



(RESEARCH ARTICLE)



## Study the concentrations of Leptin, adiponectin and some parameters in women with polycystic ovaries syndrome

Hussein Mohammed Abdullah <sup>1</sup>, Shatha Hizem Shaker <sup>2</sup> and Hana Attiya Salman <sup>2</sup>

<sup>1</sup> Department of Biology, College of Education for Women, Kirkuk University, Iraq.

<sup>2</sup> Biology Department, College of Education for Pure Sciences, Tikrit University, Iraq.

GSC Biological and Pharmaceutical Sciences, 2024, 28(02), 116–121

Publication history: Received on 29 June 2024; revised on 09 August 2024; accepted on 12 August 2024

Article DOI: <https://doi.org/10.30574/gscbps.2024.28.2.0293>

### Abstract

So this investigation was aimed to estimate concentrations of Leptin, adiponectin and some parameters in women with polycystic ovaries syndrome. From June to the end of February 2024, this investigation was carried out in the Teaching Azadi Hospital's laboratories. Eighty married women between the ages of 18-30 year provided blood serum samples for the study. Two groups were established from these samples, which are as follows: Control group: During the follicular phase of the menstrual cycle, thirty blood samples from healthy women were taken. Patient group: During the follicular phase, 50 PCOS women had their blood samples taken. The results showed that LH concentration in serum of PCOS patients ( $8.74 \pm 0.62$ ) demonstrated significant ( $P < 0.05$ ) increase compared with healthy women ( $6.14 \pm 0.37$ ). The concentration of FSH demonstrated significant ( $P < 0.05$ ) reduced in PCOS patients ( $3.64 \pm 1.08$ ) compared with healthy women ( $8.29 \pm 0.41$ ). testosterone concentration in serum of PCOS patients ( $0.78 \pm 0.39$ ) demonstrated significant ( $P < 0.05$ ) increase compared with healthy women ( $0.36 \pm 0.11$ ). The concentration of IGF-1R demonstrated significant ( $P < 0.05$ ) elevated in PCOS patients ( $29.02 \pm 5.67$ ) compared with healthy women ( $17.42 \pm 2.85$ ). Adiponectin concentration in serum of PCOS patients ( $2.26 \pm 0.19$ ) demonstrated significant ( $P < 0.05$ ) reduced compared with healthy women ( $5.18 \pm 0.24$ ). the concentration of Leptin demonstrated significant ( $P < 0.05$ ) increase in PCOS patients ( $29.15 \pm 3.47$ ) compared with healthy women ( $8.27 \pm 0.81$ ). Significantly lower levels of adiponectin and higher levels of leptin and IGF-1R are linked to PCOS. These results call for additional research on the roles played by leptin, IGF-1R, and adiponectin in the pathophysiology of PCOS.

**Keywords:** PCOS; Leptin; FSH; Adiponectin

### 1. Introduction

Polycystic ovarian syndrome, or PCOS, is one of the most common endocrine system disorders affecting women who are of reproductive age [1]. Polycystic ovarian syndrome is a prevalent, mysterious, and intricate illness. It affects up to 1 in 5 women in reproductive age and is the most frequent endocrinopathy [2-3]. Hyperandrogenism, persistent anovulation, and several tiny subscapular cystic follicles in the ovary as detected by ultrasonography are the hallmarks of PCOS [4]. The general population's prevalence of PCOS among women of reproductive age has been estimated to be between 4% and 12% [5-6]. However, little is known about the prevalence and characteristics of PCOS-affected women in larger, ethnically diverse populations and in usual care settings. It appears that PCOS prevalence is higher (between 37% and 90%) among women who have irregular menstruation and is also higher in the presence of specific diseases [7]. An intricate, vital, and extremely active metabolic and endocrine organ is adipose tissue. that secretes a range of hormones and cytokines known as adipokines, including adiponectin and leptin [8]. Obesity is common in PCOS-affected women, and it leads to abnormalities in adipocyte levels, including adiponectin. It is postulated that the endocrine and metabolic abnormalities observed in women with PCOS may potentially be related to the changed levels of adiponectin. Nonetheless, a crucial connection exists between PCOS and the associated endocrine and metabolic issues because of

\* Corresponding author: Hussein Mohammed Abdullah

the changed adiponectin levels. Adiponectin levels may be impacted by therapeutic treatments and weight loss [9–10]. The hormone leptin, which is produced by fat cells, controls glucose homeostasis and encourages a switch from carbohydrate to fat oxidation [11]. However, a number of endocrine and metabolic disorders can result from aberrant leptin levels. Leptin's significance in endocrine and metabolic diseases associated with PCOS has gradually come to light. For instance, accumulating data suggests that leptin levels in the blood rise gradually in obese individuals, decreasing leptin receptor sensitivity and raising leptin resistance [12]. Fertility and follicular development may be impacted by elevated leptin levels [13–14]. so this investigation was aimed to estimate concentrations of Leptin, adiponectin and some parameters in women with polycystic ovaries syndrome.

## 2. Materials and Methods

### 2.1. Study population

From June to the end of February 2024, this investigation was carried out in the Teaching Azadi Hospital's laboratories. Eighty married women between the ages of 18-30 year provided blood serum samples for the study. Two groups were established from these samples, which are as follows: Control group: During the follicular phase of the menstrual cycle, thirty blood samples from healthy women were taken. Patient group: During the follicular phase, 50 PCOS women had their blood samples taken.

### 2.2. Inclusion criteria

Married women with PCOS who are between the ages of 18 and 30 who do not have malignancies in their reproductive systems, urinary tracts, adrenal glands, or pituitaries.

### 2.3. Exclusion criteria

Women on antihypertensive drugs, as well as those with cancers of the pituitary, adrenal, or reproductive systems.

#### 2.3.1. Measurements

- Human Luteinizing Hormone (LH): LH ELISA Kit (SUNLONG, China) assays LH concentration in human serum and plasma using Sandwich-ELISA.
- Follicle-stimulating hormone (FSH): FAH ELISA Kit (SUNLONG, China) assays FAH concentration in human serum and plasma using Sandwich-ELISA.
- Testosterone (T): FT ELISA Kit (SUNLONG, China) assays testosterone concentration in human serum and plasma using Sandwich-ELISA.
- Human Insulin-like growth factors 1 receptor (IGF-1R): IGF-1R ELISA Kit (SUNLONG, China) assays IGF-1R concentration in human serum and plasma using Sandwich-ELISA.
- Adiponectin: Adiponectin was measured using ELISA kits from United States Biological Company (My biosource, USA).
- Leptin: using the Leptin (sandwich) Enzyme Immunoassay Kit to measure serum leptin levels. The sole intended application for this assay is in vitro diagnostics. The sandwich principle serves as the foundation for this solid phase enzyme-linked immunosorbent test (ELISA).

### 2.4. Statistical analysis

Version 18 of the SPSS application (Statistical Package for Social Science) was used to code and enter the data onto a computer for statistical analysis. Every data point was organized based on frequency, and the Chi-square test was used to examine correlations between variables. A p-value of less than 0.05 was deemed significant [15].

## 3. Results and Discussion

### 3.1. LH and FSH

Table (1) show the concentrations of LH and FSH in PCOS patients and healthy subjects, where LH concentration in serum of PCOS patients ( $8.74 \pm 0.62$ ) demonstrated significant ( $P < 0.05$ ) increase compared with healthy women ( $6.14 \pm 0.37$ ). The concentration of FSH demonstrated significant ( $P < 0.05$ ) reduced in PCOS patients ( $3.64 \pm 1.08$ ) compared with healthy women ( $8.29 \pm 0.41$ ).

**Table 1** The levels of LH and FSH in studied groups

Groups Parameter	Healthy women (30)	PCOS women (50)	P-Value
LH (IU/ml)	6.14± 0.37	8.74± 0.62*	0.001
FSH (IU/ml)	8.29 ± 0.41	3.64 ± 1.08*	0.001

Our findings supported earlier research showing elevated LH concentrations in PCOS patients [16–17], while FSH levels in PCOS patients were significantly lower than in healthy controls, and there was a significantly negative correlation between PCOS patients' FSH levels and testosterone levels, according to studies, hyperinsulinemia may have an impact on the hypothalamic-pituitary system, leading to an increase in LH either by increasing the frequency at which GnRH pulses [18], increasing the pituitary gland's sensitivity to GnRH hormone, or stimulating the gland more because of a malfunctioning feedback mechanism between the pituitary gland and ovarian steroids [19]. and hyperandrogenism resulted in abnormal gonadotrophin secretion with relatively high levels of LH to FSH, which stopped the growth and development of the follicles and the production of androgen. The excess androgen then converted to excess estrogen-producing terminal tissue in the ovaries, causing abnormal steroid production, which in turn continued the abnormal gonadotrophin secretion [20]. Furthermore, compared to controls, women with PCOS had a significantly higher mean serum level of LH, as indicated by table (1). This outcome was consistent with a research by Lavanya et al. [21] that found that only 17–18% of PCOS patients had high LH concentrations.

### 3.2. Testosterone and IGF-1R

Table (2) show the concentrations of testosterone and IGF-1R in PCOS patients and healthy subjects, where testosterone concentration in serum of PCOS patients (0.78± 0.39) demonstrated significant (P <0.05) increase compared with healthy women (0.36± 0.11). The concentration of IGF-1R demonstrated significant (P <0.05) elevated in PCOS patients (29.02 ± 5.67) compared with healthy women (17.42 ± 2.85),

**Table 2** The levels of testosterone and IGF-1R in studied groups

Groups Parameter	Healthy women (30)	PCOS women (50)	P-Value
Testosterone (ng/ml)	0.36± 0.11	0.78± 0.39*	0.001
IGF-1R (µg/L)	17.42 ± 2.85	29.02 ± 5.67*	0.001

The mean serum testosterone level was substantially (P<0.05) greater in PCOS-affected women than in the control group. PCOS-afflicted women frequently do not ovulate, have irregular periods, and have high levels of total and bioavailable testosterone. They also have acne and excessive facial hair development. This is a fairly prevalent ailment that is frequently linked to insulin resistance and obesity. Cortisol secretion is slightly higher in PCOS. The quality of life for women with PCOS may be negatively impacted by all of these anomalies and may have a predictive effect on society [22–23]. In PCOS, IGF-I was significantly (P <0.05) higher than in the control group. These findings are in line with research by Kebapcilar et al. [24], which discovered that PCOS patients had significantly higher IGF-I levels than controls. Serum IGF-1 levels in PCOS patients were found to be higher than in normal, healthy women, according to Kebapcilar et al. [25], but Silfen et al. [26] found no discernible differences between the two groups. As of yet, conclusive findings on the quantity and function of IGF-1 in PCOS patients have not been made.

### 3.3. Adiponectin and Leptin

Table (3) show the concentrations of adiponectin and leptin in PCOS patients and healthy subjects, where Adiponectin concentration in serum of PCOS patients (2.26± 0.19) demonstrated significant (P <0.05) reduced compared with healthy women (5.18 ± 0.24), the concentration of Leptin demonstrated significant (P <0.05) increase in PCOS patients (29.15 ± 3.47) compared with healthy women (8.27 ± 0.81),

**Table 3** The concentrations of Adiponectin and Leptin in studied groups

<b>Parameter \ Groups</b>	<b>Control (30)</b>	<b>Women with PCOS (50)</b>	<b>P-Value</b>
Adiponectin ( $\mu\text{g/ml}$ )	5.18 $\pm$ 0.24	2.26 $\pm$ 0.19*	0.001
Leptin (ng/ml)	8.27 $\pm$ 0.81	29.15 $\pm$ 3.47*	0.001

In the current investigation, serum adiponectin levels were considerably lower in women with polycystic ovarian syndrome than in healthy females. Several studies have also evaluated the relationship between adiponectin and PCOS. Adiponectin levels in PCOS women are significantly lower than in BMI-matched healthy controls, according to the majority of studies [27]. PCOS women in this study had BMIs significantly higher than controls and were overweight. The reason why women with PCOS have lower levels of adiponectin has been the subject of various theories. Adiponectin concentration fluctuates with the degree of obesity and is unaffected by insulin resistance, according to some studies, while other studies indicate that variations in adiponectin levels are caused by insulin resistance and glucose intolerance [28]. The lower expression of adiponectin mRNA in both subcutaneous and visceral fat tissue was shown to be consistent with the lower levels of circulating adiponectin found in women with PCOS. An analysis of the adipose tissue in women with PCOS suggests that the increased adiposity, as shown by a higher BMI in the current study, may be the reason for the lower adiponectin levels observed in them. In contrast to controls, young, non-obese PCOS patients had greater levels of adiponectin, according to Arikan et al. [29]. Leptin's role has been clarified by recent reports, which also show that it may be related to PCOS [30]. In line with earlier research, this study found that serum leptin levels were higher in PCOS patients as compared to the non-PCOS control group. High levels of leptin in PCOS have been linked to ovulatory dysfunction and infertility by interfering with the formation of the mature oocyte and ovarian steroidogenesis [31-32]. Furthermore, a vicious cycle of PCOS may be created by the interaction of hyperleptinemia with hyperandrogenemia and chronic low-grade inflammation [33]. Taken together, these results suggest that leptin may be involved in the onset and progression of PCOS.

#### 4. Conclusions

The concentrations of serum LH, FSH, testosterone, IGF-1R, Adiponectin, and leptin in PCOS are highlighted in this study. Measuring the levels of leptin, adiponectin, and IGF-1R may be useful in clinical settings for forecasting PCOS and its long-term consequences. Further research is warranted as it is unclear how IGF-1R, Adiponectin, and Leptin may interact with insulin and androgens in the pathophysiology of PCOS.

#### Compliance with ethical

##### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

#### References

- [1] Samradhi S., Namrata P., Swasti S., Devojit K. S., Vinod V. Polycystic Ovary Syndrome: Etiology, Current Management, and Future Therapeutics. *J. Clin. Med.* 2023, 12(4), 1454.
- [2] Jessica A. L., Alan H. D. Clinical Presentation and Diagnosis of Polycystic Ovarian Syndrome. *Clinical obstetrics and gynecology*, 2021; 64(1): 3–11
- [3] Aesha B., Sabah H.K., Anas Y. A.. The FSHR Polymorphisms Association With Polycystic Ovary Syndrome in Women of Erbil, Kurdistan in North of Iraq. *Ibn AL- Haitham Journal For Pure and Applied Science* 2017; (IHSCICONF):262.
- [4] Atia A. R., Ammar L. H., Najwa A. M. The effects of vitamin D in polycystic ovarian syndrome. *Tikrit Journal of Pure Science*, 2020; 25(5): 37-40,
- [5] Joan C. Lo, Seth L. Feigenbaum, Jingrong Yang, Alice R. Pressman, Joe V. Selby and Alan S. Epidemiology and Adverse Cardiovascular Risk Profile of Diagnosed Polycystic Ovary Syndrome. *J Clinical Endocrinology and Metabolism (JCEM)* 2006; 91: 1357.

- [6] Sarhat ER, Abid IM, Kamel NA, Sarhat TR, Abass KS. Changes of serum Interleukin and Chemerin levels in patients with Polycystic Ovary syndrome. *J Adv Pharm Educ Res.* 2021;11(4):11-
- [7] Zacur HA. Epidemiology, clinical manifestations and pathophysiology of polycystic ovary syndrome. *Adv. Stud Med.* 2003;3 : S733-S739.
- [8] Ahmed S. E., Entedhar R. S., Neda A., Thuraia R. S., Kasim S. A. Altered Serum Marker of Adipokines Profile in Breast Cancer Women. *Indian Journal of Forensic Medicine and Toxicology*, 2021; 15(3): 1-7.
- [9] Alvarez-Blasco F. José I B., José L M., Héctor F E. Prevalence and characteristics of the polycystic ovary syndrome in overweight and obese women. *Arch Intern Med.* . 2006; 166(19): 2081-2086.
- [10] Mohammed M., Huda M., Ali H. The Effect of Entamoeba Histolytica Infection on Levels of Adiponectin and Histamine in Children. *Bahrain Medical Bulletin* 2022; 44(2): 961-963.
- [11] Perry RJ, Wang Y, Cline GW, Rabin-Court A, Song JD, Dufour S, et al. Leptin Mediates a Glucose-Fatty Acid Cycle to Maintain Glucose Homeostasis in Starvation. *Cell.* 2018; 172:234–48.
- [12] Reid IR, Baldock PA, Cornish J. Effects of Leptin on the Skeleton. *Endocr Rev.* 2018; 39:938–59.
- [13] Catteau A, Caillon H, Barrière P, Denis MG, Masson D, Fréour T. Leptin and Its Potential Interest in Assisted Reproduction Cycles. *Hum Reprod Update.* 2016; 223:320–41.
- [14] Childs GV, Odle AK, MacNicol MC, MacNicol AM. The Importance of Leptin to Reproduction. *Endocrinology*, 2021; 162:bqaa204.
- [15] Abdul, M.R., Rahim, S.M., Saleh, A.H. Cardioprotective Activity of Costus Root Ethanol Extract in Experimentally-Induced Hypothyroidism in Female Albino Rats. *HAYATI Journal of Biosciences*, 2023; 30(6): 1054–1060.
- [16] Mahmoud MI, Habeeb F, Kasim K. Reproductive and biochemical changes in obese and non-obese polycystic ovary syndrome women. *Alexandria Journal of Medicine*, 2015;51[1], 5-9.
- [17] Isik H, Aynioglu O, Timur H, Sahbaz A, Harma M, Can M, Guven B, Alptekin H, Kokturk F. Is xanthine oxidase activity in polycystic ovary syndrome associated with inflammatory and cardiovascular risk factors? *J Reprod Immunol.* 2016; 116:98- 103.
- [18] McCartney CR, Eagleson CA, Marshall JC. Regulation of gonadotropin secretion: implications for polycystic ovary syndrome. *Semin Reprod Med.* 2002;20(4):317–326.
- [19] Adashi E, Hsueh A, Yen SS. Insulin enhancement of LH and FSH levels by cultured pituitary cells. *Endocrinol.* 1981;108:1441–1449.
- [20] Ropelato MG, Rudaz MG, Escobar ME, Bengolea SV, Calcagno ML, Veldhuis JD, et al. Acute effects of testosterone infusion on the serum luteinizing hormone profile in eumenorrheic and polycystic ovary syndrome adolescents. *J Clin Endocrinol Metab.* 2009;94(9):3602–3610.
- [21] Lavanya, R; Deepika, K. and Madhuri, P. (2008). Polycystic ovaries and infertility: Our experience. 1(2): 65-72.
- [22] Arlt, W.; Auchus, R.J. and Miller, W.L. (2001). Thiazolidinediones but not metformin directly inhibit the steroidogenic enzymes P450c17 and 3beta - hydroxysteroid dehydrogenase. *J Biol Chem.* 276: 16767–16771
- [23] Harborne, L.; Fleming, R.; Lyall, H.; et al. (2003). Metformin or antiandrogen in the treatment of hirsutism in polycystic ovary syndrome. *J Clin Endocrinol Metab.* 88: 4116–4123.
- [24] Kebapcilar A, Tatar M, Ipekci S et al. (2014): Cornea in PCOS patients as a possible target of IGF-1 action and insulin resistance. *Archives of Gynecology and Obstetrics*, 290(6): 1255–1263.
- [25] Kebapcilar A.G. et al. Cornea in PCOS patients as a possible target of IGF-1 action and insulin resistance. *Arch Gynecol Obstet*, 2014; 5: 1-4.
- [26] Silfen M.E. et al. Early endocrine, metabolic, and sonographic characteristics of polycystic ovary syndrome (PCOS): comparison between nonobese and obese adolescents. *J Clin Endocrinol Metab*, 2003; 4: 1-7.
- [27] Matthews DR., Treacher D F., Turner R C. Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. *Diabetologia.* 1985; 28:7
- [28] Ramanand SJ., Balasaheb B G., Jaiprakash B R., Milind H P., Ravi R G., Suyog S J. Clinical characteristics of polycystic ovary syndrome in Indian women. *Indian J Endocrinol Meta.* 2013;17:1.

- [29] Carmina E, Oberfield SE, Lobo RA. The diagnosis of polycystic ovary syndrome in adolescents. *Am J Obstet Gynecol.* 2010;203(3):201.e1–5.
- [30] Rizk NM, Sharif E. Leptin as Well as Free Leptin Receptor Is Associated With Polycystic Ovary Syndrome in Young Women. *Int J Endocrinol* (2015) 2015:927805.
- [31] Vázquez MJ, Romero-Ruiz A, Tena-Sempere M. Roles of Leptin in Reproduction, Pregnancy and Polycystic Ovary Syndrome: Consensus Knowledge and Recent Developments. *Metabolism* (2015) 64:79–91.
- [32] Vilariño-García T, Pérez-Pérez A, Santamaría-López E, Prados N, Fernández-Sánchez M, Sánchez-Margalet V. Sam68 Mediates Leptin Signaling and Action in Human Granulosa Cells: Possible Role in Leptin Resistance in PCOS. *Endocr Connect* (2020) 9:479–88.
- [33] Li N, Yang C, Xie H, Liu Y, Liao Y. Effects of Aerobic Exercise on Rats With Hyperandrogenic Polycystic Ovarian Syndrome. *Int J Endocrinol* (2021) 2021:5561980.