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EXAMINING THE RELATIONSHIP BETWEEN HORMONAL STATUS, BODY MEASUREMENTS, AND BIOCHEMICAL MARKERS IN WOMEN WITH POLYCYSTIC OVARIAN SYNDROME

Biochemistry

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ABSTRACT

Background: Polycystic ovarian syndrome (PCOS) is a leading cause of anovulatory infertility and it significantly increases the risk of developing metabolic syndrome.This study aims to assess the hormonal status in women with PCOS and examine how it correlates with anthropometric measurements and biochemical parameters. **Materials & Methods:** We conducted a case-control study involving 100 women diagnosed with PCOS and 100 age-matched healthy controls, all between 18 and 40 years old. We measured body mass index (BMI), waist-to-hip ratio (WHR), fasting blood glucose levels, lipid profiles, and hormonal levels in both groups. **Results:** Hormonal levels of LH and FSH were significantly elevated in women with PCOS compared to healthy controls ($P < 0.0001$). FSH levels exhibited significant positive correlations with anthropometric measurements (BMI, WHR), biochemical parameters (total cholesterol, triglycerides, LDL, and total cholesterol/HDL ratio), and hormonal profiles (LH, FSH, LH/FSH ratio) in women with PCOS. **Discussion & Conclusion:** The study highlights a high prevalence of hypothyroidism, dyslipidemia, and elevated levels of LH, FSH, and an increased LH/FSH ratio.

KEYWORDS

INTRODUCTION

Polycystic ovary syndrome (PCOS) is characterized by hormonal imbalances related to reproduction, resulting in symptoms such as hyperandrogenism and infertility (Miguel and Manuel, 2020). This condition leads to the ovaries producing excessive amounts of androgens. Polycystic ovarian syndrome (PCOS) is characterized by the presence of numerous small cysts (fluid-filled sacs) on the ovaries. Women with PCOS typically exhibit elevated levels of luteinizing hormone (LH) and reduced levels of follicle-stimulating hormone (FSH), leading to menstrual cycle regulation issues (Kambale et al., 2023). Although, there is no specific treatment for polycystic ovary syndrome (PCOS), the condition can be managed through strategies such as lowering blood sugar levels and using medications to regulate the menstrual cycle, with insulin-sensitizing drugs being a common first-line treatment. Additionally, gonadotropins may be employed as an initial treatment to promote ovulation (Gudovic et al., 2024). This study aims to assess the hormonal status of women with PCOS and investigate its correlation with anthropometric measurements and biochemical parameters.

MATERIALS AND METHODS

The case-control study was conducted at New Medical College Hospital (NMCH), affiliated with Government Medical College in Kota.

Inclusion criteria

All participants both cases and controls, were aged between 18 and 40 years and were attending the obstetrics and gynecology outpatient clinic. The subjects were women diagnosed with PCOS based on established criteria, who had not used oral contraceptives for at least three months and were premenopausal (FSH <12 IU/L). The control group consisted of women without PCOS had regular menstrual cycles, and exhibited no clinical or biochemical signs of hyperandrogenism, such as irregular menstruation or hirsutism.

Exclusion criteria

Patients under 18 years and over 40 years were excluded. Individuals with diabetes mellitus, hypertension, thyroid disorders, renal diseases, cardiovascular diseases, or Cushing's syndrome were not eligible. Pregnant or lactating women and those who had taken hormonal, hypoglycemic, or lipid-lowering medications within the past six weeks were also excluded.

After consulting with patients in the gynecology outpatient clinic, informed consent for study enrollment was obtained. During clinic hours, anthropometric measurements, including height, weight, waist to-hip ratio, and body mass index (BMI), were recorded in the central clinical laboratory. Subsequently, a 5 ml venous blood sample was drawn from the antecubital vein of each participant after an overnight fast of 10 to 12 hours, using standard aseptic techniques. Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) levels were measured using electrochemiluminescence immunoassay.

RESULTS

A total of 100 subjects diagnosed with PCOS and 100 controls were included in the study. The mean age was found to be 24.07 for PCOS subjects and 26.6 years for controls. Women with PCOS exhibited significantly higher mean values for body mass index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR) compared to controls ($P<0.001$).Their mean fasting blood sugar (FBS) (100.6 mg/dl ±21.4) levels were also significantly elevated as compared to normal control group (85.6 mg/dl ±7.4). Additionally, Cholesterol, triglycerides, low density lipoprotein (LDL-C), and very low-density lipoprotein (VLDL-C) were marginally elevated (178.10±42.8mg/dl; 131.38±52.8; 111.94±44.4 and 23.87±10.5respectively) whereas HDL-C level decline in PCOS group (42.28±14.4mg/dl) as compared to control group. Furthermore, the lipid risk factors such as LDL-C/HDL-C ratio and TC/HDL-C ratio were also elevated in PCOS subjects compared to control group (Table 1).

Hormonal levels, including LH and FSH were all significantly elevated in the PCOS group. It is evident from the data that hormonal level of normal control group remains within normal limits (FSH: 7.94±2.5; LH: 7.69±2.4) whereas FSH and LH level were elevated in PCOS group (16.08±36.4 and17.75±21.2respectively). The LH/FSH ratio in PCOS group was significantly higher than the normal control group (Table 1).

Moreover, FSH showed significant positive correlation with TC (r=.235), LDL (r= 0.059), LDL/HDL R (r=.264) and TC/HDL R (r=0.268). LH showed non-significant positive correlation with TC (r= 0.103), TG (r= 0.135), LDL (r= 0.273), VLDL (r= 0.135), LDL/HDL R (r=.070) and TC/HDL R (r=0.087). As seen in table, BMI, WHR showed positive correlation with FSH and LH. But BMI showed significant positive correlation with FSH (r= 0.302) and WHR showed significant positive correlation with FSH (r= 0.231) and LH (r= 0.210) only (Table 2&3). Negative correlations were found among LH/FSH ratio, BMI and WHR in women with PCOS.

Table 1: Comparison Of Mean Values Of Parameters Between Pcos Women And Healthy Control

Parameters	PCOS Women (*N*=100) (Mean±SD)	Control (*N*=100) (Mean±SD)	Significant *p* value
Weight	60.33±5.9	55.96±4.8	.000
Height	155.10±6.3	161.03±4.7	.000
BMI	25.11±2.4	21.58±1.6	.000
WC	76.24±8.0	72.94±5.9	.001
HC	96.16±3.7	95.24±6.0	.201
WHR	0.79±.07	.76±.02	.001
FBS	100.61±21.4	85.64±7.4	.000

TC	178.10±42.8	155.08±23.1	.000
TG	131.38±52.8	99.94±63.1	.000
HDL	42.28±14.4	48.24±9.6	.001
LDL	111.94±44.4	86.85±27.2	.000
VLDL	23.87±10.5	19.98±12.6	.019
LDL/HDL Ratio	3.09±2.0	1.90±.78	.000
TC/HDL Ratio	4.72±2.1	3.33±.80	.000
FSH	16.08±36.4	7.94±2.5	.027
LH	17.75±21.2	7.69±2.4	.000
LH/FSH Ratio	1.86±1.5	1.06±.49	.000

p< 0.05 is significant

Table 2: Showing Correlation Of Bmi And Whr With Hormones In Women Diagnosed With Pcos

Sr.No.	Variables		BMI	WHR
1.	FSH	*R*	.302**	.231*
		P	.002	.021
2.	LH	*R*	.183	.210*
		P	.069	.036
3.	LH/FSH Ratio	*R*	-.068	-.065
		P	.501	.524

p< 0.05 is significant

Table 3: Showing Correlation Of Lipid Profile With Hormones In Women Diagnosed With Pcos

Sr. No.	Variables		TC	TG	HDL	LDL	VLDL	LDL/HDL R	TC/HDL R
1	FSH	*r*	.235*	.003	-.146	.273**	.003	.264**	.268**
		p	.019	.978	.148	.006	.978	.008	.007
2	LH	*r*	.103	.135	.027	.059	.135	.070	.087
		p	.306	.182	.788	.562	.182	.487	.387
3	LH/FSH Ratio	*r*	-.174	.182	.213*	-.280*	.182	-.276**	-.262**
		p	.084	.070	.033	.005	.070	.005	.009

p< 0.05 is significant

DISCUSSION

An endocrinological imbalance and metabolism are associated with PCOS. It can result in metabolic syndromes as well as difficulties related to reproduction and childbirth. The majority of women with PCOS diagnoses are either overweight or obese, according to studies that link the condition's frequency to the severity of obesity (Naidu et al., 2013). Similar to earlier research, the present study discovered that 50% of women with PCOS are overweight or obese (Taneja et al., 2019).Our results complement the findings of Shah et al. (Shah et al., 2017) and ThathapudiS et al. (Thathapudi et al., 2014) but they contradict the finding of Rasool Suzan Omer (Omer, 2015) that PCOS women did not exhibit significantly high WHR.

Women with PCOS experience worsening clinical, hormonal, and metabolic alterations when they are obese (Sarbhai and Paul, 2016). El-Hafeez HA et al. found that women with PCOS who had higher waist circumferences and BMIs also had insulin resistance (El-Hefez et al., 2013). Anthropometric measures and lipid parameters showed strong positive relationships, according to research by Saghafi-Asl et al. They found that the waist to height ratio (WHR) and low-density lipoprotein cholesterol among PCOS patients showed the highest relationships (Saghafi-Asl et al., 2013). We also looked at the current, noteworthy positive connection between BMI and WHR and the lipid markers TC, TG, and LDL-C. Our research revealed that PCOS women had low HDL-c levels and high TC, TG, and LDL-c values, which was consistent with earlier findings from Sarbhai et al., (Sarbhai and Monini, 2016). Our study found deranged lipid parameters with significant increased mean value of TC, TG, LDL-C, VLDL-C and decreased HDL-C in PCOS women after the comparison with healthy control women

The current study, which is consistent with earlier research (Taneja et al., 2019), found that PCOS patients had higher FBS levels than control women. It is believed that insulin resistance can lead to both glucose intolerance and changes in glucose uptake. A major part of the pathophysiology of PCOS is played by insulin resistance and hyperinsulinemia. According to certain research, hypothyroidism can be brought on by insulin resistance and elevated testosterone production (Corbould, 2007).According to a study by Taneja et al. (Taneja et al., 2019), PCOS women had significantly higher levels of LH, FSH, and the LH/FSH ratio (p<0.0001) than healthy females. Compared to healthy women we found that PCOS women had significantly higher mean values of LH, FSH, and LH/FSH Ratio. This outcome was found in the Shah et al. study (Shah et al., 2017).

CONCLUSION

Women with PCOS have a higher risk of developing diabetes and cardiovascular disease, with increased obesity They also have higher prevalence of insulin resistance, dyslipidemia, and hypothyroidism. The study highlights the importance of early diagnosis and monitoring of biochemical, metabolic, and endocrine markers for early treatment.

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