Study effects of adiponectin on the plasma growth hormone level in male rats

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Abstract:

For study of effects of adiponectin hormone on the plasma growth hormone level in the male rats, thirty male rats were divided into two equal groups. A dose of 20 microgram of adiponectin had been given to each individual in the first group (treatment group)for fifteen successive days. Level of plasma growth hormone has been measured and compared with control group. A significant increase was observed.

دراسة تأثير الأدبونكتين على مستويات هرمون النمو في بلازما ذكور الجرذان

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الخلاصة:

تم في هذا البحث أختبار تأثير هرمون الادبونكتين على مستوى هرمون النمو في ذكور الجرذان. . استخدم ثلاثون جرذا مقسمين على مجموعتين، حقن كل فرد من مجموعة المعاملة بخمس عشر جرعة (20 مايكروغرام) من الأدبونكتين مذابا في 0.5 مل من الملح الفسيولوجي NaCl 0.9%، جرعة واحدة في الغشاء البرتوني لكل يوم، ولخمسة عشر يوما متتاليا . . اما افراد مجموعة السيطرة فقد حقن كل واحد بخمس عشر جرعة 0.5 مل من المحلول الملحي، جرعة واحدة في اليوم. سحب الدم في اليوم السادس عشر وجرى قياس مستوى هرمون النمو، اظهر التحليل الاحصائي وجود زيادة معنوية في مستوى الهرمون عند حيوانات المعاملة

Introduction:

It is now clear that white fat depots are not inert lumps put are actually endocrine tissues that secrete not only leptin but also other hormones that affect fat metabolism. Several of these hormones which are synthesized and secreted by adipocyte tissue have been discovered and studied in recent years, like leptin, resistin. Adiponectin which are collectively called adipokines. Some of the adipokines decrease rather than insulin resistance, leptin and adiponectin for example decrease insulin resistance. Further complicating the situation, marked insulin resistance is present in the rare metabolic disease congenital lipodystrophy in which fat depots fail to develop. This resistance is reduced by leptin and adiponectin (1).

Adiponectin is a protein hormone that modulates metabolic processes including of glucose regulation and fatty acid catabolism (2). It is synthesized by adipose tissue and secreted into the bloodstream. It is very abundant in plasma relative to many hormones. Its plasma levels are inversely correlated with body fat percentage (body mass index) and it seems to play a role in helping to stave off or ameliorate disorders such as obesity, diabetes and atherosclerosis (3).

Adiponectin is a 244-amino acid long polypeptide (4). Adiponectin is also called GBP-28, apMI, Adipo Q and Acrp 30. it is encoded by the ADIPOQ gene (5). Adiponectin accounts for about 0.01% of all plasma protein, around 5-10 microgram /ml . The females have higher level than male. Weight reduction significantly increases circulating levels(6). Adiponectin exerts some of its weight reduction effects via the brain (7).

Adiponectin suppresses the metabolic derangement that result in type 2 diabetes, obesity, atherosclerosis , non-alcoholic fatty liver disease (2,3, 8). Adiponectin binds to a number of receptors, so far, two receptors have been identified with homology to G protein-coupled receptors, and one receptor similar to the cadherin family (9,10).

Adiponectin localises to the skeletal muscle suggesting that adiponectin receptors might be present in muscle. In vitro insulin treatment suppress adiponectin gene expression in adipocytes. Insulin reduces the level of adiponectin mRNA in a dose dependent fashion. Hyperinsulinaemic euglycaemic clamp study showed adiponectin level suppression in both diabetic and non-diabetic subjects (11,12).

Testosterone therapy reduces plasma adiponectin and may well explain the sex differences in plasma adiponectin levels. Obese patients tend to have lower adiponectin levels probably due to feedback inhibition by fat accumulation. Adiponectin levels also lower in patients with metabolic syndrome including diabetes, hypertention and hypertriglyceridaemia; states which characterize by insulin resistance. Adiponectin levels strongly correlate with insulin sensitivity (13,12,7,5).

Adiponectin may decrease circulating free fatty acids by increasing nuesterified (nonestrified) free fatty acid (NEFA) oxidation in the skeletal muscle, thus decreasing the triglyceride content of muscles and reducing hepatic triglyceride deposition with resultant improved insulin sensitivity. A direct effect of adiponectin on hepatic free fatty acid (FFA) uptake is also possible (14,7).

Materials And Methods:

Adiponectin:

The hormone [product of Pepro Tech EC (uk)] was contained in vials, each vials with 1mg adiponectin. For the purpose of this study, the utilized vial has been dissolved in 25ml of normal saline (0.9% NaCl solution) so each 0.5ml of the solution contain 20 microgram

of adiponectin (the daily dose for one treated animal).

Animals:

Thirty male white rats, 8-10 weeks age have been used in this study. Rats were divided randomly into two equal groups and enclosed in certain cages appropriate for rats to live in. there where five rats in each cage.

The cages were kept in a conditioned room (21C° -24C°). The rats were left for one week to adapt. Standard pellet diet was provided. Water and food were provided ad libitum.

Each animal in the treatment group received a daily intraperitoneal injection of 20 microgram of adiponectin, dissolved in 0.5 ml normal saline (0.9% NaCl solution) for 14 days. While each rat in the control group was injected a daily intraperitoneal injection of 0.5 ml normal saline (without adiponectin).

On the 16th day of the experiment blood was collected with heparin and centrifuged (2500 rpm) and the plasma stored at -20C° until the determination of plasma growth hormone level was carried out.

Plasma growth hormone concentration was determined by using RIA Kit, supplied by the National Institute of Digestive Diabetes and Kidney Disease (NIDDK) U.S.A.

Statistical Analysis:

Statistical analysis was carried out by using the statistical analysis system. Student's test was used to find the significant difference ($p<0.05$).

The Results:

Table (1) shows clear differences in the plasma GH levels in comparison between control group and treatment group. Data indicated that adiponectin increased GH levels significantly.

Table 1 . Plasma growth hormone level(ng/ml)

Control group	2.1	2.3	2.4	2.4	2.6	2.6	2.7	2.9	2.9	2.9	3	3.2	3.5	3.6	3.7
Treated group	3.2	3.2	3.4	3.4	3.5	3.5	3.5	3.7	3.9	4.1	4.1	4.4	4.4	5	5.2

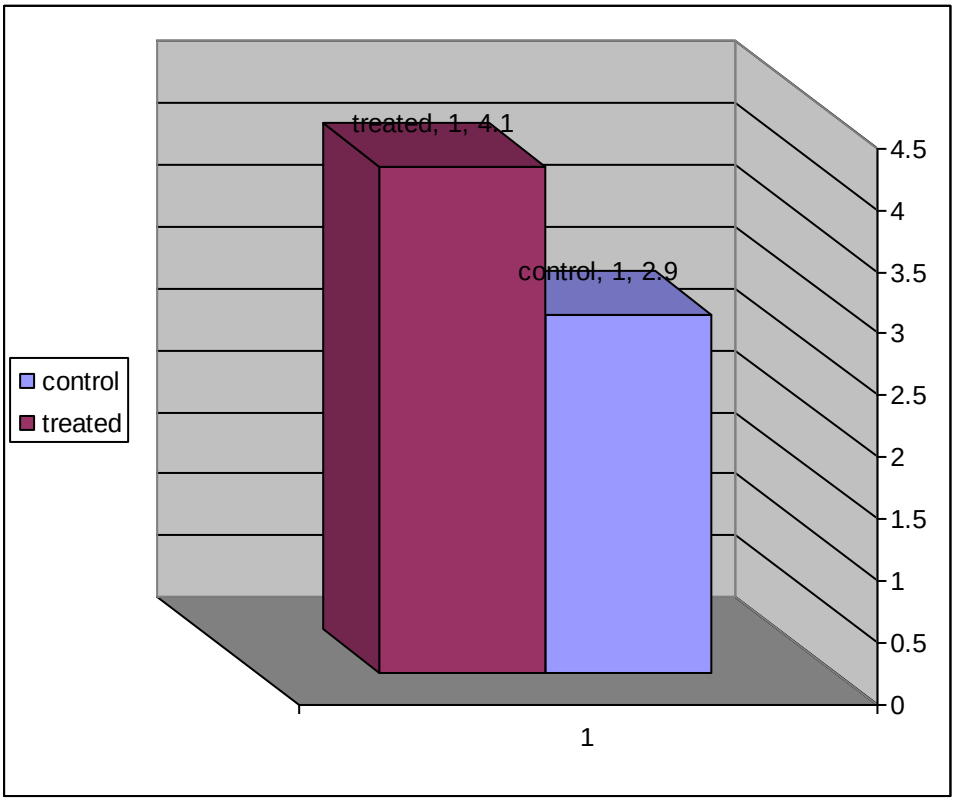

Fig-1 Differences between plasma GH levels of treated and control female rats

Discussion:

It is known that the production of growth hormone (somatotropin) is regulated by growth hormone – releasing hormone (GH-RH or somatocrinin) and growth hormone – inhibiting hormone [GH-IH or somatostatin or somatotropin release – inhibiting hormone (SRIH)] stimulate GH-IH and inhibit GH-RH (15).

In addition to that, there are several other factors known to stimulate growth hormone secretion, like starvation, hypoglycemia. Growth hormone increases during the first period of sleep (16).

The concentration of growth hormone increases as much 10 fold or more as its normal concentration after depletion of the body stores of protein or carbohydrates (17).

It is difficult to find accurate reasons for that elevation of the plasma growth hormone level with still inadequate information about functions of adiponectin, but it is rational to say that because the adiponectin decreases insulin resistance, this feature may causes hypoglycemia which is inturn considered as a factor stimulates growth hormone secretion.

Also it is possible that the adiponectin stimulates secretion of growth hormone-releasing hormone which causes increasing in growth hormone releasing.

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