

Interleukin-10 levels in Iraqi women with polycystic ovary syndrome

Zainab Ali Hlail¹ , Alyaa Abdul-Munem Alshukri²

Abstract

The polycystic ovary syndrome (PCOS) is one of the most common reproductive abnormalities, affecting 5–10% of the population in the reproductive age. Interleukin-10 (IL-10), a major proinflammatory cytokine in chronic inflammation also called human cytokine synthesis inhibitory factor (CSIF), has been shown to be closely associated with insulin resistant (IR), low level of anti-mullerian hormone (AMH), body mass index (BMI) and cardiovascular abnormalities.

The change of serum Interleukin-10 (IL-10) levels in women with polycystic ovary syndrome (PCOS), as well as the relations between IL-10 levels and body mass index (BMI) and anti-mullerian hormone (AMH) in PCOS patients, are not fully understood. Objective:

The aim of this study was to evaluate serum concentrations of interleukin-10 (IL-10) in relation with hormonal changes and high body mass index (BMI) in patients with and without polycystic ovary syndrome (PCOS).

Material and Methods:

In this study, 200 Iraqi women aged between 20-50 years were studied. The patients were divided into two groups: study group (n=100, PCOS women) and age-matched controls group (n=100 normal women). The blood sample was obtained on the 2nd day of menstruation cycle. IL-10 concentrations were determined in both groups.

Results:

Women with PCOS exhibited higher body mass index (BMI) and serum concentrations of IL-10 levels more than controls ($p < 0.05$); however, levels of IL-10 were not significantly increased when compared with BMI-matched controls ($p > 0.05$). IL-10 levels were significantly correlated positively with BMI and low anti-mullerian hormone (AMH) levels.

Conclusion:

The data of this study suggested that serum IL-10 levels were found to be higher in women with PCOS as compared to controls.

Raised serum IL-10 levels may be related to BMI and AMH levels.

Keywords: Interleukin-10, inflammation, anti-mullerian hormone, body mass index, polycystic ovary syndrome

مستويات الإنترلوكين-10 لدى النساء العراقيات المصابات بمتلازمة تكيس المبايض

م. د. زينب علي هليل¹ ، م. م. علياء عبد المنعم محمد²

المستخلص

متلازمة تكيس المبايض (PCOS) هي واحدة من أكثر التشوهات التناسلية شيوعاً، حيث تصيب 5-10% من السكان في سن الإنجاب. وقد ثبت أن الإنترلوكين-10 (IL-10)، وهو أحد السيتوكينات الرئيسية المسببة للالتهابات المزمنة، ويسمى أيضاً عامل تثبيط تخليق السيتوكين البشري (CSIF)، يرتبط ارتباطاً وثيقاً بمقاومة الأنسولين (IR)، وانخفاض مستوى هرمون مضاد مولر (AMH)، ومؤشر كتلة الجسم (BMI)، واضطرابات القلب والأوعية الدموية.

لم يُفهم تماماً تغير مستويات الإنترلوكين-10 (IL-10) في المصل لدى النساء المصابات بمتلازمة تكيس المبايض (PCOS)، وكذلك العلاقة بين مستويات IL-10 ومؤشر كتلة الجسم (BMI) وهرمون مضاد مولر (AMH) لدى مريضات متلازمة تكيس المبايض. الهدف:

هدفت هذه الدراسة إلى تقييم تركيزات الإنترلوكين-10 (IL-10) في مصل الدم وعلاقتها بالتغيرات الهرمونية وارتفاع مؤشر كتلة الجسم لدى مريضات مصابات بمتلازمة تكيس المبايض (PCOS) وغير مصابات بها.

Affiliation of Authors

^{1,2} College of Medicine , Ibn Sina University of Medical and Pharmaceutical Sciences, Iraq, Baghdad, 10001

¹zainab.ali9213@ibnsina.edu.iq

²alyaa.munem@yahoo.co.uk

¹ Corresponding Author

Paper Info.

Published: Oct. 2025

انتساب الباحثين

^{1,2} كلية الطب، جامعة ابن سينا للعلوم الطبية والصيدلانية، العراق، بغداد، 10001

¹zainab.ali9213@ibnsina.edu.iq

²alyaa.munem@yahoo.co.uk

¹ المؤلف المراسل

معلومات البحث

تاريخ النشر: تشرين الاول 2025

المواد والطرق:

في هذه الدراسة، أُجريت دراسة على 200 امرأة عراقية تتراوح أعمارهن بين 20 و50 عامًا. قُسمت المريضات إلى مجموعتين: مجموعة الدراسة (100 امرأة مصابة بمتلازمة تكيس المبايض)، ومجموعة ضابطة مطابقة للعمر (100 امرأة سليمة). أُخذت عينة الدم في اليوم الثاني من الدورة الشهرية. وُحِدَت تراكيز IL-10 في كلتا المجموعتين.

النتائج:

أظهرت النساء المصابات بمتلازمة تكيس المبايض ارتفاعًا في مؤشر كتلة الجسم (BMI) وتركيزات IL-10 في المصل مقارنةً بالمجموعة الضابطة ($p < 0.05$)؛ ومع ذلك، لم ترتفع مستويات IL-10 بشكل ملحوظ مقارنةً بالمجموعة الضابطة المطابقة لمؤشر كتلة الجسم ($p > 0.05$). ارتبطت مستويات IL-10 ارتباطًا إيجابيًا كبيرًا بمؤشر كتلة الجسم وانخفاض مستويات هرمون مضاد مولر (AMH).

الخلاصة:

أشارت بيانات هذه الدراسة إلى أن مستويات IL-10 في المصل كانت أعلى لدى النساء المصابات بمتلازمة تكيس المبايض مقارنةً بالمجموعة الضابطة. قد يرتبط ارتفاع مستويات الإنترلوكين-10 في المصل بمستويات مؤشر كتلة الجسم (BMI) وهرمون مضاد مولر (AMH).

الكلمات المفتاحية: الإنترلوكين-10، الالتهاب، الهرمون المضاد لمولر، مؤشر كتلة الجسم، متلازمة تكيس المبايض

Introduction

The polycystic ovary syndrome is one of the most general reproductive disorders affecting in 5.0–10.0 percent of the reproductive age population and has multiple degrees of manifestation. The symptoms of PCO include anovulation, hirsutism and obesity, but the biological changes are expressed by high levels of lutein hormone, compromised lutein hormone / follicle stimulating hormone relationships and high levels of testosterone [1,2]

Hyperandrogenism is partly linked to hyperinsulinism caused by insulin resistance. Morphological signs are manifested as atypical ultrasonographic appearance of polycystic ovaries [3].

The variations in the reported prevalence of PCOS have been attributed to the use of different diagnostic criteria. Three main diagnostic criteria systems that are currently accepted for PCOS are those from the National Institutes of Health (NIH, 1990), Rotterdam (ASRM/ ESHRE, 2003), and Androgen Excess Society (AES, 2006). According to the Rotterdam criteria, the diagnosis of PCOS is based on the presence of at least two of the

following three clinical features: polycystic ovary morphology as oligo/amenorrhea and hyperandrogenism. However, the NIH criteria require only oligo/amenorrhea and hyperandrogenism for a diagnosis, while the AES criteria require a combination of biochemical or clinical hyperandrogenism along with chronic anovulation or polycystic ovary morphology [2,3].

Interleukin-10 (IL-10) is a crucial anti-inflammatory cytokine produced in response to anti-inflammatory signals by various immune cells, including T cells, B cells, macrophages, and dendritic cells [4,5]. In contrast, IL-11, a member of the IL-10 family, primarily functions as an inflammatory cytokine but can also exhibit pro-inflammatory properties similar to IL-10 [6]. Other study investigated the association of common polymorphisms of the interleukin-10 genes with the occurrence and clinical characteristics of PCOS. The polymorphism in the interleukin-10 gene was found to correlate with the occurrence of PCOS, the serum level of FSH and subsequent LH/FSH ratio correlated with the polymorphism of IL-10 within the PCOS [7].

Immunity barrier and immune regulatory mechanisms are very important in the processes of follicle development, fertilization, and implantation of the fertilized egg in the uterus [8]. The pro-inflammatory cytokines, particularly interleukin (IL)-1 activates the hypothalamous-pituitary-adrenal (HPA) axis. HPA axis controls adrenal steroidogenesis and metabolic factors including insulin and obesity-related signals [9,10].

Methods: This case-control study included 100 women with polycystic ovary syndrome (PCOS) as a case group and 100 healthy women as a

control group. The groups were matched for age and body mass index. Serum IL-10 levels were assessed using an ELISA assay. The parameters were compared between groups, and correlations between serum levels were explored.

Results

The level of IL-10 showed significant difference in PCOS patients and control. The level was 285 ± 166.573 (Pg /ml), 131 ± 105.061 (Pg /ml) in PCOS patients and control respectively. Ranging of serum interleukin-10 (IL-10) level between 0 and 627 Pg/ml, as show table (1) and table (2).

Table (1): Serum interleukin-10 (IL-10) value of the PCOS and control groups involved in the study

Serum IL-10 (Pg /ml)	Number	Mean	Std.Deviation	P-value
Patients	100	285	166.573	<0.0001
Controls	100	131	105.061	

The receiver Operator characteristic curve

Table (2): The receiver Operator characteristic curve (ROC) for calculating the most appropriate cut-off value for different between control and polycystic ovarian syndrome in term of IL-10

Test Result Variable(s)	Accuracy	Std. Error ^a	Asymptotic Sig. ^b	Best cut off point (above is positive)	Sensitivity (%)	Specificity (%)
IL-10	.7673	.0302	.0000	193	73	78

Discussion

Polycystic ovarian syndrome is clinically important not because of decreased fertility, but also because of long term metabolic and cardiovascular disease. PCOS is commonly characterized by hirsutism, anovulation, and polycystic ovaries. Often, PCOS is comorbid with insulin resistance, dyslipidemia, and obesity; it also carries significant risk for the development of

cardiovascular and metabolic squeal, including diabetes and metabolic syndrome [11].

The level of IL-10 showed significant difference in PCOS patients and control. The level was 285 ± 166.573 (Pg /ml), 131 ± 105.061 (Pg /ml) in PCOS patients and control respectively. Ranging of serum interleukin-10 (IL-10) level between 0 and 627 Pg/ml, The current study suggested that Proinflammatory cytokines may play a role in the

pathogenesis of polycystic ovarian syndrome. In the present study, serum IL-10 was significantly higher in PCOS women. This result agrees with that of another study that showed that IL-10 may be an early low-grade chronic inflammatory marker among PCOS patients [12].

IL-10 is an adipokine that is produced by adipocytes and stromal cells of the fat tissue and evidence show that IL-10 may play a role in insulin resistance [13,14]. Moreover, mediators of chronic low-grade inflammation such as IL-10 are predictors of risk of type 2 diabetes [15]. It has been presented that in PCOS women, IL-10 levels are increased [16]. Several studies have suggested that IL-10 increment may be related to hyperandrogenism and insulin resistance in PCOS patients. However, the findings on effects of IL-10 on insulin resistance are different. Some evidence has shown that insulin resistance in PCOS patients is due to defects in insulin signaling pathway and in PCOS, adipocyte-derived factors such as free fatty acids and IL-10 affect insulin signaling in the skeletal muscles [17].

References

- [1] Samy, N. . (2009) ‘Clinical significance of inflammatory markers in polycystic ovary syndrome: Their relationship to insulin resistance and body mass index’, *Disease Markers*. doi: 10.3233/DMA-2009-0627.
- [2] Zainab et al. (2020), Immunological and molecular detection of Tumor necrosis factor- α (TNF- α) in Iraqi Women with Polycystic Ovarian Syndrome. Immunological and molecular detection of Tumor necrosis factor- α . P J M H S Vol. 14, NO. 3, JUL – SEP 2020 1100-1103. chrome-<https://pjmhsonline.com/2020/july-sep/1100.pdf>.
- [3] Rothenberg, S. S. . (2018) ‘Polycystic ovary syndrome in adolescents’, *Best Practice and Research: Clinical Obstetrics and Gynaecology*. doi: 10.1016/j.bpobgyn.2017.08.008.
- [4]Wang, W., Zheng, J., Cui, N., Jiang, L., Zhou, H., Zhang, D., & Hao, G. (2019). Baicalin ameliorates polycystic ovary syndrome through AMP-activated protein kinase. *Journal of Ovarian Research*, 12(1). <https://doi.org/10.1186/s13048-019-0585-2>
- [5]Mahdi, H. B., & Abdulhameed, W. A. (2024). TNF-alpha and IL-10 Levels in Iraqi PCOS and Non-PCOS Patients Undergoing ICSI: An Immunological Perspective. *Al-Rafidain Journal of Medical Sciences*, 6(1). <https://doi.org/10.54133/ajms.v6i1.558>.
- [6]Cabus, U., Kabukcu, C., Fenkci, S., Caner, V., Oztekin, O., Fenkci, V., & Enli, Y. (2020). Serum Caspase-1 levels in women with polycystic ovary syndrome. *Taiwanese Journal of Obstetrics and Gynecology*, 59(2). <https://doi.org/10.1016/j.tjog.2020.01.007>
- [7]Dawson, A. J. . (2017) ‘Endocannabinoid receptor blockade reduces alanine aminotransferase in polycystic ovary syndrome independent of weight loss’, *BMC Endocrine Disorders*. doi: 10.1186/s12902-017-0194-2.
- [8]De Alencar, J. B. . (2016) ‘Polymorphisms of Cytokine Genes and Polycystic Ovary Syndrome: A Review’, *Metabolic Syndrome and Related Disorders*. doi: 10.1089/met.2016.0101.
- [9]Dumesic, D. A. . (2015) ‘Scientific statement on the diagnostic criteria, epidemiology, pathophysiology, and molecular genetics of polycystic ovary syndrome’, *Endocrine Reviews*. doi: 10.1210/er.2015-1018.

- [10]Escobar-Morreale, H. F., Luque-Ramírez, M. and San Millán, J. L. (2005) ‘The molecular-genetic basis of functional hyperandrogenism and the polycystic ovary syndrome’, *Endocrine Reviews*. doi: 10.1210/er.2004-0004.
- [11]Ghowsi, M., Khazali, H. and Sisakhtnezhad, S. (2018) ‘Evaluation of Tnf- α and Il-6 mRNAs expressions in visceral and subcutaneous adipose tissues of polycystic ovarian rats and effects of resveratrol’, *Iranian Journal of Basic Medical Sciences*. doi: 10.22038/ijbms.2017.24801.6167.
- [12]Lin, Y. S. . (2011) ‘Interleukin-6 as an Early Chronic Inflammatory Marker in Polycystic Ovary Syndrome with Insulin Receptor Substrate-2 Polymorphism’, *American Journal of Reproductive Immunology*. doi: 10.1111/j.1600-0897.2011.01059.x.
- [13]Meier, R. K. (2018) ‘Polycystic Ovary Syndrome’, *Nursing Clinics of North America*. doi: 10.1016/j.cnur.2018.04.008.
- [14] Zangeneh, F. Z., Naghizadeh, M. M. and Masoumi, M. (2017) ‘Polycystic ovary syndrome and circulating inflammatory markers’, *International Journal of Reproductive BioMedicine*. doi: 10.29252/ijrm.15.6.375.
- [15] Dai, M., Hong, L., Yin, T., & Liu, S. (2024). Disturbed Follicular Microenvironment in Polycystic Ovary Syndrome: Relationship to Oocyte Quality and Infertility. In *Endocrinology (United States)* (Vol. 165, Issue 4). <https://doi.org/10.1210/endocr/bqae023>
- [16] Jasim, R. A., Umran, M. A., & Humadi, E. H. (2020). Correlation between serum interleukins levels with anthropometric data and lipid profiles in obese iraqi women with polycystic ovary syndrome. *Iraqi Journal of Science*, 61(1). <https://doi.org/10.24996/ijs.2020.61.1.7>
- [17] Jasim, R. A., Umran, M. A., & Humadi, E. H. (2020). Correlation between serum interleukins levels with anthropometric data and lipid profiles in obese iraqi women with polycystic ovary syndrome. *Iraqi Journal of Science*, 61(1). <https://doi.org/10.24996/ijs.2020.61.1.7>