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Effect of PCOS in some Physiological Parameters

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Abstract

Objective: The study was designed to research the relationship between PCOS and hyperinsulinemia, BMI, lipid profile, and age groups.

Method: The study sample was divided into two groups: the first group included 200 women with polycystic ovaries, and the second group was the control group (25 women).

Results: The result showed an increase in insulin, T.G., VLDL, LDL, cholesterol, and body mass index of patients compared with the healthy group and an increase in the number of infections in the age group (20–29).

Conclusion: There is adverse affect for PCOS on the studied physiological parameters.

Keywords: PCOS, hyperinsulinemia, Obesity, lipid profile, BMI.

تأثير متلازمة تكيس المبايض على بعض المعايير الفسيولوجية

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الخلاصة

الهدف: هدفت الدراسة الى البحث عن العلاقة بين متلازمة تكيس المبايض وفرط الانسولين، كتلة الجسم، صورة الدهون والفئات العمرية .

طريقة العمل: تم تقسيم عينة الدراسة الى مجموعتين تضمنت المجموعة الأولى 200 امرأة مصابة بمتلازمة تكيس المبايض والمجوعة الثانية هي المجموعة الضابطة تضمنت 25 امرأة سليمة

النتائج : أظهرت النتائج انه هناك زيادة في مستويات الانسولين T.G, VLDL, LDL والكولسترول وكتلة الجسم لدى النساء المصابات مقارنة مع النساء السليمات وزيادة في عدد الإصابات في الفئة العمرية (20 – 29).

الاستنتاجات: هناك تأثيرات سلبية للإصابة بتكيس المبايض على المعايير الفسيولوجية المدروسة.

الكلمات المفتاحية : متلازمة تكيس المبايض ، فرط الانسولين، السمنة، صورة الدهن، مؤشر كتلة الجسم .

1. Introduction

Polycystic ovary syndrome (PCOS) is the most common ovarian disorder associated with increased secretion of the androgen hormone in women and is multifactorial, genetic, nongenetic, and very complex [1] [2]. Affecting 5-20% of women of fertile age [3]. Insulin resistance, exposure to hyperandrogenism, and increased luteinizing hormone (LH) compared to follicle-stimulating hormone (FSH) secretion are associated with PCOS [4]Some studies have indicated that hyperandrogenism, insulin resistance, oxidative stress, and infertility in polycystic ovary syndrome are associated with changes in genes, and these changes related to lipids promote hyperandrogenism development. On the other hand, hyperandrogenism, as an important factor, causes an increase in lipid concentration and obesity. Also, hypercholesterolemia is associated with higher body mass index (BMI) and higher fasting insulin and insulin resistance (IR) levels than women with PCOS, and normal cholesterol levels in addition to the hypertriglyceridemia in women with polycystic ovaries cause obesity in the abdominal area, which in turn increases the secretion of androgens from the ovaries.

The high levels of testosterone concentration in the adrenal gland also cause inflammation and increased abdominal obesity [5] [6]Both Type II diabetes mellitus (T2D) and PCOS are common conditions associated with compensatory hyperinsulinemia and insulin resistance. It is known that impaired glucose tolerance is common in women with polycystic ovary syndrome, and research has shown that women with T2D are more likely to have polycystic ovaries compared to healthy women [7]. A study by Livadas [8] showed the association of PCOS with the incidence of T2D may be relatively strong, despite the current heterogeneity of data, the constantly changing nature of this disorder, and uncertainty regarding the exact mechanisms regulating the development of glycemia during PCOS. When comparing infected and healthy women with the same weight, it turns out that the prevalence of impaired tolerance glucose T2D in PCOS is higher than in healthy women [9]. Women with PCOS are more likely to experience infertility associated with little or no ovulation [10]. and metabolic syndrome, cardiovascular diseases such as hypertension and dyslipidemia, endometrial dysplasia, endometrial cancer, and malignant ovarian tumors in the future, as well as pregnancy complications such as premature birth, low birth weight, and preeclampsia, as well as emotional and mental disorders [11] [12].

Aim of study: The study was designed to research the relationship between PCOS and hyperinsulinemia, BMI, lipid profile, and age groups.

2. Method and materials

2.1 Study design

The sample was divided into two groups. The first included 200 women suffering from polycystic ovary syndrome who visited the hospital for the period from June 28 to October 15, with ages ranging from 13 to 45 years.

They were diagnosed based on the presence of 2 out of 3 diagnostic signs of polycystic ovary syndrome, hyperandrogenism (acne, hirsutism), a lack of ovulation or its absence, the

presence of 10–12 ovarian cysts or more, and an increase in the size of the ovaries, which were examined by ultrasound imaging [2].

The second group was the control group, which included 25 healthy women who did not suffer from any disease.

2.2 Measurement of Inulin

Measured by COBAS e 411(ROCH, Germany) and R.B.S., LDL, VLDL, HDL, Triglyceride, and Cholesterol were measured using COBAS E311 (Electrochemiluminescence (ECL) technology, Germany).

2.3 Measurement of Body mass index (BMI)

The body mass index was determined by using the equation: BMI = weight in kilograms divided by the square of height in meters

Thin (15-19.9), normal weight (20-24.9), over weight (25-29.9), Obesity (30 - ≥40) [13].

2.4 Statistical Analysis

The Statistical Analysis System (SAS 2018) program was used to detect the effect of different groups (patients and controls) on study parameters. A t-test was used to significantly compare between means in this study.

3. Results and discussion

3.1 Effect of PCOS on Random Blood Sugar and Insulin Concentration.

The results of this study showed that there is a significant increase in insulin concentration and a non-significant level of random blood sugar (R.B.S.) in PCOS women when compared with the healthy group ($P \leq 0.01$) (Table 1). When comparing infected and healthy women with the same weight, it turns out that the prevalence of impaired tolerance for glucose and T2D in PCOS is higher than in healthy women. The increase in insulin concentration, despite the fact that there are normal concentrations of glucose, may be due to the resistance of cells to insulin in order to regulate glucose in the blood. Kim et al. [14] explained that the regulation of glucose concentration depends on an increase in insulin secretion or a decrease in glucose production from the liver, while Janssen [15] showed that overnutrition may cause hyperinsulinemia and a decrease in hepatic insulin clearance. The use of fat-supplemented foods is a reason for the deposition of lipids and the increase of insulin resistance in the liver and skeletal muscles [16].

The increase in insulin level may be due to obesity and the increase in BMI of women with PCOS, where Lustig et al. [17] and Zhang et al. [18] explained that obesity causes hyperinsulinemia, while Ferrannini et al. [19] and Reaven [20]pointed out that obesity and diabetic mellitus are associated with hyperinsulinemia, an increase in T.G., and decreases in HDL, while Kim et al. [14] explain that obesity and resistance to insulin cause an increase in the fat diet, which enhances insulin secretion and a decrease in first-pass hepatic insulin extraction. This may provide a secondary physiological mechanism to preserve pancreatic β-cell function during insulin resistance [14].

Some studies revealed that there is a relationship between PCOS and insulin resistance, hyperinsulinemia, and impaired cell response [21] [22], which are considered indicators of metabolic inefficiency [23].

Table 1- Effect of PCOS on Random blood sugar and insulin concentration

Group	Mean ± SE	
	Inulin (µU/mL)	**R.B.S. (mg\dl)**
Patients	33.20 ±0.82	103.30 ±2.50
Control	14.75 ±0.68	102.60 ±2.54
T-test	2.239 **	7.492 NS
P-value	0.0001	0.846

** (P≤0.01), NS: Non-Significant.

3.2 Effect of PCOS on Lipid Profile

The results of this study showed that there is a significant increase in light-density lipoprotein (LDL) cholesterol, very light-density lipoprotein (VLDL) cholesterol, triglyceride and Total cholesterol concentration, and non-significant increase in high-density lipoprotein (HDL) cholesterol concentration of PCOS women when compared with the healthy group (P≤0.01) (Table 2).

PCOS is associated with an increase in the concentration of body lipid [24] and an increase in body weight, which causes an increase in triglyceride, LDL, and waist circumference from indicators important associated with dyslipidemia [25], so PCOS women are at high risk of contracting cardiovascular disease as a result of dyslipidemia [24]On the other hand, the result of this study showed an increase in body weight and body mass index in women with PCOS, which explains and supports the increase in lipid profile concentration.

Table 2- Effect of PCOS on Lipid Profile

Lipid profile / Group	Mean ± SE (mg\dl) LDL mg\dl	VLDL mg\dl	HDL mg\dl	Triglyceride mg\dl	Cholesterol mg\dl
Patients	104.94 ±2.08	30.24 ±2.33	37.90 ±1.66	151.20 ±5.74	187.60 ±9.06
Control	91.50 ±3.23	23.42 ±0.77	38.60 ±1.88	117.10 ±9.72	151.60 ±5.58
T-test	8.078 **	5.166 **	5.274 NS	23.743 **	22.365 **
P-value	0.0026	0.0001	0.783	0.0074	0.0033

** ($P \leq 0.01$), NS: Non-Significant.

3.3 The Relationship between PCOS and Body mass index

Among the 200 women with PCOS, 49% suffered from obesity, 25% had overweight, 24% had a normal weight, and 2% were thin according to Nuttall [13].

Obesity results from an increased intake of food on energy consumption [26]or may be due to hyperinsulinemia as a result of insulin resistance, which causes changes in the pathways controlling lipid consumption, lipogenesis, and lipolysis at several levels and the expansion of adipose tissues [27] [28] The result of this study revealed an increase in insulin concentration, which reflected on the body weight of women.

On the other hand, Farkas et al. [29]explained that PCOS is characterized by insulin resistance and a decrease in cell sensitivity to insulin, so the uptake of carbohydrates increases. In addition to the effect of many variants combined, which present in different or the same genes and cause obesity [30], Despite the effect of these genes, which are associated with the mass of fat and obesity (FTO), they are not directly connected with PCOS, but they have an effect on insulin resistance and obesity in addition to metabolic factors [31]. Also, the variants within FTO influence hyperandrogenemia in PCOS women [32].

On the other side, impaired cholecystokinin (CCK) secretion, which is associated with a high level of testosterone, plays an important role in increasing appetite for eating and causing an increase in body weight [33]. And obesity may result from the accumulation of fat in the abdomen and insulin resistance, which result from an increase in corticosteroid production in women with PCOS [34].

Table 3- The relationship between PCOS and Body mass index

Weight	Thin	Normal weight	Over weight	Obesity
Rate(%)	2%	24%	25%	49%

3.4 The Relationship between PCOS and the age group

Among the 200 women with PCOS, there were 23% (13–19 years old), 51% (20–29 years old), 21% (30–39 years old), and 5% (40–45 years old).

Many studies and research have indicated that the highest incidence of the syndrome occurs in the reproductive age and the period of reproductive system activity. In this period, the ovaries are exposed to the effects of hormonal changes, especially gonadotropins, in addition to the high secretion of androgens. A study by Otto et al. [35] pointed out that the syndrome usually occurs in women during puberty, and the most important characteristic is the high concentration of androgens and insulin and increased insulin resistance. While Adone and Fulmali [36]proved that teenage girls are more likely to be infected if they are characterized by an unhealthy lifestyle, this was consistent with the results of the study by Ajmal et al. [37] and Zeng et al. [38], which indicated that polycystic ovary syndrome usually affects women of childbearing age as a result of the interaction of genetic and environmental factors and their reflection on the secretion of hormones.

Table 4- The relationship between PCOS and the age group

Age	13-19	20-29	30-39	40-45
Rate(%)	23%	51%	21%	5%

4. Conclusion

The results of this study appeared that there are adverse affect for PCOS on the studied physiological parameters.

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