

REVIEW ARTICLE

The Polycystic Ovaries Syndrome Prevalence in Relation to Body Mass Index Among Patients in AL-Diwaniyah City-Iraq

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Abstract:

Background: Polycystic ovarian syndrome (PCOS) is the most common endocrine condition in women of reproductive age, increasing the risk of infertility. It affects an estimated 12-21% of women of reproductive age and involves clinical signs such as oligo or anovulation, hirsutism, acne, and polycystic ovaries on ultrasound. Many women with PCOS (between 38% and 88%) are overweight or obese. Even modest weight loss of 5% body weight has been shown to result in significant improvements in both symptoms of hyperandrogenism and ovulatory function in women with PCOS. The majority of women with PCOS also experience metabolic dysfunction, which is commonly referred to as Metabolic Syndrome (Mets). Metabolic Syndrome is a condition that is characterized by a combination of different physiological and metabolic abnormalities. These abnormalities include hyperinsulinemia, hyperglycemia, hypertension, and dyslipidemia.

Aim of the study: The present study aims to evaluate the confounding effect of a high body mass index which is associated with PCOS among patients in AL-Diwaniyah city in Iraq.

Subjects and Method: The study was planned to be a case-control study to assess the prevalence of polycystic ovarian syndrome in relation to BMI in cases in AL-Diwaniyah city in Iraq. At the end of the study, 120 women were separated into two groups. The first group consisted of 60 women with PCOS illness, while the second group consisted of 60 normal women who had not been diagnosed with PCOS. Each group was further subdivided into two groups where group[A] was overweight, and group[B] was normal weight.

Results: There was a significant difference in mean BMI ($p < 0.001$), with the PCOS overweight-obese group having the highest mean BMI, followed by the control overweight-obese group, then the control normal weight group, and lastly came the PCOS normal weight group. Furthermore, there was a significant difference in mean waist circumference ($p < 0.001$), with the PCOS overweight-obese group having the highest mean waist circumference, followed by the control overweight-obese group, the control normal weight group, and finally the PCOS normal weight group. There was no statistically significant difference in marital status between the research groups ($p = 0.082$). Furthermore, there was a significant difference in the frequency of difficulties in lowering waist circumference ($p < 0.001$). The highest frequency was seen in the control overweight-obese group, followed by the PCOS overweight-obese group, the control normal weight group, and lastly the PCOS normal weight group.

Conclusion: According to the current study findings, overweight and obese women tend to have a greater prevalence of PCOS than normal-weight individuals. It is crucial to indicate that PCOS can develop in women of normal weight.

Keywords:

PCOS, BMI, infertility, Obesity

Introduction

Polycystic ovarian syndrome (PCOS) is mainly a hyperandrogenic condition that is certainly the most prevalent premenopausal endocrinopathy (3). The major problem in PCOS appears to be the excess production of androgens by the ovaries and adrenal glands. The primary defect in androgen secretion is triggered in a significant proportion of PCOS patients by factors such as hyperinsulinism

which is caused by insulin resistance and/or the secretion of metabolically active substances by visceral adipose tissue because these factors can facilitate androgen synthesis at the ovaries and the adrenals of predisposed women (4). The incidence of obesity in PCOS patients is higher than in the overall female population, and the prevalence of PCOS is higher in overweight and obese women than in lean opposites (5).



Obesity has a significant influence on the PCOS phenotype, especially the metabolic connections and consequences of the disease. Obesity, among other things, is definitely linked to PCOS infertility and raises the risk of metabolic syndrome and its constellation of cardiovascular risk factors in these women. Patients with polycystic ovarian syndrome (PCOS) usually have abdominal adiposity, overweightness, and obesity. A substantial body of research implies that abdominal obesity and the accompanying insulin resistance contribute to ovarian and potentially adrenal hyperandrogenism. However, excess androgen may lead to abdominal fat formation in hyperandrogenic women. Recent genomic and proteomic investigations of PCOS patients' visceral fat revealed variations in gene expression and protein composition when compared to non-hyperandrogenic women. A conference was convened in Rotterdam, The Netherlands, May 1–3, 2003 sponsored in part by the European Society for Human Reproduction and Embryology and the American Society for Reproductive Medicine(1). The meeting proceedings recommended that PCOS is defined when at least two of three features are present: 1) irregular or absent menstrual cycles, 2) signs of elevated androgen levels in the body, and 3) the presence of polycystic ovaries. It was emphasized that other conditions with similar symptoms should be ruled out before making a PCOS diagnosis. Obesity exacerbates the metabolic and psychosocial comorbidities of PCOS, hence weight control and prevention are critical in teenage PCOS (6). Furthermore, weight loss techniques of up to 7% of the body weight have improved menstrual irregularity and testosterone levels (7). Metformin can also be administered in addition to COCPs, particularly in teenagers with PCOS and a BMI of 25 kg/m², as well as high-metabolic risk populations such as specific societies and persons at high risk of type 2 diabetes.

Participants and Methods

A case-control observational study had been performed on 120 women from the outpatient clinic of the Maternity and Pediatric Teaching Hospital in AL-Diwaniyah-Iraq (government services). In the center of AL-Diwaniyah the area is about 8153 km² approximately 1.9% of the total area of the diameter (Iraq) and the population of AL-Diwaniyah 2023 is about 1022,750 people. A questionnaire form was established depending on information obtained from reviewing published articles [14] [15] and the consultation specialists. These cases were divided into two groups, where the first group contained sixty women who were already diagnosed with PCOS (by clinical and biochemical indication) and the second contained sixty aged-matched control women who had no clinical or hormonal abnormalities and were recruited into the study. Each group was subdivided into two groups; Group A was women with normal BMI (BMI-19-24.9) and Group B was women with higher BMI (BMI >25 kg/m²).

The participants' ages ranged between 19 and 40 years. The patients were examined and diagnosed as having PCOS by gynecologists at the outpatient clinic of the Maternity and Pediatric Teaching Hospital in AL-Diwaniyah-Iraq. The patients with PCOS diagnoses based on the Rotterdam criteria with women satisfied at least two of the three criteria: 1) oligomenorrhea/oligo-ovulation (O); 2) clinical or biochemical hyperandrogenism (H); 3) polycystic ovaries on transvaginal

ultrasound (P) and exclusion of related disorders such as hypothyroidism, hyperprolactinemia, and adrenal hyperplasia. The laboratory results included endocrine secretion evaluation by measuring the hormone levels in serum, namely, luteinizing hormone (LH), follicle-stimulating hormone (FSH), and Testosterone (T). Serum concentrations of three hormones were measured by using mini-VIDAS (VIDAS 12 model, 1992), through an enzyme-linked fluorescent assay (ELFA) technique. The weight was measured in kilograms by weight measuring device, and the height was measured in meters by length measuring device, BMI was calculated manually where a person's weight in kilograms was divided by the square of height in meters[16].

Inclusion Criteria

The inclusion criteria included individuals with the following cases:

1. All the adult overweight females with body mass index (BMI) of $\geq 25\text{kg}/\text{m}^2$, aged 19-40 years who were normal and did not have PCOS.
2. All the adult normal weight females with body mass index (BMI) of $<25\text{kg}/\text{m}^2$, aged 19-40 years who were normal and did not have PCOS.
3. All the adult overweight females with body mass index (BMI) of $\geq 25\text{kg}/\text{m}^2$, aged 19-40 years, who were diagnosed with PCOS based on Rotterdam 2003 criteria.
4. All the adult normal weight females with body mass index (BMI) of $< 25\text{kg}/\text{m}^2$, aged 19-40 years who were diagnosed with PCOS. based on Rotterdam 2003 criteria.

Exclusion Criteria

The exclusion criteria included individuals with the following cases:

1. The individuals who refused to participate in the study.
2. The pregnant women.
3. The Menopause women.
4. All the women with autoimmune diseases such as SLE.
5. All the women with thyroid dysfunction.
6. All the women diagnosed with Cushing's syndrome.
7. All the women diagnosed with hyperprolactinemia, and adrenal hyperplasia.

The data were collected and transformed into a spreadsheet of Microsoft Office Excel 2010 and then into an SPSS (statistical package for social sciences) version 23. Numeric quantitative data were expressed as mean, range, and standard deviation (SD), whereas qualitative data were expressed as numbers and percentages. A Comparison of the mean between any two groups was done according to an independent sample t-test, paired t-test, and analysis of variance (ANOVA) while the chi-square test was used to evaluate the association between any two categorical variables. The level of significance was considered at $P \leq 0.05$.

Results

Table 1 shows the socio-demographic characteristics of the patients and the control participants enrolled in the current investigation. There was a significant difference in mean age (p 0.001), with the control overweight-obese group having the highest mean age, followed by the PCOS overweight-obese group, then the control normal weight group, and lastly the PCOS normal weight group. There was also a significant difference in mean BMI (p 0.001), with the PCOS overweight-obese group having the highest mean BMI, followed by the control overweight-obese group, then the control normal weight group, and lastly the PCOS normal weight group. Furthermore, there was a substantial change in mean waist circumference (p 0.001), The PCOS overweight-obese group had the largest mean waist circumference, followed by the control overweight-obese group, then the control normal weight group, and finally the PCOS normal weight group. There was no statistically significant difference in marital status between research groups (p = 0.082). There was also a significant difference in the frequency of difficulty in reducing waist circumference (p 0.001), with the control overweight-obese group having the highest frequency, followed by the PCOS overweight-obese group, the control normal weight group, and finally the PCOS normal weight group.

Table 1: Socio-demographic characteristics of patients and control subjects enrolled in the present study

Characteristic	Control normal weight group n = 30	Control overweight-Obese group n = 30	PCOS normal weight n = 30	PCOS overweight-obese n = 30	p
Age (years)					
Mean ±SD	25.60 ±6.37	29.67 ±5.93	23.73 ±4.66	27.80 ±3.83	< 0 . 0 0 1 O ***
Range	18 -38	20 -39	18 -34	19 -35	
BMI(kg/m²)					
Mean ±SD	21.22 ±1.96	29.49 ±3.31	19.79 ±2.19	31.02 ±2.81	< 0 . 0 0 1 O ***
Range	16.8 -23.3	26 -36.1	15.8 -23.3	26.1 -36.2	
Waist circumference					
Mean ±SD	75.73 ±8.09	93.00 ±6.87	74.53 ±4.68	99.60 ±10.36	< 0 . 0 0 1 O ***
Range	59 -89	84 -110	65 -82	85 -119	
Marital status					
Married	24 (80.0 %)	26 (86.7 %)	18 (60.0 %)	24 (80.0 %)	0.082 C NS
Not married	6 (20.0 %)	4 (13.3 %)	12 (40.0 %)	6 (20.0 %)	
the participant suffering from difficulty in reducing the waist circumference					

Yes	6 (20.0 %)	30 (100.0 %)	0 (0.0 %)	28 (93.3 %)	< 0 . 0 0 1 C ***
No	24 (80.0 %)	0 (0.0 %)	30 (100.0 %)	2 (6.7 %)	

n: number of cases; SD: standard deviation; O:one way ANOVA; C: chi-square test; NS: not significant; ***: significant at p ≤ 0.001

The Indicative Clinical Features of PCOS

Table 2 displays the indicative clinical features of PCOS. There was a significant difference in body hair history across research groups (p 0.001). There was a statistically significant difference in scalp hair loss between research groups (p 0.001). There was a significant difference in acne history across research groups (p =0.004). There was a statistically significant difference in oligo-amenorrhea across research groups (p 0.001). There was a significant difference in PCOS history by ultrasonography across research groups (p 0.001).

Table 2: Clinical characteristics suggestive of PCOS

Characteristic	Control normal weight group n = 30	Control overweight-Obese group n = 30	PCOS Normal weight n = 30	PCOS overweight-obese n = 30	p
History of body hair[hirsutism]					
Yes	4 (13.3 %)	0 (0.0 %)	26 (86.7 %)	26 (86.7 %)	< 0 . 0 0 1 C ***
No	26 (86.7 %)	30 (100.0 %)	4 (13.3 %)	4 (13.3 %)	
Scalp hair loss					
Yes	18 (60.0 %)	14 (46.7 %)	30 (100.0 %)	24 (80.0 %)	< 0 . 0 0 1 C ***
No	12 (40.0 %)	16 (53.3 %)	0 (0.0 %)	6 (20.0 %)	
History of acne					
Yes	8 (26.7 %)	8 (26.7 %)	20 (66.7 %)	14 (46.7 %)	0.004 C **
No	22 (73.3 %)	22 (73.3 %)	10 (33.3 %)	16 (53.3 %)	
History of infertility					
Yes	6 (20.0 %)	2 (6.7 %)	16 (53.3 %)	14 (46.7 %)	< 0 . 0 0 1 C ***
No	24 (80.0 %)	28 (93.3 %)	14 (46.7 %)	16 (53.3 %)	
O l i g o / amenorrhea					
Yes	8 (26.7 %)	4 (13.3 %)	28 (93.3 %)	30 (100.0 %)	< 0 . 0 0 1 C ***
No	22 (73.3 %)	26 (86.7 %)	2 (6.7 %)	0 (0.0 %)	

n: number of cases; SD: standard deviation; C: chi-square test; ***: significant at p ≤ 0.001; **: significant at p ≤ 0.01

3. The Results of Biochemical Investigations of Women Enrolled in the Study

The results of biochemical investigations of the women who enrolled in this study are shown in Table 4.4. There was a significant difference in mean FPG among the study groups ($p < 0.001$) and the levels were as PCOS overweight obese group followed by the control overweight obese group, the PCOS normal weight group, and finally the control normal weight group. There was no significant difference in HDL among the study groups ($p = 0.125$). There was a significant difference in mean LDL among the study groups ($p < 0.001$) and the levels were as PCOS overweight obese group followed by the control overweight obese group, the PCOS normal weight group, and finally by the control normal weight group. There was a significant difference in mean TG among the study groups ($p < 0.001$) and the levels were as PCOS overweight obese group followed by the control overweight obese group, the control normal weight group, and finally by PCOS normal weight group. There was a significant difference in mean LH among study groups ($p < 0.001$) and the levels were as PCOS overweight obese group followed by PCOS normal weight group, the control normal weight group, and finally the control overweight obese group. There was a significant difference in mean FSH among study groups ($p < 0.001$) and the levels were as control normal weight group followed by the control overweight obese group then PCOS overweight obese group followed by PCOS normal weight group. There was a significant difference in mean LH/FSH ratio among the study groups ($p < 0.001$) and the levels were as PCOS overweight obese group followed by PCOS normal weight group, the control overweight obese group, and finally the control normal weight group. There was a significant difference in mean testosterone among study groups ($p = 0.005$) and the levels were as PCOS overweight obese group followed by PCOS normal weight group, the control normal weight group, and finally the control overweight obese group.

Table 3: Results of biochemical investigations of women enrolled in this study

Characteristic	Control normal weight group n = 30	Control overweight-Obese group n = 30	PCOS normal weight n = 30	PCOS overweight-obese n = 30	p
FPG					
Mean ±SD	84.27 ± 20.58	92.87 ± 12.46	87.13 ± 14.46	99.00 ± 7.83	0.001 O ***
Range	60-150	75-120	65-111	87-112	
HDL					
Mean ±SD	50.20 ± 7.26	47.80 ± 6.98	49.67 ± 6.65	46.47 ± 5.99	0.125 O
Range	35-63	35-61	35-60	35-55	NS
LDL					
Mean ±SD	46.13 ± 26.74	85.09 ± 29.20	53.50 ± 29.30	104.77 ± 17.55	< 0.001 O ***
Range	15-110	17-130	15-90.1	61.5-140	
TG					

Mean ±SD	96.67 ± 22.01	102.79 ± 24.83	85.47 ± 8.72	128.20 ± 28.84	< 0.001 O ***
Range	66-154	65.8-150	70-100	85-165	
LH					
Mean ±SD	10.61 ± 4.28	10.01 ± 5.65	17.64 ± 7.18	18.70 ± 7.90	< 0.001 O ***
Range	3.32-16.3	3.86-19.2	4.58-32.02	2.63-30.2	
FSH					
Mean ±SD	10.15 ± 6.01	7.20 ± 4.30	5.37 ± 2.94	5.93 ± 5.65	0.001 O ***
Range	2.92-25.8	3.08-20.15	1.5-13.16	0.7-25.8	
LH/FSH					
Mean ±SD	1.16 ± 0.35	1.47 ± 0.55	3.55 ± 0.75	3.94 ± 1.18	< 0.001 O ***
Range	0.55-1.79	0.7-2.6	2.7-5.64	0.58-5.69	
Testosterone					
Mean ±SD	0.61 ± 0.21	0.45 ± 0.22	0.96 ± 0.33	11.17 ± 27.00	0.005 O **
Range	0.31-1.14	0.15-0.8	0.3-1.8	0.65-98	

n: number of cases; SD: standard deviation; ***: significant at $p \leq 0.001$; **: significant at $p \leq 0.01$; NS: not significant

Discussion

In this study, the increased BMI was related to a significantly increasing age in both the control and PCOS groups. The relationship between increasing age and increased mean BMI has already been established (8). The most plausible reason for this relationship is that becoming older leads to a more sedentary lifestyle, less exercise, worse food habits, and hormonal changes. On the other hand, a notable finding in this study was that PCOS can be seen in both normal-weight and obese women. Previous studies on the relationship between obesity and PCOS dominated published literature since obesity is a prevalent finding in women with PCOS and affects 40-80% of women with PCOS who were reported to be overweight or obese (9); nevertheless, the presence of PCOS in thin women showed genetic and environmental factors to illness etiology (10),(11). Other than that, obesity can be a result of PCOS rather than its cause; given the complexity of PCOS pathogenesis, it is also important to consider possible effects of PCOS on further weight gain, or at least on thwarting attempts at weight loss and maintenance through lifestyle changes. Changes in energy expenditure, mental illness, or physical inactivity are all potential mediators of these effects (12). Furthermore, both PCOS and the control group were related to an increase in waist circumference, showing that the high BMI is attributable to central obesity and that both overweight obese groups, control, and PCOS, had considerable difficulties lowering waist circumference. Aside from reproductive issues, the most significant clinical consequence of obesity in women with PCOS was the development of metabolic syndrome. Obesity, particularly abdominal obesity, is a prevalent symptom of PCOS, and its incidence varies by geographic region and race. Abdominal obesity has been linked to several clinical characteristics of PCOS, according to research. For example, due to adipose tissue dysfunction, adipocytes secrete non-physiological levels of adipokines, including IL6,

IL8, TNF- α , leptin, adiponectin, resistin, lipocalin 2, monocyte chemoattractant protein-1 (MCP1), retinol-binding protein-4 (RBP4), and CXC-chemokine ligand 5 (CXCL5), which can be involved in IR (13).

The Conclusion: According to the present study findings, overweight and obese women tend to have a greater prevalence of PCOS than normal-weight individuals. It is crucial to indicate that PCOS can develop in women of normal weight.

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