ORIGINAL ARTICLE

Correlation of Serum Leptin levels with Body Mass Index and Gender

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Abstract

***Background**: With recent discovery that adipocyte derived hormone Leptin regulating the apetite and energy expenditure in the body has made researchers interested in finding out the relationship of serum Leptin levels in comparison with BMI and Gender. Our objective was to evaluate the correlation between Serum Leptin levels and Body Masss Index [BMI] and gender.* ***Methods:** This cross sectional study was carried out at Govt Medical College Aurangabad, India. Serum leptin levels of 40 males and 40 females were measured. Their Height, Weight were measured according to standard protocol and BMI was then calculated for each individual.* ***Results**: The Average BMI in males was 25.17 ± 2.87 and Average S. Leptin levels were 10.19 ± 3.18 and Average BMI in females was 25.31 ± 2.92 and Average S. Leptin levels were 19 ± 0.67. The values of S. Leptin levels were found to be higher in females and the calculated p value was significant. There was significant strong correlation between serum leptin levels and BMI in both males and females.* ***Conclusions**: Serum Leptin levels were found to be more in females as compared to males. The serum Leptin levels were strongly positively correlated with BMI in both males and females.*

***Keywords**: Serum Leptin, Gender, Body Mass Index [BMI]*

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Introduction

Obesity has now reached epidemic proportions throughout the world including India. Obesity is now affecting 5% of population. [1] Obese patients are more prone to develop diseases such as type II diabetes, hyperlipidemia, cholelithiasis, arteriosclerosis, cardio-vascular and cerebro-vascular diseases, certain type of cancer and osteoarthritis. Obesity is associated with an increased risk of morbidity and mortality as well as reduced life expectancy. Leptin is an adiposite derived protein hormone (Greek Leptos meaning thin) it plays a key role in regulating balance between energy intake and energy expenditure including regulating appetite and metabolism. [2] It is released in blood in proportion to size of adipose tissue and relays a satiety signal to hypothalamus. [3] Leptin binds to its receptors in ventromedial nucleus of hypothalamus, known as the appetite center and influences expression of several neuropeptides that are responsible for energy intake and energy expenditure thereby decreasing body weight. Leptin receptors belong to the cytokine class I receptor family [4] and are found ubiquitously in the body, [5] indicating a general role of leptin. Genetically obese mice have mutations for ob gene resulting in lower levels of leptin. It has been found that obese persons have hyperleptinemia proportionate to body fat and they are generally leptin resistant. [6] The significant relationship between Serum Leptin concentration and the percentage of body fat suggests that adipocytes signal to the brain about the size of adipose tissue deposits and this result in decreased appetite and increased energy expenditure which together would induce weight loss. [7, 8] Adipose tissues of females are generally known to significantly

secrete higher amounts of leptin then compared to males. With this background we tried to investigate the effect of Body Mass Index and Gender on the leptin levels from the blood samples of Indian men and women in Aurangabad region in India.

Materials & Methods

This cross sectional study was done in Govt Medical College Aurangabad, India. A total of 40 males and 40 females were included in the study. The patients were selected from visitors of Gen Medicine OPD in the hospital. All patients were in the age group of 18-40 years and patients taking systemic drugs including lipid lowering agents, smoking, alcohol users, hyperlipdemia, endocrinal disorders and pregnant females were excluded from the study. A written consent was obtained from the participants after explaining the whole procedure in the local language. ICMR's Ethical guidelines for biomedical research on human subjects (2000) were followed. Institutional Ethical committee permission was obtained. A detailed history was also taken. For BMI or Quetelet index, Height was measured in centimeters on wall mounted stadiometer and weight (Kg) was determined using a weighing scale with 100gm as minimum measuring unit. The BMI is calculated as the weight in kilograms divided by the square of height in meters. In the present study the cut off level for BMI was taken as 25. Individuals with BMI $\leq$ 25 were considered normal controls and persons with BMI $\geq$ 25 were overweight and BMI $\geq$ 30 were obese. Overnight Fasting blood samples were obtained in morning between 8:00 AM to 9:00 AM. Blood samples were poured in sterile tubes and were allowed to clot at room temperature. The serum for leptin was separated 20 minutes after collection by centrifugation at the speed of 3000G for 10 minutes. The quantitative determination of serum leptin was done by Enzyme Linked Immunosorbent Assay (ELISA) using commercially available reagent kit DRG Leptin (Sandwich) EIA-2395 RUO Germany. Statistical analyses were performed using SPSS 15. Leptin levels between male and female group were compared by t- test and a p value of < 0.05 was considered significant. For correlation between serum leptin and BMI r-values were determined by Pearson's correlation test.

Results

The values of males were taken with a cut off of BMI 25 those with BMI greater than 25 were considered over weight and obese and less then BMI 25 acted as controls. The max value obtained of serum leptin levels ng/ml of BMI $<$ 25 group was 15.9 and Minimum values were 7.98. The calculated p values using students t test shows values were < 0.05 which was considered significant Table 1.

The table 2 shows the values of parameters recorded for females with BMI < 25 and BMI $>$ 25 groups. The max values recorded in BMI <25 group was 22.5ng/ml and minimum leptin levels recorded was 22.5. When the values were compared using t test the p values were found to be < 0.005 which was found to be significant.

Table 1: Serum Leptin levels in Males

BMI categories	**Serum Leptin ng/ml (Mean ± SD)**	**p values**
BMI ≤ 25 Kg/m^2	7.18 ± 0.67	< 0.05
BMI ≥ 25 Kg/m^2	12.42 ± 2.39	

Table 2: Serum Leptin levels in Females

BMI categories	**Serum Leptin ng/ml (Mean ± SD)**	**p values**
BMI ≤ 25 Kg/m^2	17.42 ± 2.66	< 0.005
BMI ≥ 25 Kg/m^2	21.03 ± 0.95	

Table 3: comparison of serum leptin values between males and females

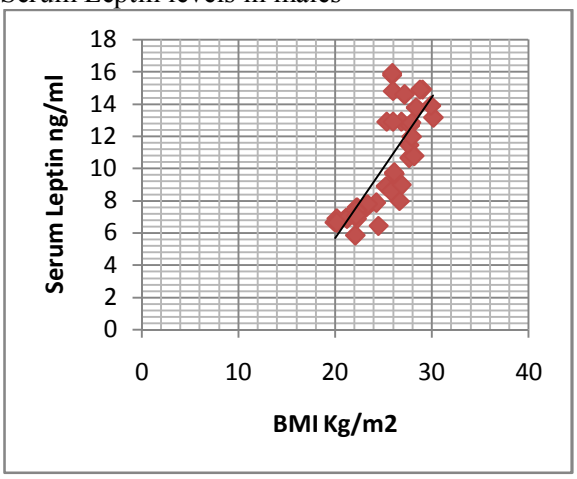
BMI categories	**Males (n =40)**	**Females (n =40)**	**p values**
BMI ≤ 25 Kg/m^2	10.19 ± 3.18	19 ± 0.67	< 0.05

The table 3 shows the values of serum leptin levels recorded between males (n=40) and females (n=40). The mean values of females were 19 ± 0.67 and mean values of males were 10.19 ± 3.18. The calculated p values were less the 0.05 which is significant.

The values of males were taken with a cut off of BMI 25 those with BMI greater than 25 were considered over weight and obese and less then BMI 25 acted as controls. The max value obtained of serum leptin levels ng/ml of BMI < 25 group was 15.9 and Minimum values were 7.98. The calculated p values using students t test shows values were < 0.05 which was considered significant Table 1.

The table 2 shows the values of parameters recorded for females with BMI < 25 and BMI > 25 groups. The max values recorded in BMI <25 group was 22.5ng/ml and minimum leptin levels recorded was 22.5. When the values were compared using t test the p values were found to be < 0.005 which was found to be significant.

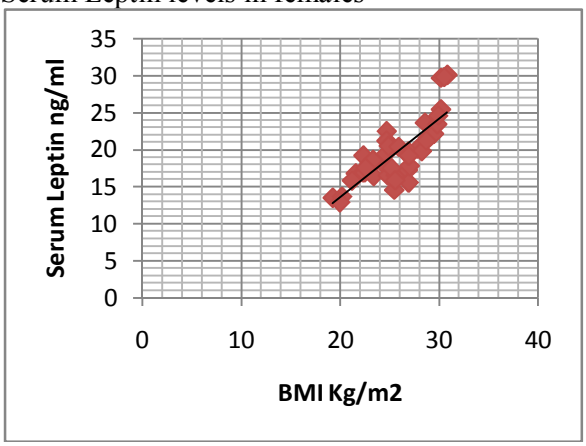
Graph 1: showing correlation of BMI with Serum Leptin levels in males



The Graph I was plotted using values obtained in males the calculated r values using Pearson coefficient correlation 'r' value was found to be + 0.79 which shows a strong positive correlation between BMI and serum leptin levels. The serum leptin levels were found to generally increase with increase in BMI.

The Graph 2 was plotted using all values of parameters obtained from females (n=40) the calculated Pearson coefficient correlation 'r' value was + 0.83 showing strong positive correlation between the BMI and Serum leptin levels.

Graph 2: showing the correlation of BMI with Serum Leptin levels in females



Discussion

In this study we found that there was a strong positive correlation between serum leptin levels and BMI. In general the serum leptin levels recorded on average in females were (19 ± 0.67) and males were (10.19 ± 3.18) the values in females were higher and the p values were found to be significant. It was in agreement with several international studies done in this area which showed that the females generally have more Serum leptin levels as compared to males. [9-12] Probable reasons could be due to the fact that females generally have higher percentage of subcutaneous fat which increases release of leptin and It has also been shown that adipose tissue increases leptin release after the administration of estradiol [13] the second reason may the fact the serum testosterone has suppressive effect on leptin gene expression in case of males. [14] Studies have now shown that gender differences in serum leptin levels do exist even after correction are made for BMI and fat. [15] In a pilot study Mariusz et al. on Serum concentrations of Leptin, Insulin, Adiponectin, resistin and grehlin and their association with obesity indices showed that leptin may be a very important pathogenic factor in patients with severe obesity. [16] A similar study conducted by Masahiro Nishina et al. on Serum Insulin and Leptin and Visceral fat accumulation in obese showed that obesity is strongly associated with Hyperleptinemia and Visceral fat accumulation. [17] It is in agreement with our present study. A study conducted by George Alberti et al. on Serum leptin

concentration and obesity suggested an important role for leptin in human metabolism and obesity. [18]

In an important study conducted by Lee J H et al. on the association of Leptin resistance in extreme obesity and its aggregation in families, suggests that Leptin resistance appears to be common in the extremely obese but rare in normal weight subjects and plasma leptin concentration aggregated in families. [19]

Researchers have shown that majority of obese subjects are hyperleptinemic they have elevated leptin levels due to increase in leptin gene expression by greater number of fat cell mass. They are generally said to be leptin resistant. [20]

The exact mechanism of the leptin resistance is not quite clear, however some studies have shown increasing in circulating leptin levels reduces the Blood Brain Barrier transport for leptin and causes alteration of leptin receptor expression and inhibits the signaling pathways in leptin responsive hypothalamic neurons. [21, 22]

Although the number of individuals in the present study were relatively small which may not necessarily represent the true sample of population, however it was clearly found that the circulating levels of leptin were strongly and positively correlated with BMI. The overall values of serum leptin obtained in the present study may differ with other similar studies done in other areas due to variations in geographical locations, cultural, socio-economic and general life style of the population in the region.

Conclusion

Within the limitation of the present study it was concluded that the serum leptin levels were significantly higher in females as compared to males and serum leptin levels were strongly positively correlated with BMI in both males and females in this group of population.

Conflict of Interest: *None declared*
Source of Support: *Nil*
Ethical Permission: *Obtained*

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