Comparison of the Lipid Profile, Blood Pressure, and Dietary Habits of Adolescents and Children Descended from Hypertensive and Normotensive Individuals

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Objective - *To compare blood pressure, lipid profile, food intake, and anthropometric data of adolescents with or without a familial history of hypertension.*

Methods - *Forty-three adolescents from both sexes were assessed, with ages ranging from 11 to 18 years old. Twenty had hypertensive parents, and 23 had normotensive parents. The following variables were examined: blood pressure, food intake, anthropometric data, lipid profile, and the results of following dietary guidelines (American Heart Association).*

Results - *The offspring of hypertensive parents had greater baseline systolic blood pressure (109 ± 3 vs. 99 ± 2 mm Hg, P=0.01), diastolic blood pressure (68 ± 2 vs. 62 ± 2 mm Hg, p=0.04), greater TC/HDL-C ratio (4.1 ± 0.3 vs. 3.2 ± 0.2, P<0.01), and greater LDL/HDL-C (2.7 ± 0.2 vs. 1.9 ± 0.1, P<0.01), and smaller values of HDL-C (43 ± 2 vs.53 ± 2 mg/dL, P<0.005). Dietary intake and anthropometric measures assessed did not differ between the groups. Even though dietary intervention resulted in reductions in body mass index (21.0± 1.2 vs. 20.1 ± 1.1 kg/m², P<0.01), it did not change dyslipidemia present in the offspring of hypertensive individuals.*

Conclusion - *Increased blood pressure levels and less favorable lipid profiles are found among offspring of hypertensive parents, where low levels of HDL-C were the most relevant finding regardless of anthropometric or nutritional variables.*

Keywords: adolescence, blood pressure, dietary habits, lipids

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Received: 5/15/2002
Accepted: 3/31/2003

Despite greater emphasis in the adult population on the correlation between blood pressure and coronary artery disease, and strokes and renal disorders, blood pressure values during childhood seem to be associated with hypertension at a more advanced age [1].

The prevalence of systemic blood hypertension in children and adolescents is estimated at 6 to 8%, respectively [2].

Considering these facts, it is important that adolescents are guided towards the prevention of risk factors, such as obesity, excessive salt intake, and lack of exercise that seems to be associated with the increase in blood pressure values and aging [3].

Additionally, an unfavorable lipid profile and an increase in blood pressure, especially in association with other risk factors, are, according to the World Health Organization (WHO)[4], conditions that favor the greater development of atherosclerosis during childhood.

Epidemiologic studies have demonstrated that hypertensive patients have unfavorable lipid profiles more frequently than does the general population [5-7]. In the Tromso[6] study, a biological intercorrelation between blood pressure and lipids seemed to be associated with coronary artery disease.

Diet may play an essential role in the prevention of systemic blood hypertension [8]. Poor dietary habits, such as a high intake of food rich in saturated fat, cholesterol, and salt in association with the lack of exercise, have been related to several chronic diseases, especially hypertension, hyperlipidemia, and diabetes mellitus, conditions frequently associated in adult life [9-11].

Based on the early beginning of atherosclerosis in children and adolescents, and due to the increased importance of blood hypertension and its correlation with dyslipidemia in coronary disease in adults, this study aimed at verifying blood pressure and assessing lipid alterations in this population. The study also examined possible changes in lipid profile through a controlled dietary intervention.

Methods

The research was approved by the Ethics Committee for Research at the Federal University of São Paulo/Paulista School of Medicine and started after written consent was obtained from one parent.

Twenty adolescents with hypertensive parents [2] of both sexes and ages ranging from 11 to 18 years old were assessed, followed-up in the Cardiology Department wards. The control group comprised 23 volunteers with normotensive parents. Those who had at least 1 hypertensive parent were considered offspring of hypertensive parents, and all subjects were assessed according to age, sex, and level of sexual maturation according to Tanner' s criteria [12] (tab. I). Parents of adolescents had their blood pressure assessed (data not presented) to classify the 2 groups: offspring of hypertensive parents and offspring of normotensive parents.

Adolescents had their lipid profile determined after 12 to 14 hours of fasting, by using the color metric enzyme method. LDL-C was estimated using the Friedewald formula [13]. All the analyses were performed with the Opera machine (Bayer, Germany).

Blind determination of blood pressure was performed, using a mercury column sphygmomanometers, in the Cardiology Department with the patient in a seated position, with 2 measures after 5 minutes, and 1- to 2-minute intervals between them [2].

The tables of percentiles for boys and girls with ages ranging from 10 to 17 years old from the *Second Task Force on Blood Pressure Control in Children*, 1987 [14] was used as a reference for the analysis of results. Dietary habits were assessed through the frequency of food, 24-hour diet diary, and a 3-day dietary journal, with the participation of parents. Based on these data, on anthropometric measures, and on laboratory examinations, customized nutritional guidance was created for the adolescents, monitored every month for a 16-week period.

For calculation and elaboration of the nutritional guidelines, the following programs to support blood pressure were used: CIS-EPM/UNIFESP and the virtual nutri–USP [15,16].

Nutritional guidelines were elaborated based on dietary recommendations (DRs), for the macro and micro nutrients according to the age group studied, in addition to the recommendation of the *American Heart Association* (AHA, phase I) when the presence of dyslipidemia was detected [3].

Weight, height, body mass index, skinfold measurements (triceps, subscapular), and abdominal circumference were obtained (tab. I).

Body mass index values obtained were assessed in percentiles according to the criteria established by Sichieri and Allam [17], for the age group from 10 to 17 years and 11 months old, and for adolescents above this age, according to the American survey *National Health and Nutrition Examination Survey* (NHANES I) [18].

Percentiles related to the skinfold measurements were assessed according to the American survey NHANES I and the waist circumference according to Freedman et al criteria [19].

Data were expressed as mean ± SD. For the comparison of continuous variables, the nonpaired Student *t* test was used, and the paired test was used for the dietary intervention examination. Homogeneity of the groups was examined by the chi-square test. Level of rejection of the null hypothesis was fixed at 5%.

Results

Systolic blood pressure (SBP) and diastolic blood pressure (DBP) values obtained were greater in offspring of hypertensive parents than in those of normotensive parents, although they were within the normal percentile for the age (tab. I). Differences between the groups regarding skinfold (triceps and subscapular), abdominal circumference, as well as for body mass index obtained did not occur, but decrease in this parameter was noted after nutritional intervention (tab. II).

Although differences between the dietary intake of the adolescents in the baseline period was not observed (tab. III), lower total caloric value and a tendency to increase the consumption of monounsaturated fat and a reduction in saturated fat were obtained after dietary guidance (tab. II).

Table I - Characteristics of the adolescents of hypertensive and normotensive parents

Parameters	Offspring of hypertensive	Offspring of normotensive	P
Age (years)	14.9 ± 0.5	14.3 ± 0.5	NS
Male/female (%)	55/45	43/57	NS
Prepubescent (N)	5	0	NS
Pubescent (N)	65	79	NS
Postpubescent (N)	30	21	NS
Body mass index (kg/m²)	22 ± 3.9	19.6 ± 2.5	NS
Subscapular skinfold (cm)	13.1 ± 1.4	10 ± 0.9	NS
Tricipital skinfold (cm)	14.7 ± 1.6	11.3 ± 1.4	NS
Abdominal circumference (cm)	73.9 ± 2.8	68.2 ± 1.5	NS
Systolic blood pressure (mmHg)	109 ± 3*	99 ± 2	0.001
Diastolic blood pressure (mmHg)	68 ± 2*	62 ± 2	0.040

N- number of youngsters; *SBP and DBP in offspring of hypertensive individuals > offspring of normotensive individuals (unpaired *t* test); ns- nonsignificant.

Table II - Changes obtained after nutritional guidance between offspring of hypertensive individuals with dyslipidemia

Parameters	Preguidance	Postguidance	P
Cholesterol (mg/dL)	177 ± 10	168 ± 9	0.51
LDL-C (mg/dL)	119 ± 9	106 ± 8	0.29
HDL-C (mg/dL)	39 ± 3	42 ± 4	0.53
Triglycerides (mg/dL)	99 ± 13	103 ± 10	0.84
TC/HDL-C	4.7 ± 0.2	4.4 ± 0.4	0.62
LDL-C/HDL-C	3.1 ± 0.2	2.9 ± 0.4	0.63
BMI (kg/m²)	21 ± 1.2	20.1 ± 1.1*	0.006
Total Caloric Value (Kcal)	2677 ± 160	1801 ± 108*	0.0002
Proteíns (%)	15.4 ± 0.9	18.4 ± 1.1	0.051
Carbohydrates (%)	50.4 ± 2.1	52.1 ± 1.9	0.55
Total Fat (%)	34.1 ± 1.7	29.5 ± 1.5	0.055
AG monounsaturated (%)	9.1 ± 0.6	11.3 ± 1	0.09
AG polyunsaturated (%)	8.5 ± 0.7	7.4 ± 0.4	0.17
AG saturated (%)	14.7 ± 1.5	11.2 ± 0.9	0.052

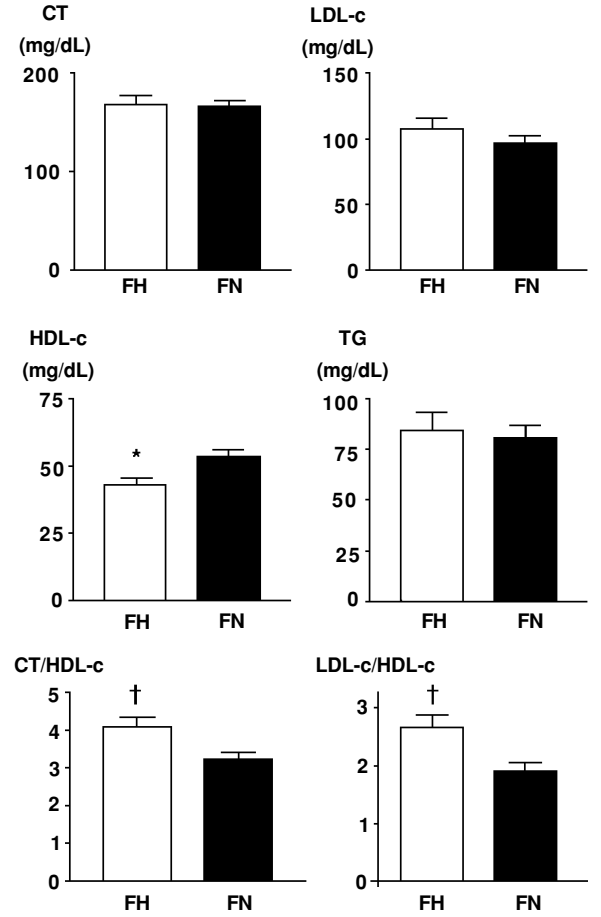
BMI - body mass index. * values obtained for BMI and total caloric values lower after nutritional intervention for 16 weeks (paired *t* test).

Table III - Food intake for offspring of hypertensive and normotensive individuals

Parameters	Offspring of hypertensive	Offspring of normotensive	P
Total caloric value (Kcal)	2442 ± 136	2225 ± 85	0.17
Proteíns (%)	15.6 ± 0.6	16 ± 2.7	0.66
Carbohydrates (%)	49.6 ± 1.4	48.2 ±1.4	0.49
Fat (%)	34.8 ± 1.3	35.8 ± 1.1	0.55
AG monounsaturated (%)	9.1 ± 0.7	9.6 ± 0.8	0.67
AG polyunsaturated (%)	8 ± 0.5	7.2 ± 0.4	0.20
AG saturated (%)	13.5 ± 1.2	17 ± 1.5	0.07
Cholesterol (mg)	243 ± 17	382 ± 119	0.29
Sodium (mg)	3409 ± 337	3775 ± 341	0.45
Potassium (mg)	2485 ± 241	2219 ± 147	0.34
Fibers (g)	16.2 ± 1.6	14.3 ± 1.4	0.37

Absence of significant differences for food intake between offspring of hypertensive individuals and offspring of normotensive individuals.

Figure 1 shows that offspring of hypertensive parents had lower baseline HDL-C values (43 ± 2 vs. 53 ± 2 mg/dL, P<0.005), and greater TC/HDL-C indexes (4.1 ± 0.2 vs. 3.2 ± 0.2, P<0.001) and LDL-C/HDL-C (2.7 ± 0.2 vs. 1.9 ± 0.1, P<0.001) in comparison to offspring of normotensive parents. These populations did not differ regarding total cholesterol (168 ± 8 vs. 166 ± 5 mg/dL, ns) and LDL-C (108 ± 8 vs. 97 ± 5 mg/dL, ns) obtained at baseline. After dietary guidance, restricted to offspring of hypertensive parents with dyslipidemia, changes were not observed in comparison to the new lipid profile obtained (tab. II).



* P=0.004 vs. offspring of normotensive individuals, unpaired *t* test; P=0.006 vs. Offspring of normotensive, unpaired *t* test. TC = total cholesterol; LDL-C = low-density lipoprotein cholesterol; HDL-C = high-density lipoprotein cholesterol; TG = triglycerides.

Fig. 1 - Values obtained for the lipid profile between offspring of hypertensive individuals (OH) and of normotensive individuals (ON).

Discussion

Our study identified, among offspring of hypertensive parents, higher blood pressure levels and a more unfavorable lipid profile (reduction in HDL-C and in the ratio TC/HDL-C and LDL-C/HDL-C) when compared with offspring of normotensive parents. Considering that all of these factors were associated with a greater development of atherosclerosis in children and adolescents in the anatomopathologic studies of Bogalusa [20] and PDAY [21], primary prevention of cardiovascular disease is suggested. Although the age group studied had normal blood pressure values, the observation that offspring of hypertensive parents had higher systolic and diastolic blood pressure values compared with those in the control group of adolescents, also suggests that values currently considered normal for these youngsters may be revised in the future, enabling, at least, the identification of a population with a greater probability of developing hypertension and atherosclerosis in adult life. However, broad prospective studies, in the modern view of hypertension and atherosclerosis, are necessary to create new diagnostic criteria. In fact, those who are younger should be identified early, regarding their cardiovascular risk, to introduce more effective prevention.

A weak correlation for blood pressure between couples and between parents and adopted children has been demonstrated, which agrees with our findings. But this correlation index is increased between parents and consanguineous children, even though they have the same habits, suggesting a strong genetic influence in the pattern of blood pressure [22-25].

In our study, lower values of HDL-C were observed between the offspring of hypertensive patients, despite the similar body mass index and dietary habits in the intake of monounsaturated, polyunsaturated, and saturated fat, as well as carbohydrates and proteins.

Giannini et al [7] observed a higher frequency of dyslipidemia among relatives of hypertensive individuals, with lower HDL-C values among other abnormalities. Additionally, similar results were reported in the Tronso study [6] where hypertensive individuals had increased values of cholesterol and triglycerides, as well as lower HDL-C values. In another epidemiologic study [26], hypertensive individuals had dyslipidemia more frequently than did normotensive individuals, with a correlation between hypertension and hypercholesterolemia, regardless of other variables, such as age and body mass index.

The importance of HDL-C as an early marker of metabolic alterations in this group of adolescents of hypertensive parents seems to be established by these several studies and may represent one of the mechanisms to accelerate

atherosclerosis in hypertension, by impairment in cholesterol transport.

Regarding dietary habits, we have observed that adolescents from both groups have similar diets, with an intake of food rich in cholesterol, saturated fat, and sodium, greater than those recommended by the III Brazilian Consensus of Blood Hypertension [2], and with low-fiber intake in disagreement with the recommendations for cardiovascular prevention in this age group [27-32].

To conclude, our study identified an unfavorable risk profile among the children of hypertensive parents. New criteria in cardiovascular risk stratification in children and adolescents with greater sensitivity for identifying abnormal pressure and lipid parameters seem relevant. In this context, greater emphasis on the control of risk factors, encouragement of physical activity, as well as the correction of dietary habits from childhood, customized in those with greater risk, may reduce or delay cardiovascular events in adult life.

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