Estimation of serum testosterone hormone according to anthropometric class in adult men

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Abstract. Evaluate the serum concentration of testosterone hormone in some healthy adult's men according to their characteristics of anthropometric measurements. This study included ninety-eight volunteer's adult's men, their ages (20-50) years, the blood samples were taken from subjects at the morning during 8:30-10:30 o'clock. ELISA kit was used to assay the serum level of testosterone hormone and the anthropometric measurements have been done such as; body mass index (BMI), waist circumference (WC) and percentage of body fat (BF%) by a special formula and the subjects were assorted depending on classes of anthropometric measurements. The results showed a significant decrease in serum level of testosterone hormone (p<0.05) in obese groups compared with the leaner groups. The class of the anthropometric measurements predicts the state of testosterone hormone level.

Keyword: testosterone hormone, anthropometric class, adult men.

Introduction

The stable body weight depends on an equal balance calories intake from food and expenditure of calories, due to a lot of intake calories without accompaniment expenditure energy, the extra calories will store in the fat cells present in adipose tissue and cause overweight and leads to obesity(Hall et al.,2012), as previous literature has suggested that endocrine and genetic, physiological, behavioral factors play a significant role in the etiology of obesity in turn obesity is associated with multiple alterations in an endocrine system including the abnormal level of circulating blood hormone. (Cheung and Mao, 2012).

Testosterone is a steroid hormone from the androgen group which has a significant influence on important aspects of life such as physical appearance, behavior, mentality, abilities, sexuality and social status and plays a significant role in obesity, glucose homeostasis, and lipid metabolism (Saad and Gooren, 2011;Van Anders et al.,2015) As it's known for some time that testosterone has a major influence on body fat composition and muscle mass in the male( Kelly and Jones, 2013) then the component of body fat is an essential in the diagnosis of obesity and used as an indicator of health risk and which type of body fat is closely connected with the metabolic disorder, in particular, the visceral adipose tissue, likely the bioavailability of testosterone molecule correlated independently with visceral adipose tissue (Nielsen et al.,2007; Przybylska et al., 2012 ) this
reasonable to estimate body fatness by measures the body fat percentage depending on the classification in which listed in the table 1.

Table 1. General body-fat percentage categories in adult men (Muth,2009)

| Description  | Fat% |
|--------------|------|
| Essential fat   | 2-5 % |
| Athletes      | 6-13 % |
| Fitness       | 14-17 % |
| Acceptable    | 18-24 % |
| Obese         | 25 % + |

Accordingly, the current study was conducted to figure out the grade of testosterone hormone that influence by the body fatness.

Materials and Methods

Subjects and blood collection

The present study was conducted in the college of science for women, university of Babylon, subjects enrolled in this study included (98) volunteer apparently healthy non-smoking with ages between (20-50) years. Those selected adult men were assorted into subgroups according to their body mass index and body fat percentage and waist circumference classes.

Anthropometric measurements

Body Mass Index (BMI) was calculated by the following equation.

\[ BMI = \frac{\text{weight (kg)}}{\text{square height (m}^2)} \]

and the ranking of body mass index named according to WHO (2004) criteria. While the Body fat percentage was calculated by the following equation (Chumlea et al., 2002):

\[ \text{Lean body weight} = 94.42 + 1.082(\text{weight in pound}) - 4.15(\text{waist in inches}) \]

\[ \text{Body fat }\% = \frac{(\text{body weight – lean body weight } \times 100)}{\text{body weight}}. \]

Waist in inches = waist in cm /2.54

Weight in pound = weight in kg *2.2

Protocol to measure waist circumference were based on the procedure by Ma et al. (2013). However, the cut-off point values of WC for men 90 cm associated with BMI of 25kg/m\(^2\) which was applied in our study by reason that action level of WC is more opportune with demographic factors with our study population and provided more significant data. Accordingly, our population were assorted into two groups, one of them included individual with a large (WC) ≥90 cm, the other group included the subjects with a small (WC) < 90 cm.

Determination of serum testosterone concentration

Human testosterone concentration was measured by Enzyme Linked Immune Sorbent Assay as mentioned in procedure of Elabscience Biotechnology company kit.
The standard curve of testosterone determination was plotted in figure 1 as below:

![Figure 1: The standard curve of Testosterone concentration](image)

**Statistical Analysis**

Data analysis were performed on SPSS (version 18.0) software, data are being expressed as mean ± SD, a nova and independent -sample T test were used to determine any statistical difference for investigated parameters among subjects, post hoc test applied to multiple comparison among investigated characteristics, the (p <0.05) were considered statistically significant.

**Results**

Our results revealed that testosterone level was significantly lower (p<0.05) in obese subjects (5.2±1.8ng/ml) than in subjects with normal weight (7±2.2ng/ml) as showed in figure 2.

According to body fat percentage the results were showed that serum testosterone level has significantly lower (p<0.05) in obese group compared with those subjects in athletes' group.

In addition, subjects with large waist circumference recorded lower significant of testosterone level(p<0.05) than subjects who have wider waist circumference as exhibited in figure 4.
Figure 2. values of testosterone hormone according to Body Mass Index (BMI) categories.

*p < 0.05 vs. normal weight group

Figure 3. Values of testosterone hormone according to Body fat percentage categories.

*p < 0.05 vs athletes group
**Figure 4.** Values of testosterone hormone according to Waist circumference categories.

*p< 0.05 vs small WC group

**Discussion**

We assumed that low circulating testosterone hormone level contribute to the development of obesity.

Inconsistent with this hypothesis our data shows that low testosterone level associated with greater body fat percentage, body mass index and wider waist circumference, this obtains agrees with a hypothesis by Kelly and Jones(2013) who suggested that testosterone has a major influence on body fat composition and muscle mass in the male and the insufficiency of this hormone is related with an increased fat mass particularly central obesity moreover, other literature work confirms that obesity impairs testosterone levels then the low testosterone promote increased fat deposition was primarily proposed as the hypogonadal obesity cycle (Fui et al., 2014) while other explain in another research about the role of sex hormone concluded that testosterone hormone represent a potentiate leptin signaling as a central mechanism to suppress lipid synthesis and promote lipolysis as a peripheral mechanism (Yanase et al., 2015).

Testosterone is converted to 17β estradiol (E2) by the enzymatic activity of aromatase in adipose tissue (Stocco,2012), hence higher adipocyte expression of aromatase makes a subsequent reduction of circulating testosterone, in turn, this falling in testosterone level is induced increasing adipocytes number and fat deposition, which gradually leads to a further lowering that one hormone (Kelly and Jones, 2013), therefore the insufficiency of the amount or action of steroid hormone causes the obesity (Yanase et al.,2015)

**Conclusion**

Reduction in testosterone concentration contributed to obesity occurrence, in other words, obesity has an enhanced role to reduce the secretion of testosterone in the body.

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