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Association between Hyperandrogenemia, Obesity and Mental Health Disorders among Women with Polycystic Ovary Syndrome in Ismailia

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Abstract

Polycystic ovarian syndrome (PCOS) has been linked to mood as well as eating disorders. The presence of acne, obesity & hirsutism appears to contribute to a negative body image, but hormonal imbalances may also have a substantial impact. The objective of this trial is to assess the frequency of depression, anxiety, disorders, eating as well as food cravings among individuals diagnosed with polycystic ovarian syndrome. Additionally, the study aims to explore the potential connection between these psychological conditions and obesity, insulin resistance, in addition to hyperandrogenism. In this particular instance of a control study, a total of forty-one individuals diagnosed with Polycystic Ovary Syndrome will be selected, along with forty-one healthy individuals who are matched in terms of age & body mass index (BMI). The assessment of emotional & food problems will involve the utilization of self-administered questionnaires, namely the Eating Attitudes Test (EAT)-26, Hamilton anxiety scale (HAS), Beck Depression Inventory-II (BDI-II), as well as Food Craving Questionnaire-Trait (FCQ-T). This study showed that BMI significantly positively correlated with HOMA2-IR, Δ4-Androstenedione, BDI-II, and HAS. However, BMI significantly negatively correlated with EAT-26 and FCQ-T. There is a significant difference between BMI subgroups regarding HOMA2-IR, SHBG, testosterone, EAT-26, FCQ-T, BDI, and HAS. Obesity as well as hyperandrogenism in women with PCOS raise the probability of experiencing sadness as well as food cravings, leading to a harmful loop that worsens obesity & metabolic syndrome.

Keywords: Anxiety, Depression, PCOS, Obesity, IR, Hyperandrogenism.

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1. Introduction

PCOS is the prevailing endocrine condition among ladies in their reproductive years [1]. As per the National Institute of Child Health & Development, Polycystic ovarian syndrome is characterized by the existence of excessive male hormones (hyperandrogenism) along with infrequent or absent menstrual periods (oligomenorrhea or amenorrhea), without any other recognized hormonal problems [2]. PCOS is frequently accompanied with comorbidities for example obesity, hyperinsulinemia, insulin resistance (IR), as well as metabolic syndrome [3]. With the exception of endocrine dysfunctions, PCOS appears to impact the psychological well-being of cases. Research has indicated that acne, obesity, in addition to hirsutism are linked to a negative perception of one's body and a lack of confidence, resulting in heightened levels of depression, anxiety & eating disorders, including intense food cravings and episodes of excessive eating [4-5].

In addition, besides physical changes, hormonal imbalances for instance insulin resistance & disrupted secretion of ghrelin as well as cholecystokinin can also contribute to the enlargement of psychological & eating disorders in people with Polycystic ovarian-syndrome. Furthermore, elevated levels of testosterone have been discovered to encourage bulimic behavior, while anti-androgen therapy appears to improve it [6-7]. Eating disorders exacerbate obesity, insulin resistance, as well as metabolic syndrome, leading to a perpetual cycle of negative effects [8-10]. The objective of this research was to address the issue of obesity, insulin resistance, and hyperandrogenism in patients with PCOS. We additionally sought to identify any possible associations among PCOS, obesity, insulin resistance, & hyperandrogenism, and to assess the prevalence of depression, eating disorders, anxiety, in addition to food cravings in this population.

2. Patients & Methods

2.1. Study population

The subjects were categorized into two groups: a study group comprising individuals with Polycystic Ovary Syndrome, along with a healthy control group.

2.2. Inclusion criteria

Individuals were classified as belonging to the PCOS group if they met the new Rotterdam criteria for diagnosing Polycystic Ovary Syndrome, which comprise the occurrence of at least 2 out of the following three features: Oligomenorrhea refers to a medical condition characterized by infrequent or irregular menstrual periods. The presence of excessive levels of androgens in the body, either by clinical symptoms or biochemical tests; as well as the presence of many cysts on the ovaries, a condition known as polycystic ovaries. Oligomenorrhea is characterized by having fewer than eight menstrual cycles per year for a prolonged period of time, excluding the use of oral contraceptive tablets. Clinical hyperandrogenism involve the presence of hirsutism and/or severe acne that necessitates medical intervention. Biochemical hyperandrogenism encompasses increased levels of free testosterone, total testosterone, or dehydroepiandrosterone sulfate. Polycystic ovaries were characterized as having at least 12 follicles in each ovary, with each follicle measuring among two & nine mm in diameter, and/or an enlarged ovarian volume at least ten milliliters, as determined by a radiologist during sonography. The control group consisted of healthy people who were matched with those with PCOS in terms of age & BMI. Controls were chosen from individuals who were in good health and accompanied patients (including those with PCOS as well as other conditions). These individuals had regular menstrual cycles & no signs of hyperandrogenism.

2.3. Exclusion criteria

Participants who experienced menarche within three years prior to the start of the research, the following medical conditions are included: pregnancy, Diabetes Mellitus, Cushing syndrome, Thyroid dysfunction, Hyperprolactinemia, Non-classic congenital adrenal hyperplasia, recognized or clinically obvious psychiatric or behavioral disorders, Acute or chronic ailment, other endocrine illness, Rheumatologic diseases & Liver disease. Prior administration of metformin or any hormonal drug, for instance combined oral contraceptive pills, within a period of less than six months prior to the commencement of the study, Administration of antidepressants, anxiolytics, or other psychiatric medications, as well as alcohol consumption.

2.4. Study procedure

2.4.1. Study design and setting

This case control trial was done at the Psychiatry Department & Obstetrics and Gynecology, Faculty of Medicine, Suez Canal University and designed to include study group of women with Polycystic ovarian-syndrome patients & control group of age in addition to BMI matched healthy controls.

2.4.2. Sampling procedure

All individuals who satisfied the inclusion criteria and were patients at Suez Canal University Hospital were randomly chosen to participate in the research.

2.4.3. Sample size

Sample size was determined in relation to the following formula [11]:

$$n = 2\left[\frac{(Z_{\frac{\alpha}{2}} + Z_{\beta}) \times \sigma}{\mu_1 - \mu_2}\right]^2$$

Where:

n= sample size.

$\mathbf{Z_{\beta}}$ = 0.84 (The critical value that separates the lower 20 percent of the Z distribution from the upper 80%).

$\mathbf{Z_{\alpha/2}}$ = 1.96 (The critical value that divides the central 95 percent of the Z distribution from the 5% in the tail).

$\boldsymbol{\mu_1}$ = mean Beck Depression Inventory score in the trial group=11.69.

$\boldsymbol{\mu_2}$ = mean Beck Depression Inventory score in the control group = 5.80. So, the total sample size were 41 participants per group.

σ = the estimate of the standard deviation (in the study group) = 9.49

All study participants were subjected to the following:

1. Anthropometric measurements.
2. Biochemical parameters.
3. Eating disorders

2.5. Ethical considerations

The study was done after approval of ethical committee of Faculty of Medicine, Suez Canal University. An informed written consent was gained from each participant before participation. All the data was strictly confidential. All the data was used in this research only. All the participants were informed about the results of the trial. At any moment, for any reason, & with no disruption to their daily lives, any participant might opt out of the research. People were provided with the researcher's phone number as well as all available communication options, allowing them to return at any moment for any explanation.

3. Results and Discussion

Among hormonal diseases affecting reproductive-aged women, polycystic ovarian syndrome ranks high. According to the Rotterdam Criteria, polycystic ovary syndrome can be identified when a patient meets two out of 3 criteria: (1) problems with menstruation or amenorrhea accompanied by a persistent absence of ovulation, (2) hyperandrogenism as shown by clinical and/or biochemical indicators, and (3) the discovery of polycystic ovaries through ultrasonography following the rule out of other endocrine disorders [12]. A lower quality of life, depression, anxiety disorders, as well as eating disorders are more frequent in women with polycystic ovary syndrome than in the general population. However, the association among PCOS as well as psychiatric illnesses is less understood and, in our opinion, has been underappreciated [13]. In contrast to the control group, those with PCOS had significantly higher levels of BMI, WC, testosterone, Δ4-Androstenedione, and DHEA-S.

There was a statistically significant decrease in SHBG & FCQ-T in PCOS individuals (Table 1). Our outcomes sustained with Stefanaki et al., (2023) who sought to examine the connection among polycystic ovary syndrome as well as mood and eating problems by looking at insulin resistance, obesity, in addition to hyperandrogenism [14]. They included 49 PCOS women (60.5%) & 32 healthy controls (39.5%), all of the same age and BMI. The following self-administered questionnaires were used for the purpose of evaluating emotional/food disorders: Eating Attitudes Test -26, Beck Depression Inventory-II, Hamilton Anxiety Scale, & Food Craving Questionnaire-Trait. Age, body mass index, and HOMA2-IR were not significantly changed amongst the two groups. Also, Berni et al., (2018) who identified no statistically distinction in age among the groups, although a significant alteration in body mass index did exist [15]. The present study shows that BMI significantly positively correlated with HOMA2-IR, Δ4-Androstenedione, BDI-II, and HAS. However, BMI significantly negatively correlated with EAT-26 and FCQ-T (Table 2). Our results were consistent with Stefanaki et al., (2023) who demonstrated that BMI significantly positively correlated with HOMA2-IR, Δ4-Androstenedione, BDI-II, and HAS [14]. However, BMI significantly negatively correlated with EAT-26 and FCQ-T. Also, Berni et al., (2018) who discovered a larger percentage of women diagnosed with PCOS (n=1956, 11.55%) had a history of anxiety, compared to controls (n = 1579, 9.32%; P < 0.00001) [15]. Recorded diagnoses of bipolar illness also increased significantly, with 535 cases (3.16%) compared to 384 cases (1.4%) in the control group (P < 0.00001). In patients with polycystic ovary syndrome, 1.55% had a history of an eating disorder, compared to 1.03% in the control group (n = 175, P = 0.00003). Women who suffer from polycystic ovary syndrome as well as anxiety had higher free testosterone levels than women who do not experience anxiety, & their Ferriman-Gallwey scores were higher in those who simultaneously experience anxiety and depressive symptoms [16]. In a nationwide Swedish registry trial, Cesta et al., (2016) discovered an increased susceptibility to many mental illnesses in both PCOS individuals and their offspring [17]. These findings could be explained by endocrine problems, since hyperandrogenicity affects approximately half of the sisters of PCOS women [18]. However, both sets of brothers have abnormalities in the secretion of gonadotropins & steroidogenic hormones [19]. This trial illustrates that there is a significant variance amongst BMI subgroups regarding HOMA2-IR, SHBG, testosterone, EAT-26, FCQ-T, BDI, and HAS (Table 3). Our results supported with Stefanaki et al., (2023) who demonstrated that a significant difference between BMI subgroups regarding HOMA2-IR, SHBG, testosterone, EAT-26, FCQ-T, BDI, and HAS [14]. Depression, anxiety disorders, bipolar illness, & binge eating disorder are more common in women with polycystic ovary syndrome as opposed to controls, according to two separate studies [20-21]. Anxiety symptoms were more common in females with PCOS than in women with no PCOS [22].

Table 1: Basic characteristics.

	PCOS (n=41)	**Controls (n=41)**	**p**
Age (years)	28.29 ± 2.51	28.41 ± 2.92	.840
BMI (kg/m^2)	28.45 ± 3.06	26.28 ± 2.54	**.001**
Waist circumference (cm)	113.56 ± 10.88	102.29 ± 12.92	**.001**
HOMA2-IR	3.18 ± 1.5	2.59 ± 0.913	.089
SHBG (IU/l)	3.83 ± 0.85	5.78 ± 2.01	**<0.001**
Testosterone (ng/ml)	0.421 ± 0.197	0.287 ± 0.186	**.002**
Δ4-Androstenedione (ng/ml)	2.59 ± 0.951	1.73 ± 0.445	**<0.001**
DHEA-S (µg/dl)	280.93 ± 81.97	185.46 ± 59.76	**<0.001**
EAT-26	15.59 ± 8.52	20.39 ± 12.54	.148
FCQ-T	35.71 ± 11.38	48.46 ± 19.75	**.003**
BDI-II	28.49 ± 10.15	26.28 ± 10.87	.513
HAS	16.68 ± 7.6	14.98 ± 6.44	.475

This table shows that BMI, WC, testosterone, Δ4-Androstenedione, DHEA-S were significantly higher amongst PCOS cases in contrast to controls. However, SHBG and FCQ-T were significantly lesser among PCOS individuals.

Table 2: Correlation between BMI and Δ4-Androstenedione with other parameters.

	BMI		**Δ4-Androstenedione**	
	R	p	r	p
HOMA2-IR	.588	**<0.001**	.088	.586
SHBG	.132	.412	.114	.478
Testosterone	.394	.137	.132	.410
Δ4-Androstenedione	**.667**	**<0.001**	--	--
DHEA-S	.101	.529	-.224	.159
EAT-26	-.662	**<0.001**	-.124	.441
FCQ-T	-.618	**<0.001**	-.270	.087
BDI-II	.839	. **<0.001**	.144	.370
HAS	.657	**<0.001**	.091	.569

This table shows that BMI significantly positively correlated with HOMA2-IR, Δ4-Androstenedione, BDI-II, and HAS. However, BMI significantly negatively correlated with EAT-26 and FCQ-T.

Table 3: Basic characteristics according to BMI among PCOS group.

	Normal (n=5)	**Overweight (n=22)**	**Obese (n=14)**	**P**
HOMA2-IR	1.51 ± 0.306	2.99 ± 1.66	4.07 ± 0.668	**.001**
SHBG (IU/l)	2.78 ± 0.279	4.15 ± 0.823	3.7 ± 0.692	**.004**
Testosterone (ng/ml)	0.16 ± 0.056	0.41 ± 0.217	0.536 ± 0.040	**<0.001**
Δ4-A (ng/ml)	2.18 ± 0.847	2.7 ± 1.01	2.56 ± 0.902	.574
DHEA-S (µg/dl)	216.6 ± 56.23	297.41 ± 83.25	278.0 ± 80.29	.159
EAT-26	22.8 ± 8.41	18.73 ± 6.7	8.07 ± 5.62	**<0.001**
FCQ-T	20.8 ± 4.55	41.82 ± 9.91	31.43 ± 8.06	**<0.001**
BDI-II	12.8 ± 4.82	25.32 ± 6.18	39.07 ± 3.99	**<0.001**
HAS	7.4 ± 3.36	14.82 ± 5.77	22.93 ± 6.27	**<0.001**

This table displays that there is a significant alteration amongst BMI subgroups regarding HOMA2-IR, SHBG, testosterone, EAT-26, FCQ-T, BDI, and HAS.

4. Conclusion

The vicious cycle of obesity as well as metabolic syndrome is exacerbated when hyperandrogenism & obesity put women with polycystic ovary syndrome at a higher risk of depression and food cravings.

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