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Analyzing the biochemical, clinical, and hormonal characteristics of patients with polycystic ovary syndrome

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Abstract

To analyze the biochemical, clinical, and hormonal characteristics of patients with four phenotypes of Polycystic ovary syndrome (PCOS). A total of 225 patients admitted to Medistate Kavacık Hospital Gynecology and Obstetrics outpatient clinic and Giresun University Faculty of Medicine Gynecology and Obstetrics clinic between January 2019 and January 2020 diagnosed as PCOS and healthy controls were included in the study. The revised Rotterdam criteria were applied to diagnose PCOS. The patients with PCOS were divided into Type I classic, Type II classic, Ovulatory and Normoandrogenic PCOS. Biochemical, clinical, and hormonal values were compared. The mean age of the participants is 28 (±5.7) and the mean body mass index (BMI) is 26.15 (±5.36). The mean Ferriman Gallwey Score (FGS) is 7.4(±5.4), which is normal. There is a statistically significant difference between the four PCOS groups and control group in terms of age (p-value=0.000), BMI (p-value=0.000), Luteinizing hormone / Follicle stimulating hormone (LH/FSH) (p-value=0.000), and fasting blood sugar (p-value=0.01). There is a statistically significant difference among the four phenotypes in terms of BMI (p-value =0.002), LH/FSH (p-value =0.000), LH (p-value =0.000), free T4 (p-value =0.01), fasting insulin (p-value =0.001), total testosterone (p-value =0.000), FGS (p-value =0.000), etc. Age, BMI, LH/FSH, FSH, LH, fasting blood sugar, and hirsutism are good predictors of PCOS.

Keywords: anovulation, hyperandrogenism, hirsutism, phenotype, polycystic ovary syndrome

1. Introduction

Polycystic ovary syndrome (PCOS) affects 5-8 % of women at reproductive age as the most frequent endocrinopathy (1). PCOS is characterized by chronic anovulation, biochemical or clinical hyperandrogenism, and polycystic ovaries morphology (2). It is a multifactorial disorder due to environmental and genetic factors. PCOS includes different phenotypes due to its heterogeneous nature (3). It is considered a metabolic and systemic disorder like insulin resistance and hyperglycemia, increasing the risk of type II diabetes mellitus (DM) and cardiovascular diseases (4), hyperinsulinemia, insulin resistance (IR), and dyslipidemia (5).

Women with PCOS have hyperinsulinemia and IR affecting the hypothalamo pituitary ovarian axis, increasing the secretion of Luteinizing hormone (LH) over Follicle stimulating hormone (FSH), producing ovarian androgen, and reducing follicular maturation and Sex Hormone Binding Globuline (SHBG) (4).

Obesity plays an important role in the clinical features and pathophysiology of PCOS due to increased circulation of free androgen in blood, causing to change in the function of ovarian granulosa cells and the development of follicles (6). Based on the four phenotypes defined by the Rotterdam (7), the hormonal and anthropometrical differences show more similarity of the phenotype D to the control group than the other PCOS phenotypes in a study by Yilmaz et al. in Turkey (8). According to Dewailly et al. (9), those with polycystic ovaries and oligo-anovulatory morphology had mild endocrine features of PCOS. The clinical variants and classical form of PCOS in a Bulgarian population show significant differences in hormonal and anthropometric indices (10).

The present study aims to analyze the biochemical, clinical, and hormonal characteristics of patients with four phenotypes of PCOS, compare them in the four phenotype groups and the five study groups.

2. Materials and methods

This retrospective study was conducted on 225 patients who admitted to Medistate Kavacık Hospital Gynecology and Obstetrics outpatient clinic and Giresun University Faculty of Medicine Gynecology and Obstetrics clinic between January 2019 and January 2020. The Ethics Committee approved this study of Beykoz University, Turkey (Date:26.02.2020 Decision No:1). All procedures conducted in studies, including human participants, conformed to the national or institutional research committee's ethical standards and the 1964 Helsinki Declaration and its later amendments or other ethical standards.

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Table 1. The descriptive statistics of variable

Variable	Minimum	Maximum	Mean	Sd
Age	18	41	28	5.7
BMI	16.9	44.9	26.15	5.36
LH/FSH	0.01	6.9	1.34	0.9
HOMA-IR	0.59	14.77	3.03	2.07
FSH	1.51	10.9	5.79	1.76
LH	0.04	52.57	7.37	5.4
Estradiol	6.98	330.9	56.5	46.2
Free T4	0.52	16.2	1.3	1.3
TSH	0.46	7.98	2.35	1.3
Prolactin	0.49	143	21.6	16.05
Fasting Sugar	73	130	93.1	8.9
Fasting Insulin	3.1	54.04	12.9	8.02
Cholesterol	20	352	191.05	49.4
LDL	-48.8	243.8	107.5	36.5
HDL	24	154	57.6	16.5
Triglyceride	31	341	105.7	52.1
Testosterone	3	141	32.9	18.4
DHEA-SO4	33.8	677.3	289.5	95.03
Leukocytes	3.75	13.5	7.9	2.1
Neutrophil	1.66	9.83	4.8	1.6
Basophils	0.01	2.47	0.06	0.2
Lymphocytes	0.04	4.89	2.3	0.7
Monocytes	0.03	1.36	0.5	0.1
Hb	9.6	24.5	13.09	1.3
Htc	30.7	45.2	39	3.02
PLT	116000	419000	262050.2	53405.4
PCT	0	1	0.2	0.07
RDW	10.9	18.4	13.3	1.3
MPV	6.9	12.8	9.5	1.002
MCV	69.9	98.2	85.01	5.08
FGS	0	22	7.4	5.4

The revised Rotterdam criteria were applied to diagnose PCOS. Biochemical, clinical, and hormonal values were compared. The patients with PCOS were divided into four groups: Type I classic PCOS (hyperandrogenism+chronic anovulatuary+PCOS) (n=72), Type II classic PCOS (hyperandrogenism+chronic anovulatuary+normal ovaries) (n=10), ovulatory PCOS (n=19), and normoandrogenic PCOS (normoandrogenism+chronic anovulatuary+PCOS) (n=38). The criteria for inclusion in the study was age between 18 and 41 years. The criteria for exclusion from the study were: smoking; having DM, endocrinopathy, or hypertension; use of drugs that alter the metabolism of insulin, lipids, or hormones up to three months before the study; deficiency of vitamins B6 and B12 or taking vitamin supplements up to 6 months before the study.

2.1. Statistical analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 19). The student's t-test was used to compare the means of the two groups. A p-value of < 0.05 was considered statistically significant. The Kolmogorov–Smirnov test shows that only variables of FSH, Hematocrit (Htc), and mean platelet volume (MPV) have a normal distribution and other variables have no normal distribution. To investigate the significant difference among the groups for the normal variables, One-way ANOVA is used, and in nonparametric variables, Kruskal-Wallis test is used. Post-hoc Dunn test is used to analyze the significant results more.

Table 2. The comparison of five groups in terms of the studied variable

Variable	Type I classic PCOS (n:72)	Type II classic PCOS (n:10)	Ovulatory PCOS (n:19)	Normoandrogenic PCOS (n:38)	Control Group (n:86)	Chi-Square	Sig.
	Mean (sd)	**Mean (sd)**	**Mean (sd)**	**Mean (sd)**	**Mean (sd)**		
Age	**25.1 (2.07)**	**25.7 |(4.7)**	**27.05 (5.7)**	**26.6 (4.9)**	**31.4 (5.01)**	**52.02**	**0.000**
BMI	**27.3 (5.8)**	**20.9 (1.7)**	**27.04 (4.5)**	**27.4 (4.3)**	**24.9 (5.2)**	**23.09**	**0.000**
LH/FSH	**1.8 (1.1)**	**0.8 (0.2)**	**0.9 (0.6)**	**1.4 (0.60**	**0.9 (0.6)**	**56.8**	**0.000**
HOMA-IR	**3.8 (2.4)**	**2.04 (0.8)**	**2.6 (1.4)**	**3.8 (2.3)**	**2.2 (1.2)**	**46.5**	**0.000**
FSH	5.5 (1.5)	6.9 (1.6)	5.9 (1.7)	5.4 (1.8)	6 (1.8)	F=2.18	0.07
LH	**9.7 (5.01)**	**5.6 (1.6)**	**6.03 (4.9)**	**7.8 (5.1)**	**5.7 (5.5)**	**46.1**	**0.000**
Estradiol	66.8 (61.7)	34.1 (9.8)	48.6 (20.5)	51.7 (32.9)	54.3 (41.2)	7.7	0.1
Free T4	**1.4 (1.7)**	**1.05 (0.06)**	**1.2 (0.4)**	**1.6 (1.6)**	**1.3 (1.07)**	**11.5**	**0.02**
TSH	2.4 (1.4)	2.1 (1.4)	2.06 (1.2)	2.6 (1.2)	2.2 (1.2)	5.6	0.2
Prolactin	24.4 (17.5)	16.6 (4.1)	18.01 (9.8)	23 (13.3)	20.1 (17.5)	8.3	0.08
Fasting Blood Sugar	**94.9 (10.2)**	**98 (7.1)**	**90.8 (6.8)**	**94.3 (9.4)**	**90.9 (7.4)**	**11.8**	**0.01**
Fasting Insulin	**16.04 (9.5)**	**8.6 (3.8)**	**11.06 (5.03)**	**16.2 (9.2)**	**12.9 (8.02)**	**45.7**	**0.000**
Total Cholesterol	184.4 (47.2)	195.4 (45.4)	187.1 (55.8)	199.02 (51.5)	193.4 (49.6)	2.2	0.6
LDL	109.1 (40.1)	96.8 (36.7)	106.4 (33.3)	105.3 (31.9)	108.7 (36.3)	1.7	0.7
HDL	57.4 (17.7)	59.2 (13.6)	53.6 (13.2)	55.02 (16.3)	59.6 (16.6)	3.6	0.4
Triglycerides	106.8 (48.6)	85 (26.4)	116.2 (74.9)	112.1 (44.4)	101.9 (54.4)	4.2	0.3
Total testosterone	**45.03 (21.6)**	**30.7 (10.1)**	**41.02 (15.5)**	**29.3 (10.9)**	**22.9 (12.1)**	**65.2**	**0.000**
DHEA-SO4	**321.7 (104.4)**	**300.4 (45.4)**	**321.2 (88.2)**	**248.8 (80.5)**	**272.2 (88.5)**	**19.06**	**0.001**
Leukocytes	8.1 (2.1)	9.9 (1.8)	7.8 (2.1)	8.08 (2.3)	7.6 (2.08)	9.3	0.05
Neutrophil	4.8 (1.7)	6.06 (1.1)	5.05 (1.7)	4.9 (1.7)	4.7 (1.6)	7.3	0.1
Basophils	**0.07 (0.2)**	**0.07 (0.03)**	**0.04 (0.02)**	**0.09 (0.4)**	**0.04 (0.02)**	**16.8**	**0.002**
Lymphocytes	2.4 (0.7)	2.8 (0.7)	2.1 (0.6)	2.3 (0.8)	2.2 (0.7)	8.5	0.07
Monocytes	0.5 (0.1)	0.6 (0.2)	0.5 (0.2)	0.4 (0.1)	0.5 (0.2)	7.6	0.1
Hb	**13.5 (1.03)**	**12.9 (1.4)**	**13.2 (1.3)**	**12.9 (1.06)**	**12.8 (1.6)**	**20.5**	**0.000**
Htc	**40.2 (2.7)**	**37.5 (3.3)**	**38.9 (3.6)**	**38.8 (2.7)**	**38.1 (2.9)**	**F=5.8**	**0.000**
PLT	265684.7 (44511.4)	287000 (38108)	234000 (58727.2)	266736 (54102.3)	260232.5 (59611.8)	9.4	0.05
PCT	0.2 (0.09)	0.15(0.1)	0.2(0.04)	0.2(0.05)	0.2(0.05)	3.9	0.4
RDW	**13 (1.2)**	**13.1 (0.5)**	**13.2 (1.4)**	**13.5 (1.2)**	**13.6 (1.3)**	**13.9**	**0.007**
MPV	**9.3 (0.9)**	**9.9 (0.4)**	**10.1 (1.2)**	**9.4 (0.7)**	**9.6 (1.04)**	**F=3.03**	**0.01**
MCV	**86.1 (4.4)**	**82.1 (4.6)**	**83.9 (5.6)**	**85.5 (5.1)**	**84.4 (5.3)**	**11.4**	**0.02**
FGS	**13.3 (3.2)**	**12.5 (1.4)**	**9.7 (2.7)**	**4.4 (3.06)**	**2.8 (1.9)**	**161.6**	**0.000**

3. Results

Table 1 shows that the mean age of the participants is 28(±5.7). The mean BMI of the participants is 26.15(±5.36). The mean LH/FSH, FSH, fasting blood sugar, fasting insulin, and total cholesterol are 1.34 (±0.9), 5.79 (±1.76), 93.1 (±8.9), 12.9 (±8.02), and 191.05 (±49.4), respectively. The mean FGS is 7.4 (±5.4), which is normal.

Table 3. The pairwise comparisons of 5 groups

		Test Statistics	Sig.
Age			
Control	**Type I classic PCOS**	-70.5	0.000
	Type II classic PCOS	-64.7	0.02
	Ovulatory PCOS	-53.8	0.000
	Normoandrogenic PCOS	-49.7	0.02
BMI			
Type II classic PCOS	**Ovulatory PCOS**	-80.8	0.01
	Normoandrogenic PCOS	81.2	0.002
Type II classic PCOS	**Normoandrogenic PCOS**	-87.6	0.002
LH/FSH			
Type II classic PCOS	**Type I classic PCOS**	78.2	0.004
Control	**Normoandrogenic PCOS**	52.3	0.000
Control	**Type I classic PCOS**	70.6	0.000
Ovulatory PCOS	**Type I classic PCOS**	65.5	0.001
HOMA-IR			
Type II classic PCOS	**Type I classic PCOS**	66.9	0.02
Control	**Normoandrogenic PCOS**	58.08	0.000
Control	**Type I classic PCOS**	62.6	0.000
LH			
Control	**Normoandrogenic PCOS**	37.03	0.03
Control	**Type I classic PCOS**	66.8	0.000
Ovulatory PCOS	**Type I classic PCOS**	66.06	0.001
Free T4			
Type II classic PCOS	**Normoandrogenic PCOS**	-71.2	0.02
Fasting Blood Sugar			
Control	**Type II classic PCOS**	55.5	0.01
Fasting Insulin			
Type II classic PCOS	**Normoandrogenic PCOS**	-72.5	0.01
Type II classic PCOS	**Type I classic PCOS**	73.6	0.008
Control	**Normoandrogenic PCOS**	58.3	0.000
Control	**Type I classic PCOS**	59.4	0.000
Total testosterone			
Control	**Ovulatory PCOS**	74.4	0.000
Control	**Type I classic PCOS**	79.7	0.000
Normoandrogenic PCOS	**Type I classic PCOS**	48.08	0.002
DHEA-SO4			
Normoandrogenic PCOS	**Type I classic PCOS**	47.4	0.003
	Ovulatory PCOS	53.5	0.03
Basophil			
Normoandrogenic PCOS	**Type II classic PCOS**	90.2	0.001
Control	**Type II classic PCOS**	76.5	0.004
Ovulatory PCOS	**Type I classic PCOS**	71.6	0.04
Ovulatory PCOS	**Type II classic PCOS**	-65.1	0.02
Hb			
Control	**Type I classic PCOS**	44.9	0.000
Htc			
Control	**Type I classic PCOS**	46.7	0.000
RDW			
Control	**Type I classic PCOS**	-32.9	0.01
MPV			
Type I classic PCOS	**Ovulatory PCOS**	-43.63	0.09
MCV			
Type II classic PCOS	**Type I classic PCOS**	60.8	0.05
FGS			
Control	**Ovulatory PCOS**	86.3	0.000
	Type II classic PCOS	114.4	0.000
	Type I classic PCOS	122.4	0.000
Normoandrogenic PCOS	**Ovulatory PCOS**	63.1	0.005
	Type II classic PCOS	91.2	0.001
	Type I classic PCOS	99.2	0.000

Table 2 shows that there is a statistically significant difference between the four PCOS groups and control group in terms of age (p-value=0.000), BMI (p-value=0.000), LH/FSH (p-value=0.000), Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) (p-value=0.000), LH (p-value=0.000), free T4 (p-value=0.02), fasting blood sugar (p-value=0.01), fasting insulin (p-value=0.000), total testosterone (p-value=0.000), Dehydroepiandrosterone Sulfate (DHEA-SO4) (p-value=0.001), Leukocytes (p-value=0.005), Basophils (p-value=0.002), Hemoglobin (Hb) (p-value=0.000), Htc (p-value=0.000) Platelet (p-value=0.05), Red cell distribution width (RDW) (p-value=0.007), MPV (p-value=0.01), mean cospusculer volume (MCV) (p-value=0.02) FGS (p-value=0.000).

Table 4. Comparison of 4 groups

Variable	Type I classic PCOS	Type II classic PCOS	OVULATORY PCOS	Normoandrogenic PCOS	Chi-Square	Sig.
	Mean (sd)	**Mean (sd)**	**Mean (sd)**	**Mean (sd)**		
Age	25.1 (2.07)	25.7|(4.7)	27.05 (5.7)	26.6 (4.9)	3.03	0.3
BMI	27.3 (5.8)	20.9 (1.7)	27.04 (4.5)	27.4 (4.3)	14.4	0.002
LH/FSH	1.8 (1.1)	.8 (0.2)	0.9 (0.6)	1.4 (0.60)	24.8	0.000
HOMA-IR	3.8 (2.4)	2.04 (0.8)	2.6 (1.4)	3.8 (2.3)	13.7	0.003
FSH	5.5 (1.5)	6.9 (1.6)	5.9 (1.7)	5.4 (1.8)	F=2.4	0.07
LH	9.7 (5.01)	5.6 (1.6)	6.03 (4.9)	7.8 (5.1)	19.8	0.000
Estradiol	66.8 (61.7)	34.1 (9.8)	48.6 (20.5)	51.7 (32.9)	7.3	0.06
Free T4	1.4 (1.7)	1.05 (0.06)	1.2 (0.4)	1.6 (1.6)	10.01	0.01
TSH	2.4 (1.4)	2.1 (1.4)	2.06 (1.2)	2.6 (1.2)	4.9	0.1
Prolactin	24.4 (17.5)	16.6 (4.1)	18.01 (9.8)	23 (13.3)	4.9	0.1
Fasting Blood Sugar	94.9 (10.2)	98 (7.1)	90.8 (6.8)	94.3 (9.4)	4.5	0.2
Fasting Insulin	16.04 (9.5)	8.6 (3.8)	11.06 (5.03)	16.2 (9.2)	16.1	0.001
Total Cholesterol	184.4 (47.2)	195.4 (45.4)	187.1 (55.8)	199.02 (51.5)	2.2	0.5
LDL	109.1 (40.1)	96.8 (36.7)	106.4 (33.3)	105.3 (31.9)	1.6	0.6
HDL	57.4 (17.7)	59.2 (13.6)	53.6 (13.2)	55.02 (16.3)	1.1	0.7
Triglycerides	106.8 (48.6)	85 (26.4)	116.2 (74.9)	112.1 (44.4)	3.06	0.3
Total testosterone	45.03(21.6)	30.7(10.1)	41.02 (15.5)	29.3 (10.9)	21.2	0.000
DHEA-SO4	321.7 (104.4)	300.4 (45.4)	321.2 (88.2)	248.8 (80.5)	15.2	0.002
Leukocytes	8.1 (2.1)	9.9 (1.8)	7.8 (2.1)	8.08 2.3)	6.8	0.07
Neutrophil	4.8 (1.7)	6.06 (1.1)	5.05 (1.7)	4.9 (1.7)	6.06	0.1
Basophils	0.07 (0.2)	0.07 (0.03)	0.04 (0.02)	0.09 (0.4)	14.9	0.002
Lymphocytes	2.4 (0.7)	2.8 (0.7)	2.1 (0.6)	2.3 (0.8)	5.5	0.1
Monocytes	0.5 (0.1)	0.6 (0.2)	0.5 (0.2)	0.4 (0.1)	8.1	0.04
Hb	13.5 (1.03)	12.9 (1.4)	13.2 (1.3)	12.9 (1.06)	8.3	0.03
Htc	40.2(2.7)	37.5 (3.3)	38.9 (3.6)	38.8 (2.7)	F=4.05	0.009
PLT	265684.7 (44511.4)	287000 (38108)	234000 (58727.2)	266736 (54102.3)	9.3	0.02
Pct	0.2 (0.09)	0.15 (0.1)	0.2 (0.04)	0.2 (0.05)	3.7	0.2
RDW	13 (1.2)	13.1 (0.5)	13.2 (1.4)	13.5 (1.2)	8.1	0.04
Mpv	9.3 (0.9)	9.9 (0.4)	10.1 (1.2)	9.4 (0.7)	F=3.9	0.01
MCV	86.1 (4.4)	82.1 (4.6)	83.9 (5.6)	85.5 (5.1)	10.09	0.01
Ferriman Galleway Score	13.3 (3.2)	12.5 (1.4)	9.7 (2.7)	4.4 (3.06)	82.4	0.000

The mean ages of Type I classic PCOS is 25.1(±2.07), the mean age of Type II classic PCOS is (25.7) (±4.7), the mean age of Ovulatory PCOS is 27.05(±5.7) and the mean age of Normoandrogenic PCOS is 26.6(±4.9), significantly lower than that of control Group (31.4(±5.01). The mean BMI of Type I classic PCOS (27.3(±5.8)), Ovulatory PCOS (27.04±4.5), and Normoandrogenic PCOS (27.4(±4.3) are significantly higher than that of the control Group (24.9(±5.2)). The mean LH/FSH of Type I classic PCOS (1.8(±1.1)) and normoandrogenic PCOS 1.4(±0.60) are significantly higher than that of the control group 24.9(±5.2).

The mean fasting blood sugar of Type I classic PCOS (94.9(±10.2)), Type II classic PCOS (98(±7.1)), and normoandrogenic PCOS (94.3± (9.4)) is significantly higher than that of the control group (90.9(7.4)). The mean FGS of Type I classic PCOS (13.3(±3.2), Type II classic PCOS (12.5(±1.4)), Ovulatory PCOS 9.7(±2.7), and Normoandrogenic PCOS (4.4(±3.06)) is significantly higher than that of the control group (2.8(±1.9)).

The pairwise comparison in Table 3 shows that there is a statistically significant difference between Type I classic PCOS (P-value=0.000), Type II classic PCOS (P-value=0.02), Ovulatory PCOS (P-value=0.000), and Normoandrogenic PCOS (P-value=0.02) and the control group in terms of age. There is a statistically significant difference between Type II classic PCOS and Ovulatory PCOS in terms of BMI (P-value=0.01). Type II classic PCOS and Normoandrogenic PCOS show statistically significant

differences in BMI (P-value=0.002). Type II classic PCOS and the control show statistically significant differences in fasting blood sugar (p-value=0.01). There is a statistically significant difference between ovulatory PCOS, Type II classic PCOS, Type I classic PCOS groups, and the control group in FGS. Table 4 shows that there is a statistically significant difference among the four groups in terms of BMI (p-value =0.002), LH/FSH (p-value=0.000), HOMA-IR (p-value =0.003), LH (p-value =0.000), free T4 (p-value =0.01), fasting insulin (p-value=0.001), total testosterone (p-value=0.000), DHEA-SO4 (p-value=0.002), Basophils (p-value=0.002), Monocytes (p-value=0.04), FGS (p-value=0.000),etc.

Table 5. Pairwise comparisons of 4 groups

		Test Statistics	Sig.
BMI			
Type II classic PCOS	**Ovulatory PCOS**	-47.8	0.01
	Type I classic PCOS	49.6	0.002
	Normoandrogenic PCOS	-51.7	0.002
LH/FSH			
Type II classic PCOS	**Type I classic PCOS**	49.7	0.001
Ovulatory PCOS	**Type I classic PCOS**	40.7	0.001
HOMA-IR			
Type II classic PCOS	**Type I classic PCOS**	-39.8	0.03
	Normoandrogenic PCOS	41.4	0.01
LH			
Ovulatory PCOS	**Type I classic PCOS**	39.7	0.001
Free T4			
Type II classic PCOS	**Normoandrogenic PCOS**	-44.03	0.01
Fasting Insulin			
Type II classic PCOS	**Normoandrogenic PCOS**	-44.5	0.01
Type II classic PCOS	**Type I classic PCOS**	43.9	0.007
Total testosterone			
Normoandrogenic PCOS	**Type I classic PCOS**	35.5	0.000
DHEASO4			
Normoandrogenic PCOS	**Type I classic PCOS**	29.2	0.002
	Ovulatory PCOS	32.9	0.02
Basophils			
Normoandrogenic PCOS	**Type II classic PCOS**	54.1	0.001
Ovulatory PCOS	**Type II classic PCOS**	42.8	0.03
Type I classic PCOS	**Type II classic PCOS**	-38.9	0.02
Monocytes			
Normoandrogenic PCOS	**Type II classic PCOS**	40.5	0.02
Hb			
Normoandrogenic PCOS	**Type I classic PCOS**	22.1	0.03
Platelet			
Ovulatory PCOS	**Type II classic PCOS**	45.6	0.02
MCV			
Type II classic PCOS	**Type I classic PCOS**	39.1	0.02
FGS			
Normoandrogenic PCOS	**Ovulatory PCOS**	34.9	0.01
	Type II classic PCOS	62.3	0.000
	Type I classic PCOS	71.6	0.000
Ovulatory PCOS	**Type I classic PCOS**	36.6	0.002

Pairwise comparison of four phenotype groups in Table 5 shows that there is a statistically significant difference between Type II classic PCOS and Ovulatory PCOS (0.01), Type II classic PCOS and Type I classic PCOS (0.002), and Type II classic PCOS and Normoandrogenic PCOS (0.002) in terms of BMI.

4. Discussion

The findings show that the mean age of the control group was the highest. Type II classic PCOS group had the lowest BMI, followed by the control group with the mean BMI (24.9±5.2). Type I classic PCOS group had the highest LH/FSH. Type II classic PCOS had the highest fasting blood sugar. Fasting insulin was the highest in the normoandrogenic PCOS group. The four phenotype groups and the control group showed a

statistically significant difference in age, BMI, LH/FSH, fasting blood sugar, fasting insulin, free T4, total testosterone, Hb, Htc, PLT, FGS, etc.

In the comparison of the four phenotype groups, BMI was the highest in the normoandrogenic PCOS. Type I classic PCOS group had the highest LH/FSH. Normoandrogenic PCOS had the highest fasting insulin, followed by Type I classic PCOS. Type I classic PCOS had the highest FGS as compared with the other three groups.

Carmina et al. (11) found the intermediate values between phenotype A PCOS and controls for total testosterone levels and BMI and that those with phenotype C PCOS had lower BMI than those with phenotype A PCOS while slightly higher BMI than the controls, which is in line with the study by Jamil et al. (12) Our study found that the third group had slightly higher BMI than the first group and the controls and the first group had the highest testosterone.

Jamil et al. (12) found a significant difference among the four groups in total testosterone, not in line with the study by Sahmay et al. (13) but consistent with the study by Guastella et al. (14), showing that phenotype C had higher testosterone than phenotype D and Dewailly et al. (9).

Jamil et al. (12) also found obesity in 50% of the women, which is consistent with a study by Pasquali et al. (6), while the mean BMI of the women in the present study was 26.15. Jamil et al. (12) found that the number of overweight people was the same in the control and PCOS groups, not consistent with our study results. Pehlivanov et al. (10) found that women with phenotypes A and B were more obese, while our study found that phenotype A group was more obese than the controls.

There were higher LH/FSH ratio and LH levels in all PCOS phenotypes than in the control group reported by Dewailly et al. (9), while LH/FSH in our study was higher in the first, third, and fourth groups than in the second and control groups. LH level was the highest in phenotype A compared with the other phenotype's groups and the control group.

Dewailly found no difference in serum FSH levels of all phenotypes (9), consistent with our study results and the study by Jamil et al (12). Yilmaz (8) and Jamil et al. (12) found that LH/FSH ratio in phenotype D was lower than that in phenotype A, consistent with our study.

In our study, the mean FGS was normal in the participants and was the highest in the type I classic PCOS group, and hirsutism was significantly higher in the PCOS phenotype groups than in the control group. The clini¬cal features of hyperandrogenism were significantly different among the PCOS groups and between the PCOS Group and the control group, not consistent with the study by Jamil et al (12), Thathapudi et al. (15) and Farhan et al. (16).

Kucur et al. (17) showed the difference between PCOS phenotypes in serum LH levels and FGS score. Phenotype B had higher IR but not statistically significant. Yilmaz et al. (8) also reported significantly higher serum LH/FSH and LH values in all phenotypes than the control group, in line with our study results.

Like our study, Yilmaz et al. (8) found the FGS score to be the highest in phenotype B and the lowest in phenotype 4, which is in line with our study results.

Despite the articles in the literature with the same results as our study, it was recently reported that High density lipoprotein (HDL) levels were significantly lower in hyperandrogenic PCOS phenotype than the non-hyper androgenic phenotypes (8, 18, 19).

It is concluded that the control group was older than the four phenotype groups. Women in the Type II classic PCOS group had the lowest BMI and the highest fasting blood sugar. Type I classic PCOS group had the highest LH/FSH. The normoandrogenic PCOS group had the highest fasting insulin. The four phenotype groups and the control group showed a statistically significant difference in age, BMI, LH/FSH, fasting blood sugar, fasting insulin, FGS, etc. Among the four phenotype groups, women in the normoandrogenic PCOS group had the highest BMI, and those in the type I classic PCOS group had the highest LH/FSH. In general age, BMI, LH/FSH, FSH, LH, fasting blood sugar, and hirsutism are good predictors of PCOS.

Conflict of interest

The authors declare that they have no competing interest.

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