

Original Article

The Investigation of the Relationship between Metabolic Parameters in Women with Polycystic Ovary Syndrome

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Abstract

Background: For exploring the relationship between metabolic changes and thyroid function in polycystic ovary syndrome (PCOS) patients, metabolic, endocrine, and thyroid parameters were assessed. **Materials and Methods:** Alterations in endocrine, metabolic, and clinical characteristics in PCOS patients compared with healthy women were studied within a prospective investigation. Also, thyroid parameters were considered. **Results:** 300 women with normal ovulatory and PCOS patients were included and matched by age. There were significant increases in triglyceride (TG), cholesterol (Chol), and total dihydrotestosterone (DHT) in PCOS patients. Also, overall levels of fasting blood sugar (FBS)cc, follicle-stimulating hormone (FSH), testosterone (T), prolactin, and thyroid-stimulating hormone (TSH) were higher in compared with the normal women, but these higher amounts were not statistically significant. There was an insignificant decrease in luteinizing hormone (LH), high-density lipoprotein (HDL), and free T4 in PCOS patients compared with the controls.tissues. **Conclusion:** Our data suggest the metabolic alterations in PCOS patients.The small increases of TG, CHL, and DHT levels may depend on these alterations in PCOS patients' metabolic parameters. Further investigations may clear a vague understanding of the relationship between metabolic parameters alteration and thyroid function.

Keywords: Polycystic ovary syndrome (PCOS), metabolic changes, T4, triglyceride, cholesterol.

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Introduction

One of the most usual endocrine diseases in women of 15-45 age is polycystic ovary syndrome (PCOS) (1). PCOS patients are at the elevated menace

of multiple risk factors such as psychological and cardiovascular disorders, insulin resistance, endometrial cancer, and especially obesity since the nature of the essential pathomechanisms of PCOS are heterogeneous (2). Besides similar clinical features,

pathophysiological abnormalities and risk factors, thyroid disorders are prevalent in many PCOS patients (3-5). For example, hypothyroidism, as one of the thyroid disorders, may cause polycystic ovarian morphology (6). Hence, due to the vague relation between PCOS and thyroid disorders, the exclusion of thyroid disorders is essential before making a PCOS diagnosis.

Further sophisticated relationships among PCOS, autoimmunity, lipid profile disorders, and thyroid dysfunction were found recently, and these kinds of topics have attracted more attention from scientists and researchers in recent years. Calvar et al. claim that (7) PCOS patients have higher insulin resistance index, the occurrence of thyroid abnormalities, and alterations in lipid profile related to healthy women. Also, Trummer et al. (8, 9) represent that PCOS patients have increased thyroid-stimulating hormone (TSH) levels and hypothyroid disorders. A study by Al-Saab and Haddad (10) confirmed a higher prevalence of anti-TG and/or anti-TPO in euthyroid PCOS patients than healthy women. The available literature opposes the connection between endocrine parameters, such as metabolic alteration, lipid profiles, thyroid functions, and sexual hormones (7, 8, 10-12). Concerning this history, the present investigation was carried out to explore these parameters in Iranian PCOS patients compared to healthy women.

Methods

During a case-control study, PCOS patients were elected among women matched by age 18 to 39 years referred to Shiraz's Shahid Doran Hospital in 2019. Three hundred patients with PCOS and three hundred healthy subjects were included in the study. Defined by the NIH in 1990 (13), diagnosis of PCOS was excluded based on clinical symptoms of ovarian disorders such as amenorrhea, oligomenorrhea or infertility, and laboratory or clinical signs of hyperandrogenism, such as hirsutism or acne. Appropriate history and clinical examination were made in all patients and controls. This study is the results of a research project approved by the Student Committee of Shiraz University of Medical Sciences. Laboratory measurements Blood samples were collected after 14-12 hours and circulating levels of

FBS, triglyceride, cholesterol, HDL, prolactin, FSH, LH, Testosterone, DHEA-S, T4, and TSH were assessed. It should be noted that written consent was obtained for both groups. Measurement of FBS, triglyceride, cholesterol, HDL was assessed by an enzymatic method (Pars test kit), and testosterone, DHEA-S were evaluated by the RIA method (Immunotech kit). Prolactin, FSH, LH were measured by chemiluminescence (Owjazma kit) and T4 and TSH measurement were performed by the ELISA method (Pishtaz Kit). The Friedwald formula [$LDL = Chol - (TG / 5 + HDL)$] was applied to calculate LDL.

Statistical Analysis. For statistical analysis, T-test and Mann-whitneyU tests were implemented for quantitative variables, and Fisher Exact and Chi-square tests were used for qualitative variables, and p-value <.05 was considered as significant. Also, SPSS 17.0 was applied for statistical analysis.

Results

The clinical features and endocrine parameters of both groups are shown in Table 1 and Table 2.

As shown in Table 1, the most common clinical features in patients with PCOS were irregular menstrual cycles (60%), overweight (81%), hirsutism, especially in overweight patients (70%), and infertility (65%). Other clinical features in the patients with PCOS included abortion (16%), hair loss (35%), metabolic syndrome (14%). Also, the prevalence of hirsutism in lean patients was 41% (Table 1). In Table 2, the metabolic characteristics of patients with PCOS related to the control group are also compared. Regarding these characteristics, triglyceride levels were significantly different in samples with PCOS compared with control samples so that the mean triglyceride level in affected samples was 170 mg/dl while it was 146 mg/dl in control samples. This difference was statistically significant (p-value <.0001).

Also, regarding the cholesterol level, the results showed a significant increase (P-value <0.0001) in the PCOS group (mean 179 mg/dL) compared to the control group (152 mg/dL). Besides, a significant (P-value <0.0001) increase in DHT was observed in PCOS compared to the control group. HDL levels in

Table1. Clinical features of two PCOS patients and healthy groups.

Clinical features	PCOS(N%)		Non-PCOS(N%)	
	Yes	No	yes	No
Preterm delivery	84(28%)	216(72%)	45(15%)	255(85%)
Metabolic syndrome	42(14%)	258(86%)	33(11%)	267(89%)
Irregular menstrual cycles	180(60%)	120(40%)	60(20%)	240(80%)
hair loss	105(35%)	195(65%)	45(15%)	255(85%)
Hirsutism in obese patients	210(70%)	90(30%)	54(18%)	246(82%)
Hirsutism in lean patients	123(41%)	177(59%)	39(13%)	261(87%)
Infertility	195(65%)	105(35%)	66(22%)	234(78%)
Overweight	243(81%)	57(19%)	75(25%)	225(75%)
Abortion	48(16%)	252(84%)	36(12%)	264(88%)

Table2. Metabolic parameters and endocrine features in polycystic syndrome- and non-polycystic syndrome group.

	PCOS (n=300)	Non-PCOS(n=300)	P value
Age (years)	28.79±7.03	29.23±7.16	>0.9999
FBS (mg/dl)	86±9.81	86.83±6.82	>0.9999
FSH (IU/L)	6.82±5.79	6.23±1.79	>0.9999
LH (IU/L)	6.22±5.69	6.80±1.57	>0.9999
Testosterone (ng/ml)	0.63±0.35	0.26±0.13	>0.9999
Triglyceride (mg/dl)	170.35±30.67	146.80±21.82	<0.0001
Cholesterol (mg/dl)	179.08±17.48	152.44±31.9	<0.0001
HDL (mg/dl)	43.06±2.94	48.30±5.50	=0.0755
Prolactin (ng/ml)	19.21±18.79	14.07±4.42	=0.0865
TSH (mIU/L)	4.31±3.44	3.91±0.99	>0.9999
T4 (ng/dl)	7.40±1.99	8.42±1.08	>0.9999
DHT (pg/ml)	254.82±97.19	61.16±20.26	<0.0001

Data are shown as mean±SD. P<0.05 was considered statistically significant.

affected samples were lower than healthy samples (mean 48), but this difference was not statistically significant (P-Value = 0.07). One-way ANOVA test analyzed all obtained data in this study.

Discussion

The PCOS is classified as a hyperandrogenic syndrome and defined by biochemical hyperandrogenism and clinical feature. In this study, the most common clinical features in PCOS patients were overweight, hirsutism, infertility, irregular menstrual cycles, hair loss, abortion, and metabolic syndrome with 81%, 70%, 65%, 60%, 35%, 16% and 14% frequency, respectively.

Due to our obtained data, serum triglyceride, cholesterol, and total DHT are observed to be elevated in PCOS patients, which is consistent with other research (11–13). Regarding metabolic parameters (FBS and lipid profile), the stability in PCOS patients is expected. FBS, as one of the essential metabolic factors, was found with no change in patients with

PCOS related to the control group. Triglyceride and cholesterol are significantly higher in patients with PCOS, which proved that PCOS patients have lipid metabolism disorders. In general, our data are supported and confirmed by other researchers (14–16). Our results showed a small increase in TSH in PCOS patients, which was insignificant. One possible mechanism for this TSH elevation in women is that increased leptin in obesity has been proposed to act directly in the hyperthyrotropinemia and subsequent increased susceptibility to hypothyroidism (17). Another suggested mechanism is that obesity is associated with an elevation of pro-inflammatory markers, especially in patients with metabolic syndrome, which could lower the activity of the deiodinase-2 at the pituitary level with the consequence of elevated TSH levels (18). Also, the amount of T4 in PCOS patients showed a slight decrease related to the control group. An explanation for this issue may be that the TSH elevation is too small to induce the feedback. However, due to the lack of

investigations studying this hypothesis, more explorations are needed for examination and confirmation. Finally, despite the insignificant TSH elevation in our study compared with our control group, T4 remained in the normal range. We suggest that the patients in our study have been in some euthyroid conditions or have only very mild hypothyroidism without clinical relevance ("subclinical hypothyroidism", SCH).

Also, an investigation has claimed that in women with PCOS, higher triglyceride and cholesterol were associated with SCH (19). Thus, our investigation suggests an association between the metabolic alterations in PCOS and SCH, whereby the causal relationship and the mechanisms are still unclear. In the sexual hormones section, we assessed FSH, LH, testosterone, Prolactin, and total DHT in PCOS patients and compared them to healthy women. FSH, testosterone, and prolactin were slightly higher in PCOS patients, but this elevation was not significant. Also, LH was a bit lower compared to healthy women, but it was not substantial too. We found an extreme elevation amount of DHT in PCOS patients related to the significant control group. Based on our results, it is suggested that the risk of developing fat and hormonal abnormalities be recommended to all PCOS patients, and the necessity of lifestyle modification should be advised.

Conclusion

In this study, the level of TG, CHL, and DHT in PCOS patients were higher than the healthy women group. Since there have been unclear changes in many other metabolic parameters or phenotypic manifestations, the relationship between the thyroid function and PCOS needs further investigation.

Conflict of Interest

The authors declared no conflict of interest.

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