Low Adiponectin Levels Predict Type 2 Diabetes in Mexican Children

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Adipose tissue is not only an energy storage organ, it also plays an important role in the combination of endocrine, metabolic, and inflammatory signals in the organism in order to regulate insulin sensitivity and energy metabolism (1–3). Among other adipocytokines secreted by adipocytes, adiponectin could participate in this regulation (3,4). Obesity and hyperinsulinemia are suggested as the potential mechanisms for the suppression of adiponectin levels in the body, and ethnicity may play a role in adiponectin regulation among different groups (5). Because the Mexican population is a combination of Amerindian, Caucasian, Negro, and Asiatic gene admixtures (6), it is relevant to investigate the association of adiponectin with type 2 diabetes, particularly in obese Mexican children.

RESEARCH DESIGN AND METHODS — We studied 40 children with type 2 diabetes and 73 children with normal glucose tolerance (evaluated after fasting and 2 h after glucose ingestion) who were aged 8–16 years (63 girls and 50 boys). The protocol was approved by the hospital research committee. After obtaining signed informed consent from parents, a clinical interview, anthropometric and blood pressure measurements, and acanthosis nigricans were assessed (Table 1). The subjects were classified according to percentiles for age and sex established by National Health and Nutrition Examination Survey (7).

After a 12-h overnight fast, blood samples were taken to determine glucose, HbA1c, total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, and anti-GAD. Plasma insulin and adiponectin determinations were done by radioimmunoassay. Homeostasis model assessment (HOMA) of insulin resistance (HOMA-IR) and HOMA-ß (for β-cell function) indexes were estimated (8).

RESULTS — Patients in the 95th percentile of BMI had the highest blood glucose levels (P = 0.037). There were significant differences in triglycerides, total cholesterol, HDL cholesterol, and LDL cholesterol blood levels between control and type 2 diabetic children. There were also significant differences in HDL cholesterol levels across BMI percentiles. Insulin levels, as well as log HOMA-IR and HOMA-ß, increased with BMI percentile (P = 0.001, P < 0.001, and P = 0.011, respectively), but there were no differences between patients and control subjects.

The univariate analysis showed that there were significant negative correlations between adiponectin levels and age (r = −0.313, P < 0.01), BMI (r = −0.385, P < 0.001), log HOMA-IR (r = −0.397, P < 0.001), body weight (r = −0.427, P < 0.001), and insulin concentrations (r = −0.381, P < 0.001). There was a significant difference in adiponectin concentration between type 2 diabetic and control subjects (t = 5.09, P = 0.001) (Table 1).

In multiple linear regression analysis, BMI (r = −0.215, P = 0.045), waist-to-hip ratio (r = 0.228, P = 0.014), insulin levels (r = −0.276, P = 0.005), and diabetes (r = −0.367, P < 0.001) were independently correlated with adiponectin levels (R² = 0.379, P < 0.001). In a multiple logistic regression analysis, high adiponectin concentration predicted a lower prevalence of type 2 diabetes (odds ratio 0.86, P = 0.001) independent of sex, age, and BMI (R² = 0.318, P < 0.001). Adiponectin levels were negatively correlated with log HOMA-IR (r = −0.159, P = 0.05), and this association was independent of BMI (R² = 0.46, P < 0.001) (Table 2).

CONCLUSIONS — This study showed that adiponectin is strongly associated with age, body weight, BMI, insulin concentration, and HOMA-IR in Mexican children. Moreover, we found that high adiponectin levels predicted a lower prevalence of type 2 diabetes.

In children, adiponectin levels decrease with age (9). Obesity and BMI also have been strongly negatively correlated (5,9–11) with adiponectin levels in adults, adolescents, and children. In our study, small differences in adiponectin levels were found between lean and obese control subjects. Compared with previous reports, changes could be attributable to age and genetic background, influenced by a strict selection criteria (including an oral glucose tolerance test).

In adults, adiponectin concentration is negatively associated with HOMA-IR and positively correlated with HDL cholesterol, independent of age and BMI (12). We also found a negative correlation between HOMA-IR (independent of BMI) and adiponectin, but in contrast, we did not find differences by sex. In healthy 5- and 10-year-old Pima Indian children, a negative correlation was also reported (5).
between adiponectin levels and BMI and fasting serum insulin. Similar results were found (13) in 12- to 14-year-old children from the Los Angeles area, most of them lean. Most insulin-resistant children are overweight or obese, and some are more insulin resistant than others (14). Adiponectin has been considered an insulin-sensitizing adipocytokine (15).

In our study, high adiponectin levels predicted lower prevalence of type 2 diabetes, independent of BMI, sex, and age. To our knowledge, this is the first report of adiponectin levels in children with type 2 diabetes, and adiponectin levels may explain, at least in part, the link between obesity, insulin resistance, and type 2 diabetes at early ages.

Acknowledgments—This study was supported by the FOFOI (Fondo para el Fomento de la Investigación)-Instituto Mexicano del Seguro Social grant.

Table 2 —Multiple linear regression analysis

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>r</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>-0.215</td>
<td>0.045</td>
</tr>
<tr>
<td>Waist-to-hip ratio</td>
<td>0.228</td>
<td>0.014</td>
</tr>
<tr>
<td>Diabetes</td>
<td>-0.367</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Insulin</td>
<td>-0.276</td>
<td>0.005</td>
</tr>
</tbody>
</table>

The dependent variable is adiponectin (in micrograms per milliliter). $R^2 = 0.318$, $P < 0.001$

We thank the technical work of Olga Gaja, Guadalupe Pérez, Gabriela Galicia, and Irma Alvarez. We also thank the Department of Endocrinology, Hospital de Pediatría, Centro Médico La Raza, for providing the patients with type 2 diabetes. We also thank Dr. Michael Stumvoll for his critical review of the manuscript.

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