

Effect of Adiponectin Hormone on the Serum Testosterone Level in Male Rats

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الخلاصة:

الأدبونكتين احد الهرمونات التي يصنعها ويفرزها النسيج الدهني في الجسم والتي تم اكتشافها في السنوات الأخيرة. الهدف من هذا البحث هو دراسة تأثير هرمون الأدبونكتين في مستوى هرمون التستوستيرون في مصل دم ذكور الجرذان، وذلك باستخدام عشرين جرذا ذكرا. قسمت الجرذان إلى مجموعتين متساويتين، وأسكنت في أقفاص خاصة معدة لهذا الغرض. أعطى كل فرد من أفراد المجموعة الأولى (التجربة) جرعة يومية من الأدبونكتين مقدارها ٢٠ مايكروغراما مذابة في ٠.٢ مل من ألحم الفسيولوجي (٠.٩) في ألغشاء البرتوني، ولعشرين يوما متتاليا. وفي نفس الوقت حقن كل فرد من المجموعة الثانية (السيطرة) بجرعة ٠.٢ مل ملح فسيولوجي في ألغشاء البرتوني، جرعة يومية، ولمدة عشرين يوما. في اليوم الحادي والعشرين، سحب الدم من الحيوانات وجرى قياس مستوى هرمون التستوستيرون في مصل الدم وتمت المقارنة إحصائيا بين المجموعتين. كان مستوى الهرمون أعلى في مجموعة الأدبونكتين وبفارق معنوي $p < 0.05$.

Abstract

Adiponectin is a newly discovered hormone released by adipocytes.

This study has aimed to determine the effect of intraperitoneal administration of adiponectin hormone on the serum testosterone level in male rats. Daily injections of 20 microgram of adiponectin were given to 10 adult male rats for 20 successive days.

Serum testosterone was measured on 21st of experiment by using VIDAS testosterone kit. Results gave a significant increase of serum testosterone level ($p < 0.05$) in comparison with a control group.

Introduction

Adipose cells release leptin hormone, which serves to tell your body how much stored energy (as fat) you have. Two other hormones released by adipose cells both affect the sensitivity of cells to insulin. Resistin is an insulin antagonist, while adiponectin enhances sensitivity to insulin[1].

It is now clear that white fat depots are not inert lumps but are actually endocrine tissues that secrete not only leptin but also other hormones that affect fat metabolism. The most intensively studied of these **adipokines** are leptin, TNF α , adiponectin and resistin. Leptin and adiponectin, for example, decrease insulin resistance[2].

Adiponectin is a 244- amino- acid-long polypeptide[3]. Adiponectin modulates a number of metabolic processes, including glucose regulation and fatty acid catabolism[4].

Adiponectin is secreted into the bloodstream where it accounts for approximately 0.01% of all plasma protein at around 5-10 microgram/ml. plasma concentrations reveal a sexual dimorphism, with females having of higher levels than males. Levels of adiponectin are reduced in diabetics compared to non-diabetics. Weight reduction significantly increases circulating levels[5].

Researchers at the University of Pennsylvania School of Medicine have established in animal model that adiponectin secreted by fat tissue acts in the brain to reduce body weight. In contrast to leptin, a related hormone, adiponectin can cause weight loss by raising metabolic rate while not affecting appetite. When adiponectin, which is involved in glucose and lipid metabolism, was introduced into the cerebrospinal fluid of mice, they showed no changes in food intake, but their metabolism rose. The animal burn off more calories, so over time loses weight, while leptin caused weight loss by suppressing appetite and increasing metabolic rate[6].

In 15 study participants without diabetes, higher levels of the “bad” proteins, interleukin 6 and tumor necrosis factor alpha, were associated with a lower ability to respond to insulin and use glucose. On the other hand, higher levels of the “good” protein adiponectin were associated with an increased ability to use glucose. This suggests that low production of adiponectin in subcutaneous fat is linked with an elevated risk of heart disease[7].

Researchers have found that mice with low levels of the protein hormone adiponectin may also have high levels of protein called albumin which in humans, may be a sign of kidney disease. To prove the relationship, they also studied mice without adiponectin (adiponectin knockout) compared to wild-type mice whose levels were normal. The team found that the knockout mice had three times the level of urine albumin that the wild-type mice. In a separate study researchers measured the adiponectin levels of a group of obese African American adolescents. They found similar results-subjects who had a low level of adiponectin also had the condition known as albuminuria. Albuminuria is an indicator for kidney disease[9].

A fat-derived protein known for its effects on the liver and skeletal muscle might also serve as an energy-conserving signal to the brain during periods of starvation. The adiponectin, acts on the brain to boost appetite and slow energy expenditure in an effort to maintain adequate fat stores during lean times.

First off, there is the question of whether adiponectin even reaches the central nervous system.

The researchers now report evidence in mice that adiponectin receptors are present in the hypothalamic region of the brain and that some forms of the chemical enter the cerebrospinal fluid from the blood.

Then, supposing adiponectin reaches the central nervous system, there is the question of what effect, if any, it has there.

Once in the brain, adiponectin enhances the activity of a metabolic enzyme called AMP-activated protein kinase (AMPK) to stimulate greater food consumption.

Moreover, the researchers found that adiponectin decreased energy expenditure. They also showed that blood and spinal fluid adiponectin levels in the brain normally increase during fasting and decrease after refeeding, suggesting that adiponectin acts mainly during food shortages.

So that research claims that adiponectin increases appetite, unlike leptin, which has the opposite effect. Further, adiponectin leads to lower activity and energy expenditure, thus conserving available energy supplies. But such effects are reversed if adiponectin is absent.

In adiponectin-deficient mice, AMPK activity in the brain slowed, causing the animals to eat less and expend more energy. That action, in turn, made the animals resistant to becoming obese even on a high-fat diet. Moreover, animals lacking adiponectin lost more fat after 12 hours of fasting than normal mice did.

If indeed adiponectin tends to lead to lower activity levels and energy expenditure, one has to ask whether it promotes fat storage or even obesity. The research suggests that is the case[9].

Materials and Methods

Twenty male (260-320gm body weight) rats (13 week age mean) were used, divided into two equal groups and housed in standard cages. Standard chow and tap water were available *ad libitum*. One group was assigned experimental group, and each individual of which was received a daily intraperitoneal injection of 20 microgram of adiponectin dissolved in 0.2 ml normal saline for 20 successive days.

While each rat of the control group was injected with a daily dose of 0.2 ml normal saline for 20 successive days.

On the 21st day of experiment, the blood was collected (directly from the heart) in test-tubes and allowed to clot at room temperature. Level of testosterone was measured by using VIDAS[®] Testosterone (TES) kit. This kit is an automated quantitative test for use on the VIDAS instruments for the enzyme immunoassay measure of total testosterone in serum.

The adiponectin is synthesized by Pepro Tech EC (UK) and contained in vials, each vial contains one mg.

Results

It is clear from table-1, and figure-1, that data of treatment group are higher than those of control group, fact suggests effect of adiponectin on the serum testosterone level.

Table-1: serum testosterone levels in nanogram/ml Data arranged up grading

Control Group	3.6	3.6	3.7	3.8	4.1	4.1	4.2	4.2	4.3	4.5
Treatment Group	3.6	3.7	3.7	4.2	4.3	4.5	4.5	5.1	5.3	5.2

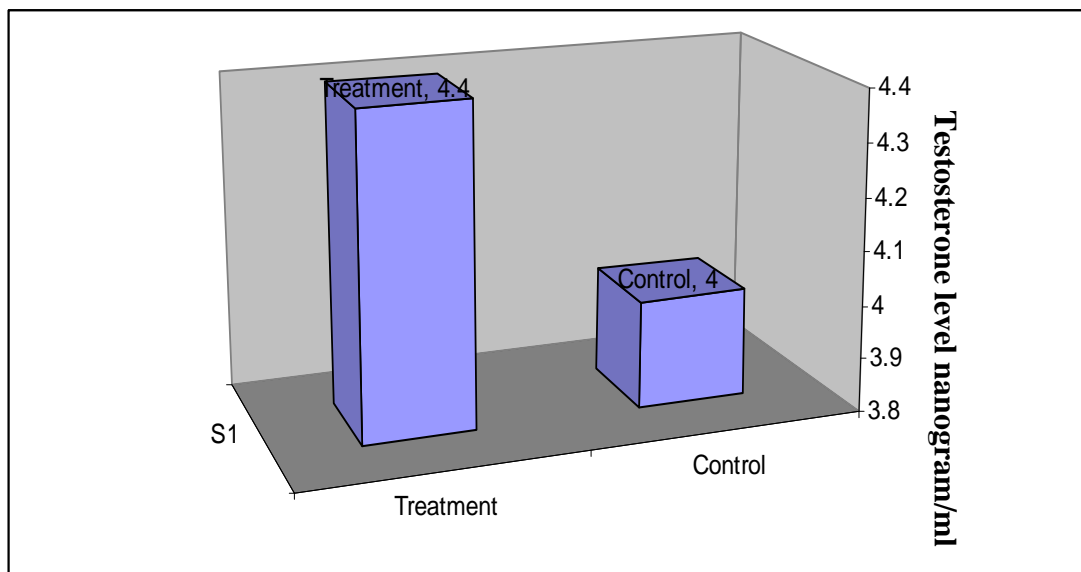


Figure-1: difference of serum testosterone levels between experimental and control animals. Nanogram/ml.

Statistical analysis

The statistical analysis was performed by using SPSS system which showed a significant ($p < 0.05$) increasing in testosterone level of males those treated with adiponectin.

Discussion

A major share of the control of sexual functions in both the male and the female begins with secretion of gonadotropin-releasing hormone (GnRH) by the hypothalamus. This hormone in turn stimulates the anterior pituitary gland to secrete two other hormones called gonadotropic hormones: (1) luteinizing hormone (LH) and (2) follicle-stimulating hormone (FSH). LH is the primary stimulus for the secretion of testosterone by the testes [10].

So far studies and references about adiponectin are not enough for the researcher to be able to announce accurate reasons for his experiment results which relate to effect of adiponectin exactly.

According to this fact, we can only propose some suggestions which might stand behind the effects of adiponectin on the serum testosterone level in this domain.

1- The adiponectin has receptors in the hypothalamus which stimulated secretion of larger amounts of gonadotropin-releasing hormone, which in turn increased releasing of LH, and LH caused higher secretion of testosterone.

2- The adiponectin stimulated the pituitary gland itself to release larger amounts of LH.

3- Adiponectin might triggered the Leydig cells in the testes to secrete more testosterone.

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