Int J Pharm Bio Sci 2015 April; 6(2): (B) 1096 - 1100

**Research Article** **Biochemistry**

**International Journal of Pharma and Bio Sciences** **ISSN 0975-6299**

# INFLUENCE OF CIGARETTE SMOKING AND LEPTIN LEVELS IN OVERWEIGHTINDIVIDUALS

**K.A. ARUL SENGHOR*, MEERA SHIVASEKAR AND K. RAMACHANDRAN**

*Department of Biochemistry, SRM Medical College Hospital & Research Centre Kattankulathur, Tamil Nadu.*

## ABSTRACT

An increase in Leptin levels is well-known in obese individuals which is the consequence of increased body fat mass. Cigarette smoking is one of the major causes of morbidity and mortality with Respiratory and Cardiovascular disease. Adipocytokines like Leptin have been identified to play an important role in obesity and inflammation. Objective The main objective of this study is to compare serum Leptin levels in overweight smokers and overweight non-smokers. Materials and Methods This is a cross-sectional study carried out in subjects with BMI more than 25.0 to 29.9.Smoking history was investigated. We measured Leptin concentration (DRG Sandwich – ELISA) and blood lipid levels in 30 middle aged male smokers and 30 non-smokers. Waist circumference was measured and body fat % was calculated. Results Mean of serum Leptin showed a statistically significant elevation in the overweight smokers as compared to non-smokers ($p < 0.05$). In overweight smokers, serum Leptin levels were significantly increased with the number of cigarettes smoked per day. And Leptin levels correlated positively with BMI, waist circumference, body fat % in all the subjects. Our study showed a significant strong negative correlation with HDLc and positive correlation with Cardiac Risk Ratio (TC/HDLc) in overweight smokers. Thus, male chronic smokers have a higher leptin levels and justifies the degree of adiposity. Smoking not only triggers immune system but induces a decrease in hypothalamic sensitivity to leptin and thereby increases adipose tissue leptin production. Smoking appears to be one of the direct modulators of leptin metabolism in overweight subjects.

**KEYWORDS: Leptin, Waist circumference, smokers.**

***Corresponding author**

**K.A. ARUL SENGHOR**
**Department of Biochemistry, SRM Medical College Hospital & Research Centre Kattankulathur, Tamil Nadu.**

# INTRODUCTION

Leptin is a 16kDa protein, product of ob gene synthesized by the white adipose tissue. It is an adipose-derived hormone and has central and peripheral actions that regulate the body weight and energy expenditure which is mediated by hypothalamic leptin receptors (1). The levels of circulating leptin reflect the amount of adipose tissue in the body. The biological activities of leptin on target tissues are carried out through selective binding to a specific receptor, Leptin receptor (*LEPR)*. *LEPR* maps in humans to the 1p31 chromosome.Studies have proved that hyperleptinemia contribute to atherogenesis in obese individuals. Leptin-to-arcuate pathway is the best characterized pathway that targets neurons in hypothalamus through leptin receptor and interacts with neuro-endocrine system involved in appetite regulation such as Neuropeptide Y and Agouti-related peptide (2). Smoking is one of the modifiable risk factor. Chronic smokers have a direct impact on distribution of person's body fat and may have an abnormal function in hypothalamus that is related to weight gain and obesity. Studies have demonstrated that cigarette smoking directly elevates circulating plasma leptin concentration (3).Another study had highlighted the association of leptin levels and craving in individuals with alcohol dependence (4). It has been demonstrated that risk of cardiovascular events and abnormal glucose metabolism are associated with cigarette smoking and leptin may be a marker and contributes to CHD risk profile (5). Smoking is one of the important modifiable risk factor for the prevention of CVD as well as diabetic state (6). Evidence on the association between the leptin levels and smoking are discordant. Considering the role of leptin in obesity, it was hypothesized that smoking may also influence leptin levels. This study examines whether leptinconcentration differ between overweight smokers and overweight non-smokers.

# MATERIALS AND METHODS

This was a hospital based cross-sectional study. The subjects were recruited from in and around kattankulathur area.

***Inclusion criteria***

The study included 60 male participants with BMI 25 to 29.9 between the age 30 and 60 years. Out of which 30 were cigarette smokers and 30 subjects were healthy control who are non-smokers. Informed consent was duly taken from each subject under study according to the guidelines of the Institutional Ethical Committee.

***Exclusion criteria***

Subjects with Diabetes, hypertension, cardiac disease, history of alcoholic and any other chronic illness like tuberculosis, malignancy, hepatitis, renal disease were excluded.

***Study design***

All the selected subjects underwent a Master Health checkup with an initial screening evaluation that included a medical history, past history, smoking history, physical examination, ECG, chest x-ray.History of smoking data was collected from the subjects who had smoking habit of more than 10 years of durationand the number of cigarettes smoked per day. Accordingly the subjects were classified as Group 1: n = 12 (less than 5 cigarettes per day), group 2: n = 10 (5 – 10 cigarettes per day) and group 3: n = 8 (more than 10 cigarettes per day). Anthropometric measures including height, weight and waist circumference were taken in the subjects in standing position and without shoes. Body weight was measured in Kilograms. Height was measured in meters. Waist circumference (cm) was measured as the smallest measure around the umbilicus.

***Biochemical Analysis***

A venous blood sample was collected from the antecubital vein of each subject after 12 hours of overnight fasting. Blood Leptin concentration was determined by ELSIA (DRG sandwich – Human Leptin kit) in Bio-Rad ELISA equipment. The detection limit of the leptin assay was 1 ng/ mL. Olympus AU 400 was used to analyze the biochemical parameters. Fasting blood glucose was enzymatically determined by Glucoseoxidase – peroxidase method. Total cholesterol (TC) by cholesterol oxidase and High density

lipoprotein cholesterol (HDLc) by precipitation assay method were measured. Cardiac Risk ratio TC/HDLc was calculated.

### *Calculation and Data analysis*

Body Mass index (BMI) was calculated from body weight in Kilogram divided by height in square meters. Body fat content was calculated (7) using the formula:

Body fat % for men = [(0.567 x WC in cm) + (0.101 x age in years)]- 31.8

### *Statistical Analysis*

Baseline data in smokers and non-smokers were compared using student's t test. Relationship between leptin concentration and other relevant variables were determined with Pearson Correlation coefficient. All data are presented as mean ± Standard Deviation. Statistical significance is denoted by P value less than 0.05.

## RESULTS

About 60 overweight subjects with BMI 25 to 29.9 were studied. Out of which 30 subjects were overweight smokers and age matched 30 subjects were overweight non-smokers. The mean values of the physical and biochemical variables of the subjects are summarized in Table (1). The mean age of the male smokers was 47 ± 8 years who were chronic smokers with duration of more than 10 years. Physical parameters for obesity like weight in Kg and BMI didn't differ much in the smokers from the non-smokers. They were all overweight subjects with BMI ranging from 25 to 29.9. Interestingly waist circumference in cm in smokers was significantly higher than overweight non-smokers. The adipose tissue derived biochemical parameter Leptin levels was significantly higher in smokers as compared to non-smokers. As per (Figure 1), the mean of leptin concentration increased proportionally with the number of cigarettes smoked per day. Furthermore, in smokers Cardiac Risk ratio was higher than in the non-smokers.

### *Correlation results*

Significant positive correlation was seen between Leptin and weight, BMI, TC, TC/HDLc (Table 2). Waist circumference was found to have statistical correlation with Leptin concentration in overweight smokers. But HDLc was found to have negative correlation with Leptin levels in overweight smokers.

**Table 1**

***Physical and Biochemical variables of the Non-smokers and Smokers***

| Variables | Non-smokers N = 30 | Smokers N = 30 | p- value |
|---|---|---|---|
| Weight (Kg) | 76.9 ± 5.8 | 77.73 ± 8.4 | NS** |
| Height (Mts) | 1.65 ± 0.05 | 1.64 ± 0.06 | NS** |
| BMI | 28.27 ± 3.3 | 29.95 ± 3.82 | NS** |
| Waist circumference (cm) | 92.4 ± 9.68 | 98 ± 8.30 | 0.02 |
| Body fat % | 24.08 ± 6.12 | 36.7 ± 9.34 | 0.01 |
| Total Cholesterol(mg/dL) | 174.57 ± 23.03 | 189.13 ± 18.39 | 0.01 |
| HDLc (mg/dL) | 46 ± 4.07 | 36.8 ± 1.39 | 0.01 |
| TC/ HDLc | 3.94 ± 0.75 | 5.33 ± 1.39 | 0.02 |
| Leptin ng/ ml | 4.02 ± 2.1 | 7.83 ± 6.4 | 0.004*** |

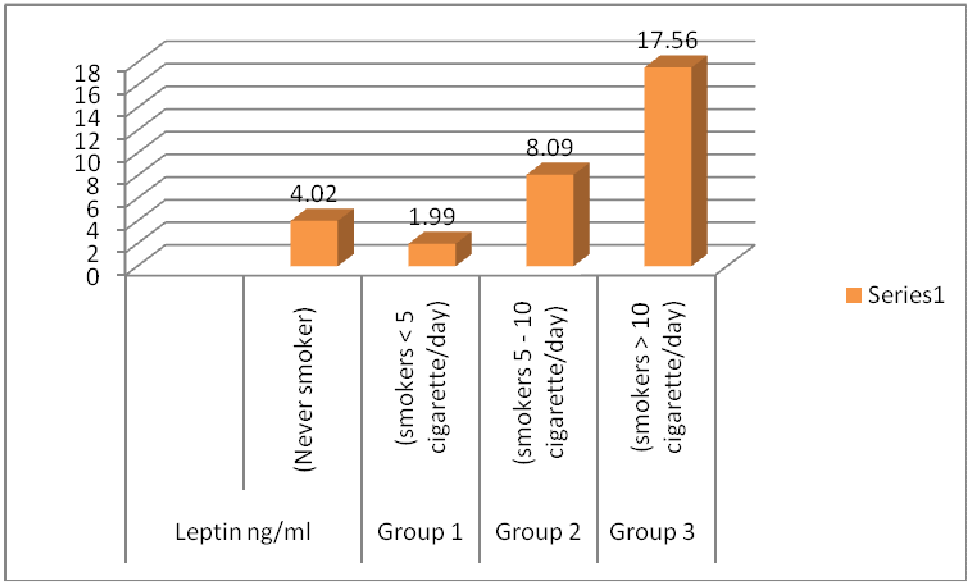
***Values are expressed in Mean ± Standard Deviation***
***P value < 0.05 is considered significant.***
***** NS- Not significant***
******Highly significant***

**Table 2**
***Correlation values of Leptin with other variables of Overweight Smokers***

| Variables | Correlation values | Correlation |
|---|---|---|
| Weight | 0.50 | '+' |
| Waist circumference | 0.34 | '+' |
| BMI | 0.70 | '+' |
| Total cholesterol | 0.8 | '+' |
| HDLc | - 0.66 | '-' |
| TC/ HDLc | 0.73 | '+' |

| Correlation | Negative | Positive |
|---|---|---|
| Small | -0.03 to -0.1 | 0.1 to 0.3 |
| Medium | -0.5 to -0.3 | 0.3 to 0.5 |
| Strong | -1.0 to -0.5 | 0.5 to 1.0 |

**Figure 1**
***Comparison of Mean Leptin levels with number of cigarettes per day***




## DISCUSSION

Obesity and overweight is a major contributor of several chronic diseases like Type 2 Diabetes, Cardiovascular disease and Hypertension. Moreover overweight human population has reached epidemic proportions in Asian Indian subjects. It is well known that tobacco smoke is harmful to health which has the principal component nicotine; the contributor for complications of chronic diseases. Leptin is considered as multi-function adipocytokine and many studies have reported low levels of leptin in smokers. we see many chronic smokers who are obese or overweight. So our work was intended to study leptin levels in overweight smokers and overweight non-smokers. The data presented in the results showed that Body Mass index is a measure of weight rather than a measure of body fat. Waist circumference in overweight smokers characterizes with visceral fat and indirectly measured central obesity. Moreover, secretory factors like adipocytokines released from adipose tissue cause abnormal metabolic changes and favors inflammatory conditions (8). The increased risk of medical illness is augmented with high waist circumference in Asian Indians (9). A possible explanation of higher leptin levels in overweight smokers could be nicotine induced leptin production or reduced renal leptin clearance and another possibility is that disruption of hypothalamic sensitivity to leptin. It is also possible that overweight smokers tend to develop greater leptin resistance. This is supported by a study study where the circulating levels of leptin are associated with increased craving to smoke in abstinent smokers and also contributes to post-cessation changes in appetite and weight

(10). Elevated leptin concentration may contribute to the risk of cardiovascular disease by causing alteration in lipid metabolism (11). This study confirms the relation of leptin to waist circumference in overweight smokers which has been proposed to have a link with the biomarkers of CHD (12).

## CONCLUSION

The findings of this study suggest that cigarette smoking increases leptin concentration in overweight subjects. Significant correlation of leptin to selected anthropometric measurements of obesity is confirmed and justifies the cardiovascular risk in overweight smokers. Future studies are needed to determine leptin resistance in chronic smokers.

## ACKNOWLEDGEMENT

The authors thank Ms. Uma for her contribution in our work.

## REFERENCES

1. Van Gaal LF, Wauters MA, Mertens IL, Considine RU, De Leeuw IH. Clinical endocrinology of human leptin. Int J Obes Rel Metab Disorder, 23(1): 29-36, (1999).
2. Cone RD. Anatomy and regulation of the central melanocortin system. Nat Neurosci, 8: 571 – 578, (2005).
3. Li MD, Parker SL, Kane JK. Regulation of feeding-associated peptides and receptors by nicotine. Mol Neurobiol, 22(1-3): 143-165, (2000).
4. Hillemacher T, Bleich S, Frieling H, Kraus T, Ramskogler K, Lesch O, et al. Evidence of an association of leptin serum levels and craving in alcohol dependence. Psychoneuroendocrinology, 32: 87– 90, (2007).
5. Al-Daghri N, Al-Rubean K, Bartlett WA, Al-Attas O, Jones AF, Kumar S. Serum leptin is elevated in Saudi Arabian patients with metabolic syndrome and coronary artery disease. Diabet Med, 20(10): 832-837, (2003).
6. C G Foy, R A Bell, D F Farmer, D C Goff Jr, L E Wagenknecht. Smoking and incidence of diabetes among US adults: finding from Insulin Resistance Atherosclerosis Study. Diabetes Care, 28: 2501 – 07, (2005).
7. Lean MEG, Han TS, Decuenberg P. Predicting body composition by densitometry from simple anthropometric measurements. Am J Clin Nutr, 63: 4 – 14, (1996).
8. Susmita Bag and Anand Anbarasu. Obesity : a critical Review. International Journal of Pharma and Bioscience, 2(4): 583-592, (2011).
9. Mohan V, Deepa R. Obesity and abdominal obesity in Asian Indians. Indian J Med Res, 123(5): 593-6, (2006).
10. Mustafa al'Absi, Stephanie Hooker, Koji Fujiware et al. circulating levels are associated with increased craving to smoke in abstinent smokers. Pharmacology, Biochemistry and Behaviour, 97: 509-513, (2011).
11. Kwang Kon Koh, Sang Min Park, Michael J. Quon. Leptin and Cardiovascular Disease. Circulation, 117(25): 3238-3249, (2008).
12. Lofgren I, Heron K, Zern T, West K, Patalay M, Shachter NS, Koo SI, Fernandez ML. Waist circumference is a better predictor than body mass index of coronary heart disease risk in overweight premenopausal women. J Nutr, 134(5): 1071-1076, (2004).