Blood Pressure Levels in Urban School-Age Population in Chile

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SUMMARY Two blood pressure (BP) measurements separated by 3 months were performed according to international guidelines on 2976 students (11 to 19 years) of different economic levels. Obesity was defined based upon height and weight. With the first measurements, 50th and 95th percentile value distribution curves were defined. Systolic hypertension (SH) was found in 9.5%; 10.2% were males and 8.9% females. The sample showed that 8.1% were obese (240 cases); among them the incidence of SH increased to 28.8% (69 cases) \((p < 0.01)\). In the entire sample, diastolic hypertension (DH) was 4.3%; males, 2.7%, and females, 5.5% \((p < 0.01)\). Among obese students, DH increased to 8.3% (20 cases) \((p < 0.01)\), and showed prevalence figures of 5.8% for obese males and 10.3% (14 cases) for obese females. After a second measurement, DH for the sample decreased to 1.8%. Salt intake and familial antecedents of high BP showed differences between hypertensive and normal populations. (Hypertension 3 (suppl II): II-238-II-241, 1981)

KEY WORDS • blood pressure • adolescents • systolic hypertension • diastolic hypertension • obesity

THE idea that essential hypertension can begin early in life \(^1\) and be partially determined by genetic factors \(^2\) has become increasingly accepted. Pediatricians are recognizing the need for early detection, prevention, and control of risk factors.\(^*\) This stresses the importance of epidemiological research in different geographic areas to obtain information on distribution of blood pressure (BP) values, incidence of hypertension, and role of risk factors.

The purposes of our study were to: 1) build the first BP distribution curves for a Chilean urban adolescent population; 2) compare these curves with those presented in the American Report of the Task Force on BP Control in Children;\(^10\) 3) establish the prevalence of suspicious values of systolic hypertension (SH) and diastolic hypertension (DH); and 4) relate obesity, excessive salt intake, and familial antecedents of hypertension to individual BP values.

Method

Our sample was made up of 2,976 students 11 to 19 years old, selected from three schools to provide contrast in socioeconomic levels. They lived in metropolitan Santiago, Chile's capital, with an estimated population of 3.5 million, 22% of them belonging to the 10- to 19-year age group.

Antecedents of familial hypertension and previous determinations of BP were obtained through a written form answered by each student's parents. After a previous appointment, height, weight, and BP measurements were performed at school, in a quiet room around 20°C during normal lecturing time. Height and weight were determined in indoor clothing without shoes. BP measurements were taken following the recommendations of the American Task Force;\(^10\) observers were always the same physicians. Only 37% of the students had previous determinations of BP. The first measurement values were used to build percentile distribution curves by age and sex. According to the recommendations of the Task Force, we labeled as suspicious individuals in the 95th or over percentile of that report's figures, because we had no national reference values of BP in children. Subjects with diastolic values at or over the 95th percentile were rescreened within 3 months, and they are still being followed to obtain a third measurement.
BLOOD PRESSURE IN CHILEAN ADOLESCENTS

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
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<tr>
<td>11-14</td>
<td>622</td>
<td>50.8</td>
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<td>15-19</td>
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<tr>
<td>Total</td>
<td>1325</td>
<td>44.5</td>
<td>1651</td>
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To define obesity, relative weights were computed for each subject as a percentage above or below the median weight for all subjects with the same height, age, and sex. Weights of 120% or over were considered obese. Rough information on salt intake habits was obtained by questioning the subjects. The addition of extra salt to daily family food and/or the habit of eating high salt-content foods were defined as excessive salt intake.

**Results**

The makeup of our population is given in table 1. Females 15 to 19 years are slightly overrepresented.

**Blood Pressure Percentiles**

Comparison between our 50th and 95th percentiles for systolic blood pressure (SBP) and those of the American Task Force is given in figure 1. Our values are higher. Conversely, Chilean diastolic pressures (DBP) are consistently lower except for females older than 15 years (fig. 2).

**Prevalence of Hypertension and Risk Factors**

The prevalence of suspicious values of SH is given in table 2; 9.5% of the sample was estimated to be hypertensive after the initial measurement. Younger individuals tended to be more hypertensive; no significant difference by sex was found, but males older than 15 years had higher systolic values than females.

Of our study population 8.1% were obese, without a significant sex difference (table 3); 28.8% of them were considered hypertensive after the first examination. The difference with the total sample was statistically significant. Obese males presented a higher prevalence of SH than obese females in all age groups, particularly between 15 and 19 years, where 40.4% of obese males were hypertensive as opposed to 16.3% of obese females.

The prevalence of suspicious values of DH is shown in table 4; 4.3% of the sample had DBP values at or over the 95th percentile after the first survey. All 127 diastolic hypertensive individuals were rechecked 3 months later and 54 of them remained hypertensive, giving a new prevalence for the total sample of 1.8%. Sex difference was significant in both examinations. In contrast to SH, females showed persistently higher prevalence of DH than males, particularly between 15 and 19 years. DH within the obese population was

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**TABLE 1. Sample Distributed by Age and Sex, Santiago, Chile, 1979-1980**

<table>
<thead>
<tr>
<th>Age (yrs)</th>
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<th>Total</th>
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<tbody>
<tr>
<td></td>
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<td>44.5</td>
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</tbody>
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**FIGURE 1. Selected percentiles of systolic blood pressure. Santiago, Chile, 1979-80, compared to the Report of the U.S. Task Force on Blood Pressure 1977.**

**TABLE 2. Prevalence of Suspicious Values of Hypertension at First Measurement**

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Hypertensive</td>
<td>%</td>
</tr>
<tr>
<td>11-14</td>
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<tr>
<td>Total</td>
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<td>135</td>
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8.3% after the first measurement and declined to 3.3% in the second one. The difference with the total sample was significant only in the initial screening for both sexes, although we should keep in mind that we are now dealing with a smaller number of subjects.

Familial antecedents of hypertension were found in 9% of the parents of the total sample, 23.5% in parents of DH individuals.

While 52% of the DH students declared high salt intake, only 38.2% of the normotensive population did.

**Discussion**

The Task Force Report provides a valuable guideline with which to study BP in diverse settings and ethnic groups. Following those recommendations, we have built the first Chilean adolescent BP distribution grids. The trend of our systolic values is higher than the American Task Force figures. Chilean diastolic pressures, in contrast, were lower except in females 15 to 19 years of age. We are now in a better situation to promote BP determination in common child health control. This national frame of reference also allows us to follow one individual’s track.

Fixler et al. in Dallas have also used the Task Force’s definitions, studying a population from diverse racial origins mostly consisting of individuals around 14 years of age. Comparison of the mean and 95th percentile values of their Latin American population with those of our values for that same-age population shows ours are constantly higher. However, despite the fact that both groups can be classified as “Latin-Americans”, we believe that they are not comparable given the wide racial diversity of Latin-American people. Racial differences in DBP have been described for black and white populations only after 18 years of age.

It will be important to describe and compare BP distribution values in the first two decades of life, employing the same methodology in assessing other world communities. Before publication of the Task Force recommendations became available, hypertension prevalence figures upon initial examination varied in different publications from 1.4% to 13.4% in the first survey. A constantly observed phenomenon in follow-up projects is the reduction of the initial prevalence at first examination to figures at third examination around 0.7% to 1.6%. As a consequence, massive screening is not recommended, and BP determination must be a routine procedure in child health control.
In our initial measurements, we found 9.5% had SH. Higher figures were found in children 11 to 14 years old. This could be attributed to fear. There is no agreement on whether systolic or diastolic pressure is a better guide to prognosis. We choose to follow suspected diastolic hypertensive individuals. In the first examination we obtained suspicious values of DH in 4.3% of the subjects. This figure decreased to 1.8% 3 months later, corroborating the reduction phenomenon. As far as higher prevalence of DH in females is concerned, we think that this finding should be studied in depth with bigger samples.

The relationship between hypertension and obesity is a widely recognized fact. It has been described particularly for SH and females. We also found a significant correlation between suspected hypertension and obesity, but this finding was more evident between obese males 15 to 19 years and in those with SH. As has been pointed out by Dustan et al. confirmation of the relationship between obesity and hypertension provides a striking opportunity for prevention through nutritional health education. Hypertensive parents and excessive salt intake were found to be two factors of significance. Nevertheless, we think that differences in group size do not allow us to come to strong conclusions.

References
Blood pressure levels in urban school-age population in Chile.
C Norero, N A Vargas, D Mayne, A Monti, M Kutz and R Saito

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