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A Study of Some Physiological Variables in Women Suffering from Polycystic Ovary Syndrome in Diyala Governorate-Iraq

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Abstract.

Polycystic ovary syndrome is an endocrine, metabolic, and polygenic genetic disorder that leads to infertility in about 10% of women of reproductive age. The current study aims to assess the impact of some hormone levels (prolactin, progesterone, Luteinizing Hormone (LH), TSH, follicle stimulating hormone (FSH), insulin, and vitamin D3) on the risk of polycystic ovarian syndrome in women living in the Diyala population. In the current study, 33 samples from healthy women were used for the control group; the 54 samples were obtained from women patients with polycystic ovarian syndrome in the age range of 20 to 40 who returned to Al-Batoul Teaching Hospital and Al-Shams Laboratories in the city of Baqubah, the center of Diyala Governorate. The samples were collected beginning in October 2022 and till in May 2023, for the group of patients and healthy women's. The current study's findings indicate that the levels of LH, testosterone in female patients varied significantly ($P<0.05$), in comparison to healthy women (7.78±3.62 Vs 5.43±2.81 and 0.52±0.21 VS 0.17±0.09). Conversely, it was shown that female patients' levels of vitamin D3 (24.31±11.85) were lower than those of healthy females (35.66±15.64). Lastly, there were no statistically significant changes ($P > 0.05$) found between the female patients and the healthy female patients in the levels of FSH, TSH, prolactin, and insulin. In addition to the existence of additional positive and negative correlations between the current variables, which are not significant, the study's results demonstrated a significant positive correlation between testosterone and FSH ($P = 0.026$, $R = 0.304$*) based on the Pearson correlation coefficient. The current study's results indicate that LH and testosterone had the highest sensitivity (72% and 74%) and specificity (55% and 58%) at cut-off points (4.37 and 0.17), as well as a statistically significant difference ($P<0.05$) in identifying patients with polycystic ovary syndrome, based on the ROC curve, which is used to determine the sensitivity and specificity of variables in diagnosing patients with the syndrome.

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1. INTRODUCTION

A problem in the hormonal balance of the ovaries in women who are of reproductive age is known as polycystic ovarian syndrome (PCOS) [1]. It stands for a prevalent disease among reproductive-age women [2]. Five to ten women who are of reproductive age are affected by PCOS syndrome, which is characterized by a number of symptoms such as obesity, hirsutism, and anovulation [3]. Small cysts containing ovarian fluid are a hallmark of PCOS [4,5]. Alternatively, they might be tiny, benign, non-cancerous growths inside the ovary that interfere with ovulation and make it harder to become pregnant [6]. While PCOS is an incurable chronic illness, some of its symptoms may be managed by women who have it by changing their lifestyles, taking medication, and undergoing reproductive treatments [7].

It has been established through the pathophysiology of the condition and numerous recent studies that women with the syndrome experience long-term negative effects on their lives, such as psychological disorders and sleep disturbances [8], ovarian weakness and hypothalamic abnormalities [9], abnormal eating behavior and depression disorders, anxiety about expectations of marriage and childbearing [10], and anxiety that accounts for 80% of cases of reproductive infertility [11].

Even though the ovary is the major source of malfunction, both the clinical indicators and the severity of symptoms are dependent on external circumstances. LH levels, insulin resistance (IR), and obesity (OB) are these variables. The pathophysiology of PCOS syndrome involves four primary disorders: elevated and superfluous androgen production, elevated insulin production, impaired insulin action, and aberrant ovarian morphology characterized by numerous cysts and increased ovarian size [12].

Health issues such as type 2 diabetes, hypertension, high blood pressure, high cholesterol, heart disease, and endometrial cancer are more common in women with ovarian syndrome than in other women. Because polycystic ovarian syndrome causes irregular menstruation, which makes pregnancy difficult, it is the primary cause of infertility. It is coupled with an absence of ovulation. Numerous tiny fluid-filled cysts may develop in both ovaries in polycystic ovarian syndrome, and this condition may lead to pelvic inflammation [13].

Because of the high ratio of follicle-stimulating hormone (FSH) to luteinizing hormone (LH), PCOS causes multiple small cysts to form in both ovaries, with more than 25 cysts in each ovary or cyst sizes larger than 10 ml [14,15]. Women with PCOS may experience an increase in body and facial hair, acne, obesity, irregular or interrupted menstruation cycles, heavy menstrual flow, or trouble becoming pregnant. Additional symptoms include enlarged ovaries with cysts, elevated blood sugar levels, and infertility [16].

Furthermore, symptoms such as male-pattern baldness, changes in complexion, skin darkening, anxiety, sadness, and mood swings have been observed [17]. Other issues include stress, low self-esteem, eating disorders, the emergence of dark spots on the skin, sleep apnea, and psychosexual dysfunction [18]. An abnormal FSH to LH ratio is a major factor in the formation of ovarian cysts. Studies have shown that this imbalance leads to an increase in the production of androgens, which causes symptoms associated with PCOS such as hirsutism and acne [19]. In the population of Diyala Governorate, the current study aims to determine the effect of high or low levels of sex hormones, insulin, and vitamin D3 on the risk of PCOS.

2. MATERIALS AND METHODS.

2.1 Study Samples.

The current study was conducted on a group of females in two groups: the first group was women with polycystic ovary syndrome, and the second group was healthy women who visited Al-Batoul Teaching Hospital in the infertility unit and also within some external laboratories in the Baquba Center, including the Al-Shams Laboratory, the first branch and the second branch, where blood samples were taken from the women. Healthy women and women with polycystic ovary syndrome (PCOS) during the period from October 2022 to May 2023, there were 87 research samples total, of whom 54 had been identified by a professional as having polycystic ovarian syndrome and 33 were healthy individuals in the 20–40 age range. Using plastic medical syringes, 8 ml of venous blood was extracted. The blood was then put in test tubes to be tested for hormones (prolactin, progesterone, Luteinizing Hormone (LH), TSH, follicle stimulating hormone (FSH), vitamin D3, and insulin levels.

Determine the level of vitamin D3, insulin, and hormones.

Prolactin, D3, FSH, LH, TSH, and insulin levels were measured using the Cobas e411 instrument in accordance with the Roch company's operating procedure. Electrochemical immunoassay system (ECLIA).

2.2 The general assessment principle.

The Roche Diagnostic Cobas e 411 is a completely automated, software-controlled random-access system for immunoassay analysis [20].

Table 1. The study's diagnostic kit, along with its manufacturer and location or origin.

No.	Diagnostic kit name	Manufacture company	location or origin
1	LH Calset II(Elecsys)	Roche	Germany
2	FSH Calset II(Elecsys)	Roche	Germany
3	TSH Calset II(Elecsys)	Roche	Germany
4	Prolactin II(Elecsys)	Roche	Germany
5	Testosteron II(Elecsys)	Roche	Germany
6	Insulin calset(Elecsys)	Roche	Germany
7	Vitamin D3(Elecsys)	Roche	Germany

2.3 STATISTICAL ANALYSIS

SPSS version 25 was used for the statistical analysis, along with Graph Pad Prism version 6. Number and percentage formats were used to characterize the data and notional rankings, and the chi-square test was used to compare percentages. The T and F tests were used to compare the arithmetic means of the quantitative data, which were expressed as mean ± SD. The cut-off points of sensitivity and specificity for vitamin D3 and hormones in diagnosing patients with polycystic ovarian syndrome were found using the ROC curve. At a significance threshold of P≤0.05, significant differences were computed.

3. RESULTS AND DISCUSSION.

Comparison of insulin, vitamin D3, and sex hormone levels between women with polycystic ovarian syndrome and healthy. The study's findings in Table 2 demonstrated that patients with polycystic ovary syndrome had higher levels of both testosterone and LH than healthy women did. These findings were in line with those of [21]. Who found that the primary sign of a gonadotropin metabolism disorder in polycystic ovarian syndrome patients is an increase in LH levels. Furthermore, compared to healthy women, PCOS patients had considerably greater levels of total testosterone. This result could be explained by the atypical frequency and amplitude of GnRH release from the hypothalamus in PCOS patients, which causes the pituitary gland to produce more LH and increases the synthesis of androgens. The BMI measures and levels of hormonal markers (prolactin, LH, and testosterone) were found to be greater in women with PCOS, except for FSH, which showed only slight variations when compared to those without PCOS, according to the researchers [22]. According to the current findings, female patients had lower prolactin levels than healthy controls, which was in line with findings [23]. Low blood prolactin levels have been linked to metabolic risk in individuals with polycystic ovarian syndrome who are infertile, according to the study. Significant variations in blood vitamin D levels were seen among female patients with normal polycystic ovarian syndrome, these results are consistent with the researcher's results [24].

Table 2. Comparison of sex hormones, vitamin D3, and insulin between polycystic ovary syndrome patients and healthy women.

Groups		N	Mean	SD	P value
LH (IU/L)	Patients	54	7.78	3.62	p<0.05*
	Healthy	33	5.43	2.81	
FSH (IU/L)	Patients	54	6.88	2.28	p>0.05
	Healthy	33	5.95	1.73	
TSH (uIU/ml)	Patients	54	1.76	0.55	p>0.05
	Healthy	33	1.91	0.92	
rolactin (ng/ml)	Patients	54	19.98	7.77	p>0.05
	Healthy	33	20.10	8.17	
Testosterone (ng/ml)	Patients	54	0.52	0.21	p<0.05*
	Healthy	33	0.17	0.09	
Vitamin D3 (ng/ml)	Patients	54	24.31	11.85	p<0.05*
	Healthy	33	35.66	15.64	
Insulin (U/ml)	Patients	54	15.22	6.94	p>0.05
	Healthy	33	14.44	5.57	

P<0.01***, P<0.05*, P>0.05.

This researcher demonstrated that the majority of individuals with polycystic ovarian syndrome had blood levels of vitamin D that were either insufficient or below ideal, and these findings were in line with the findings of the current investigation. Several studies on vitamin D levels in polycystic ovarian syndrome patients are inconclusive for various reasons. Polycystic ovarian syndrome studies' initial diagnostic standards—not all used Rotterdam criteria—may have affected results. as well as, research was also done in several locations. Vitamin D insufficiency is a global issue, but population 25(OH)D concentrations vary. More people in industrialized nations use oral vitamin D supplements than in developing nations. The study groups' selection season also affected vitamin D concentrations, but most previous research ignored this [24]. Serum testosterone, body fat mass, and insulin resistance (IR) were negatively correlated with vitamin

D levels. Vitamin D reduces metabolic issues in PCOS by improving fat metabolism and insulin resistance (IR).

PCOS patients' mental health can benefit from vitamin D pills. Vitamin D's role in PCOS needs further study in cell cultures, animal models, and humans. Doctors need clinical trials to find the best treatments [25].

Vitamin D treatment may improve fat metabolism, insulin resistance, and hyperandrogenism in PCOS patients, according to randomized controlled trials [26]. According to the current findings, female patients had lower TSH levels than healthy controls These results are inconsistent with the researcher's results [27]. According to the present findings, there was no discernible difference in the levels of insulin in the sick and healthy women.

The findings of [28]. which revealed decreased insulin levels in individuals with polycystic ovarian syndrome compared to healthy women, are inconsistent with these findings. Women with PCOS who have insulin resistance should have their blood pressure, liver enzymes, visceral obesity, and high blood triglycerides checked, according to prior research [28]. Phenotypic stratification may also assist medical professionals in anticipating unfavorable metabolic effects.

According to [29], study indicated imply that women with PCOS may require regular monitoring for metabolic problems due to their elevated risk of insulin resistance. The correlation between sex hormones, vitamin D3, and insulin in polycystic ovary syndrome patients. Based on the Pearson correlation coefficient, which is used to measure the correlation between quantitative variables.

Table 3. correlation between sex hormones, vitamin D3, and insulin in polycystic ovary syndrome patients.

		LH (IU/L)	TSH (uIU/ml)	Testosterone (ng/ml)	Insulin (U/ml)
LH (IU/L)	r	1	-0.112	0.183	-0.007
	p		0.420	0.186	0.958
FSH (IU/L)	r	0.162	0.173	0.304*	0.007
	p	0.243	0.211	0.026	0.958
Prolactin (ng/ml)	r	-0.187	-0.144	-0.095	-0.052
	p	0.176	0.299	0.494	0.710
Vitamin D3 (ng/ml)	r	-0.132	0.062	-0.008	-0.210
	p	0.340	0.655	0.954	0.127
Insulin (U/ml)	r	-0.007	0.053	-0.100	1
	p	0.958	0.705	0.473	

The current results demonstrate a favorable connection between FSH and testosterone (P = 0.026 ،R = 0.304*) markers in women with polycystic ovary syndrome. Furthermore, the current findings demonstrate both positive and negative relationships between hormones, insulin, and vitamin D. These connections, however, did not reach statistical significance (P > 0.05). A recent study found a substantial correlation between the blood levels of LH-FSH and testosterone in Sudanese women with polycystic ovarian syndrome. Moreover, it is possible to distinguish between women with androgen hyperandrogenism and those without PCOS using an LH-FSH ratio larger than one [22].

Prior research suggests that the metabolism of glucose is influenced by serum prolactin [30]. On the one hand, the effects of varying blood prolactin levels on glucose metabolism are varied. Patients with hyperprolactinemia were more likely to have impaired glucose tolerance and insulin resistance [31]. These changes can be reduced using dopamine receptor agonists that reduce prolactin levels in the blood. However, when serum prolactin is in the normal physiological range, its relationship with glucose metabolism is reversed [32]. Pituitary and hypothalamic production of prolactin can be efficiently stimulated [23] suggesting that prolactin may directly increase the synthesis of testosterone. Blood prolactin levels above normal can suppress gonadotropin-releasing hormone (GnRH) production and release from the hypothalamus, as well as decrease GnRH secretion to the portal vein, under specific physiological and pathological circumstances [33].

Specificity and sensitivity to insulin, vitamin D3, and sex hormones.

Table 4's findings indicate that in women with polycystic ovarian syndrome, LH and testosterone had the highest sensitivity (72% and 74%, respectively) and specificity (55% and 58%, respectively). These outcomes were in line with those of [23], which demonstrated the privacy (75% and 72%) and sensitivity of LH and testosterone (86% and 83%).

The high sensitivity, specificity, and ovarian volume of testosterone, and LH are employed in the diagnosis of polycystic ovary syndrome in teenage females. Furthermore, the diagnostic accuracy for identifying polycystic ovarian syndrome in teenage women is enhanced by the combination of four distinct markers [22].

Table 4. ROC curve, insulin, vitamin D3, and the sensitivity and specificity of sex hormones.

Variables	AUC	St. error	p value	cut-off	Sensitivity %	Specificity %
LH (IU/L)	0.63	0.06	0.04*	4.37	72	55
FSH (IU/L)	0.56	0.06	0.32	5.62	61	57
Testosterone (ng/ml)	0.74	0.05	0.001***	0.17	74	58
Insulin (U/ml)	0.42	0.06	0.19	10.40	43	46
TSH (uIU/ml)	0.57	0.06	0.26	1.65	60	58
Prolactin (ng/ml)	0.52	0.06	0.81	17.47	55	50
Vitamin D3 (ng/ml)	0.60	0.06	0.12	22.50	66	54

CONCLUSION

It was observed that the level of LH and Testosterone increased in female patients with polycystic ovary syndrome compared to healthy females, while the level of vitamin D decreased in female patients with polycystic ovary syndrome compared to healthy females. As for the levels of FSH, TSH, Prolactin, and insulin, there were no significant differences between patients and healthy women. Additionally, it was shown that the maximum sensitivity and specificity were recorded by both testosterone and LH. When identifying polycystic ovarian syndrome in female patients.

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