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Research Article

**THE RELATIONSHIP OF SERUM LEPTIN LEVELS WITH  
BLOOD GLUCOSE FASTING IN POLYCYSTIC OVARIAN  
SYNDROME OF VIRGIN FEMALES****Dr. Maria Aslam<sup>1</sup>, Dr. Anam Aslam<sup>2</sup>, Dr. Zainab Afzal<sup>3</sup>**<sup>1</sup>Allama Iqbal Medical College, Lahore, <sup>2</sup>WMO at BHU Idlana, Tehsil Bhowana, District Chiniot, <sup>3</sup>MBBS from AJ&K Medical College, Muzaffarabad.**Article Received:** November 2020 **Accepted:** December 2020 **Published:** January 2021**Abstract:**

**Objective:** The aim of our study was to find out the relationship of serum leptin levels with blood glucose fasting, LH, BMI and FSH in polycystic ovarian syndrome of virgin females.

**Study Design:** A cross-sectional study.

**Place and Duration:** The study was conducted at Gynae and Obs department, General Hospital Lahore for the duration of one year starting from November, 2019 to September, 2020.

**Methodology:** In our present study we collected samples of 77 young virgin females age range from 15 to 30 years. All samples were scrutinized for luteinizing hormone (LH), blood glucose fasting (BGF), serum leptin level and follicle stimulating hormone (FSH). We use Rotterdam Criteria to divide patients in 04 groups. For the measurement of serum leptin assay we use Sandwich- ELISA method. We use a pre-designed questionnaire to gather data from patients. SPSS v.20 was used for the analysis of data.

**Results:** In our present study we collected samples of 77 young virgin females, out of these 77 samples 14 cases were non- PCOS while 63 cases were PCOS. These patients were divided into 04 sub-groups according to BMI, 14 patients (18.18%) were in lean (non-PCOS) group, 15 patients (19.48%) were in lean (PCOS) group, 30 patients (38.96%) were in overweight (PCOS) group and 18 patients (23.37%) were in obese (PCOS) group respectively.

**Conclusion:** According to our study we conclude that serum leptin was having positive relationship with blood glucose fasting and BMI in PCOS females. Yet, we couldn't find any relationship of serum leptin with LH and FSH in PCOS females. In PCOS females the reason for increasing of BSF and BMI is hyperleptinemia.

**Key Words:** Body Mass Index, Serum Leptin, Polycystic Ovarian Syndrome, Blood Sugar Fasting

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**INTRODUCTION:**

Polycystic Ovarian Syndrome (PCOS) is an endocrine disorder which has become cosmopolitan in nature. It is taking its toll in both clinical and public health sectors [1]. PCOS affects 1 in 15 women worldwide [2]. 510% of females are affected in reproductive age [3]. Prevalence of PCOS is 9.13% amongst South Asian PCOS was first identified around 20th century by two Chicago Gynecologists - Dr. Irving Stein and Michael Leventhal [4]. Stein and Leventhal had found an association of polycystic ovaries with amenorrhea. It turned out to be a landmark study for the reproductive world [5]. PCOS affects individuals in multiple ways including reproductive repercussions (subfertility, hyperandrogenism and hirsutisms), metabolic derangements (raised insulin, DM and CVD) and psychological health issues (anxiety, depression and deteriorated quality of life) [6]. Leptin is a Greek word stemming from leptos. Leptos means thin. It is a satiety hormone. It is secreted by fat cells and inhibits hunger to regulate energy balance. Leptin consists of 167 amino acid peptide that is secreted in a pulsatile manner. The key role of leptin is monitoring energy homeostasis. This is accomplished by impacting on feeding behavior and energy expenditure [7].

Leptin receptors (LepRs) are expressed in two different neurons in arcuate nucleus of hypothalamus. These either repress or arouse feeding. The mutual orchestrated functioning of both kind of neurons help regulate energy balance. Both types are sensitive to leptin and insulin as they have LepRs [8]. Leptin plays an important role in homeostasis by participating in reproductive axis with excitatory effects at hypothalamus and suppressive actions at ovaries [9]. Our study was planned to estimate the serum leptin level in PCOS among young unmarried females reporting at our hospital. The study was conducted on young girls to find if an early detection of PCOS along with certain parameters can help in alleviation of symptoms. The gap in study is still the controversial relation between leptin and other parameters. The study aims to determine the correlation of serum leptin levels with serum FSH, LH, Blood Glucose fasting and BMI in young females with Polycystic Ovarian Syndrome.

**METHODOLOGY:**

This descriptive cross-sectional study was conducted at Gynae and Obs department, General Hospital Lahore for the duration of one year starting from November, 2019 to September, 2020. The target population was all unmarried women who were between 15-30 years of age. We collected responses of

77 cases based on consecutive sampling. Women with adrenal or hypothalamic aberrations, Cushing's syndrome, subgroup III of 30 subjects with overweight and subgroup IV of 18 subjects with obese. Hypo- or hyperthyroidism, hyperprolactinemia was excluded from the study. Those patients were also excluded from our population who were on a prescription affecting their hormones for at least 3 months prior to study. The females taking any drugs (oral contraceptive pills, insulin sensitizers, steroids, androgenic drug use) or suffering from any medical diseases (diabetes mellitus, thyroid dysfunction, congenital adrenal hyperplasia, Cushing's syndrome) were sidelined from research. Written consent from patients was taken individually. These subgroups were divided by BMI categories. BMI was calculated by dividing weight by height in square meter ( $\text{kg}/\text{m}^2$ ).

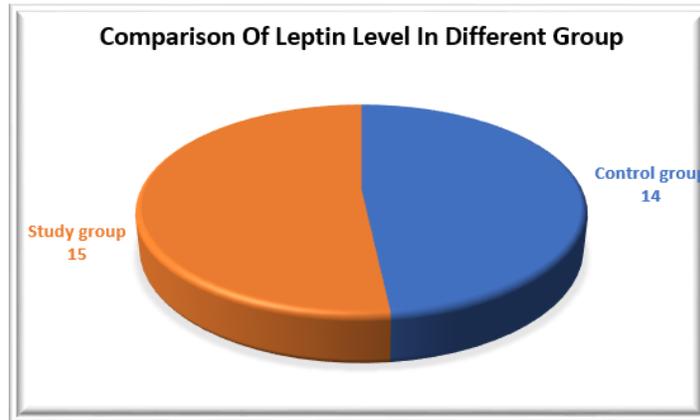
Classification of PCOs and non-PCOs is according to World Health Organization. PCOS comprise of two of three features: 1) oligo- and/or anovulation, 2) clinical and/or biochemical signs of hyperandrogenism, and 3) polycystic ovaries on ultrasonography. This classification is according to World Health Organization [10]. These criteria include exclusion of androgen excess or related disorders before diagnosing it as PCOS [11]. After an overnight fast, blood samples were taken to be centrifuged at 25,000 revolutions per second for 8 minutes for sera separation which were stored at 20°C for further analysis at Biochemistry Research Laboratory IIMC. All samples were examined for blood glucose fasting (BGF), luteinizing hormone (LH), follicle stimulating hormone (FSH) and serum leptin level. Statistical analysis was done in SPSS version 20. We used Kolmogorov Smirnov test to test the normality of quantitative variables, Mann Whitney U test for comparison of leptin level in PCOs and non-PCOs. Kruskal Wallis test for comparing leptin levels against 3 BMI groups in PCOs. Spearman rho correlation was used to determine correlation between leptin and BGF. P value <0.05 will be considered as significant.

**RESULTS:**

In our present study we collected samples of 77 young virgin females, out of these 77 samples, 63 were diagnosed cases of PCOS and remaining 14 were non-PCOS. The subjects were divided into two groups namely control and study group. Control group (group I) without PCOS comprised of 14 subjects with lean weight. Study group (group II) with PCOS comprised of 15 subjects with lean weight. There was no significant difference in average leptin level between control group (non-PCOS) and study group (PCOS) with p value 0.331 by Mann-Whitney U test.

**Table No 01: Comparison of Leptin Level in Study and Control Group with Normal Weight**

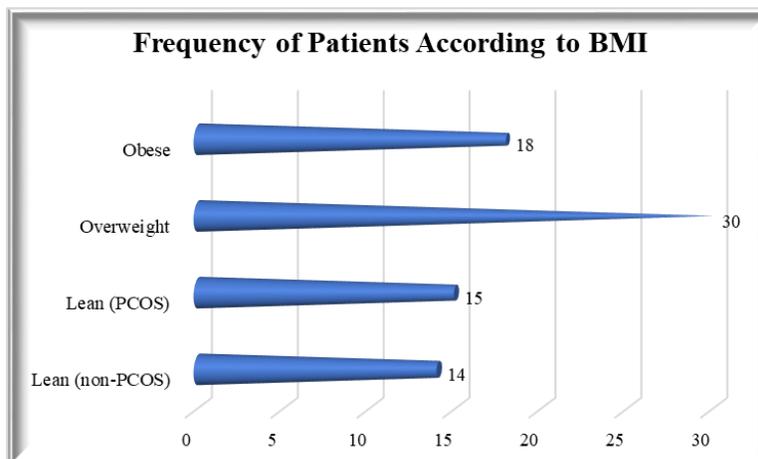
Groups	Qty	Mean $\pm$ SD	P-value
Control group	14	3263.46 $\pm$ 1461.83	0.331
Study group	15	3637.97 $\pm$ 1259.18	



Out of these 77 samples 14 cases were non- PCOS while 63 cases were PCOS. These patients were divided into four sub-groups according to BMI, 14 patients (18.18%) were in lean (non-PCOS) group, 15 patients (19.48%) were in lean (PCOS) group, 30 patients (38.96%) were in overweight (PCOS) group and 18 patients (23.37%) were in obese (PCOS) group respectively.

**Table No 02: Frequency of Patients According to BMI**

Subgroup	Qty	%age
Lean (non-PCOS)	14	18.18%
Lean (PCOS)	15	19.48%
Overweight	30	38.96%
Obese	18	23.37%



The Kruskal-Wallis test shows that there was significant difference of average leptin level between subgroups II, III and IV with p value 0.015. The average leptin level changed in different BMI categories. Here we applied Kruskal-Wallis (Non-Parametric ANOVA) test to test the hypothesis that “average leptin level of different BMI categories is equal” against the alternative that it is not. The P value 0.015 shows that average leptin level is different in different BMI categories. The difference in mean leptin levels in lean, overweight and obese patients was highly significant. Thus, in PCOs, leptin level is significantly changed in different BMI groups. There is considerable elevation in leptin levels in the PCOS women as compared to controls.

**Table No 03: Serum Leptin Levels in Different BMI Categories of PCOS Women**

Study Group	Mean $\pm$ SD	P-value
Lean Weight	3263.46 $\pm$ 1461.83	0.015
Overweight	4603.37 $\pm$ 1223.73	
Obese	4261.05 $\pm$ 1504.13	

Spearman rho correlation was calculated between Leptin, FSH, LH and BSF. Leptin level significantly correlated with BSF with high correlation coefficient 0.488. There was no significant correlation between leptin and follicle stimulating hormone as well as luteinizing hormone.

**Table No 04: Correlation of Leptin and other Variables in PCOS Group**

Correlation with Leptin	Follicle Stimulating Hormone	Luteinizing Hormone	Blood Sugar Fasting
Correlation Coefficient	-0.113	-0.053	0.488
P-Value	0.327	0.65	0.00

### DISCUSSION:

In the current study, the possible relation between leptin, BMI, BSF, FSH and LH in females with PCOS is investigated. Our findings suggest that PCOS women show a considerable elevation in leptin levels as compared to controls. Also, that leptin is significantly correlated with BMI and blood sugar fasting. There is no correlation between FSH and LH. Our study highlights that increased BMI is associated with increased leptin levels. These findings are similar to those observed by Baig et al. in which serum leptin is considerably correlated with BMI [6]. Chakrabarti confirmed that positive relation exists between serum leptin and BMI [12]. Serum leptin concentration was found to be related with BMI by a study conducted by Erturk [13]. Leptin levels were found significantly raised in patients with PCOS than in controls in study underwent by Zheng [14].

The major action of leptin on nutrition is visible through the hypothalamic-pituitary gonadal axis. (Christian et al.,2018) [15]. In our study, serum leptin level is significantly related with BMI in PCOS women. This result is corroborated with other studies

as given above. This finding is expected as greater the fat depots, increased the BMI and more fat would lead to higher secretion of leptin. Leptin has been shown to be raised with increasing BMI in many other studies. Jacobs and Conway reported higher serum leptin levels in women with higher BMIs among PCOS [16]. Shore et al. found hyperleptinemia among adolescent girls with PCOS [17]. Leptin controls reproductive physiology and pathophysiology by two ways. One is by changing perceptibility of adenohypophysis to GnRH and second, by modulating the follicles and corpus luteum in ovaries to form steroid hormones. Hence, serum leptin has definitely a role to play in the pathogenesis of PCOS with raised BMI categories. Thus, leptin is assumed to be a bridge between body's metabolic gauge and axis of reproduction [18].

Leptin shows no correlation with FSH and LH whereas blood sugar fasting has a significant correlation with leptin. Sir-Petermann et al. had conducted a study with no relation found between leptin and LH [19]. Baig et al. narrated same observation for FSH and LH [6]. Studies by Legro and colleagues revealed that women with PCOS had

hyperglycemia. Vast proportion of them had glucose intolerance, a few had impaired glucose tolerance and little number had type II diabetes [20]. Susanne Hahn et al. found that leptin correlated with blood glucose, insulin resistance and other metabolic parameters in PCOS patients. Similarly, same study found no significant correlation with gonadotropins (FSH, LH) [21]. Baig et al. found strong correlation between leptin and BSF [6]. These effects were due to raised blood sugar levels and ensuing insulin resistance. Leptin decreases glucose mediated insulin secretion by leptin receptors in hypothalamus and therefore attenuates its action at level of cells [22].

Leptin plays an important role in PCOS of higher BMI categories. Obesity leads to leptin resistance which opposes insulin action [23]. It is seen that females with PCOS and obesity show greater tendency of being hyperglycemic and hyper insulinemic. The role of leptin in PCOS-related obesity is that it changes the sensitivity and secretion of end organ tissues to insulin [24,25]. Simultaneously, obesity encourages increased levels of insulin like growth factors by way of insulin resistance leading to increased blood sugar [26].

#### CONCLUSION:

According to our study we conclude that serum leptin was having positive relationship with blood glucose fasting and BMI in PCOS females. Yet, we couldn't find any relationship of serum leptin with LH and FSH in PCOS females. In PCOS females the reason for increasing of BSF and BMI is hyperleptinemia.

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