

Measuring the Levels of Leptin and Serotonin Associated with Obesity in Adult Men in Hilla City, Iraq.

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Abstract

Objective: The purpose of this study is to estimate the serum level leptin and serotonin in adult men according to the characteristics of anthropometric measurements as well as to investigate its relationship with leptin and serotonin levels.

Methods and procedures: This study included ninety-eight adult men volunteers, whose ages ranged between (20-50) years. The blood samples were taken between 8:30 and 10:30 o'clock in morning. The ELISA kit has been used to assay the serum levels of leptin and serotonin hormones. The research population has been classified according to the anthropometric measurements, such as; the body mass index (BMI), the waist circumference (WC) and the percentage of body fat (BF%) which is calculated by a special formula.

The results showed a significant increase ($p < 0.01$) in the serum level of leptin hormone in obese groups in a comparison with the control groups, whereas there is a significant decreased ($p < 0.05$) in the serum level of serotonin hormone in obese groups compared to the control groups. Furthermore, a significant negative correlation ($p < 0.03$) between the serum leptin and serotonin is noticed.

Conclusion: we concluded that there is a negative correlation between the serotonin (5- hydroxy tryptamine .5-HT) hormone and obesity, for whenever the obesity increases, the level of the serotonin in the blood decreases. The leptin hormone, on the other hand, has a positive correlation with obesity. Therefore, the correlation between these two hormones is negative.

Keyword: Leptin hormone, Serotonin hormone, Obesity, Adult men.

Introduction

Obesity is a worldwide medical condition in which there is an excessive accumulation of fat that may impair health [1]. The major causes of obesity include the excessive eating, endocrine and genetic predisposition and the lack of physical activity. These all lead to that extra calories will be stored in the fat cells present in the adipose tissue, these factors embody the main role in the current epidemic of obesity [2],[3]. As well, the class of obesity may have a role in the variation level of some neurotransmitter and metabolic hormones in some adult men [4].

Leptin is a peptide hormone (Cytokine- like hormone) secreted by white adipose cells in proportion to the amount of adipose tissue mass. The peripheral effects of leptin primarily include regulation of insulin secretion and energy metabolism in fat cells and skeletal muscles, where it seems to play a role ensuring the maintenance of adequate energy stores and thereby protect against starvation [5]. Leptin implicated in

regulation of food intake and energy homeostasis in both rodents and humans, it's found both centrally and peripherally. The role of peripheral leptin has been more extensively investigated, leptin receptors are found in multiple tissues [6] signifying its importance in homeostatic regulations.

Serotonin (5-hydroxy tryptamine, 5-HT) is a monoamine neurotransmitter, biochemically derived from tryptophan [7].

Serotonin is synthesized in both the serotonergic cell of the CNS (central serotonin) and its role is respond to acute and chronic stress and feeding behavior, and peripherally serotonin is mainly aggregated in enterochromaffin cells of gastrointestinal tract (GIT) and stored in platelets [8]. The world health organization classification [9] for obesity is based on the body mass index (BMI), which is the weight (in kilograms) divided by the square of height (in meters), but only the BMI only is a crude indicator of body fat content, therefore the waist size is a better correlation of the total body fat than the BMI [10]. The classification of adult men according to fat percentage categories [11], is shown in Table [1].

Table 1. General body- fat percentage categories in adult men [11].

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

Materials and Methods

Research population

The present study was conducted in the College of sScience for Women, University of Babylon. The research population of this study included 98 volunteer with no obvious health problems, non-smoking whose ages range between 20-50 years. Those selected adult men were subdivided into subgroups according to their body mass index and their body fat percentage and waist circumference classes.

Anthropometric measurements

Body Mass Index (BMI) was calculated by the following equation. BMI= weight (kg)/square height (m²), and the ranking of body mass index are indicated according to WHO (2004) criteria. While the body fat percentage was calculated by using the following equation [12]:

Lean body weight =94.42+1.082(weight in pound)-4.15(waist in inches)

Body fat %= (body weight –lean body weight *100)/body weight.

Waist in inches = waist in cm /2.54

Weight in pound = weight in kg *2.2

The protocol of measured waist circumference which reflects the abdominal fat is based on umbilicus level by measured at a horizontal level around the navel by using flexible, non-stretchable measuring tape. The men are asked to relax and exhale to get the most accurate measurements recorded [13]. However, the cut- off point values of WC for men 90 cm which is associated with BMI of 25kg/m² which was applied in our study by reason that action level of WC is more opportune with demographic factors with our study population, and it provides more significant data. Accordingly,

the population was assorted into two groups, one of them included individual with a large (WC) ≥ 90 cm, the other group included the men with a small (WC) < 90 cm.

Determination of serum leptin concentration

Human leptin concentration was measured by Enzyme Linked Immune Sorbent Assay (Elisa) as mentioned in procedure of Elabscience Biotechnology company kit. The standard curve of leptin determination was plotted in Figure 1, as shown below:

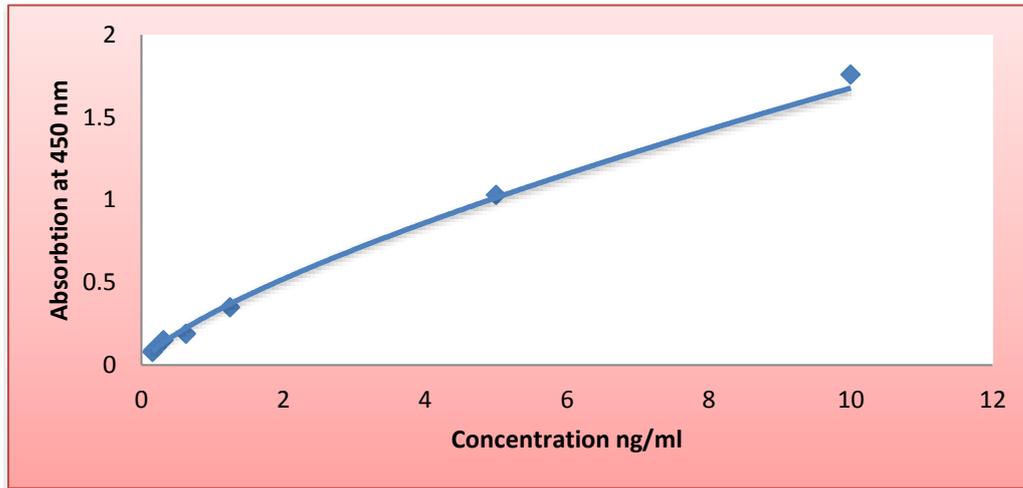


Figure 1: The standard curve of leptin concentration

Determination of serum serotonin concentration

Human serotonin concentration was measured by Enzyme Linked Immune Sorbent Assay as mentioned in procedure of Elabscience Biotechnology company kit.

The standard curve of serotonin determination was plotted in Figure 2 as shown:

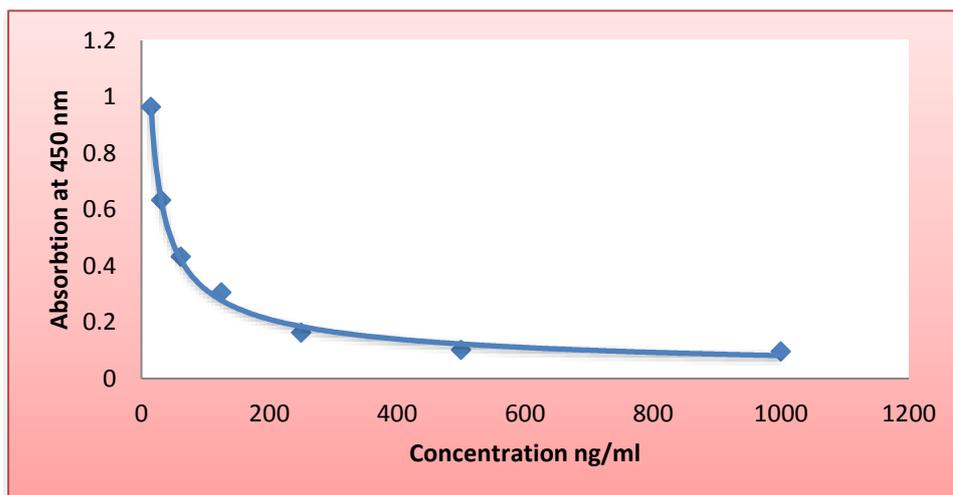


Figure 2: The standard curve of serotonin concentration

Statistical Analysis

Data analysis was performed on SPSS (version 18.0) software. The data is expressed through the mean \pm SD, and ANOVA and independent -sample T test, used to determine any statistical difference for investigated parameters among the population member. The post hoc test is applied to display a multiple comparison among investigated characteristics, where the ($p < 0.05$) was considered to be statistically significant.

The results

Our results showed that the leptin level indicated a highly significant increase ($p < 0.01$) in the obese group compared to control group of leaner members. In addition, there was a significant elevation ($p < 0.05$) of leptin hormone in the overweight group compared with control group, as showed in Figure 3.

For the body fat percentage results, these showed that the serum leptin level had significantly higher ($p < 0.05$) in obese group in matching with those for athletes, fitness and acceptable group, as shown. in Figure 4.

In addition, men with a large waist circumference recorded. A higher significance of leptin level ($p < 0.05$) than men who had small waist circumference as presented in Figure 5.

On the other hand, findings obtained from this study of serotonin hormone level indicated a significant drop ($p < 0.05$) in obese group than those leaner group as showed in figure 6. Furthermore, there was significant lowering ($p < 0.05$) in obese subjects versus subjects who in fitness and acceptable group, as showed in figure 7. So that serotonin concentration had a significant fall ($p < 0.05$) in the sera of large WC group versus small WC group, as showed in figure 8.

Furthermore for the obese group there was a significant negative correlation between serum leptin and serum serotonin ($r = -0.38$, $p = 0.03$), shown in figure 9.

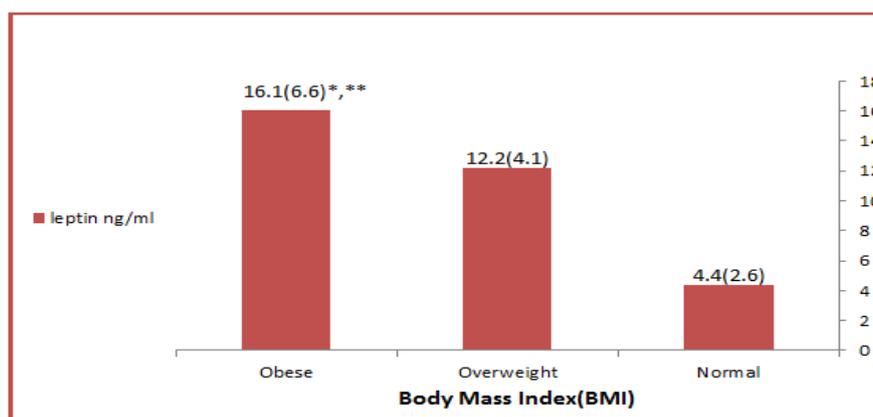


Figure 3. Serum level of leptin hormone in male according to Body Mass Index (BMI) categories.

* $p < 0.01$ vs. normal weight group, ** $p < 0.05$ vs. overweight group.

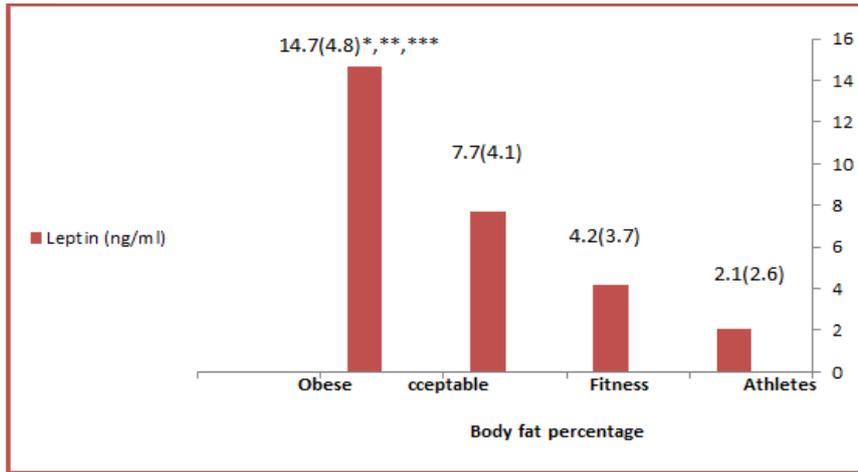


Figure 4. Serum level of leptin hormone in male according to Body fat percentage categories.

*p< 0.05 vs. acceptable group, **p<0.05 vs. fitness group, ***p<0.05 vs. athletes group.

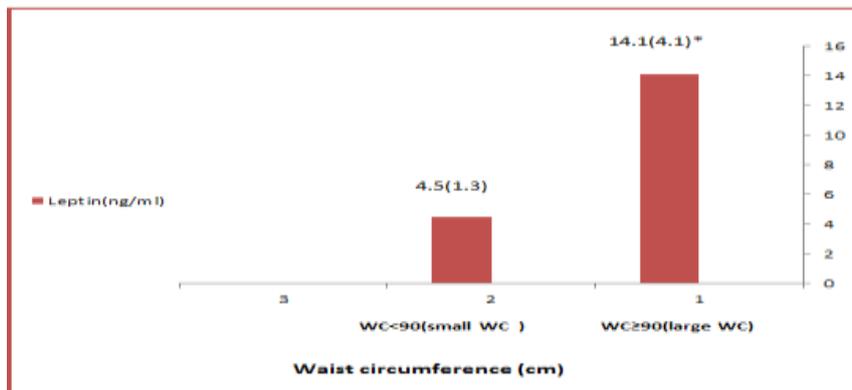


Figure 5. Serum level of leptin hormone in male according to Waist Circumference (WC) categories.

*p< 0.05 vs. small WC group.

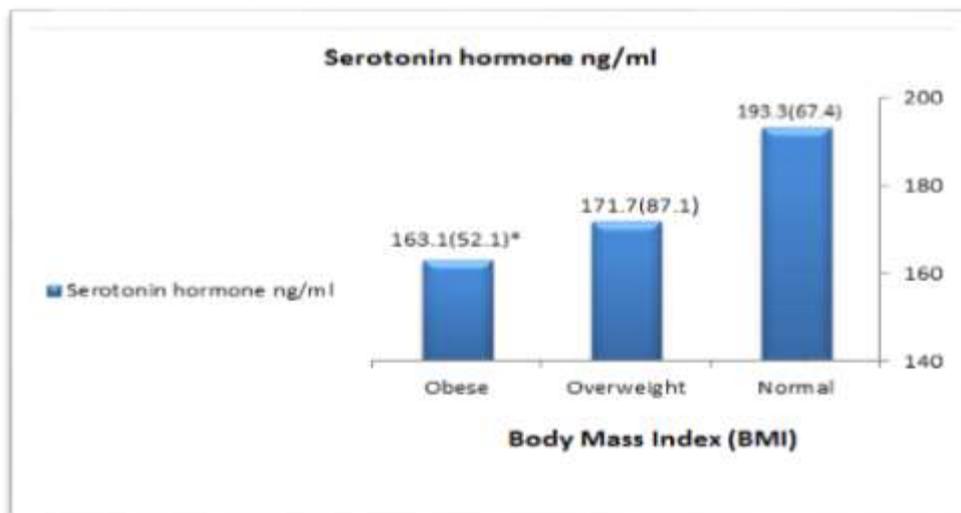


Figure 6. Serum level of serotonin hormone in male according to Body Mass Index (BMI) categories.

*p< 0.05 vs. normal weight group.

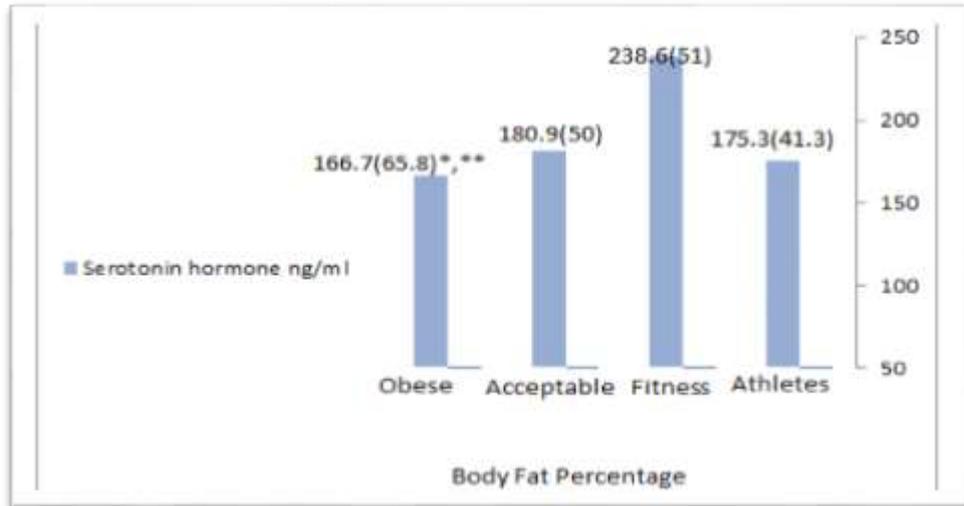


Figure 7. Serum level of serotonin hormone in male according to Body fat percentage categories.

*p< 0.05 vs. acceptable group, **p<0.05 vs. fitness group.

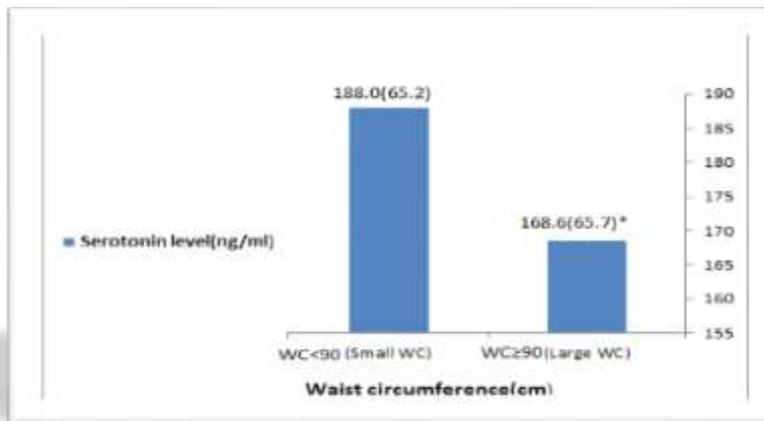


Figure 8. Serum level of serotonin hormone in male according to Waist Circumference (WC) categories.

*p< 0.05 vs. small WC group.

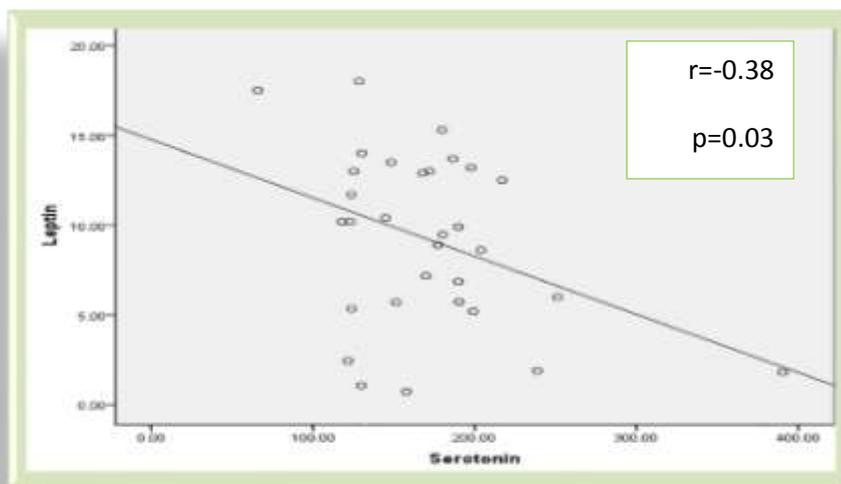


Figure 9. Negative significant correlation between leptin hormone level and serotonin level(ng/ml) in obese men subject.

Discussion

In the current study, we found that obese men had higher leptin levels and lower serotonin (5-HT) levels than lean men. The increase in number and size of adipose tissue in obese individual contributed to a greater secretion of leptin hormone, which has a controlling effect on satiety and hunger. Moreover, the leptin hormone has a direct effect on the carbohydrate metabolism linked to several other hormones [14], [15]. The majority of obese humans have high serum leptin levels, which suggests leptin resistance [16], or loss of sensitivity for several hormone in which several mechanism contribute to leptin resistance related to a down regulation of β -adrenergic receptor in white adipose tissue, eventually resulting in a decreased responsiveness to sympathetic stimulation [17]. This hypothesis suggests that some cases of human obesity may be due to reduced leptin action in the brain, and affected individuals are unlikely to respond to pharmacological treatment with leptin [18]. Other researchers reported that both high and low levels of leptin in humans have been associated with leptin resistance accompanying obesity, which are assumed to influence disorders that could affect neuro cognitive functions [19]. The high leptin concentration in obese men probably explained that increase in leptin release from large fat cells. Furthermore, leptin can serve as an indicator of fat content and its level may be decreased by reduction of body fat even though BMI values remain unchanged [20]. However leptin increases as body fat increase in attempt to reduce food intake and increase thermogenesis and leptin decrease if energy intake remains constant and energy expenditure is increased lipid content of adipose tissue should ultimately decline [21].

In this study, we found that the level of peripheral serotonin 5-HT is low in obese group, we hypothesis that circulating serotonin may contribute to the development of obesity. The resent studies [22] which imply that peripheral serotonin plays role in the development of obesity. This may be regarded with that serotonin hormone plays an important role in satiety by exhibiting control over hunger and satiety through several receptors, these receptors are responsible for the reduced intake of food and energy balance [23], so serotonin and serotonergic systems throughout the body have been shown to exert an influence on food consumption by control of satiety and thus body fat distribution [24]. Other theories according to [25] whom founded that obesity arises when people over eat in response to negative mood. These theories included that over eating in motivated by the urge to satisfy a psychological need, such urges could be related with a neurochemical imbalance in the (CNS) or (PNS) as noted by Hodge [26]. Since the secretion is one of a chemical neurotransmitter has been shown is a biochemical marker of mood [27], [28] as low serotonin level which may be contributed in lower of mood state [29].

However this allowing to excessive eating to improve mood supporting of the trend to become overweight or obese. This agrees with Monti [30] who reported that function of serotonin in regulates mood and food intake, more over Namkung *et al* [31] was established there was an inverse relationship between central serotonin level and food intake, whereas owing to the selective nature of blood, brain barrier, peripheral serotonin concentration may not necessarily equate to serotonin availability in the brain [32], [33] where (CNS) serotonin dependent upon plasma tryptophan crossing the blood-brain barrier, brain serotonin concentration however one determined by ratio of plasma tryptophan to other large neutral amino acids (LNAAs) which compete with it for uptake into the brain, through consumption of carbohydrates, insulin is released which allows uptake of the (LNAAs) into skeletal muscle means that tryptophan can pass more easily into the brain [34], [35]. Thus

increased serotonin production in the brain subsequent to high carbohydrate intake can produce mood- enhancing post- ingestional effects further drive intake of this type of foods and weight gain [36].

Furthermore, the negative correlation between leptin and 5-HT was observed in this study, circulating leptin interacts with peripheral 5-HT [16] the peripheral leptin level were reduced by serotonin, since serotonin exerted direct effects on adipocytes and regulated leptin release from adipocytes[37].

Also, peripheral serotonin may influence obesity is through interaction with leptin which is thought regulate (inhibit) appetite in the regulation of energy and body fat [26].

Conclusion

From these data, we can be concluded that, both leptin and serotonin (5-HT) hormones considered as a part of a common output pathway for the expression of appetite, whereas the present results show an inverse correlation, whenever leptin increase serotonin decrease, and these hormones have a bi directional role: both effected and affected by obesity.

Conflict of Interests.

There are non-conflicts of interest .

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الخلاصة

الهدف من الدراسة لتقدير تركيز هرموني اللبتين والسيروتونين في مصل الرجال البالغين وايضا بحث العلاقة بين الهرمونين المذكورين في مجتمع الدراسة.

الاساليب وطرائق العمل: شملت الدراسة 98 شخص سليم ظاهريا تتراوح اعمارهم بين (20-50) سنة وتم جمع العينة في الصباح للفترة (8:30-10:30) وتم اجراء التحليل بطريقة الاليزا وتم تقسيم مجتمع الدراسة حسب المعايير الجسمانية حيث تم حساب الطول و وزن الجسم ومن ثم حساب مؤشر كتلة الجسم ونسبة الدهون وفق معادلات خاصة.

النتائج: اظهرت النتائج زيادة معنوية ($p<0.01$) لمستويات هرمون اللبتين في مصل الاشخاص البدناء مقارنة بمجموعة السيطرة اما السيروتونين فهناك انخفاض معنوي ($p<0.05$) عند البدء مقارنة بمجموعة السيطرة بالإضافة الى وجود علاقة عكسية معنوية ($p<0.03$) بين اللبتين والسيروتونين.

الاستنتاج: استنتجنا من الدراسة الحالية ان هناك علاقة عكسية بين هرمون السيروتونين والسمنة فكلما زادت السمنة قلت مستويات السيروتونين في الدم بينما هرمون اللبتين يزداد بزيادة السمنة , كما وجد حصول علاقة عكسية بين الهرمونين مع بعضهما البعض. **الكلمات الدالة:** هرمون اللبتين, هرمون السيروتونين, السمنة, البالغين.