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FACTORS ASSOCIATED WITH PRE-HYPERTENSION IN YOUNG SCHOOL-AGED ADULTS

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ABSTRACT

Objective: To analyze the factors associated with pre-hypertension in young school-aged adults. **Design and Sample:** Cross-sectional study conducted from August 2015 to September 2016 with 1073 young school-aged adults in schools from Fortaleza-Ceará-Brazil. **Measures:** In the multivariate analysis, the statistical procedure for adjusting the potential confounding effects was the logistic regression. **Results:** The pre-hypertension is 5.5 more prevalent in men, while those with a family history of hypertension is 1.5 more prevalent. Moreover, for those who work more than eight hours a day, the prevalence of pre-hypertension is 1.9 higher. Among those with overweigh and abdominal adiposity, the prevalence of the outcome was, respectively, 2.5 and 1.6 higher. **Conclusions:** The prevalence of pre-hypertension in young school-aged adults is useful to monitoring this condition and incorporation of its registers in daily practices of health systems, subsidizing public polices of promotion to health allowing the development of nursing preventive actions.

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INTRODUCTION

Pre-hypertension, recognized by the Seventh Joint National Committee (JNC 7), published in 2003, is a condition characterized by systolic blood pressure (SBP) between 120 and 139 mmHg and/or diastolic blood pressure (DBP) between 80 and 89 mmHg. It also aims to identify a category of individuals with borderline blood pressure values, at risk of presenting hypertension and its associated complications in the future (Hu *et al*., 2017). The global prevalence of pre-hypertension ranged from 21% to 37.7% in population-based studies, except for Iran, which had higher rates (52.1%). Pre-hypertension is not a category of disease; however, pre-hypertensive individuals are at higher risk of developing hypertension and increasing cardiovascular risk when compared to normotensive individuals, requiring periodic monitoring (Ferrazo *et al*., 2014). In young school-aged adults, changes in blood pressure are an important risk factor for the development of hypertension (Moura *et al*., 2015).

Nevertheless, young adults with high blood pressure tend to maintain this picture over the years. Therefore, it is necessary to evaluate the factors that contribute to this situation in order to promote actions and/or strategies for the prevention and control of pre-hypertension in this age group. Nevertheless, there are still few Brazilian studies conducted on the prevalence of pre-hypertension as well as non-existence of recent studies on the such theme. Thus, the objective of this study was to analyze the factors associated with pre-hypertension in young school-aged adults. Evidence generated by this piece of research can early identify predisposing factors of Non-Transmissible Chronicle Diseases (NTCD), allowing the development of preventive actions in the health area.

MATERIALS AND METHODS

Design and sample: This is a cross-sectional study developed in secondary schools and youth adult education centers located in Fortaleza (capital of Ceará, Brazilian Northeast Region). The choice of the research site was based on the idea that

school is a place with potential for health promotion and encouragement of the autonomy of young people. The study population was from young adults aged between 20 and 24 years, according to the World Health Organization (WHO) and the Brazilian legal framework that contextualizes the Statute of the Child and Adolescent (from the Portuguese ECA) in the scope of adolescent and youth health (Ministério da Saúde, 2005).

Measures

Falls: Considering that the number of young students was unknown, it was decided to define the sample based on the calculation for infinite populations, reaching a sample of 1073 enrolled in regular elementary school. The inclusion criteria were young people (20-24 years old) who did attend school on the day of collection. The exclusion criteria were pregnant young women (considered as other parameters to identify overweight), as well as those who moved in wheelchairs since there were no means available for the accomplishment of anthropometric measures for this group. The students were selected for convenience in 52 schools. Data was collected from August 2015 to September 2016. The following variables were used as predictors: sex, race, marital status, family history of hypertension, having children, religion, employment, daily working hours, individual income, overweight and obesity, excess abdominal adiposity and physical activity. In this study, the observed outcome was pre-hypertension, identified by the BP classification of young adults. A questionnaire was built to collect data for this study, containing data on demographic, occupational, anthropometric, blood pressure and lifestyle variables. Blood pressure was measured by an indirect method using an auscultatory technique and calibrated aneroid sphygmomanometer. The technique to verify and evaluate pressure levels followed the protocol recommended by the Brazilian Society of Cardiology (Sociedade Brasileira de Cardiologia, 2016).

Factors Associated: Anthropometric measurements were performed in a standardized way. The values considered normal for the measurement of Abdominal Circumference (AC) were 88 cm for women 102 cm for men. For the waist-hip ratio (W/H), it was considered normal W/H = 0.85 for females and W/H = 0.95 for males. Weight was measured on a digital scale and the classification of overweight/obesity was performed using the Body Mass Index (BMI) based on the WHO recommendation. For the assessment of physical activity, students who performed at least 150 minutes of moderate physical activity per week were considered active. In order to bring benefits to the participants of the research, the researchers informed them about the results, also providing due guidance regarding the specific results. When any referrals for clinical interventions were necessary, the student was informed of the services available in the public health network of the municipality, being under their responsibility the search and clinical follow-up.

Analytic strategy: The IBM Statistical Package for Social Sciences (SPSS) software was used for data processing. In the univariate analysis, simple and relative frequencies were calculated. In the bivariate analysis, Pearson's chi-square test was performed for the categorical variables, considering in all tests the level of statistical significance of 5%. To estimate the association strength of possible markers of incorretos of Pre-Hypertension, the odds ratio (OR) was calculated, with a confidence interval of 95%. In the multivariate analysis, the statistical procedure for adjusting the potential confounding effects was the logistic regression. For inclusion in the initial regression model, the value $p<0.20$ obtained in the bivariate analysis was adopted. The criteria established in this step of analysis was the Wald test for the variables that remain in the model, with presentation of at least one category with statistical significance of p-value <0.05. When any variable presented $p> 0.05$, a new analysis was performed, removing it from the model for its best fit. Finally, residue analysis was performed in order to isolate points in which the model has little adhesion and points that employ an undue influence on the model. In addition, data inclusion method in all phases of the regression was the backward stepwise input. Participants signed the informed consent form, thus allowing their participation in the study. The study was approved by the Ethics Committee in Research of the State University of Ceará, under the number 263.271, according to resolution 466/12 of the National Health Council, which involves researches with human beings (Brasil, 2013).

RESULTS

There are presented in Table 1 the variables and frequencies of sociodemographic, anthropometric, behavioral and occupational characteristics of 1073 young school-aged adults. Pre-hypertension was present in 21.2% of the study participants. The majority (85.8%) were black people, and little more than half (55.5%) had a family history of hypertension. Nearly one-third (32.2%) of young adults reported family history for other cardiovascular diseases. Overweight reached little more than one-third (36.7%) of the participants. Concerning the practice of moderate physical activity, more than half (54.4%) was classified as inactive. It is observed, in Table 1, that almost one-third (32.5%) of male participants presented altered blood pressure levels. Participants of other races or skin colors (black, brown and indigenous) had lower percentages of pre-hypertension compared to those of the white race (21.0 and 22.4, respectively). Individuals with family history of hypertension had the highest prevalence of pre-hypertension (23%). Among the modifiable risk factors, people without partners and without children were the ones with higher rates of pre-hypertension (21.7% and 22.4%, respectively). Overweight and abdominal adiposity contributed to the prevalence of the outcome (30.7% and 25.7%, respectively). Table 2 shows the Pearson chi-square values resulting from the association between the outcome and the predictor variables and their respective crude OR values. It is also possible to highlight that in Table 2 the multivariate adjusted OR values showed that men are 5.5 times more likely to present pre-hypertension, while those with family history of hypertension have 1.5 more prevalence of the outcome analyzed. Daily working hours, overweight and abdominal adiposity were also associated with the outcome. For those who work more than eight hours a day, the OR value showed 1.9 more prevalence of pre-hypertension. Among those who showed overweight/obesity and abdominal adiposity, the prevalence was respectively 2.5 and 1.7 higher for the outcome. The model presented adequate adjustment.

DISCUSSION

The epidemiological field in health plays an important role in the organization of activities, thus contributing to the strengthening of actions related to health promotion and

Table 1. Sociodemographic, anthropometric, behavioral and occupational characteristics of young school-aged adults. Fortaleza-Ceará-Brazil, 2019

Variables	Frequency			Pre-hypertension	
	n	%	IC[a] 95%	Yes n (%)	No n (%)
Sex					
Male	508	47.3	(44.5 - 50.3)	165 (32.5)	343 (67.5)
Female	565	52.7	(49.7 - 55.5)	61 (11.0)	503 (89.0)
Black race					
No	152	14.2	(12.3 - 16.4)	34 (22.4)	118 (77.6)
Yes	921	85.8	(83.6 - 87.7)	193 (21.0)	728 (79.0)
Family history of Hypertension					
Yes	595	55.5	(52.5 - 58.4)	137 (23.0)	458 (77.0)
No	478	44.5	(41.6 - 47.5)	90 (18.8)	388 (81.2)
Marital status					
No partner	851	79.3	(76.7 - 81.8)	185 (21.7)	666 (78.3)
With partner	222	20.7	(18.2 - 23.3)	42 (18.9)	180 (81.1)
Children					
Yes	223	20.8	(18.5 - 23.3)	37 (16.6)	186 (83.4)
Religion					
Catholic	524	48.8	(46.1 - 51.8)	109 (20.8)	415 (79.2)
Other	549	51.2	(48.2 - 53.9)	118 (21.5)	431 (78.5)
Employment					
No	371	34.6	(31.7 - 37.5)	65 (17.5)	306 (82.5)
Yes	702	65.4	(62.5 - 68.3)	162 (23.1)	540 (76.9)
Daily working hours					
> 8 hours	238	22.2	(19.8 - 24.5)	70 (29.4)	168 (70.6)
≤ 8 hours	835	77.8	(75.5 - 80.2)	157 (18.8)	678 (81.2)
Family income					
> 1 minimum wage	150	14.0	(12.1 - 16.1)	43 (28.7)	107 (71.3)
≤ 1 minimum wage	923	86.0	(83.9 - 87.9)	184 (19.9)	739 (80.1)
Overweight and obesity					
Yes	394	36.7	(33.7 - 39.7)	121 (30.7)	273 (69.3)
No	679	63.3	(60.3 - 66.3)	106 (15.6)	573 (84.4)
Excessive abdominal adiposity					
Yes	183	17.1	(14.7 - 19.4)	47 (25.7)	136 (74.3)
No	890	82.9	(80.6 - 85.3)	180 (20.2)	710 (79.8)
Physical activity					
Active	489	45.6	(42.7 - 48.6)	103 (21.1)	386 (78.9)
Inactive	584	54.4	(51.4 - 57.3)	124 (21.2)	460 (78.8)

Source: Research Data, 2016; a: Confidence interval

Table 2. Factors associated with pre-hypertension in young school-aged adults after multivariate analysis with odds ratio adjustment. Fortaleza-Ceará, Brazil, 2019

Variables	Crude OR[a]	p-value	Adjusted OR[a]	p-value[b]
Sex		<0.001		<0.001
Male	3.90 (2.82 - 5.38)		5.49 (3.76 - 8.02)	
Female	1		1	
Black race		0.693		-
No	1.08 (0.71 - 1.64)		-	
Yes	1		-	
Family history of SAH[c]		0.095		0.016
Yes	1.29 (0.95 - 1.73)		1.49 (1.07 - 2.06)	
No	1		1	
Marital status		0.360		-
No partner	1.19 (0.82 - 1.72)		-	
With partner	1		-	
Children		0.062		-
No	1.44 (0.98 - 2.13)		-	
Yes	1		-	
Religion		0.781		-
Catholic	0.95 (0.71 - 1.28)		___	
Other	1		-	
Paid work		0.035		-
Yes	1.41 (1.02 - 1.94)		-	
No	1		-	
Working hours		<0.001		<0.001
> 8 hours	1.79 (1.29 - 2.49)		1.92 (1.34 - 2.73)	
≤ 8 hours	1		1	
Family income		0.016		-
> 1 minimum wage	1.61 (1.09 - 2.38)		-	
≤ 1 minimum wage	1		___	
Overweight and obesity		<0.001		<0.001
Yes	2.39 (1.77 - 3.22)		2.53 (1.77 - 3.61)	
No	1		1	
Yes	1.36 (0.94 - 1.97)		1.65 (1.01 - 2.70)	
No	1		1	
Physical activity		0.946		-
Active	1.01 (0.75 - 1.35)		-	
Inactive	1		-	

Source: Research Data, 2016; a: Odds Ratio; b: Pearson chi-square; c: Systemic Arterial Hypertension.

assistance, including the school environment (Florencio, 2014). The prevalence of prehypertension was higher with family history, male gender, occupational risk and daily workday in this study. Therefore, the prevalence of pre-hypertension among young school-aged adults in the present study was higher than a study conducted in Saudi Arabia, with individuals in the same age group, and lower than young adults living in Indian regions (Sonbol *et al*., 2017). Differences in prevalence rates between studies can be attributed to pre-hypertension classification criteria as well as to population differences and changes in the socioeconomic circumstances and lifestyles. In view of the classification issue, studies need to adhere to the standards in determining the criteria for pre-hypertension (Kini *et al*., 2016). The presence of pre-hypertension in young school-aged adults may be related to the development of hypertension in the adult phase or even in the youngster. Pre-hypertension is a condition associated with increased incidence of hypertension since the factors that elevate blood pressure in hypertension are the same ones that cause its elevation in pre-hypertension (Kini *et al*., 2016).

Studies in some Western countries have shown that hypertension is more common among ethnic minority groups of African descendants than among whites (Batiha *et al*., 2015; Chor *et al*., 2015). In the final design of these studies, skin color is sometimes associated with prehypertension, sometimes not. In the final regression model, family history was associated with pre hypertension, which was different of another piece of research (Meinema *et al*., 2015). It is known, however, that such a non-modifiable variable is constantly associated with hypertension and cardiovascular diseases. A study conducted in a city in the Northeast of Brazil with young school-aged adults found 68.7% of the sample with a family history of hypertension (Al-Maqbali *et al*., 2013). Studies have shown that the prevalence of hypertension is higher in individuals with a family history of hypertension at all levels (parents, grandparents, siblings and children) than those without such family history (Duboz *et al*., 2016). In addition, genetic research has confirmed this association (Ranasinghe *et al*., 2015). Regarding the variables that remained in the final logistic model, male gender was statistically related to the outcome. In a survey of 15,296 participants aged 15 years or more in China, the prevalence of pre-hypertension was higher in men (Hu *et al*., 2017). In a population-based study conducted in a municipality in the South of Brazil in 2009, this health problem was strongly associated with males. In a cross-sectional study carried out in the Brazilian northeast with the objective of estimating the prevalence of prehypertension in quilombo communities and evaluating associated factors, high blood pressure figures were more prevalent in males and presented statistical association in adjusted analysis (Ranasinghe *et al*., 2015). Men are more frequently exposed to the risk factors associated with prehypertension.

The association between hypertension and overweight has been analyzed and evidenced in the specialized literature. Such analyzes are important, since they may support discussions related to the relationship between pre-hypertension and blood pressure levels in young adults. Cross-sectional population-based studies have been responsible for elucidating the existence of such association and identifying the prevalence of high blood pressure in overweight, central or general obesity groups (Lim *et al*., 2015; Bezerra *et al*., 2017). Measurement of adiposity accumulation in the abdomen can be performed by waist circumference, waist-hip ratio, and waist-height ratio, in which changes in normal fat distribution patterns in the abdominal region are named central obesity (Santiago *et al*., 2015). Meanwhile, for body weight assessment, the BMI has been the most accepted measurement, being overweight and obesity the denominations for changes in this case (Duboz *et al*., 2016). A study carried out with a large sample in the Senegalese capital including people aged 20-90 years observed an association between hypertension and general obesity (measured by BMI) in women and hypertension and central obesity (measured by waist-height ratio) in men (Corrêa, 2016). Because it is a cross-sectional design, causality cannot be evidenced. However, the results alert the relationship between the variables and indicate the need for monitoring blood pressure levels in different age groups. The analysis of samples with the same age profile (young adults) of the present study evidenced the relationship between high blood pressure and body weight as measured by BMI or abdominal adiposity measured by waist circumference in another study (Duboz *et al*., 2016; Albanese *et al*., 2017).

A case-control with Brazilian young school-aged adults performed a statistical analysis with logistic regression and identified an association between high diastolic blood pressure and overweight (BMI $\geq$ 25kg/m^2). A total of 441 students (147 cases and 294 controls) were analyzed in this study. Diastolic pressure was analyzed as a predictive variable and BMI was classified as an outcome. In the study, hypertensive patients were approximately seven times more likely to develop overweight/obesity (Duboz *et al*., 2016). The multivariate analysis performed in this study demonstrated that working more than 8 hours daily is a factor associated with pre-hypertension. A study conducted in India between 2011 and 2013 with 9,546 individuals showed a significant correlation between work and pre-hypertension. However, this study did not evidence that workload was related to the variable pre-hypertension (Kini *et al*., 2016). The factors related to high blood pressure levels in young people have been revealed by this study and several others performed in the world. Science shows the determinants and conditionings of hypertension, providing subsidies for the prevention and treatment of such health condition, which occurs with unfavorable clinical evolution in people with the disease. Early intervention in subjects with no change in blood pressure or in pre-hypertensive stage may avoid changes in future levels or reduce the deleterious effects of high blood pressure in the human body. The limitation of this study is related to the identification of predictor variables and outcome at the same time, with difficulty of causal inferences. The design of studies with methodological designs that allow the follow-up of the sample until the outcome appears should strengthen the evidence on causal factors related to prehypertension in young adult students.

Conclusion

The prevalence of pre-hypertension in young school-aged adults showed a high percentage of people with this condition, considering the pressure levels indicated for a young population. Such prevalence of pre-hypertension was higher with family history, male gender, occupational risk and daily working hours. Information on the prevalence of pre-hypertension in young-aged adults is useful for monitoring this condition and incorporating its registers in daily practices of health systems, subsidizing public policies of promotion, vigilance and attention to health. The generated evidence

contributes to and health area by bringing previous knowledge to a condition already installed and poorly explored by researchers (the prevalence of pre-hypertension) and its associated factors. This information allows the preventive care of nursing as objective and directed as possible; this care aims to sensitize on healthy habits and behavior change and to prevent future illnesses.

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