the smokers, apparently an unexpected situation. However, the results presented on Table 4 allow us to suppose that hypertension in the group of ex-smokers occurs due to overweight, which is also one of the factors that determine the rise in blood pressure.[17] The difference between the prevalence figures is not significant (p= 0.243), probably due to the very small number of ex-smokers. Smoking cessation frequently causes an increase in weight. In the present study, however, it is not known whether excessive weight preceded the abandonment of smoking or not. In addition, it is possible to suppose that the decision to stop smoking may be connected

[a] Ministério da Saúde. Secretaria de Vigilância em Saúde. Secretaria de Atenção à Saúde. Instituto Nacional de Câncer. Coordenação de Prevenção e Vigilância. Inquérito domiciliar sobre comportamentos de risco e morbidade referida de doenças e agravos não transmissíveis: Brasil, 15 capitais e Distrito Federal, 2002-2003. Rio de Janeiro; 2004 .

[b] Ministério da Saúde. Pratique saúde contra a hipertensão arterial. [citado 2009 set 02] Disponível em http://portal.saude.gov.br/portal/saude/visualizar_texto.cfm?idtxt=23616&janela=1

with medical recommendations, due to the presence of physical inconveniences caused by smoking, or even to the presence of arterial hypertension, among other factors. The extent of the period during which the individual smoked was not investigated, nor the period of time that elapsed after the abandonment of the habit of smoking or the number of attempts the individual performed. These pieces of information might explain this situation better.

Body weight was another relevant factor in relation to arterial hypertension. The choice of BMI to classify overweight and obesity was due to the fact that it is an index that has an important explanatory power concerning the occurrence of arterial hypertension.[18] Thus, it was possible to observe a strong trend towards the increase in hypertension prevalence with the increase in the BMI.

Our results agree with other studies,[10] which also used the same classification for arterial hypertension (BP=140/90), like the one carried out in Bambuí (Southeastern Brazil), where the odds ratio of arterial hypertension for overweight was 2.82 and for obesity, 4.29, considering eutrophia as the basal category.[7] Reductions of 7-10 mmHg in systolic pressure and 6-7 mmHg in diastolic pressure were observed when body weight decreased by approximately 8 kg.[4] This suggests that the reduction in fat deposits decreases the risk for arterial hypertension.

The variables of the distal level did not associate with the outcome. Military rank, period of time of military work and income were excluded after entering the model ($p>0.10$) and level of schooling remained until the end of the modeling. It is believed that this may have occurred because they are variables that are related to each other. In the intermediate level, the variable alcohol consumption was eliminated in the simple analysis ($p>0.20$) and age remained in the model and did not associate with hypertension.

It is possible to conclude from the present study that prevalence of arterial hypertension is high among the studied military personnel. Being an ex-smoker proved to be a risk situation for arterial hypertension, as well as having higher BMI. On the other hand, regular and intense physical activity proved to be a protection factor for arterial hypertension.

It is believed that the results of our study, in addition to the others that already exist in Brazil, indicate the magnitude of arterial hypertension. We hope they can contribute to the planning of conducts that aim to control this health problem in the young population.

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