

Type 2 Diabetes Mellitus is Associated with Lower Serum Adiponectin Level in Bangladeshi Population

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ABSTRACT

Background: The physiological role of adiponectin is not yet fully clear, but it is now generally accepted that it has a protective role against the development of lifestyle disorders, related to insulin resistance and atherosclerosis. Insulin resistance is one of the basic defects of type 2 diabetes (T2DM) and adiponectin is inversely associated with T2DM. As serum adiponectin level has not yet been investigated in Bangladeshi T2DM subjects, so that the present study has been under taken to find out the association of T2DM with serum adiponectin level in Bangladeshi population.

Methodology: In this observational case control study, sixty six (66) T2DM subjects, seventy four (74) healthy control subjects were included. Diabetes was diagnosed and classified as per WHO criteria. Serum Adiponectin was measured by Enzyme Linked Immunosorbent Assay (ELISA) method. Serum glucose was measured by glucose-oxidase method; serum insulin was measured by chemiluminescence-based ELISA technique. The insulin secretory capacity (HOMA %B), insulin sensitivity (HOMA %S) & insulin resistance (HOMA IR) were assayed by homeostasis model assessment method.

Results: The study subjects were BMI matched. BMI of the Control subjects and T2DM subjects (Mean±SD) were 25.02±3.55 and 25.85±3.62. Age (year) of the Control subjects and T2DM subjects (Mean±SD) were 42.46±9.24 and 48.49±8.09. Median (range) fasting serum insulin in the control and T2DM was 14.68 (1.86-45.92) and 18.09 (4.10-42.78) respectively which was not statistically significant (p=0.214). Median (range) HOMA %B values in the control and T2DM subjects was 160.10(33.40-493.40) and 100.45(17.70-349.30). Median HOMA %B in the T2DM group was significantly lower compared to the control (p=0.0001). Median (range) HOMA %S values in the control and T2DM subjects was 44.20(9.80-339.40) and 32.80(14.30-154.70) respectively. Median HOMA %S in the T2DM group was significantly lower compared to the control (p=0.036). Median (range) serum adiponectin (µg/ml) of the control and T2DM subjects was 8.70 (0.76-15.96) and 6.19 (1.13-22.37). Serum adiponectin was significantly lower in T2DM compared to the control (p=0.0001).

Conclusions: From this study it may be concluded that, T2DM subjects have both insulin secretory defects and insulin resistance and associated with lower serum adiponectin level in Bangladeshi population.

Key Word: T2DM, Adiponectin, Insulin sensitivity, Insulin resistance

Introduction

It has been estimated that the total diabetic patients in Bangladesh was more than 3 million in 2000, and this number would rise to 11.1 million by the 2030. The proportional increase in Bangladesh seemed relatively higher compared to other Asian countries¹. An epidemiological study has revealed that the prevalence of DM in Bangladesh had increased exponentially in urban and rural populations which is double in urban than in

rural areas (8% vs. 4%) and rises with affluence². Age adjusted prevalence of T2DM was about 5.6% among the rural population³. This creates a great challenge to the health care system in the developing country like Bangladesh, since diabetes is a lifelong disease and requiring daily treatment³. Several pathogenic processes are involved in the development of diabetes. These range from autoimmune destruction of the β-cells of the

pancreas with consequent insulin deficiency to abnormalities that result in resistance to insulin action. Impairment of insulin secretion and defects in insulin action frequently coexist in the same patient, and it is often unclear which abnormality, if either alone, is the primary cause of the hyperglycemia⁴.

Excess adiposity is one of the most important risk factor for the development of insulin resistance and type 2 diabetes⁵. Adipose tissue, in addition to being a fat store, secretes a number of hormones and proteins collectively termed adipokines^{6,7}. Of all the adipokines, adiponectin has drawn special attention, largely due to its effects on both insulin sensitivity and inflammation⁸.

In healthy nonobese subjects, the plasma level of adiponectin is 4-14 $\mu\text{g/ml}$ ^{9,10} and according to Funahashi and Matsuzawa¹¹, the concentration of adiponectin, ranges from 4 to 30 $\mu\text{g/mL}$ in the blood. Although the physiological role of adiponectin is yet to be determined, but it has been proposed that it has protective effects against the development of atherosclerosis^{12,13} and animal studies and cell culture experiments have shown that direct stimulation of nitric oxide synthesis is responsible for the anti-inflammatory mechanism and antiatherogenic effects of adiponectin¹⁴. Some found that administration of adiponectin decreased the attachment of monocytic cell to human aortic endothelial cells which is an early event in atherosclerotic vascular damage^{13,15}. These clinical and experimental observations suggest that adiponectin plays some protective role against the atherosclerotic vascular change and decreased plasma adiponectin in type 2 diabetic patients may contribute to the development of atherosclerotic complications¹⁶. Though adiponectin has no effect on normal insulin secretion, but diminishes the pro-apoptotic effects of cytokines and FFA on β -cells¹⁶. A prospective study shows that higher adiponectin levels are consistently associated with a lower risk of type 2 diabetes across diverse populations¹⁷. Low concentration of adiponectin predicted subsequent development of IGR and T2DM in initially normoglycemic middle aged people¹⁸.

Low adiponectin is shown to be predictive of future diabetes in many populations, including the Asian Indians^{19,20}. It is now established that, adiponectin is one of the strongest and most consistent biochemical predictors of type 2 diabetes²¹.

In a series of studies on Bangladeshi population to investigate the basic defects of T2DM both insulin secretory defect and insulin resistance had been found²²⁻²⁴. Another study has showed that T2DM have evidence of subclinical inflammation which is associated with insulin resistance but not with insulin

secretory defect in Bangladeshi population²⁵. In a recent study in Bangladesh, it was found that ratio of fasting glucose to adiponectin may be an important factor for the development of type 2 diabetes and associated with insulin sensitivity and insulin secretory capacity in prediabetic or IGR subjects²⁶.

Based on the above findings and as serum adiponectin level has not yet been investigated in Bangladeshi T2DM subjects, this study has been under taken to find out the level of serum adiponectin in Bangladeshi T2DM subjects.

Material and Methods

This observational case control study was conducted in the Biomedical Research Group, Research Division, Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), Dhaka, Bangladesh from July 2011 to June 2012. Total 140 (one hundred and forty) subjects were recruited in this study irrespectively of race, religion and socioeconomic status. Out of 140, 74 subjects were healthy control and 66 were T2DM subjects respectively who were BMI matched. Diabetes was diagnosed and classified as per WHO criteria. Serum Adiponectin was measured by Enzyme Linked Immunosorbent Assay (ELISA) method. Serum glucose was measured by glucose-oxidase method. Serum insulin was measured by chemiluminescence-based ELISA technique. The insulin secretory capacity (HOMA%B), insulin sensitivity (HOMA%S) & insulin resistance (HOMA IR) were assayed by homeostasis model assessment method. The data were analyzed by appropriate univariate, bivariate and multivariate statistical tests.

Results

BMI of the Control and T2DM subjects (Mean \pm SD) were 25.02 \pm 3.55 and 25.85 \pm 3.62, ($p=0.172$) (Table 1). Age (year) of the Control and T2DM subjects (Mean \pm SD) was 42.46 \pm 9.24 and 48.49 \pm 8.09 (Table 1). Median (range) fasting serum insulin ($\mu\text{IU/ml}$) in the control and T2DM was 14.68 (1.86-45.92) and 18.09 (4.10-42.78) respectively which did not show statistical significance difference ($p=0.214$) (Table 2). Median (range) HOMA%B values in the control and T2DM subjects was 160.10(33.40-493.40) and 100.45(17.70-349.30). Median HOMA%B in the T2DM group was significantly lower compared to the control ($p=0.0001$) (Table 2). Median (range) HOMA%S values in the control and T2DM subjects was 44.20(9.80-339.40) and 32.80(14.30-154.70) respectively. Median HOMA%S in the T2DM group was significantly lower compared to the control ($p=0.036$) (Table 2). Median (range) serum adiponectin ($\mu\text{g/ml}$) of the control and T2DM subjects

was 8.70 (0.76-15.96) and 6.19 (1.13-22.37) (Fig 1). Serum adiponectin was significantly lower in T2DM compared to the control ($p=0.0001$).

Table-I: Anthropometric measurements of the study subjects.

Variables	Control (n=74)	T2DM (n=66)	p values Control vs T2DM
Age (years) (Mean±SD)	42.46±9.24	48.49±8.09	4.114/0.0001
BMI (kg/m ²)	25.02±3.55	25.85±3.62	1.372/0.172

Table-II: Glycemic status of the study subjects

Variables	Control (n=74)	T2DM (n=66)	p values (Control vs T2DM)
FSG (mmol/L)	5.3 (4.2 -6)	7 (4.3-15.4)	7.583/0.0001
F Insulin(μIU/ml)	14.68 (1.86 - 45.92)	18.09 (4.10 - 42.78)	1.242/0.214
HOMA%B	160.10(33.40 - 493.40)	100.45(17.70 - 349.30)	4.714/0.0001
HOMA%S	44.20(9.80 - 339.40)	32.80 (14.30 - 154.70)	2.096/0.036
HOMA IR	3.49 (0.46 -11.43)	5.77 (1- 28.34)	4.673/0.0001

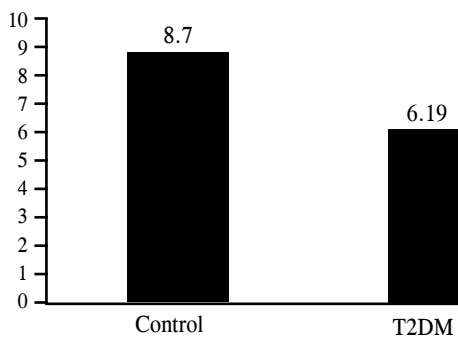


Fig1: Serum adiponectin level in the study subjects

Discussion

The physiological role of adiponectin is not yet fully clear, but it is now generally accepted that it has a protective role against the development of lifestyle disorders related to insulin resistance and atherosclerosis. Insulin resistance is one of the basic defects of T2DM and serum adiponectin level is inversely associated with insulin resistance. This study was aimed to assess the serum adiponectin level in Bangladeshi T2DM subjects. Serum adiponectin, Serum insulin, Insulin secretory capacity (HOMA%B), Insulin sensitivity (HOMA%S) and Insulin resistance (HOMAIR) of sixty-six (66) T2DM and seventy four (74) healthy control subjects were measured. The median (range) serum adiponectin (μg/ml) of the control subjects

was 8.70 (0.76-15.96) which was within normal range (4 - 14 μg/ml)^{9,10}. This result was also compatible with only one study done in Bangladeshi population (1.9-19 μg/ml)²⁷. Lower limit of serum adiponectin level in this study was below the normal level of previous studies. It may be due to small sample size, age difference, BMI difference. The median (range) serum adiponectin (μg/ml) of the T2DM subjects was 6.19 (1.13-22.37). This result was consistent with the other studies^{9,10}. This result was also compatible with IGR population in Bangladesh²⁷. Serum adiponectin level of T2DM subjects was significantly lower than the control subjects ($p=0.0001$). It indicates that low serum adiponectin level is associated with T2DM in Bangladeshi population. From group difference analysis it seems evident that serum adiponectin has an inverse association with T2DM which indicates serum adiponectin level is inversely associated with T2DM. This finding was consistent with other studies^{28,29,30,32}. Median HOMA%B of T2DM group was significantly lower than the control subjects ($p=0.0001$). It indicates T2DM subjects in this study have insulin secretory defects. The median HOMA%S of T2DM subjects was significantly lower than the control subjects ($p=0.036$). The median (range) HOMA IR of control and T2DM subjects were 3.49(0.46-11.43) and 5.77(1.0-28.34). The median HOMA IR of T2DM subjects was significantly higher than the control subjects ($P=0.0001$). These findings indicate T2DM subjects in this study have insulin resistance. Impairment of insulin secretion and defects in insulin action frequently coexist in the same T2DM patients⁴.

Conclusions

From the findings of this study, it may be concluded that T2DM subjects have both insulin secretory defects and insulin resistance; and serum adiponectin level was significantly lower in T2DM subjects in Bangladeshi population.

Conflict of interest: none

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