

The Relationship between Leptin Hormone and Central Obesity in the Women Suffers from Polycystic Ovary Syndrome: A Case–Control Study

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Abstract

Background: One of the hallmarks of polycystic ovarian syndrome (PCOS) is central obesity (CO), and conditions brought on by PCOS are likely to worsen when CO is present. The hormone leptin acts as a conduit to transmit metabolic signals from the brain's neural networks to the pituitary-ovarian axis. **Objective:** It is to find the correlation between central adiposity and blood levels of leptin in women with PCOS. **Materials and Methods:** For this study, 150 women were recruited: 75 were control ($n = 75$) and 75 were PCOS ($n = 75$). The body mass index (BMI); waist circumference; hip circumference; waist/hip ratio and level of circulating serum leptin were assessed for each individual. The data analysis was conducted utilizing SPSS software (version 23). **Results:** Leptin hormone, a higher significant in the group of PCOS when compared with the control group ($P > 0.05$). A positive significance correlation was found between the level of leptin with BMI, waist circumference, and hip circumference ($P < 0.05$). Leptin level showed an AUC of 0.93 at a cutoff point of 10 ng/mL, giving a sensitivity (93%) and specificity (96%). **Conclusion:** The positive association between serum leptin and CO with BMI could be the cause of the increased leptin levels in the PCOS women.

Keywords: Body mass index, level of leptin, polycystic ovary syndrome

INTRODUCTION

With a prevalence of 5%–20% worldwide, polycystic ovarian syndrome (PCOS) is a complex condition combining metabolic and endocrine abnormalities.^[1] Women who are fertile may experience a number of symptoms, such as obesity, insulin resistance, hyperandrogenism, and irregular ovulation.^[2,3]

The hormone leptin, which is produced by fat cells, controls glucose homeostasis and encourages a switch from carbohydrate to fat oxidation.^[4] However, a number of endocrine and metabolic disorders can result from aberrant leptin levels. Reduced sensitivity to leptin can lead to the buildup of additional triglycerides in the muscle, liver, pancreas, and adipose tissue, which can compromise insulin production and sensitivity and ultimately lead to central obesity (CO) and insulin resistance.^[5,6]

It has been discovered that the danger of endocrine diseases, including insulin resistance, reduced tolerance of glucose, and other abnormalities of metabolism in PCOS women, is highly correlated with being overweight or obese.^[7-9] It is also critical to stress that one of the main characteristics of PCOS is visceral fat, commonly known as CO, as opposed to subcutaneous fat.^[10] Patients with PCOS may experience both local and systemic oxidative stress due to CO, which suggests that CO exposure may make PCOS-related illnesses worse.^[11] The assessment of central fat distribution, which is linked to numerous disorders apart from body mass index (BMI), is done using measurements

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of anthropometric indicators, like (CO) waist circumference; waist/hip ratio (WHR); and waist/height ratio (WHTR).^[12-14] The World Health Organization criteria^[15] were used to define CO in women. Waist circumference (WC) ≥ 80 cm or WHR ≥ 0.85 .

MATERIALS AND METHODS

150 women with PCOS ($n = 75$) and control ($n = 75$) were gathered for this case-control study from a private clinic in the province of Babylon between January 2023 and the end of September 2023.

BMI, waist/hip ratio, hip circumference, and waist circumference were measured. It was utilized using a leptin ELISA Kit purchased from Elabscience.

The data analysis was conducted utilizing SPSS software (version 23). Use the t test for continuous data. Correlation between persons was performed. Also performed is a binary logistic regression analysis for PCOS compared to a healthy control group. Using a healthy control group as a reference, a receiver operating characteristics (ROC) curve was created to assess the sensitivity and specificity of evaluated factors in PCOS. A P value of <0.05 was considered significant.

Approval ethical

The current study was conducted according to principles that have their origin in the Declaration of Helsinki. The verbal approval was taken before taking the sample. Information and the study protocol consent form were reviewed and approved by a local ethics committee, depending on document number 117 (January 5, 2023) to get this approval.

RESULTS

In total, 150 women participated in the study, 75 of them had PCOS and the remaining 75 were controls. Table 1 shows the anthropometric data for these women, showing significant differences in BMI, waist/hip ratio, and waist (cm) ($P < 0.05$).

Table 2 shows leptin levels in the studied groups.

Leptin hormone was higher significantly in the group of PCOS compared with the control group ($P > 0.05$).

Figure 1 shows the correlation of leptin hormone with the anthropometric measurements in PCOS women, there was significant positive correlation between leptin level with BMI, WC, and Hip circumference ($P < 0.05$). In the control group insignificant positive correlation between the levels of leptin with BMI, WC, and Hip circumference ($P > 0.05$) as shown in Figure 2.

The logistic regression was done to know the effect of different parameters in PCOS women compared to the

Table 1: Data of demographic and anthropometric of the study groups

Variable	PCOS patients (75)		Control (75)	P value
	No.	%	No.	
Age (mean $\pm$ SD) years	29.34 $\pm$ 5.12		30.31 $\pm$ 6.44	0.231
Waist (cm)	100.40 $\pm$ 6.92		88.45 $\pm$ 6.23	0.013*
Hip (cm)	111.43 $\pm$ 10.12		102.64 $\pm$ 9.44	0.11
Waist-to-hip ratio	0.94 $\pm$ 0.22		0.80 $\pm$ 0.19	0.043*
BMI (kg/m ²)	30.12 $\pm$ 2.44		27.51 $\pm$ 5.11	0.03*

* P value < 0.05 was significant

Table 2: BMI groups in the study groups

Parameter	PCOS = 75	Controls = 75	P value
Leptin (ng/mL)	18.10 $\pm$ 6.71	7.80 $\pm$ 1.22	0.001*

* P value < 0.05 was significant

control group as reference group, as shown in Table 3, where leptin level, BMI, W/H ratio appeared to be significant diagnostic factors of PCOS, however, the higher odds ratio (OR) reported with W/H ratio (OR = 2.542) and a significant ratio for leptin (OR = 2.31). Women with higher W/H ratios and high levels of leptin are more likely to be diagnosed with PCOS with other diagnostic criteria.

To evaluate the sensitivity and specificity, a ROC curve was used to assess the factors tested for PCOS diagnosis [Figure 3]. At a cutoff point of 10ng/ml, leptin level showed an AUC of 0.93, giving a sensitivity of 93% and specificity of 96%, indicating that leptin level is thought to be a significant diagnostic factor in PCOS that is independent of other parameters.

DISCUSSION

The PCOS group had considerably greater levels of leptin hormone than the control group ($P > 0.05$). These findings corroborate those of Chakrabarti^[16] and Peng *et al.*^[17] discovered that serum leptin in PCOS women was at higher levels. In particular, the subgroup of people with PCOS showed noticeably higher levels of leptin even when their BMI was adjusted.

The primary discovery of the current study agrees with the findings of Rouru *et al.*^[18] and Laughlin *et al.*^[19] which showed that levels of leptin were comparable in PCOS patients and control people. Whatever their BMI or amount of insulin resistance, people with PCOS have increased leptin levels. This finding is supported by the fact that adipocytes are the primary source of leptin and that higher BMI is more common in the PCOS group than in the group of control in normal women.

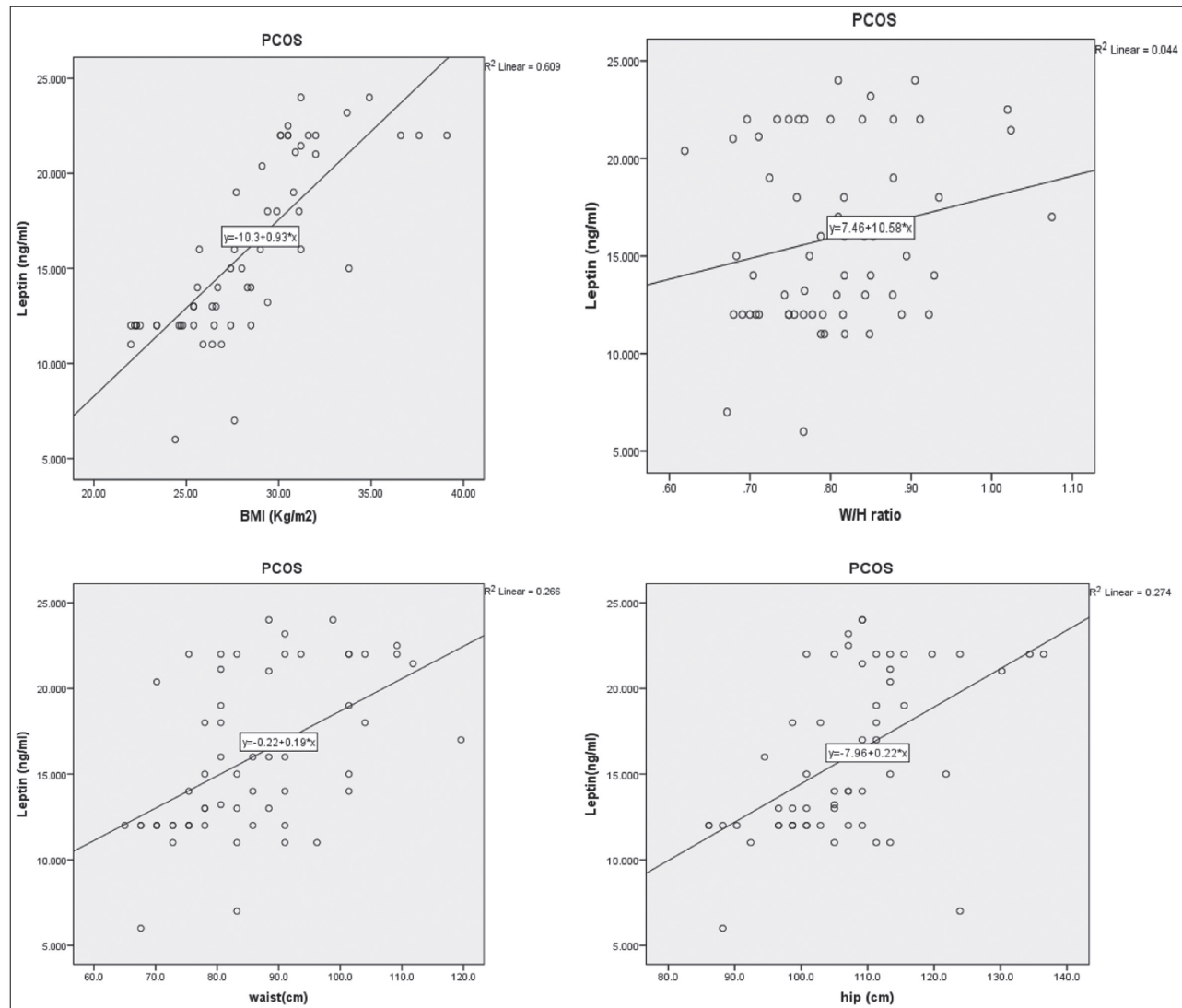


Figure 1: The correlation of leptin hormone with anthropometric measurements in PCOS women

In PCOS, hyperandrogenemia may combine with hyperleptinemia and persistent low-grade inflammation to create a vicious cycle.^[20] These results showed that leptin may be included in the onset and progression of PCOS.

According to our research, there is a strong positive link ($P < 0.05$) between hip circumference, WC, and BMI and leptin level. These findings corroborate those of Peng *et al.*^[17] who discovered that among PCOS patients, blood levels of leptin were considerably higher in the (obese group) overweight than in the (slim group) ($P < 0.001$). Additionally, in the overweight/obese category, levels of blood leptin were considerably greater in the PCOS patients, than in the (control groups).^[17]

A cross-sectional investigation indicated that the production of leptin was proportionate to the mass of adipose tissue and revealed strong relationships between levels of leptin and BMI ($r = 0.79$ in women and 0.80 in

men).^[21] We also see a positive correlation between the level of leptin and WC, which agrees with the findings of Lai *et al.*^[22] about the positive correlation between the level of leptin and CO. Additionally, a higher level of leptin in serum was linked to a higher risk of PCOS, according to multivariate logistic regression (and these findings are consistent with Peng *et al.*^[17]).

To evaluate the validity a ROC curve was used of the factors that were tested for PCOS diagnosis [Figure 3]. At a cutoff point of 10 ng/mL , leptin level showed an AUC of 0.93 , giving a sensitivity of 93% and specificity of 96% , indicating that leptin level is thought to be a significant diagnostic factor in PCOS that is independent of other parameters. Agree with the findings of Peng *et al.*^[17] who discovered that the AUC of leptin, was 73.7% with a cutoff value of 11.58 ng/mL , and that the PCOS prediction had a 77.5% sensitivity and a 62.6% specificity, respectively.

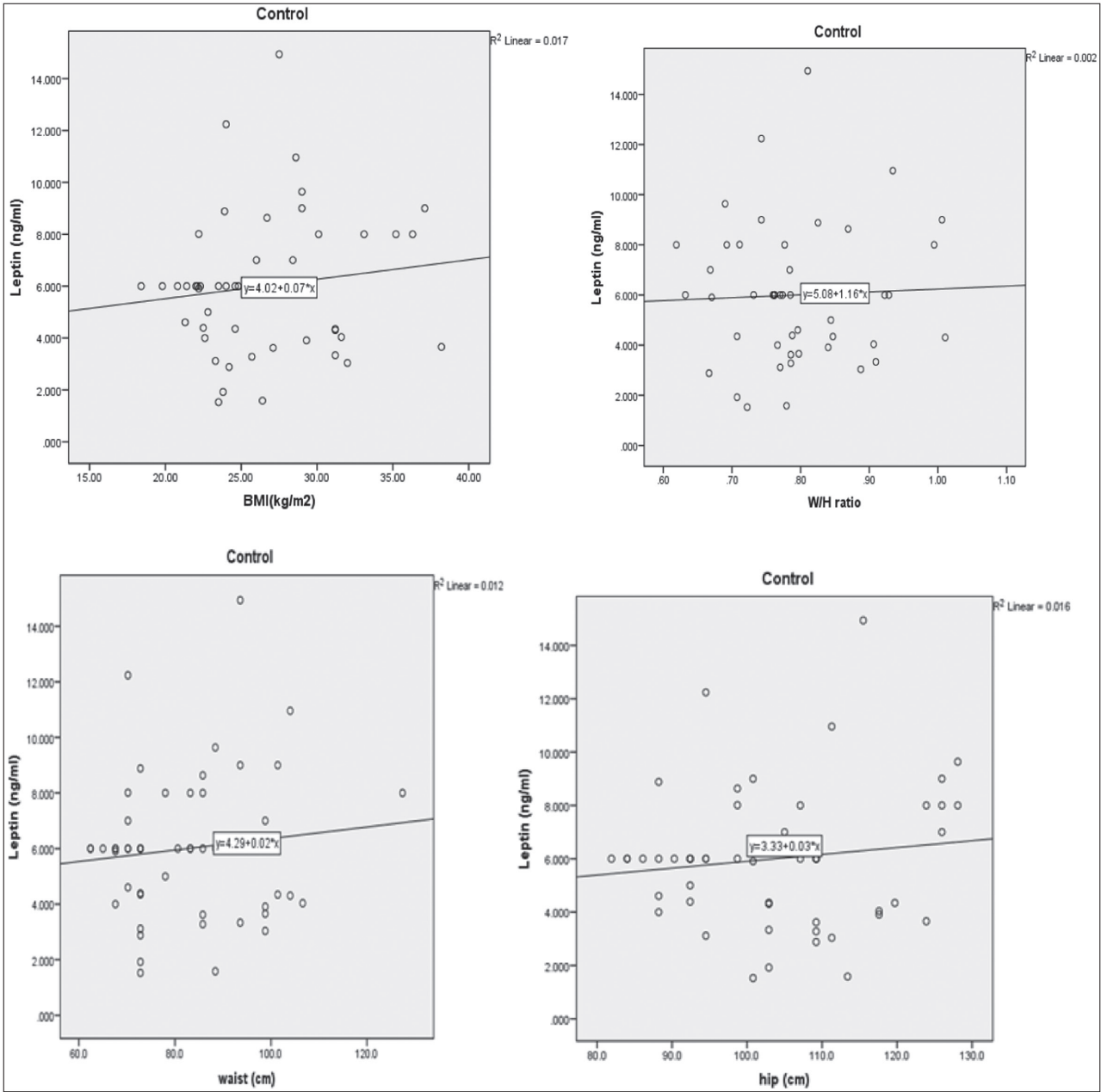


Figure 2: The correlation of leptin hormone with anthropometric measurements in the control group

Table 3: Binary logistic regression analysis for the diagnosis of PCOS				
PCOS	P value	Odds ratio	95% CI	
			Lower limit	Upper limit
Leptin (ng/mL)	0.001*	2.310	1.667	3.199
BMI	0.006*	1.79	1.032	1.212
Waist (cm)	0.074	1.021	0.998	1.045
Hip (cm)	0.448	1.011	0.983	1.040
Waist-to-hip ratio	0.046*	2.542	1.069	1.193

*P value < 0.05 was significant

Mishra *et al.*^[23] discovered that the sensitivity and specificity of PCOS prediction were 51% and 81%, respectively, and that the AUC of leptin was 70% at the threshold value of 10ng/mL.

CONCLUSION

The positive correlation between serum leptin and CO with BMI is shown to be the cause of the elevated levels of leptin in women with PCOS.

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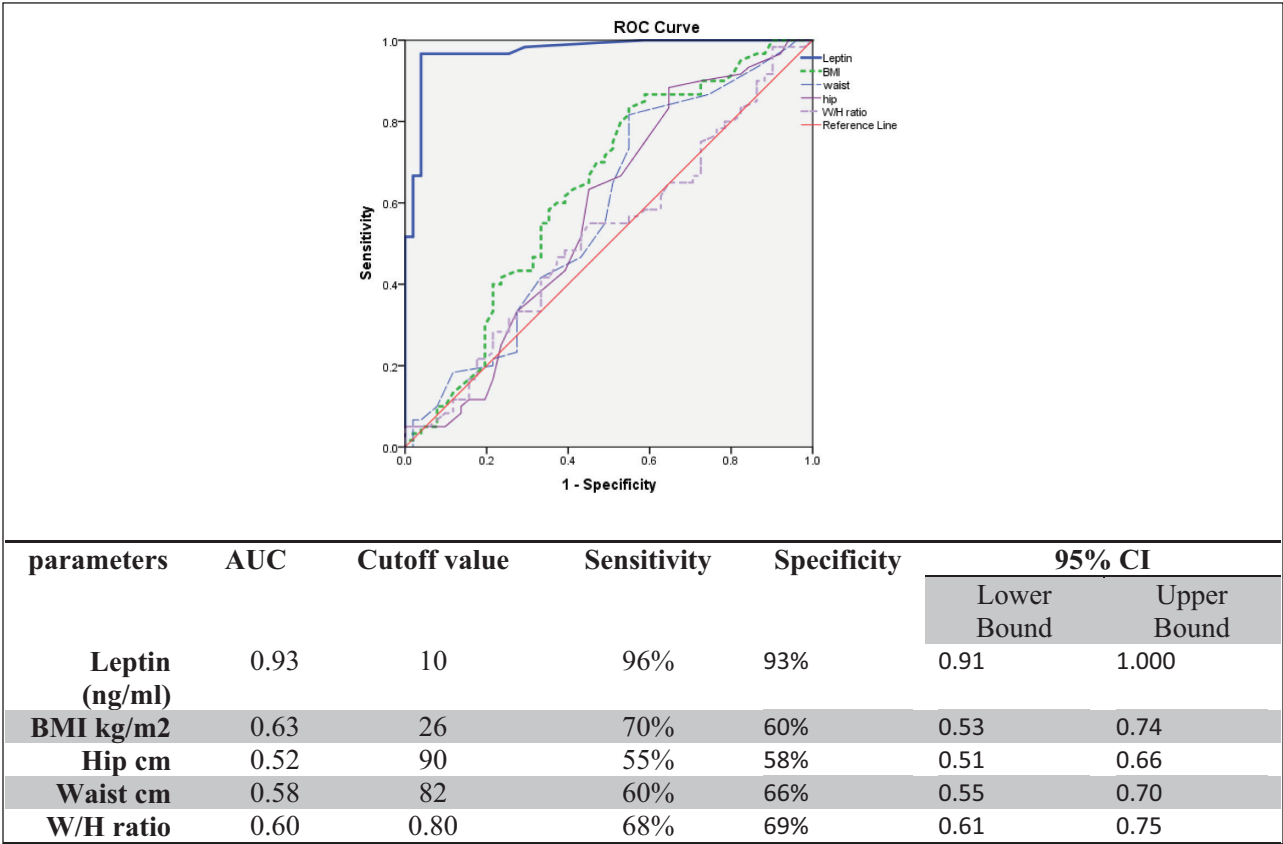


Figure 3: Curve of ROC for the validity of measured factors in PCOS diagnosis

Conflicts of interest

There are no conflicts of interest.

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