3 - Hypertension: Association With Anthropometric Indicators In Adults

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Hypertension: Association with Anthropometric Indicators In Adults

Abstract

Background: The pathogenesis of hypertension is related high weight through activation of the sympathetic nervous system and it´s well established in adults, but what anthropometric aspect are associate whit high blood pressure. **Purpose**: we analyze the association of prehypertension and hypertension based on anthropometric data in Brazilian adults. **Methods**: The cross-sectional study was composed 3445 adults of both sexes aged between eighteen and 60 years old. The variables anthropometric and blood pressure values were obtained according to standard methods. Blood pressure was classified (nom; prehypertension and hypertension) according to the recommendations of World Health Organization and the Brazilian Society of Hypertension. We examined potential frequency of subjects with and without hypertension for each variable and used a logistic regression with blood pressure as the dependent variable while anthropometric characteristics were used as an independent variable: body mass index, waist height ratio, waist circumference, age and sex. Hypertension was related to sex, age and body mass index. **Results:** The males were twice as likely to develop hypertension as females. The chance of developing hypertension increased by around 1.04 times with age. In relation to body mass index, from normal group to overweight, the chance of developing hypertension nearly doubled while, the group classified as obese, it increased three times more. **Conclusion**: These data can be used to control public health policy and to identify groups at risk since cardiovascular diseases are a major cause of death in Brazil.
Keywords: body mass index; hypertension; odds ratio and risk factors.

Hypertension: association avec des indicateurs anthropométriques chez l'adulte

Resume

Introduction: La pathogénie de l'hypertension est liée à un poids élevé par l'activation du système nerveux sympathique et est bien établie chez les adultes, mais quel aspect anthropométrique est associé à une pression artérielle élevée. **Objectif:** nous avons analysé l'association de la préhypertension et de l'hypertension basée sur des données anthropométriques chez les adultes brésiliens. **Méthodes:** L'étude transversale a consisté en 3 445 adultes des deux sexes âgés de 18 a 60 ans. Les valeurs et la pression artérielle variables ont été obtenues selon des méthodes standard. La pression artérielle a été classifiée (non; préhypertension et hypertension) selon les recommandations de l'Organisation Mondiale de la Santé et la Société Brésilienne d'Hypertension. La fréquence potentielle des personnes atteintes et sans hypertension a été examinée pour chaque régression variable et logistique avec la pression artérielle a été utilisée comme variable dépendante, tandis que les caractéristiques anthropométriques ont été utilisées comme variable indépendant: indice de masse corporelle, rapport taille, tour de taille, âge et sexe. L'hypertension était liée au sexe, à l'âge et à l'indice de masse corporelle. **Résultats:** Les hommes étaient deux fois plus susceptibles de développer de l'hypertension que les femmes. Le risque de développer l'hypertension a augmenté environ 1,04 fois avec l'âge. En ce qui concerne l'indice de masse corporelle, du groupe normal au surpoids, le risque de développer l'hypertension a presque doublé, tandis que, selon le groupe classé comme obèse, a augmenté trois fois plus. **Conclusion:** Ces données peuvent être utilisées pour contrôler les politiques de santé publique et identifier les groupes à risque, puisque les maladies cardiovasculaires sont la principale cause de décès au Brésil.
Mots-clés: indice de masse corporelle; l'hypertension; ratio de cotes et facteurs de risque.

Hipertensión: asociación con indicadores antropométricos en adultos

Resumen

Introducción: La patogénesis de la hipertensión está relacionada con el alto peso a través de la activación del sistema nervioso simpático y está bien establecida en adultos, pero qué aspecto antropométrico se asocia narco métricamente con la presión arterial alta. **Objetivo**: analizamos la asociación de prehipertensión e hipertensión basada en datos antropométricos en adultos brasileños. **Métodos:** El estudio transversal consistió en 3.445 adultos de ambos sexos de entre 18 y 60 años. Los valores variables antropométricos y la presión arterial se obtuvieron de acuerdo con los métodos estándar. La presión arterial se clasificó (no; prehipertensión e hipertensión) de acuerdo con las recomendaciones de la Organización Mundial de la Salud y la Sociedad Brasileña de Hipertensión. La frecuencia potencial de los individuos con y sin hipertensión se examinó para cada variable y la regresión logística con presión arterial se utilizó como variable dependiente, mientras que las características antropométricas se utilizaron como variables independientes: índice de masa corporal, relación de altura de la cintura, circunferencia de la cintura, edad y sexo. La hipertensión estaba relacionada con el sexo, la edad y el índice de masa corporal. **Resultados:** Los hombres tenían el doble de probabilidades de desarrollar hipertensión que las mujeres. La probabilidad de desarrollar hipertensión aumentó aproximadamente 1,04 veces con la edad. En cuanto al índice de masa corporal, del grupo normal al sobrepeso, la probabilidad de desarrollar hipertensión casi se duplicó, mientras que, según el grupo clasificado como obeso, aumentó tres veces más. **Conclusión:** Estos datos se pueden utilizar para controlar la política de salud pública e identificar grupos de riesgo, ya que las enfermedades cardiovasculares son la principal causa de muerte en Brasil.

Palabras clave: índice de masa corporal; hipertensión; probabilidades y factores de riesgo.

Hipertensão: Associação com indicadores antropométricos em adultos

Resumo

Introdução: A patogênese da hipertensão arterial está relacionada ao alto peso através da ativação do sistema nervoso simpático e é bem estabelecida em adultos, mas que aspecto antropométrico são associados à pressão arterial alta ou vizinha. **Objetivo**: analisamos a associação de pré-hipertensão e hipertensão com base em dados antropométricos em adultos brasileiros. **Métodos:** O estudo transversal foi composto por 3445 adultos de ambos os sexos com idade entre 18 e 60 anos. As variáveis valores antropométricos e pressão arterial foram obtidas de acordo com os métodos padrão. A pressão arterial foi classificada (não; pré-hipertensão e hipertensão) de acordo com as recomendações da Organização Mundial de Saúde e da Sociedade Brasileira de Hipertensão. Examinou-se a frequência potencial de indivíduos com e sem hipertensão para cada variável e utilizou-se uma regressão logística com pressão arterial como variável dependente, enquanto as características antropométricas foram utilizadas como variável independente: índice de massa corporal, relação cintura estatura, circunferência da cintura, idade e sexo. A hipertensão arterial esteve relacionada ao sexo, idade e índice de massa corporal. **Resultados**: Os homens tiveram duas vezes mais chances de desenvolver hipertensão do que as mulheres. A chance de desenvolver hipertensão arterial aumentou cerca de 1,04 vezes com a idade. Em relação ao índice de massa corporal, do grupo normal ao sobrepeso, a chance de desenvolver hipertensão quase dobrou, enquanto, segundo o grupo classificado como obeso, aumentou três vezes mais. **Conclusão:** Esses dados podem ser utilizados para controlar a política pública de saúde e identificar grupos de risco, uma vez que as doenças cardiovasculares são a principal causa de morte no Brasil.

Palavras-chave: índice de massa corporal; hipertensão; *odds ratio* e fatores de risco.

Introduction

Currently hypertension has been considered a public health problem of multicenter etiology (BENJAMIN et al., 2019), described as one of the major risk factors prevalent in the development of cardiovascular disease, vascular brain disease and congestive heart failure, or other circulatory diseases in individuals' adults (MORAN et al., 2014). These events are important causes of morbidity and mortality, with high social cost (SIEGEL, 2014; CHOW, 2017).

Hypertension has been responsible for an average of thirty per cent of deaths in adult's worldwide (BENJAMIN et al., 2019). In Brazil, the Brazilian Society of Hypertension (MALACHIAS et al., 2016) showed that the prevalent rates in urban adult population vary between 22.3% and 43.9%, and highlighted research showed a great number of hypertensive among the population of overweight men and women. Two study's (CHIRINOS et al.,2009; SHAN et al., 2012) demonstrated, using data from National Health and Nutrition Examination Survey (NHANES), the Body Mass Index (BMI) in population studies is a significant predictor for the occurrence of increased blood pressure, and an odds ratio (OR) of 1.04 (95% CI :1,02-1,06), for every five units of BMI. In addition, overweight and obese, both sex had a higher risk for hypertension (SHAN et al., 2012). Other factors has been reported as related to hypertension, such as waist circumference (WC), waist to height ratio (WHR), age and sex (HALL et al., 2015; KOTSIS et al., 2010a, 2018b). Based on these studies, the present study purpose to

associate the anthropometric variables with prehypertension and hypertension to determine the odds ratio of each to the development of this disease.

Methods

Study design

We performed a cross-sectional study of risk factors associated with anthropometric considered the increase of hypertension for the urban population of Curitiba, Parana, Brazil, through the projects undertaken by the Secretariat of Education and Sports of the State of Paraná, Department of Sport and Recreation. The design was based on cross-sectional research methodology and was developed by cross surveying database health projects by this department only resident from the municipality of Curitiba, Paraná, Brazil. The first-phase was contact with officials of the data to obtain the data and explanation that, in the second-phase was held one excluded adolescents (<18 years old) and elderly (> 60 years of age) as well as the removal of incomplete information, confusing and subjects not living in the city of Curitiba. The framers of research passed information on the procedures of data collection at the time the data were requested.

All procedures for obtaining retrospective data from this study were approved by the Ethics Research in humans of Federal University of Paraná is subject to compliance with the ethical principles contained in the Declaration of Helsinki (nº 97/2010).

Subjects

The research subjects' information was collected from a database in which they considered as inclusion and exclusion criteria for 1.277 men and 2.120 women: age between 18 and 60 years old and living in the urban area of Curitiba, Parana, Brazil. As it is a database, no sample calculation was performed

Measurement of factors

The factors that were measured were age, gender, BMI, waist circumference. Age was measured by decimal age was calculated using the birth date with the current date that was collected. Gender was collected during interviews with participants.

Trained physical education teachers collected anthropometric measurements about weight and height. The measurements were all duplicated, one third as measured when the first two values had differences greater than or equal to 0.2 kg for weight and height and 0.2 cm for height. The measurement of body weight was observed in a digital, portable, with a maximum capacity of 150 kg and 100 g scale, with the subject barefoot and wearing standard for the measure. Height was measured by portable Stadiometer graduated in millimeters (CRAWFORD, 1996). Through the ratio of body weight by height of individuals, we calculated the BMI. BMI values were categorized by means of nutritional status, according to the proposal from the World Health Organization, following the cut-off points: normal: between 18.5 to 24.99 $kg.m^2$ and overweight: 25- 29.99 $kg.m^2$, obese: above 30 $kg.m^2$ (BREDA; JEWELL; KELLER, 2019).

Waist circumference (WC) was measured at the midpoint between the last rib and the iliac crest, using a flexible anthropometric tape, with a scale of 0.1 cm and maximum length of 150 cm (TRITSCHLER, 2003). Subjects were evaluated in feet facing the evaluator, with the legs together and arms folded across his chest, and when the measure asked the guy who let the abdominal muscles relaxed. The cutoff points for the development of risk factors were 88 and 102 cm for women and men, respectively (BREDA; JEWELL; KELLER, 2019). Waist to height ratio (WHR) was obtained with calculation using division height for waist circumference, and a cutoff point for coronary risk values above 0.5 (de ONIS; HABITCHT, 1996).

Measurement of pre-hypertension and hypertension

Blood pressure was measured during all day with individuals in a seated position using a standard mercury sphygmomanometer on the left arm after a 5- to 10-min rest period. The measurement of systolic blood pressure (SBP) and diastolic (DBP) was evaluated and classified according to the assumptions set out in "VI" Brazilian Guidelines on Hypertension (2010). All blood pressure measurements were performed with the patient in the sitting position with the right arm resting in the heart region and, following the criteria to be relaxed at least five minutes in a sitting position, legs uncrossed, not to have exercised physically 60-90 minutes earlier, at least 30 minutes without caffeine intake, alcohol and cigarette consumption (SBC;SBH;SBN, 2010). Calibrate the SBP and DBP through equipment aneroid sphygmomanometer of mercury and stethoscope, and the evaluations made previously when other measures. PAS was considered, Phase I, the beginning of auditory sounds and noises and the extinction of auditory, Phase IV, it was considered as PAD. The devices were calibrated before being used.

Thus, individuals were categorized into three classes: normal, pre-hypertensive and hypertensive. The cutoff values of SBP and DBP were pre-set as: normal (SBP <130 mmHg and DBP <85 mmHg), prehypertension (SBP ≥ 130 and <140 mmHg and DBP ≥ 85 to ≤ 89 mmHg), hypertension (SBP ≥ 140 mmHg or DBP ≥ 90 mmHg) (SBC;SBH;SBN, 2010; WILLIAMMS et al., 2019).

Statistical Analysis

We start the statistical using the goodness of fit to a normal distribution data was evaluated using the Kolmogorov–Smirnov test. Data were described separately for categorical ages as means ± standard deviation for continuous variables and we used variances analyses (ANOVA) one way with Bonferroni post hoc from characterized and observed differences. After these analyses, we used the prevalence analyses for nom hypertension, prehypertension and hypertension with variables gender, age per decade and anthropometric variables.

The Multinomial backward logistic regression analysis was used to determine which categorical blood pressure indexes were associated with age, gender, BMI, WHR and WC. Data were analyzed using the program Statistical System Software Program (SPSS) for Windows version 17.0 (Chicago, IL, USA), which was used for all analysis significance level of p <0.05.

Results

Characteristics of participants

The anthropometric characteristics of the sample are shown in different age's category (Table 1). The majority variables analyzed were significantly with increased age from anthropometric measure and blood pressure that were similar in both genders.

Table 1. Characteristics of the population stratified by age categorized for both sex.

	Variables	18-29.9 (n=627)	30-39.9 (n=527)	40-49.9 (n= 586)	50-59.9 (n= 380)	F	p-*value*
FEMALE	**Age (yr)**	23.1 ± 3.5	34.7 ± 2.9[a]	44.3 ± 2.9 [a.b]	54.2 ± 2.7 [a.b.c]		
	Weight (cm)	162.5 ± 7.3	160.6 ± 7.5 [a]	159.5 ± 7.7 [a]	157.8 7.6 [a.b.c]	**34.8**	.000
	Body Mass (kg)	58.5 ± 9.3	63.5 ± 10.7[a]	65.9 12.2 [a.b]	67.7 ± 11.6 [a.b]	**71.1**	.000
	BMI (kg/m²)	21.9 ± 3.5	24.5 ± 4.9 [a]	25.7 ± 4.8 [a.b]	27.3 ± 5.8 [a.b.c]	**117.8**	.000
	WC (cm)	71.3 ± 8.7	78.1 ± 9.9 [a]	81.9 ± 11.8 [a.b]	84.9 ± 11.6 [a.b.c]	**166.0**	.000
	WtHR	0.44 ± 0.06	0.48 ± 0.07 [a]	0.51 ± 0.08 [a.b]	0.53 ± 0.07 [a.b.c]	**156.8**	.000
	SBP (mmHg)	108.0 ± 14.1	109.7 ± 13.9	112.8 ± 17.4 [a.b]	111.6 ± 16.2 [a.b.c]	**42.3**	.000
	DBP (mmHg)	68.4 ± 10.1	70.3 ± 10.7	72.5 ± 12.8 [a.b]	77.4 ± 29.15 [b.c]	**26.9**	.000
		18-29.9 (n=365)	**30-39.9 (n= 326)**	**40-49.9 (n= 366)**	**50-59.9 (n= 220)**		
MALE	**Age (yr)**	22.7 ± 3.3	34.8 ± 2.9	44.3 ± 2.9	53.9 ± 2.7		
	Weight (cm)	174.4 ± 7.3	173.7 ± 7.9	172.2 ± 8.7 [a]	170.4 ± 7.3 [a.b]	**14.5**	.000
	Body Mass (kg)	72.3 ± 11.7	79.6 ± 13.1 [a]	80.6 ± 13.1 [a]	78.9 ± 12.2 [a]	**32.0**	.000
	BMI (kg/m²)	23.6 ± 3.6	26.4 ± 4.0 [a]	27.1 ± 4.7 [a]	27.1 ± 3.8 [a]	**54.3**	.000
	WC (cm)	79.1 ± 9.3	88.1 ± 11.5 [a]	91.3 ± 11.5 [a.b]	93.4 ± 10.9 [a.b]	**100.0**	.000
	WtHR	0.45 ± 0.05	0.50 ± 0.06 [a]	0.53 ± 0.07 [a.b]	0.54 ± 0.06 [a.b.c]	**119.4**	.000
	SBP (mmHg)	116.6 ± 12.7	119.0 ± 12.0	120.9 ± 12.9 [a]	127.3 ± 16.7 [a.b]	**30.8**	.000
	DBP (mmHg)	74.0 ± 11.2	76.8 ± 9.2 [a]	79.2 ± 10.3 [a.b]	81.1 ± 12.6 [a.b]	**24.0**	.000

WC: waist circumference; WCR: waist high ratio; BMI: body Mass Index; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; [a]: different 18-29.99 years old; [b]: different de 30-39.99 years old; [c]: different de 40-49.9 years old; ANOVA one way: p<0.05

The distribution of the different variables analyzed in this study can be seen in Table 2. It may be noted that there was good representation among the age groups for females and smaller for the older population. Within the sample indicators of obesity or weight gain were less representative than the individuals classified as normal for BMI, WHR and WC. Moreover, there was a higher prevalence of arterial hypertension over the decades and in subjects with excess weight due to BMI or the greater accumulation of fat in the waist.

Table 2. Prevalence prehypertension and hypertension in Brazilian adults from gender, age per decade and anthropometric measures.

		Non BP n=2541		**Pre-HBP** n=280		**HBP** n=476	
		n	**%**	**N**	**%**	**N**	**%**
Sex	Male	1705	83.1	134	6.4	216	10.4
	Female	836	67.4	146	11.6	260	20.9
Age group	18 – 29.9	756	85.7	57	6.4	71	7.9
	30 – 39.9	702	82.2	57	6.6	97	11.3
	40 – 49.9	713	74.8	87	9.0	155	16.2
	50 – 59.9	370	61.5	79	13.0	153	25.5
WC	Normal	1664	83.0	150	7.4	195	9.6
	High	877	68.2	130	10.0	281	21.8
WtHR	Normal	1503	86.1	118	6.7	126	7.2
	High	1038	67.2	162	10.3	350	22.5
BMI	Normal	1528	86,8	106	5,9	130	7,3
	Overweight	759	69,9	130	11,9	198	18,2
	Obesity	254	57,2	44	9,5	148	33,3

WC: waist circumference; WtCR: waist-to-heigh ratio; BMI: body Mass Index; Nonhypertensive (Non BP), prehypertensive (Pre-HBP) e hypertensive (HBP); SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; $p<0.05$

Table 3 is the result of the multinomial logistic regression for pre-hypertension and hypertension based on the classification of the combination of systole and diastole associated to gender, age and anthropometric measures. Pre-hypertension is associated with gender, age and BMI. Hypertension is 238% more likely to develop hypertension in male than women. As for BMI, the obesity has three times more chances to develop hypertension than the normal group.

Table 3 - Multinomial logistic model for blood pressure divided into three categories.

Variables	Pre-hypertension OR (95% IC)	p-valor	Hypertension OR (95% IC)	*p-value*
Sex				
Male of Female	2.15 (1.65 – 2.81)	**0.001**	2.38 (1.90 – 2.98)	**0.001**
Age				
	1.03 (1.01 – 1.04)	**0.001**	1.03 (1.02 – 1.04)	**0.001**
BMI				
Normal *vs* Overweight	1.93 (1.36 – 2.73)	**0.001**	1.71 (1.26 – 2.33)	**0.001**
Normal *vs* Obesity	1.89 (1.16 – 3.07)	**0.01**	3.55 (2.44 – 5.15)	**0.001**
WC				
Normal *vs* High	1.24 (0.85 – 1.82)	0.25	1.16 (0.85 – 1.59)	0.33
WtHR				
Normal *vs* High	0.81 (0.54 – 1.22)	0.32	1.38 (0.97 – 1.96)	0.06

BMI: Body Mass Index; WC: Waist Circumference; WtCR: waist-to-heigh ratio; OR: Odds ratio. * p-value <0.05

Discussion

The results for the three tests carried out it was noted that the variables that are associated with hypertension are gender age and BMI, results similar to those found by other study's (LOLIO et al., 1993; COSTA et al., 2007; BARBOSA et al., 2008). Rosário, Scala (2009) instead found a higher prevalence for females, but the same result in relation to aging and weight gain. These indicators associated with hypertension should be taken into account when carrying out an analysis to check the possibility of an individual developing hypertension. The indicators that were being used in some health centers as the WHR and the WC are not strongly associated with hypertension. Only the classification under the DBP has entered the WC model, but this had the lowest association between selected (de ONIS; HABITCHT, 1996).

Hypertension is most likely to occur with advancing age in obese individuals and males. The literature suggests that blood pressure increases with age, especially from the sixth decade of life (WILLIAMMS et al., 2019). Supplementary possible association of increasing age with hypertension can be explained by the lower baroreflex sensitivity in hypertensive individuals not only due to thickening of the carotid wall, but also due to aging (LÁBROVÁ et al. 2005). Other risk factors are also influencing this trend, as lower socioeconomic status, inadequate diet (eg. excess salt), high consumption of alcohol, sedentary lifestyle and concomitantly through this. excess weight (SBC;SBH;SBN, 2010; CHOW et al.,2017 WILLIAMMS et al., 2019)

The Brazilian Society of Cardiology (SBC;SBH;SBN, 2010) argues that the increase in body weight may be a predisposing factor for the development of hypertension. Accounting for 20% to 30% of cases of high blood pressure, in which 75% of men and 65% of women have hypertension directly attributable to excess weight (SBC;SBH;SBN, 2010). Moreover, in the present study we observed that obesity was the highest odds ratio (3.55) among the factors. Vasan, Larson (2001) corroborates this statement by the Framingham Study, noting that blood pressure increases by up to two times three times in men and women to develop heart problems. Already according

to the WHO cited by Brazilian Society of Cardiology (SBC;SBH;SBN, 2010), the cutoff points of BMI (25.0 and 30.0 kg/m2), are strongly associated with risk of morbidity by cardiovascular diseases.

When they reported BMI cutoffs for overweight and obesity, Greenlund, Croft, Mensah (2004) present an odds ratio of developing hypertension OR: 3.34 and OR: 4.42, respectively for both sexes. And detached when the term pre-hypertension, the same study describes an association of OR: 1.46 and OR: 2.26 both figures being significant (GREENLUND; CROFT; MENSAH, 2004). Wilsgaard, Schirmer (2000) describe that the BMI change was associated with systolic and diastolic blood pressure change for both sexes. But Seo et al (2017) from a metaanalysis show WC ≥ 102/88 cm, not BMI ≥ 30, predicted development of hypertension in Hispanic/Latinos. A nother study also claims it is relatively wellestablished that viseral adiposity tissue and WC effectively predict cardiometabolic risks (KLEIN et al., 2007).

The results presented here can be used in the design and incorporation of public health policies aimed at prevention and control of factors associated with the onset of hypertension. Thus, work on the promotion and prevention of hypertension should be addressed to the control with advancing age especially in obese individuals and males. Thus, screening could be created from the cutoff with these indicators by analyzing the likelihood of developing hypertension and its advancement with the preventive program performed.

The prevalence of hypertension was around 8-14% depending on the classification used. This prevalence was lower than expected for the Brazilian population that is 20-40% (COSTA et al., 2007; BARBOSA et al., 2008, MALACHIAS et al., 2016). Therefore. in this study although signals which factors can be used to control the hypertension the study's main limitation is not representative of the hypertensive population of Salvador also in relation to gender with most women. These facts must be taken into consideration in the use of data from this study.

Certain limitations are taken into account in the annotation of the results described. The particular character of the subjects studied, city of Curitiba. State of Parana. Which in turn limits the extrapolation of observed and described also the cross-sectional study does not guarantee the temporal precedence of variables on the occurrence of hypertension. Another factor in the diagnosis of hypertension this measure based on a single measurement (MALACHIAS et al., 2016). Since the ideal would be to hold an average of two blood pressure measurements obtained at two different times (WILLIAMS et al., 2019). Finally, other variables could be assessed and controlled to better inference of the results given that some confounding variables become relevant in the estimates of the association between BMI and hypertension. As control of medications times of stress inadequate diet and others may affect the diagnosis. In contrast, the strengths of the study are also highlighted as follows: demographic and socioeconomic diversity of the sample obtaining anthropometric measurements and blood pressure by direct assessment rather than self-reported and the involvement of the multidisciplinary team in developing the study.

Considering the present results that were found are in conformity with the literature. wV can conclude based on our results that for each year of life can, using the risk factor of being overweight, can increase the chance of hypertension by 3%. As well, overweight individuals are up to 350% more likely to develop high blood pressure when compared to eutrophic individuals. We emphasize that the means of prevention for people with increasing overweight may have the same characteristics with increased occurrence of hypertension.

Conflict Of Interest

No potential conflict of interest relevant to this article was reported.

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