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Evaluation of Brain Derived Neurotrophic Factor (BDNF) hormone levels associated with obesity in some adult men

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Abstract :. Evaluated of BDNF hormone level in some adult's men according to measures of obesity categories.
Methods: The study was conducted in the College of Science for women, University of babylon, Al- Hila, Iraq. Study population involving (98) adult's men at age (20-50 years), the blood samples were taken from subjects at the morning during 8:30-10:30 o'clock for the period at the beginning of November 2015 till April 2016, and used ELIZA kit to assay the serum BDNF hormone level. The population of our study was classified depending on their anthropometric (physical) characteristics which included the body mass index(BMI), body fat percentage, and waist circumference (WC) measurements.
Results: The results showed a significant increase in BDNF level ($p<0.05$) in obese groups according to their anthropometric (physical) characteristics as compared with leaner groups.
Conclusion: The state of anthropometric (physical) measurements which included (BMI, body fat percentage, and WC) which have worked to influence on the level of serum circulating BDNF hormone in population of this study.
Key words: Brain Derived Neurotrophic Factor (BDNF) hormone, obesity, adult men.

Introduction:

Obesity is a worldwide medical condition in which excess accumulation of fat that may impair health[1].

The major causes for obesity including the lack of physical activity, excessive eating, and endocrine and genetic predisposition[2,3] and the obesity is associated with multiple alteration in the endocrine system including abnormal circulating blood hormone concentrations ,which can be due to changes in the pattern of their secretion and/or metabolism, altered hormone transport and /or action at the level of target tissue[4], thus , obesity and its associated disorder are growing epidemic across the world[5].

BDNF is known to play an important role in such factors as neuronal outgrowth, differentiation, synaptic connection, and neuronal repair[6].

A higher level in BDNF would be related to better brain health, in that manner, general significant decreased level in BDNF relates to many mental disorders such as depression, Schizophrenia, Huntington disease and Parkinson disease[7]. There was finding that certain types of physical exercise have been increased

(three fold) in BDNF level synthesis in the human brain, which is partly responsible for exercise induced improvements in cognitive function[8].

BDNF has high- affinity binding to its receptor, tropomyosin- related kinase B: (TrkB) as showed by Kubota *et al*[9], to express in various brain regions, including energy homeostasis within the hypothalamus and the hindbrain in adult animals[10].

Based on these data from animal's experiments, it is possible that impairment of BDNF production in the experimental animals causes increased food intake, and weight gain, this is one of hypothesizes pathogenesis role for this neurotrophin in human obesity. This suggests that changes in circulating BDNF in obese are likely secondary to the altered energy balance occurring in obese[11].

For that reason, our study has been debated whether the obesity influence on BDNF hormone level among our population study.

Materials and Methods:

Subjects and Blood collection

The study population included (98) volunteer apparently healthy of ages between (20-50) years. Those subjects were non- smokers, not suffering from any other serious systemic illnesses like diabetes, mellitus, cardiac diseases, renal diseases and hepatic diseases to ensure non-interference with outcome of this study.

Those selected healthy adult men were divided into subgroups according to their body mass index (fat mass) and body fat percentage (fat distribution) and waist circumference (fat abdominal).

Non-fasting blood samples were taken from the subjects enrolled in this study at the morning during 8:30-10:30 o'clock for the period at the beginning of November 2015 till April 2016.

Anthropometric measurements:

Calculation of BMI by dividing weight (in kilograms) by square height (in meters)[12], and the Body fat percentage was calculated by the specific formula[13]:

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

Considerable attention that recommended thresholds of waist circumference in men (102 cm) that correlated with BMI 30 as noted by National Institutes of health in1998(14), owing to that individuals with a waist circumference greater than proposed thresholds generally have worse metabolic profile(15)however the cut- off point values of waist circumference for men (90 cm) associated with BMI of (25kg/m^2) which was applied on our subjects by reason that action level of WC are more opportune with demographic factors with our study population and provided more significant data.

Accordingly, our population were divided into two subgroups according to their waist circumference measurements, one of which includes individuals with a large (WC)≥ 90 cm, the other group included the subjects with a small (WC) < 90 cm.

Determination of serum BDNF concentration

Human BDNF concentration was measured by **E**nzyme **L**inked **I**mmune **S**orbent **A**ssay as mentioned in procedure of Elabscience Biotechnology company kit.

The standard curve of BDNF determination was plotted in figure1 as below:

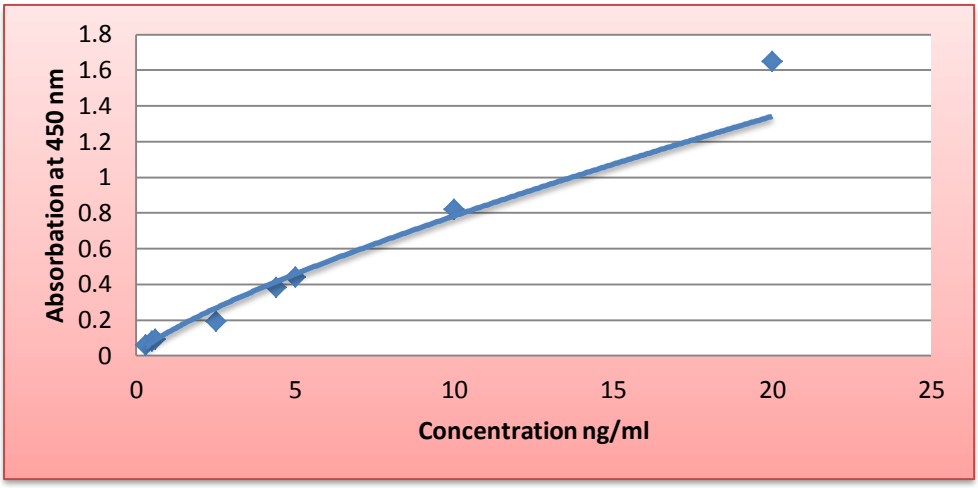

Figure 1: The standard curve of BDNF concentration

Statistical Analysis:

Data analysis were performed on SPSS (version 18.0) software, data are being expressed as mean ± SD, a nova and student's t-test were used to determine any statistical difference among investigated parameters among subjects. The p value <0.05 were considered statistically significant.

Result:

Figure 2 showed that overweight group had higher significant ($p<0.05$) level in serum BDNF hormone (19.6± 8.6 ng/ml) than those in obese and normal weight group (16.6±4.9 ng/ml), (15.2± 6.8 ng/ml) respectively.

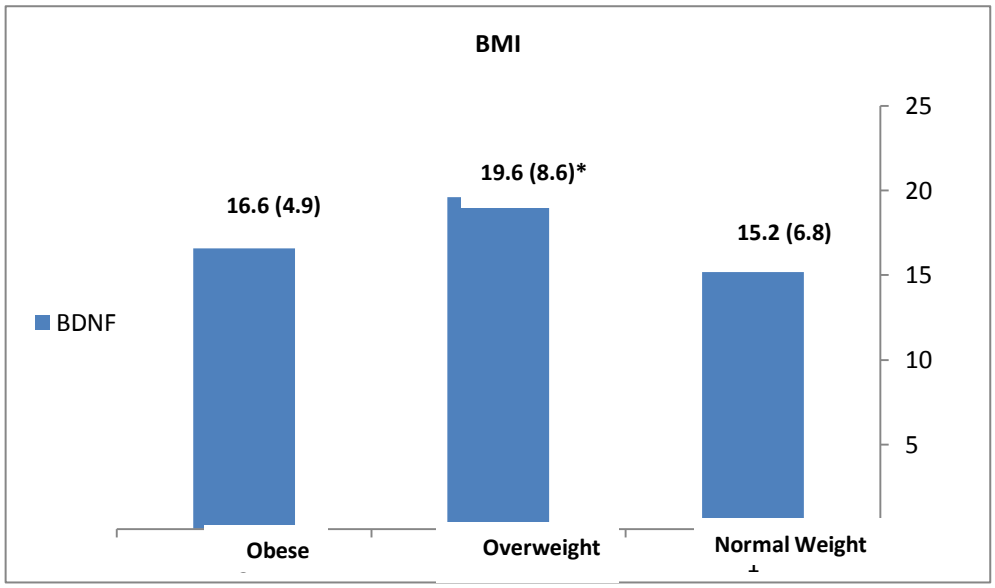

Figure 2: Values of BDNF hormone according to body mass index categories.
*p< 0.05 vs. normal weight group.

Our results exhibited that serum BDNF concentration hormone were non-significant difference between subjects in obese and fitness group (17.8±6.0 ng/ml), (18.0±6.0 ng/ml) respectively, but there was a significant decline ($p<0.05$) of BDNF level in acceptable group (13.4±5.5) versus with fitness individuals as showed in figure 3.

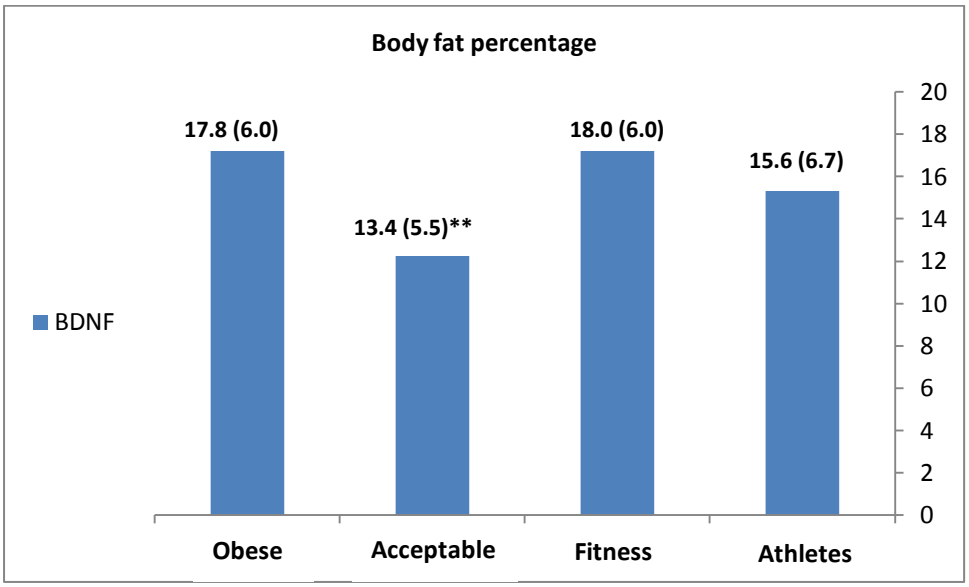

Figure 3: Values of BDNF hormone according to body fat percentage categories.
**** p< 0.05 vs. fitness group.**

There were non-significant differences were seen in the serum BDNF concentration hormone between large (WC) and small (WC) groups as showed in figure 4.

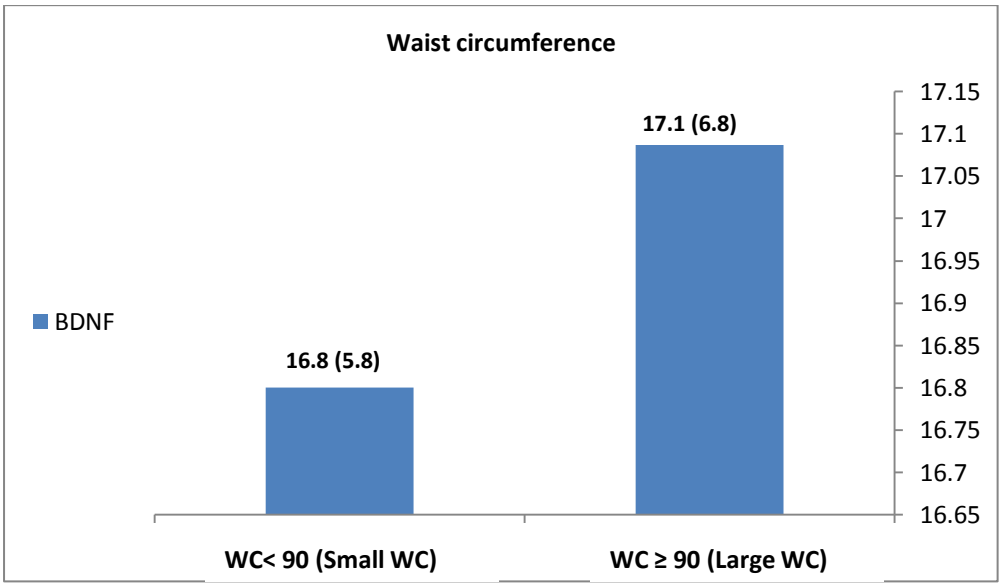

Figure 4: Values of BDNF hormone according to waist circumference categories.

Discussion:

Recent publications become apparent that BDNF is present outside of the CNS and circulates systemically[16,17] and according to studies which depending on animal models have shown that conditions linked to metabolic dysfunction, e.g. obesity can be modified by manipulation of BDNF in the brain and in the peripheral circulation[18].

In view of the above presented, the data of serum BDNF concentration in our study pointed that there was an increase of serum BDNF level in obese subjects compared with leaner group subjects. This is consistent with observation who suggested that BDNF level increase in obesity to compensate for its association pathophysiologic conditions because of its potential role in improving energy metabolism[19]. Other hypothesis

which reported that increase in BDNF level in obesity may represent an adaptive mechanism to counteract the condition of positive energy imbalance by stimulating energy expenditure and decreasing food ingestion[11], so this may explain that BDNF concentration has been influenced by BMI and body fat percentage of subjects in our study. Our observation are agreement with some authors[20-22] whom confirmed that elevated levels of plasma /serum BDNF concentrations may be an early marker of pathological metabolic changes in the body. As regarded with our results about the serum of BDNF concentration which is revealed the non- significant between subjects who have large WC and small WC as showed in figure 4 this may have attributed to that BMI value has been proved to closely related with body fat, while fails to measure abdominal fat as suggested by Camhi *et al*[23]. Other study showed not related between measure of BMI with the WC measure owing to that BMI affected by physical activity but not lead to reduction in waist circumference measurements[24].

As the relationship between BDNF and weight homeostasis in human, has been more difficult[25] so that studies were examined concentration of BDNF don't have reached to conclusive results[26]. Depending on the data from animal experimental which showed that adipose tissue BDNF/TrkB axis has a substantial influence on the feeding behavior and obesity in female mice[27] and found that BDNF and its receptor TrkB expression in adipose tissue changed by diet with high- calorie, and the role of TrkB from adipocytes led to decreased food intake and reduce accumulation of fat in female mice fed a high-calorie diet, thus, inhibition of adipose tissue BDNF/TrkB axis may be decrease obesity.

In humans, other reports on genetic variant have shown an association between the BDNF and TrkB axis and obesity in both adults and children[28]. Moreover, as noted by Kernie *et al*[29] who reported that BDNF and its receptor TrkB observed in various hypothalamus nuclei associated with early behavior and obesity, suggested that serum BDNF level reflects the eating behavior and obese condition of human.

Other literatures pointed that the sedentary behavior that causes high levels of fat mass may inhibit release of BDNF in morbid obese, but our subjects in the present study are not have the same response, owing to they were not affected by morbid obesity.

Conclusion:

Despite the concentration of BDNF was significantly increase in obese groups but these level of BDNF hormone was not reveal dramatically shift in obese groups as compared with leaner group this likely that our population were not affected with morbid obesity.

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