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Prevalence of high blood pressure in children and adolescents. Influence of obesity [3]

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PALAVRAS-CHAVE: Crianças; Pressão arterial elevada; Obesidade; Agregação familiar
KEY-WORDS: Children; High blood pressure; Obesity; Familial aggregation

Introduction

A number of pediatric studies indicate that hypertension and its complications begin in childhood [1, 2]. Strategies for the prevention of hypertension and its sequelae have included attempts to identify children with a future high risk [3].

High blood pressure (HBP) is an important and detectable clinical problem in children and adolescents. Although the prevalence of HBP in childhood is lower than in adulthood, it is not rare in children.

In recent years, there has been a greater body of knowledge about the normal range of BP in children and recognition of the normal changes in blood pressure that occur with growth and development.

Body weight and arterial blood pressure are closely correlated. The association between obesity and hypertension is supported by a wealth of consistent epidemiological data, mainly in adults [4, 5]. Hypertension is known to be at least three times more prevalent in the obese than among the general population. Furthermore, in prospective studies, weight reduction seems to be associated with a reduction in blood pressure [6, 7]. This relationship also exists in children, and interest in childhood obesity has increased with the recognition that its prognosis is poor and that a high proportion of obese children become obese adults [8]. Several important follow-up studies have demonstrated that children with persistent HBP values were at increased risk of becoming hypertensive adults [9-11] and that more than 80% of persons who were overweight in childhood became obese adults [12]. The predictability of adult high blood pressure is strengthened considerably, by more than a 40% chance, if high childhood blood pressure levels are combined with childhood obesity [13, 14].

The aim of this study is not only to report the prevalence of high normal blood pressure in children and adolescents but also to investigate the influence of obesity on this population, and on the familial aggregation. Therefore the importance of a primary prevention strategy beginning in the familial environment is recognized.

Material and methods

School children aged 5 to 18 years from two different regions of the North of Portugal, along with their siblings and parents, were screened during a period of six months. The clinical examination and data collection were conducted by three medical teams on routine school days. All the parents were invited to be present and all of those who came to the school were examined by the medical teams. The sample of 889 children consisted of 389 boys and 500 girls. Blood pressure was measured on the right arm with a mercury sphygmomanometer. The subject was seated with his arm extended over a table at heart level. A set of different sized cuffs were used. The cuff bladder used was wide enough to cover at least two-thirds of the arm completely, without overlapping [15]. The mean of six readings taken by two observers was consi-

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dered the BP value of each subject [16]. First and fifth phases of Korotkoff sounds were recorded as systolic and diastolic BP, respectively [8, 17]. Height was measured by a standard anthropometric method with the subject standing barefoot. Weight was obtained with the subject wearing only shorts and barefoot, on a balanced standard scale. Skinfold was measured with a Lange skinfold caliper [18]. To assess relative body weight, body mass index (BMI, weight/height2, in kg/m²) was calculated for each individual [19]. The criterion of HBP was defined as BP above the 90th percentile, for systolic and diastolic BP [20]. All variables were converted to age and sex in specific «Z-scores». We compared the mean values of both groups (normotensives and high blood pressure groups), by using a variance analysis (Anova). We evaluated the relationship between the body composition variables by means of a Pearson correlation procedure. An SPSS statistical package was used in all procedures.

Results

The number of children with HBP was 47 (5.2%), with a similar distribution for both sexes. More than 50% of them were under 10 years of age. Table I summarises the mean blood pressure «Z-scores» for the two groups (high blood pressure group and all the others with normal blood pressure). They are all statistically different from zero in both groups (zero in «Z-scores» is equal to the mean). No significant difference was found in blood pressure between the two sexes, but a significant difference existed for blood pessure between the normotensive and HBP groups. As shown in Table II, the mean for anthropometry variables in the two groups are also significantly different; children in the HBP group were all significantly taller, heavier and more obese than the normotensives. There are significant sex differences in skinfold and body mass index in the HBP group.

The Pearson correlation analysis between parents and children (Table III), made with the anthropometric variables, are all positive and statistically significant, with a range between 0,09 and 0,40. Only the father-son correlation for BMI is not significant. Finally, in Table IV, we can study the results of the analysis of the variance between parents and children for all four anthropometric variables

TABLE I
HIGH BLOOD PRESSURE AND NORMOTENSIVE MEAN «Z-SCORES» FOR SYSTOLIC AND DIASTOLIC BLOOD PRESSURE

	Normotensives		High Blood Pressure	
	Sys	Dia	Sys	Dia
Male	−0.240*	−0.220*	1.90*	1.65*
Female	−0.232*	−0.213*	1.88*	1.65*
Male/Female	−0.240*	−0.217*	1.89*	1.73*

* Values statistically different from zero.

TABLE II
MEAN ANTHROPOMETIC «Z-SCORES» FOR HIGH BLOOD PRESSURE AND NORMOTENSIVE GROUPS

Variables	Normotensives		High Blood Pressure	
	Male	Female	Male	Female
Height	−0.07	−0.05	0.74*	0.46*
Weight	−0.07	−0.08	0.82*	0.87*
Skinfold	−0.01	−0.05	0.34*	0.54*
BMI	−0.03	−0.06	0.34*	0.83*

* Mean statistically different from zero.

TABLE III
CORRELATION COEFFICIENTS BETWEEN PARENTS AND CHILDREN FOR ANTHROPOMETRIC VARIABLES

	N	Weight	Height	Skinfold	BMI
Father-son	132	0.17*	0.27***	0.22**	0.09
Father-daughter	140	0.29***	0.32***	0.40***	0.17*
Mother-son	300	025***	0.23***	0.36***	0.20***
Mother-daughter	330	0.29***	0.34***	0.39**	0.15**

* Values statistically different from zero.

TABLE IV
ONE-WAY ANALYSIS OF THE VARIANCE IN THE FATHERS' AND MOTHERS' ANTHROPOMETRIC VARIABLES ACCORDING TO THE NORMOTENSIVE AND HIGH BLOOD PRESSURE GROUPS

		Mean for groups (Z.scores)				
		Fathers			Mothers	
Variables	N	THP	p	NT	HBP	p
Weight	−0.18	0.60	0.0002	−0.27	0.60	0.0001
Height	−0.44	0.42	0.0001	−0.33	0.60	0.0001
Skinfold	−0.64	0.54	0.0001	−0.43	0.82	0.0001
B.M.I.	−0.08	0.40	0.01	−0.03	0.61	0.0001

NT – Normotensives; HBP – High blood pressure.

studied, the numbers achieved are all very high and with considerable statistical significance. This analysis shows that a real and very strong clustering exists between children with HBP and their parents.

Conclusion

This study confirms that, although the HBP is uncommon in childhood, it really exists. The prevalence found in this work is similar to that reported in other studies [21, 22, 23]. Significant positive correlations between all anthropometric variables and blood pressure in this group have already been published [24]. Our data indicate that BP correlates with all anthroprometric variables, but a greater influence existed in the children of the HBP group who were taller, had increased body weight and were more obese than subjects in the normotensive group therefore: it is important to note the influence of obesity among the children studied, as there was no other cause for their BP elevation [25]. It is important to note the presence of a cluster of these risk factors. The positive familial aggregation for obesity confirms the important contribution of the environment in comparison to genetic factors, as shown by Deutscher et al. [25]. The practical implication for a pattern of familial aggregation lies in the possibility of early prevention at this level. In conclusion, our results suggest that obesity is an important risk factor in children with higher BP values. Children with HBP are more likely to come from families with histories of hypertension and obesity. An important preventive measure would seem to be a continued need for heath education about these and other risk factors in growing children, especially in those with a family history of hypertension and obesity. Weight reduction seems to be the treatment of choice in obese hypertensive children. Finally, a careful risk-benefit assessment of mass screening should be performed. Pediatric hypertension is one condition for which screening may be an appropriate approach. It is often asymptomatic; its detection is simple, inexpensive, and reproducible; it has a prevalence that is not fully known, but certainly exceeds that of some of congenital diseases; if untreated, it can have important short-term consequences; and it responds well to nutritional education [23].

Resumo

A obesidade está associada com a pressão arterial (PA) elevada, principalmente em adultos. Tem sido sugerido que o tipo obesidade tem influência na etiologia da hipertensão arterial. Esta relação embora também exista em crianças é menos conhecida. O objectivo deste estudo foi avaliar a prevalência de pressão arterial elevada em crianças e adolescentes e qual a influência da obesidade nesta população, bem como o seu contributo para a agregação familiar destes factores. Foram estudadas oitocentos e oitenta e nove crianças de ambos os sexos, pertencentes a regiões do Norte de Portugal, com idades entre os 5 e os 18 anos (389 rapazes e 500 raparigas), e os respectivos pais. Foram estudadas as seguintes variáveis: a pressão arterial sistólica (PAS), a pressão arterial diastólica (PAD), o peso, a altura, a prega cutânea tricipital, o índice de massa corporal e a maturação sexual. O critério usado para definir pressão arterial elevada, foi o valor de PA igual ou superior ao percentil 90 para o sexo e idade. Todas as variáveis foram convertidas em «Z-scores». No estudo estatístico foi usado o SPSS.

Encontrámos 47 (5,2%) crianças com PA elevada. As crianças deste grupo foram comparadas com as normotensas. As crianças com PA elevada eram mais pesadas ($p < 0,005$) e mais obesas ($p < 0,0001$) do que as do grupo control. Não foram encontradas diferenças para a altura e maturação sexual. Os pais das crianças com PA elevada eram também mais pesados ($p < 0,001$) e mais obesos ($p < 0,01$) do que os pais das crianças normotensas. Em conclusão, a obesidade é um factor importante para as crianças com PA elevada. As crianças com PA elevada têm mais probabilidade de provir de famílias com história de obesidade. A identificação destes factores de risco em crianças pode ter um importante contributo para a prevenção das doenças cardiovasculares na idade adulta.

Summary in English: see page 7.

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