

Adiponectin hormone and Measurements of Plasma Membrane Voltage in Isolated Adipocytes of Control and Diabetic Patients.

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Abstract

Background: Diabetes is one of the most important and social-economic problem worldwide and characterized by serious metabolic, vascular and neurologic complications.

Aim: To isolate adipocytes in diabetic patients and estimate the electrical potential difference (membrane potential) of isolated adipocytes.

Methods: Biopsy of lipid tissue of diabetic patients were taken In Bin-Sina hospital and then adipocytes were isolated in laboratory of College of Science, Baghdad University..

Results: The Adiponectin mean serum value was significantly ($P < 0.001$) higher in diabetic patients (15.60 ± 1.73 g/ml) as compared to controls (5.80 ± 1.22 g/ml). While the measurement of isolated adipocytes current was significantly ($P < 0.001$) different in diabetic patients (-30.4 ± 4 mV) from that in controls (-61 ± 5 mV).

Conclusion: Adipocytes plasma membrane voltage was with significant difference in diabetic patients as compared to controls and this reflect the inflammatory changes at cellular level in diabetes.

Key words: Diabetes, Adiponectin, Adipocytes, plasma membrane voltage.

Introduction

Diabetes is one of the most important and social-economic problem and it is considered as the most common serious metabolic disease in human [1]. According to WHO, diabetes mellitus now affects more than 300 million people worldwide, and this increasing number indicates that diabetes will be the seventh leading cause of death in 2030 [2]. Diabetes is not one disorder, but it can arise as result of numerous defects in regulation of the synthesis, secretion and action of insulin [1]. Adiponectin, also known as adipocytes complement-related protein was identified by different groups [3]. It is an adipokine abundantly produced and secreted by adipose tissues and widely recognized for its antidiabetic, anti-inflammatory, antiatherogenic, and cardio protective effects [4]. Its secretion is reduced in obese people [5]. Kim et al [6] demonstrated that higher Adiponectin levels are protective for incident metabolic syndrome in men and women and predict new-onset metabolic syndrome. Several biochemical metabolites are associated with adiposity as well as the development of type 2 mellitus, one of these metabolites is

Adiponectin ,it is propose to mediate insulin resistance related obesity [7]. Insulin resistance seemed to have impaired the release of Adiponectin [8,9].

Cell membranes are made up of apposing layers of phospholipids that consist of head which holds a positive charge, and tails which have negatives charges, this phenomena serve as battery [10].The change in membrane voltage is very important because it will open some special channels to transport ions like K, Na, Ca as well as glucose ,this influx will alter the electrical charges of cell [11].

Patients and Methods

Study Design: Prospective case control study.

Setting: Ibn- Sina hospital outpatient clinic in Baghdad, during the period from May to August 2015.

Study population

Ten volunteered diabetic obese men were participated, their ages mean was 46 ± 8.7 years and BMI mean value of 29.73 ± 1.46 Kg/m². Ten obese non-diabetic men with mean age of 44.1 ± 9.2 years and BMR mean of 29.59 ± 1.32 Kg/m² were included in the study as control group. Clinical examination and full medical history was gathered by a specialist endocrinologist for all patients and control participants.

Exclusion criteria: Subjects with cardiovascular diseases, rheumatoid arthritis, on steroid, NSAID therapy, suffer from kidney disease or cancer was excluded from this study.

Ethical approval: The research protocol was approved by the Tikrit University College of Medicine Ethical Committee and Ibn-Sina Ethical Committee. Verbal informed consent was taken from each patient before enrollment in the study.

Determination of Adiponectin:

Adiponectin serum level was determined by ELISA kit (R&D, USA).

Adipocytes plasma membrane voltage determination:

The whole-cell patch-clamp method was used to study the membrane electrical properties of human adipocytes biopsy from the abdomen. The adipocytes were isolated in Biochemistry department, College of Science, Baghdad University as described before [12]. The voltage or current measurement across the cell membrane was determined as previously described [13].

Statistical analysis:

All the data were analyzed by using ANOVA test and Student test.

Results

The anthropometric, clinical and biochemical characteristic of the study population are shown in Table 1. There were no significant differences between normal and diabetic subjects regarding BMI. A significant higher ($P < 0.001$) mean value in fasting blood sugar in diabetic patients (166 ± 17 mg/dl) as compare to normal subjects (85.0 ± 7.5 mg/dl). Additionally, there was a significant ($P < 0.001$) decrease in Adiponectin level (5.80 ± 1.22 g/ml) in diabetic group as compared to controls (15.6 ± 1.73 g/ml).

Measurements of current across the membrane showed that the value of diabetic patients was (-61 ± 4 mV) where the value of control was (-30 mV), the different between diabetic patients and control was highly significant ($P < 0.001$).

Discussion

Adiponectin is of particular interest in metabolic disease because of its close associations with insulin sensitivity and obesity [7-9]. Plasma levels of Adiponectin correlate inversely with glucose, the finding of this agree with that reported by

several clinical studies, which have shown that Adiponectin concentration is lower in obese and type 2 diabetic patients [7,8,9,14]. However, other studies have failed to observe such relationship [15,16]. A decrease in the levels of Adiponectin due to genetic or hormonal factors has been strongly implicated in the development of insulin resistance, metabolic syndrome, and other chronic disease that are associated with obesity [17].

To our knowledge, this study was the first one that performed to measure the current of isolated adipocytes from diabetic patients. This study shows a decrease in current across the adipocytes isolated from diabetic patients and it was twice to that of controls. This reduction in the value is due to alterations in the metabolism of lipids, carbohydrate and proteins in diabetic patients [18,19].

The present study shows a decrease in current of adipocytes membrane with the increase in disease duration. It become obvious that chronic disease is always associated with a loss of voltage in plasma membrane, the duration of this disease also has some effect on the studied parameters like the voltage of the membrane. A change in the voltage of the membrane has been seen in patient with 5 years of diabetic, chronic disease is associated with lack of cellular Energy and reduced of voltage (20).

In conclusion the diabetic patients have higher levels of glucose, Adiponectin hormone and Voltage value than controlled subjects.

Table(1) Anthropometric profile ,glucose ,Adiponectin and current Values of isolated adipocytes in diabetic patients vs. control

Parameter	Control	Diabetic patients	P value
Age(years)	44.0 ± 9.2	46.0 ± 8.7	NS
Weight(Kg)	91 ± 12	89 ± 13	NS
Height(cm)	174.4 ± 6.2	176.0 ± 5.8	NS
BMI(Kg/m²)	29.59 ± 1.32	29.73 ± 1.46	NS
Glucose (mg/dl)	85.0 ± 7.5	166 ± 17	P<0.001
Adiponectin ug/ml	15.6 ± 1.73	5.8 ± 1.22	P<0.001
Current mV	-30 ± 4	-60 ± 5	P<0.001

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