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Hypertensive profile in obese and non-obese adolescents

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Abstract:
Introduction: *Cardiovascular diseases are a leading cause of death with hypertension (HTN) being a main risk factor. HTN is mostly considered an adulthood problem, however it is known that earliest stages of life are critical periods in its etiology. Detecting HTN in adolescence is fundamental since this enables monitoring its evolution and cardiovascular complications. Obesity is cited as a major cause of HTN andin Portugal childhood obesity has a high prevalence compared with other European countries. The aim of this study was to investigate the association between obesity and HTN in adolescentsfollowed-up in a paediatric cardiology department.*
Methodology*: 49 adolescents aged between 12 to 18 years old who underwent ambulatory blood pressure monitoring (ABPM) at least once in the last five years, were retrospectively studied. Simple linear regression was used to verify the relation between variables body mass index (BMI) and hypertensive profile.*
Results: *A very strong positive correlation was identified between BMI and pre-hypertension (pre-HTN) (R=0,949) and strong positive correlation between BMI and HTN stage I (R=0,873) and between BMI and HTN stage II (R=0,832).*
Conclusion: *Higher BMI was significantly associated with a higher prevalence of pre-hypertension and installed hypertension in adolescents. This increases the importance of early detection and implementation of preventive measures.*
Keywords: *Hypertension, Obesity, Adolescence, BMI, ambulatory blood pressure monitoring*

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I. Introduction

Cardiovascular diseases are the leading cause of death, with arterial hypertension being one of the main risk factorsidentified in the Portuguese population [1]. This is in many cases considered a problem of adulthood, however it is known today that earlier phases of life are critical periods in their aetiology. The acknowledgement of hypertension in adolescence is crucial, since its evolution can then be monitored and thus minimising possible cardiovascular complications, as well as enabling preventive measures and investigateits associated biological and physiological aspects[2].

In paediatrics, there are different methods of classifying blood pressure (BP) values in comparison to those considered for adulthood[3].Thus, after the interpretation ofABPM results, normal BP is defined as lower systolic blood pressure (SBP) and diastolic blood pressure (DBP) to the percentile (P)90 adjusted for gender, age and height[4]. Systolic and diastolic BP <90th percentile (for age, gender and height) is considered normal; pre-hypertension if systolic and diastolic BP>90th percentile but <95th percentile, or BP ≥120/80 mmHg, even if <90th percentile (common in adolescents); stage I hypertension if systolic and diastolic BP ≥95th percentile and ≤5 mmHg of the 99th percentile and stage II hypertension if systolic and diastolic BP>5 mmHg of the 99th percentile[5], [6].

The benefits of diagnosing and identifying mild hypertension or BP values at the normal upper limit are of upmost relevance since the predisposition to essential hypertension in adults may begin at the paediatric age. Several longitudinal studies have shown that children with higher blood pressure levels, even within limits considered normal, are more likely to become hypertensive adults[7].

Obesity is pointed out as one of the main causes of hypertension and in Portugal childhood obesity has a high prevalence when compared withother European countries, following the trend of other Mediterranean countries, with an estimated 30% of Portuguese children being overweight[8], [9]. The association between obesity and hypertension in children of different racial and ethnic groups, regardless of gender and age, synergistically influence cardiovascular risk[10].Obesity has a deleterious effect on the cardiovascular system at a very young age. Even before there are clinical manifestations, overweight or obese individuals are at higher

risk of developing target organs lesions from hypertensive cause compared to individuals with weight within normal values[11].

According to data from previous studies, prevalence of HTN in adolescents is between 1.0-5.2%,being 3 times more prevalent among obese than among non-obese[6]. Thus, it is important to clarify the prevalence of hypertension in this age group, as well as to identify risk factors associated with its originat an age when educational and prophylactic intervention is still possible and manageable.

The purpose of this study was to determine the hypertensive profile of an adolescent population and to investigate the possible relation between blood pressure and BMI values.

II. Material and Methods

Descriptive-correlational study based on retrospective analysis of 49 adolescents between the ages of 12 and 18 years old, followed-up in a paediatric cardiology clinic between January 2010 and December 2014 and who performed ABPM at least once in the last 5 years. Patients with ongoing treatment, history of pregnancy, other known pathologies or white coat hypertension syndrome were excluded from the study.

The ABPM protocol would require the patient to use a portable BP monitor which performs repeated BP measurements over the course of 24 hours. During the daytime the measurements were performed every 20 minutes and at night every 30 minutes.Success rate of ABPM in children is influenced by patient's age, with school and adolescence age subjects being most receptive to the examination [6], [7], [11]. In clinical practice, indications of ABPM are essentially the diagnosis of white coat hypertension(a child with normal BP, who is anxious at the time of the visit and with BP ≥ 95th percentile, which is not confirmed by ABPM).

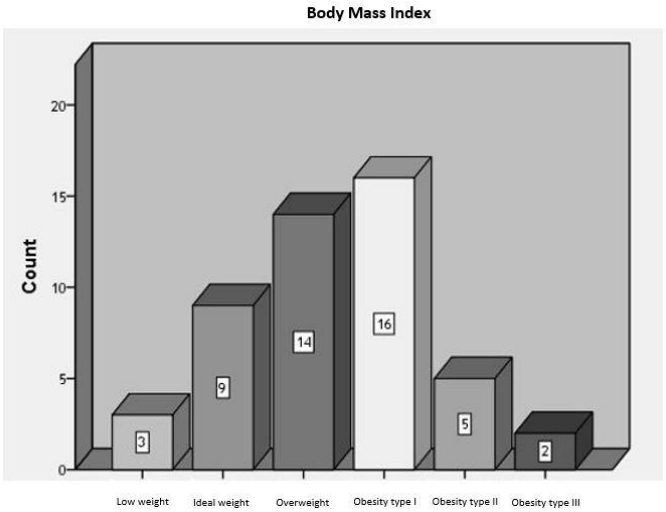
The variablesgender, age, weight, BMI and HTN were analysed using statistical data processing software (SPSS), having studied the independence of the variables BMI and HTA (chi-square test) with *p*-value criterion (sig), if $p<\alpha$meaning rejected null hypothesis, considering α the levels of significance: 1%, 2% and 5%. Correlation study (simple linear regression) was used between the variables age vs weight and BMI vs HTN, with direct analysis of Pearson's correlation coefficient $-1\leq R\leq 1$, where R is the correlation coefficient.

Confidentiality of patients' identity and data was ensured for this study's purposes in accordance to the institution's research centre policies.

III. Results

Our study included 49 adolescents, 59.2% were male and 40.8% female, with average age of 14.12 ±1.6 years old. Weight varied between 37kg and 129kg, with a mean of 79.3 ±20.9kg, showing higher concentration of adolescents weighing between 75.0 kg and 95.3kg. Regarding height, it was registered between 142cm and 187cm, with a mean of 164.1 ±9.7cm, showing higher concentration of adolescents with height between 158 and 170cm. A week positive correlation (R=0.485) was identified between the variables age and weight, which suggested that with age increase there is a slight trend of weight gain.

BMI classification was divided into 6 categories: low weight, ideal weight, overweight, obesity type I, obesity type II and obesity type III.Distribution according to the adolescent's weight is seen in Graph 1. Of these 6 categories, it is considered that the first 3 are non-obese adolescents (n=26; 53.06%) and the last 3 are of obese adolescents (n=23; 46.94%).



Graph1: Distribution according to BMI classification

To verifydependence relationship and correlation between BMI and hypertensive profile, we first summarizedthe obtained distribution of adolescents by their category of BMI and hypertensive profilein Table 1.

Table 1: Distribution by BMI and hypertensive profile

BMI * Hypertensive profile classification – Cross table

		Hypertensive profile classification			Total
		Pre HTN	HTN Stage I	HTNStage II	
BMI	Low weight	2	0	1	3
	Ideal weight	4	2	3	9
	Overweight	7	5	2	14
	Obesity I	7	4	5	16
	Obesity II	0	3	2	5
	Obesity III	0	1	1	2
Total		20	15	14	49

A linear relationship between the increase in BMI level and the respective increase in hypertensive profile level was studied and a correlation coefficient of R=0.21 was obtained which, although positive, is quite weak. Thus, it could not be concluded with this sample that weight gain in adolescence would increase the hypertensive profile.

Analysing Table 1 that crosses the BMI levels with the hypertensive profiles, we can verify there is an increase in the number of adolescents per hypertensive level up to the level of obesity I inclusive. Thereafter, only 7 adolescents in the levels of obesity II and III were present, constituting extreme levels of obesity with reduced frequency among adolescence (last level in our sample representing only 4%). As this could constitute a bias in the relation between BMI and hypertensive profile in our sample, these 7 individuals were removed.Correlations were then studied between the first 4 categories of BMI and each hypertensive profile stage. This demonstrated, in each HTN profilestage that there was a strong correlation with BMI, hence, a strong relation between the first 4 categories of BMI (representing 86% of our sample) and each hypertensive profilestage.Correlating BMI with the pre-HTN stage, there was a very strong positive correlation (R=0.949), BMI with HTN type I (R=0.873) and HTN type II (R=0.832), demonstrated a strong positive correlation. In summary, the increase in BMI was significantly associated with a higher prevalence of total hypertension (pre-hypertension and hypertension), showing a very strong correlation(R=0.979).

IV. Discussion

The prevalence of hypertension in adolescents is attributed, in part, to the high percentage of overweight individuals observed in all age groups, both in developed and developing countries. It is estimated that the prevalence of hypertension is about 3 times higher among obese than among non-obese. At present, there is still little information on the values of BP in adolescents, revealing their acknowledgement is essential, so that their evolution can be predicted, as well as the increased incidence of cardiovascular complications[1]. Early detection and prevention of modifiable cardiovascular risk factors are important, especially in younger age groups, since the existence of high blood pressure in childhood and adolescence may lead to the occurrence of hypertension in adulthood[12].

Considering the high morbidity and mortality rates caused by hypertension, it is essential to alert and make the population aware, youths in particular, for the necessityof lifestyle changes in order to prevent and control hypertension at this unsuspected time of life.Since HTN in adolescence is in many cases associated with excessive weight, it is important to highlight the consequences that may result from this problem. Overweight children have a tendency to isolate themselves since, for the most part, they can suffer from low self-esteem which can lead to problems at school and in their household and may even cause depression symptoms[13]. The diagnosis of obesity cases in children and adolescents may already indicate a group of individuals potentially fit to be followed-up, aiming at a decrease in BMI and percentage of body fat[14].Usually, young people first seek help with primary health care centres, which is why it is necessary to raise awareness among health professionals in the evaluation of cardiovascular risk factors at a young age[12]. Since the prevalence of male adolescents in our study is higher than female and all of them being hypertensive, we could identify a higher prevalence HTN in males, however, it must be taken into account that our sampling was based on convenience of available subjects in a specific paediatric department and therefore does not have criteria of representativeness, reason why they cannot be extrapolated for the general population.

According to this study, the increase in BMI was significantly associated with a higher prevalence of pre-HTN and HTN (R=0.979). Similar results were obtained in other studiesin which there was a significant relationship between blood pressure values and those of BMI[9], [10], [14]. According to Pais*et al.*, 2285 subjects with an average age of 12 years old showed a significant proportion of children and adolescents with

BP values above the 90th percentile (hypertensive) and tends to be related to obesity[15]. Moniz *et al.*,in 2011, studied 886 children between the ages of 2 and 18 years old, aiming to characterise the prevalence of cardiovascular risk factors in obese children and adolescents, having concluded that hypertension was present in 32% of the cases. There was no statistically significant difference in age and gender distribution between the group with and without high BP. The mean z-score of BMI was significantly higher in the group with BP ≥ 95th percentile [8].

Chorin*et al.*, study of 714,922 individuals with anaverage age of 17 years old showed a significant relationship between BMI and BP, both systolic and diastolic, in both genres. The objective of that study was to analyse the tendency for obesity in adolescents between 1998 and 2011 and to evaluate the relationship between BP and BMI in healthy adolescents. Their results showed that mean systolic and diastolic BP increased withhigher BMI (P <0.001 andCI 95%) in both genders [9]. Another study including 7,457 adolescents between the ages of 12 and 15, with the aim of evaluating the association between overweight, obesity and abdominal obesity with pre-HTN and HTN in adolescents. Theydemonstrated that after adjusting for age and gender, a significant association between overweight, obesity and high BP was found (p<0.001and 95% CI)[16]. Silva *et al.*, on a study with 234 adolescents between the ages of 16 and 19, presented that the increase in BMI was significantly associated with a higher prevalence of pre-HTN (9.4% in ideal weight, 16.1% in overweight and 22.7% in obese subjects) and hypertension (30.4% in ideal weight, 45.2% in overweigh and 45.5% in obese subjects [1]. Regarding the 7 adolescents who in our study were in obesity stagesII and III, although this small number was not within thetypical linear correlation trend, they were within the hypertensive profile stages I and II, which concurs mentioned studies with our observations that the levels of hypertension are dependent on the BMI.

V. Conclusion

According to our study, the increase in BMI was significantly associated with a higher prevalence of pre-HTN and HTN, showing a stronger correlation between BMI and pre-HTN. Considering this, it is important in this age group to clarify the prevalence of hypertension, as well as the respective risk factors associated with its origin, so that risk situations can be corrected effectively and at an early stage. In further studies, it would be of interest to assess cardiovascular risk factors present in this youth population, in association with elements as socioeconomical, dietary, genetic and physical activity factors to better characterisepopulations at increased risk.

References

[1] D. Silva, A. Matos, T. Magalhães, V. Martins, L. Ricardo, and H. Almeida, "Prevalência de hipertensão arterial em adolescentes portugueses da cidade de Lisboa," *Rev. Port. Cardiol.*, vol. 31, no. 12, pp. 789–794, 2012.

[2] L. S. Fonseca and V. R. Kirsten, "Fatores de risco para a elevação da pressão arterial em adolescentes," *Medicina (B. Aires).*, vol. 43, no. 55, pp. 400–407, 2010.

[3] F. Neves and A. P. Cândido, "Prevalência e fatores de risco associados à hipertensão arterial em crianças e adolescentes: uma revisão de literatura," *HU rev*, vol. 39, no. 1, pp. 45–53, 2013.

[4] M. C. C. Kuschnir and M. G. Ribeiro, "Hipertensão arterial na adolescência: abordagem e tratamento," *Adolescência e Saúde*, vol. 3, no. 3, pp. 1–4, 2006.

[5] E. Wühl *et al.*, "Management of high blood pressure in children and adolescents: recommendations of the European Society of Hypertension," *J. Hypertens.*, vol. 27, no. 9, pp. 1719–1742, 2009.

[6] A. J. M. Correia, "Abordagem da Criança e Adolescentes Hipertensos," *Nascer e Crescer*, vol. XVI, no. 3, pp. 158–167, 2007.

[7] G. Mancia *et al.*, "2013 ESH/ESC guidelines for the management of arterial hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC).," *Eur. Heart J.*, vol. 34, no. 28, pp. 2159–219, Jul. 2013.

[8] M. Moniz *et al.*, "Risco cardiovascular na obesidade infantil," *Acta Med. Port.*, vol. 24 Suppl 2, no. S2, pp. 327–32, 2011.

[9] E. Chorin *et al.*, "Trends in Adolescents Obesity and the Association between BMI and Blood Pressure: A Cross-Sectional Study in 714,922 Healthy Teenagers," *Am. J. Hypertens.*, vol. 28, no. 9, pp. 1157–1163, 2015.

[10] A. C. Cordinhã, A. Paúl, and L. Fernandes, "Obesidade infantil e hipertensão arterial - a realidade de uma população pré-escolar," *Acta Pediátrica Port.*, vol. 40, no. 4, pp. 145–149, 2009.

[11] J. Dionne, C. Abitbol, and J. Flynn, "Hypertension in infancy: diagnosis, management and outcome," *Pediatr Nephrol*, vol. 27, pp. 17–32, 2012.

[12] H. Dores *et al.*, "Tensão arterial em jovens adultos," *Rev Port Cardiol 2010;*, vol. 29, no. 10, pp. 1495–1508, 2010.

[13] F. Hernandes and M. P. Valentini, "Obesidade: causas e consequências," *Arq Bras Endocrinol Metab*, vol. 47, pp. 111–127, 2003.

[14] J. S. Ferreira and R. D. Aydos, "Prevalência de hipertensão arterial em crianças e adolescentes obesos," *Cien. Saude Colet.*, vol. 15, no. 1, pp. 97–104, 2010.

[15] R. Pais, "Hipertensão arterial e obesidade em crianças e adolescentes," in *7th Virtual Congress of Cardiology*, 2011, pp. 14–18.

[16] V. Dulskiene, R. Kuciene, J. Medzioniene, and R. Benetis, "Association between obesity and high blood pressure among Lithuanian adolescents: A cross-sectional study," *Ital. J. Pediatr.*, vol. 40, no. 5, pp. 1–10, 2014.

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