

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Correlation of Leptin with BMI, Lipid Profile and Waist, Hip Ratio in Adolescent Girls – A Pilot Study.

VS Kalai Selvi<sup>1\*</sup>, K Prabhu<sup>2</sup>, Kumaran<sup>3</sup>, PR Devaki<sup>4</sup>, Manjula Devi<sup>1</sup>, and J Rathi Roopavathi<sup>1</sup>.

<sup>1</sup>Department of Biochemistry, Sree Balaji Medical College and Hospital, Bharath University, Chrompet, Chennai 44, Tamil Nadu, India.

<sup>2</sup>Department of Anatomy, Sree Balaji Medical College and Hospital, Bharath University, Chrompet, Chennai 44, Tamil Nadu, India.

<sup>3</sup>III MBBS Student, Sree Balaji Medical College and Hospital, Bharath University, Chrompet, Chennai 44, Tamil Nadu, India.

<sup>4</sup>Department of Physiology, Sree Balaji Medical College and Hospital, Bharath University, Chrompet, Chennai 44, Tamil Nadu, India.

### ABSTRACT

The present study aimed to establish the relationship between serum leptin concentration with Lipid profile, BMI, Waist and hip circumference among a sample of 75 adolescent girls of Chennai in southern part of India. Body weight, height, waist, hip circumference and its ratio and BMI were measured and calculated. Fasting blood samples were obtained to determine serum lipid profile and leptin. The results reveal that serum leptin had strong relation with weight, total cholesterol, waist and hip circumference and weak relation with triglycerides, HDL. A reference range for leptin in adolescent girls was observed in this study and compared with the same in different areas. It was observed that leptin level seem almost similar in all the regions.

**Keywords:** Leptin, BMI, Lipid profile, waist, hip.

*\*Corresponding author*

## INTRODUCTION

Leptin is a protein, produced by the adipose tissue consisting of 167 amino acids encoded by ob gene and is located on chromosome 7 in humans [1]. It is also secreted from the hypothalamus and other peripheral tissues such as brain, stomach, skeletal muscle, placenta and mammary gland. Leptin signals the hypothalamus about the availability of fat and regulates appetite and energy expenditure in both rodents and human. The plasma level of leptin is directly proportional to body fat percentage.

India with a population of more than 100 crores has undergone significant economic and cultural changes over the past two decades. Changes in lifestyle reflect their dietary pattern and physical activity. In India the prevalence of obesity among females has reached epidemic proportions, indicated in a study conducted from overall population aged 14-70 years. About 13.03% of males and 20-26% of females are obese. This value is higher than that reported in United Kingdom, Australia, America and Italian population. It is well established that obesity is associated with various diseases like cardio-vascular disease, hypertension, diabetes, osteoarthritis and diseases of the liver and gall bladder especially in females.

With this background, the purpose of the study was to evaluate the relationship of leptin with BMI, waist hip ratio in a sample of adolescent girls and to establish a reference range in our population.

## MATERIALS AND METHODS

Study was conducted in Sree Balaji Medical College and Hospital. Eighty adolescent girls of similar age (18-21 yrs) were recruited in this study. Institutional ethical committee clearance was obtained. Informed consent was obtained from all the participants. Height and weight were measured and BMI calculated. Waist circumference was measured above the level of umbilicus and hip circumference was measured at the broadest point of pelvic girdle and their ratio was calculated. 4 ml of venous blood was collected from them after an overnight fast. Samples were centrifuged within 30 minutes after venepuncture. Serum was separated and divided into 2 aliquots. One was used for lipid profile analysis like total cholesterol, triglycerides and HDL, LDL and VLDL using colorimetric method. The other one was stored at - 20<sup>o</sup> C, for the assay for Leptin. It was analysed using leptin Elisa LDN kit. The principle of the assay was a typical two step capture or sandwich type assay, using two specific monoclonal antibodies.

## RESULTS

Results were analysed using SSPS. The mean age of our study subjects was 19.59yrs with SD 1.65. Mean BMI was 20.66 with SD 3.25. Total cholesterol was 141.55 mg/dl with SD 17.37. Mean TGL was 125 mg/dl with SD 19.506. Mean HDL was 51.38 with SD 20. The mean waist and hip circumference were 68.24±9.3cm and 79.83±10.6 respectively. The mean waist hip ratio was 0.8586. The Mean value of leptin in our study was 15.99ng/ml with SD of 7.029. correlation analysis using SPSS shows that the leptin had strong positive relation with weight (r=0.979, P value- 0.001) and total cholesterol (r=0.997, p=0.001) Leptin was weakly correlated with TGL (r = -0.823,p=0.43) HDL(r=0.871,p=0.027),waist circumference(r=0.701,p=0.075), hip circumference(r=0.853,p=0.036) and waist hip ratio(r=0.826,p=0.037).

**Tables 1: Showing mean and its standard deviation of leptin and other parameters.**

AGE(yrs)	19.59 ± 1.61
HEIGHT(cm)	156.38 ± 5.46
WEIGHT(kg)	50.48 ± 8.25
BMI	20.66±3.25
T.CHOLESTEROL(mg/dl)	141.55 ± 17.13
TRIGLYCERIDES (mg/dl)	125±19.5
HDL(mg/dl)	51.38 ± 20.5
LDL(mg/dl)	70.07 ± 14.9
VLDL (mg/dl)	23.55 ± 3.01
RATIO	2.93 ± 0.38
WAIST CIRCUMFERENCE(cm)	68.24 ± 9.3
HIP CIRCUMFERENCE(cm)	79.83 ± 10.6
WAIST / HIP RATIO	0.8586
LEPTIN(ng/ml)	15.99 ± 7.02

**Table 2: Showing correlation between Leptin, weight, Lipid profile, waist and hip circumference.**

	WEIGHT	CHOLESTEROL	HDL	WAIST CIRCUMFERENCE	HIP CIRCUMFERENCE	RATIO
LEPTIN	0.979	0.997	0.871	0.701	0.853	0.826
	0.001	0.001	0.027	0.075	0.036	0.043
	80	80	80	80	80	80

**DISCUSSION**

The association of leptin with weight, BMI, waist circumference, hip circumference, total cholesterol, HDL, triglycerides, was established in this study. A reference range for leptin in our study was obtained and compared with the reference range of the same noticed in different areas.

Leptin is a product of ob gene, is a circulating 16 KD polypeptide, influences energy homeostasis, immune and neuro endocrine function (Al Harithy). Serum level of leptin is directly proportional to percentage of body fat. The analysis of the association between leptin with weight, BMI, lipid profile and waist hip ratio showed statistically significant relation. Our finding was also consistent with other workers [2, 3, and 4]. Poor penetration of blood brain barrier by leptin, presence of less active molecular form, diminished response in leptin receptor signalling, increase the fat of white adipose tissue in various sites. Leptin resistance (i.e.) lack of sensitivity to circulating leptin contributes to the etiology of obesity. Stronger the association of leptin with waist and hip circumference shows that it correlated with overall adiposity rather than specific fat and concluded that body fat may also be important determinant of leptin concentration [5]. Nowadays waist and hip circumference are gaining importance as a predisposing risk factor for many systemic diseases like diabetes and hypertension. The strong association between leptin and obesity are noticed in many studies and this study also focussed waist hip ratio as an indicator of adiposity and compared with leptin. The increased consumption of high calorie food, sedentary lifestyle may be suggested for the relation of leptin with lipid profile. In the past two decade there has been a significant increase in the prevalence of obesity in children and adolescents and women worldwide [6]. Female showed high prevalence for overweight and obesity and waist, hip circumference and its ratio for which following explanations have been proposed [7]. Higher ratio of subcutaneous and omental fat in women reflecting its expression in body fat and leptin acting as a mediator of cell proliferation with respect to presence of leptin receptors resulting in the increased level of leptin in women. The correlation between leptin levels and cardiovascular risk factors was investigated in children of various stages and revealed that higher blood concentration of leptin correlated positively with higher lipid level [8, 9]. Few studies in Thai adults have shown higher leptin concentration in the overweight, when compared with normal weight subjects, a positive association was found between leptin level, BMI and waist circumference [10].

In our study subjects the mean value of leptin ranges from 8-22 ng/ml. The mean value of leptin concentration in adolescent girls of Chennai was equivalent to the values noted in North India. When we compare our leptin value with other countries it range from 4-27ng/ml in Non Hispanic white , 4-33ng/ml in non Hispanic Black,4-27ng/ml in Mexican American[11]. In Iran it was 14-18ng/ml [12]. Serum leptin noticed in normal weight Thai girls was found to be 4-8 ng/ml [13].Serum leptin in German adolescent girls is 6-18ng/ml. However small differences in leptin level was observed world wide with serum leptin concentration was higher in Non Hispanic black women. It is uncertain whether any physiologic concepts can be ascribed to small differences in leptin level across ethic regions, particularly when measures of body fat are imprecise. The prevalence of obesity and weight varies among ethic groups, and the present study was limited by the inability of anthropometric measures such as skin fold thickness and body circumferences. Our finding suggests that ethnicity is of limited importance in determining serum leptin concentrations.

**CONCLUSION**

A reference range for leptin level in adolescent girls of Chennai was observed in this study. When compared with the reference range of the same in different areas, it was observed that the differences in values are not of much significance. Association of serum leptin with weight, BMI waist circumference, hip circumference and lipid profile was well established in this study.

## REFERENCES

- [1] Zhang Y, Proenca R, Maffei M, Barone M, Leopold L, Friedman JM. *Nature* 1994; 372(6505): 425 – 32.
- [2] Al-Harithy RN, Al-Doghaither H, Abualnaja K. *Ann Saudi Med* 2006; 26(2): 110 – 5.
- [3] Schubring C, Prohaska F, Prohaska A, Englaro P, Blum W, Siebler T, et al. *Eur J Obstet Gynecol Reprod Biol* 1999; 86(2): 151 – 7.
- [4] Maruyama S, Minami S, Kaseki H, Ishihara K, Araki S, Suzue R. *J Nutr Sci Viataminol (Tokyo)* 2001; 47(1): 87 – 9.
- [5] Haffner SM, Gingerich RL, Miettinen H, Stern MP. *Int J Obes Relat Metab Disord* 1996; 20: 904 - 8.
- [6] Woolcock AJ, Peat J. *Am J Respir Crit Care Med* 2000; 161: S215-7.
- [7] Salem MA, EL Samany M, Monier E, Tabh F, Zaki M, Farid S. *Egypt J Pediatr* 2002; 19(3): 397 – 416.
- [8] Wu D-M Shen M-H, Chu N-F. *Eur J Epidemiol* 2001; 17: 911 – 6.
- [9] Dubey S Kabra M, Bajpai a et al. *Indian Pediatr* 2007; 44: 257 – 62.
- [10] Tungtrongchitr R, Pongpaew P, Phonrat B, et al. *Southeast Asian J Trop Med Public Health* 2000; 31: 787 -94.
- [11] Ruhl EC, Everhart EJ. *Am J Clin Nutr* 2001 ;74: 295-301.
- [12] Nahid Einollahi, Nasrin dashti Fariba Nabatchian. *Acta amedica Iranica* 2009 48;5:300-304.
- [13] Uruwan Yamborisut, Napaporn Riabroy, Benjaluck Phorat, Runsunng Tungtrongchitr. *Southeast Asian J Trop Med Public Health* 2013 40;3:544-552.