

# Adiponectin, leptin, and lipid profile in type 1 diabetic children and adolescents

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## KEYWORDS:

Adipocytokines;  
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**BACKGROUND:** Adipose tissue is known to produce and secrete a variety of bioactive substances known as adipocytokines. Adiponectin and leptin are considered to be among the most important adipocytokines:

**OBJECTIVES:** We sought to explore the relationships between adipocytokines (adiponectin and leptin), plasma lipoprotein lipid, and diabetic control indices in type 1 diabetic subjects.

**SUBJECTS AND METHODS:** In this study 63 clinically diagnosed type 1 diabetic subjects and 30 age- and sex-matched healthy control subjects were analyzed. Age, sex, diabetic duration, family history of diabetes, daily insulin dose, weight, height, body mass index, and systolic and diastolic blood pressure were recorded. Fasting blood glucose, glycated hemoglobin A<sub>1c</sub>, total hemoglobin, plasma lipoprotein, lipid and plasma concentrations of adiponectin and leptin were measured in type 1 diabetic subjects and control subjects.

**RESULTS:** In this study a significant increase in triglycerides and high-density lipoprotein cholesterol in plasma of type 1 diabetics was found as compared with normal control subjects. In type 1 diabetic subjects, plasma adiponectin was significantly elevated, whereas leptin showed a significant decrease as compared to a normal control group. Leptin concentrations showed a positive correlation with body mass index and systolic blood pressure but a negative correlation with both fasting blood glucose and glycated hemoglobinA<sub>1c</sub>.

**CONCLUSION:** The results of this study suggest that blood leptin but not adiponectin concentrations have a significant correlation with indices of glycemic control.

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Type 1 or insulin-dependent diabetes mellitus accounts for only about 5 – 10% of all cases of diabetes; however, its incidence continues to increase worldwide, and it has

serious short-term and long-term implications. Type 1 diabetes is an autoimmune disease.<sup>1</sup>

Adipose tissue is known to produce and secrete a variety of bioactive substances known as adipocytokines. Adiponectin and leptin are considered to be among the most important adipocytokines.<sup>2</sup> In recent years, these 2 adipocytokines have been reported to possess various physiological

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activities. Adiponectin has been associated with dyslipidemia in type 2 diabetes mellitus.<sup>3</sup> An inverse correlation has been shown with triglycerides levels and low-density lipoprotein (LDL) and a positive correlation with high-density lipoprotein (HDL) cholesterol.<sup>4</sup>

Adiponectin reduces insulin resistance, which may be due to the enhanced expression of genes involved in  $\beta$ -oxidation and energy dissipation, such as acyl-CoA oxidase and uncoupling protein-2. Moreover, insulin-stimulated tyrosine phosphorylation of signaling molecules, including insulin receptor and insulin receptor substrate-1 in skeletal muscle, is enhanced by adiponectin.<sup>5</sup> Leptin is considered to be a fundamental signal of satiety to the brain and has a variety of actions, ranging from sympathetic activity to hematopoiesis, lymphopoiesis, and reproductive function. Leptin has been increasingly recognized as a cytokine-like hormone with pleiotropic actions in modulating immune responses.<sup>6</sup>

The aim of the present study was to investigate adiponectin, leptin, and plasma lipoprotein lipid concentrations in type 1 diabetic subjects. In addition, it was of particular interest to explore the relationships between adiponectin, leptin, plasma lipoprotein lipid, indices of glycemic control, and different clinical and demographic characteristics of type 1 diabetic children and adolescents.

## Subjects and methods

### Subjects

This study included 63 previously diagnosed type 1 -diabetic subjects from the outpatient clinic of the National Institute of Diabetes and Endocrinology, Cairo, Egypt (test group) and 30 normal subjects from the same socioeconomic classes, age, and sex distribution (control group). All type 1 diabetic patients met the criteria of American Diabetes Association for type 1 diabetes (Report of the Expert Committee, 2003).<sup>7</sup> None of type 1 diabetic subjects were receiving any medications other than insulin. None of them was complaining of any chronic or acute illness other than diabetes mellitus. All patients and control subjects that had a body mass index  $>30$  kg/m<sup>2</sup> were excluded from the study. A full medical history, including age, sex, diabetic duration, and treatment were recorded on all patients and control subjects. A clinical examination, including weight, height, as well as laboratory measures was completed. Written informed consent was obtained from the guardians, and this study was approved by the Ethics Committee of the National Research Centre and that of National organization for teaching hospitals and institutes.

Venous blood samples were drawn in the morning after an overnight fast. Fasting plasma glucose, and lipoprotein lipid concentrations were determined by standard colorimetric enzymatic procedures. Glycated hemoglobin A<sub>1c</sub> was determined according to the method of Abraham et al<sup>8</sup> in fresh heparinized blood samples. Plasma aliquots were frozed at  $-40^{\circ}\text{C}$  until further determinations of

lipids, adiponectin, and leptin. Plasma adiponectin concentration was determined by an enzyme-linked immunoassay kit provided from Linco (St. Charles, MO). Plasma leptin was determined by enzyme-linked immunoassay kit provided by Diagnostic System Laboratories (Webster, TX).

### Statistical analysis

The data were analyzed with version 11.0 of the computer-based statistical package of Statistical Product and Service Solutions.<sup>9</sup> All the data are expressed as mean  $\pm$  SD, and the range is shown in parentheses. The comparisons between the study groups were done by use of the Student *t* test with the aid of levens's test for the equality of variance. Plasma adiponectin, leptin, and triglycerides concentrations as well as HDL/LDL ratio were skewed; therefore, the data were log-transformed to obtain a more normally distributed data. The relationships between adiponectin, leptin, and the different measured parameters were performed with the bivariate correlation by the use of Pearson correlation coefficient. Moreover, multiple regression analysis was applied to test the independent relation of adiponectin and leptin to the significantly correlated parameters. A *P* value of  $<.05$  was considered significant.

## Results

There was no significant difference for age between the type 1 diabetic subjects and healthy control subjects. Also concerning weight, height, body mass index, systolic and diastolic blood pressure, and total hemoglobin, there were no significant differences between the 2 groups. The mean diabetic duration for type 1 diabetic subjects was  $4.4 \pm 2.8$  years. The type 1 diabetic group showed a highly significant increase for both fasting blood glucose and glycated hemoglobin A<sub>1c</sub> as compared with the healthy control group (Table 1).

As shown in Table 2, total cholesterol was highly increased in type 1 diabetic subjects as compared with healthy control patients ( $187.2 \pm 41.5$  mg/dL vs.  $142.4 \pm 28.3$  mg/dL). In addition, a significant increase was observed in the mean triglyceride concentrations of type 1 diabetic subjects as compared with healthy control patients ( $96.4 \pm 48.2$  mg/dL vs.  $75.1 \pm 25.0$  mg/dL). Also, HDL cholesterol showed a significant increase in diabetic patients as compared to the control group ( $55.37 \pm 10.6$  mg/dL vs.  $37.9 \pm 8.3$  mg/dL), whereas the HDL/LDL cholesterol ratio did not show significant differences.

As shown in Table 2, plasma adiponectin was significantly increased in type 1 diabetic subjects as compared with the healthy control patients ( $23.4 \pm 8.8$   $\mu\text{g/mL}$  vs.  $17.7 \pm 6.1$   $\mu\text{g/mL}$ ). However, the plasma leptin concentration was significantly lower than that of the healthy control group ( $14.4 \pm 14.6$  ng/mL vs.  $30.3 \pm 36.0$  ng/mL).

Adiponectin was not correlated with the measured parameters (Table 3), but leptin showed a significant correlation with

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