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Correlation of Metabolic Syndrome in Different Phenotypes of Polycystic Ovary Syndrome and Pregnancy Rate

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Abstract

Introduction: Polycystic ovary syndrome (PCOS) is considered one of the most common endocrine and metabolic disorders in women of reproductive age. According to Rotterdam diagnostic criteria, Insulin resistance (IR) plays an important role in the pathophysiology of PCOS.

Aim of the study: To study the prevalence of metabolic syndrome in different phenotypes of PCOS and its relation to pregnancy rate.

Subjects and methods: The current study recruited 100 patients who were primarily diagnosed with PCOS. These patients (aged between 18-30 years) complained of irregular menstruation, signs of hyperandrogenism, and infertility. Consents were taken from all patients. Cases were classified into four phenotypes (A, B, C, and D). After reporting the clinical history, physical examinations were performed by measuring arterial blood pressure (ABP), height, weight, body mass index (BMI), abdominal circumference (AC), and assessment of clinical signs of hyperandrogenism.

Results: the study found that the classic PCOS phenotype (A and B) is the most common representing about 60 % of patients. In comparison, the ovulatory phenotype (C) and the normal-androgenic phenotype (D) represented 27% and 13% of the patients, respectively. It also revealed a statistically significant difference between the four groups of PCOS regarding the presence of Metabolic Syndrome ($P< 0.05$), with the highest prevalence in phenotype A and the least prevalence in phenotype D. It also revealed a statistically significant difference between the four groups of PCOS regarding the presence of Metabolic Syndrome ($P< 0.05$), with the highest prevalence in phenotype A and the least prevalent phenotype D.

Conclusion: Hyperinsulinemia and hyperandrogenemia can affect fertility in patients with PCOS leading to chronic anovulation.

Keywords: PCOS; hyperinsulinemia; hyperandrogenemia; pregnancy.

1. Introduction

Polycystic Ovarian Syndrom (PCOS) is one of the most common complexes and heterogeneous endocrine disorders affecting 6-10% of women of fertile age. Both reproductive and metabolic abnormalities characterize it with manifestations of hyperandrogenic disorders oligomenorrhea or amenorrhea, infertility, and obesity, based

on Rotterdam diagnostic criteria. There are different four phenotypes as following; (A) oligo-ovulation or anovulation+ clinical and/or biochemical hyperandrogenism+ polycystic ovaries (B) oligo-ovulation or anovulation +clinical and/or biochemical hyperandrogenism, (C) clinical and/or biochemical hyperandrogenism+ polycystic ovaries, and (D) oligo-ovulation or +polycystic ovaries [1].

Clinical hyperandrogenism is an essential diagnostic criterion of this syndrome, manifested as hirsutism (70%), acne (20%), androgenic alopecia (5%). Hirsutism is evaluated by using the Modified-Ferriman-Gallway index (FGI). In adult women hirsutism, acne alopecia is suitable for biochemical hyperandrogenism and should be considered an indicator of excessive androgen production. During adolescence, only hirsutism should be regarded as a surrogate of biochemical hyperandrogenism. Hirsute carriers of PCOS have a three-fold risk of developing metabolic syndrome than those without hirsutism [2].

Infertility is frequently met in PCOS as a consequence of chronic anovulation, the exact mechanism would explain that is still a matter of debate, but hyperandrogenism and obesity are considered as major causes, PCOS is characterized on pelvic ultrasound by the presence of more than 12 small follicles (2-9 mm) on the ovary due to the arrest of growth of follicles at earlier stages, granulosa cells from individual follicles obtained from anovulatory polycystic ovaries were found to be prematurely responsive to LH, typically at a diameter of 4 mm as opposed to normal follicles that are responsive to LH only once the diameter reaches 9.5mm or greater [3].

Metabolic syndrome (MS) is defined as the presence of at least three of the following criteria, abdominal obesity (a waist ≥80 cm in women), hypertension (systolic blood pressure ≥130 mmHg and/or diastolic ≥85mmHg), high levels of blood glucose (fasting level≥100mg/dl or a diagnosis of type 2 diabetes), high triglyceride levels (≥150 mg/dl), reduced HDL cholesterol (<50mg/dl) [2].

A close correlation was observed between adiposity and the severity of symptoms in PCOS. The android type of body fat distribution, which is more commonly associated with metabolic disturbances, was the studies on anthropometric parameters in women with PCOS had revealed higher body mass index (BMI) and increased waist circumference (WC) in these women [4].

The current study aimed to investigate the prevalence of metabolic syndrome in different phenotypes of polycystic ovarian syndrome and its relation to pregnancy rate in above phenotypes.

2. Subjects and methods

2.1. Subjects

The study recruited 100 women aged between 18-39 years. According to the Rotterdam Consensus, these women were diagnosed with PCOS and agreed to participate in the present research. Seven patients were lost because they did not

perform all the laboratory tests and/or a pelvic ultrasound scan. The study was conducted in the outpatient gynecological clinic at Fayoum University hospital after approval of the local institutional ethical committee. All of the eligible participants, before recruitment, signed a detailed informed consent.

2.2. Inclusion criteria

Ages were between (18-39 years). The women with irregular menstruation complaints, complaints of oligomenorrhea (when the menstrual cycle occurs at an interval ≥35 days), secondary amenorrhea (absence of menstruation over three consecutive cycles or for 6 months), and/or signs of hyperandrogenism were considered as hirsutism.

2.3. Exclusion criteria

The medical situations of pregnancy, lactation, endocrinopathies associated with anovulation (such as hypothyroidism or hyperthyroidism), or primary hyperprolactinemia were excluded.

2.4. Methodology

Full clinical history

That included age, good analysis of the complaint, detailed menstrual history, obstetric and family history, use of medications, and contraceptive methods.

2.5. Physical examinations

That was performed at the first consultation. The examinations included measuring of the arterial blood pressure (ABP), height in centimeters (cm), weight in kilograms (kg), body mass index (BMI), and Abdominal circumference (using a tape measured midway between the iliac crest and the lower coastal border). Besides, the clinical signs of hyperandrogenism, such as acne vulgaris, androgenic alopecia, hirsutism based on the presence, and distribution of terminal hair were assessed according to the modified Ferriman-Gallwey scale (hirsutism present with a score>8). Women were evaluated at least four weeks after hair removal. None of the patients underwent any permanent hair removal procedures in the presence of Acanthosis nigricans.

2.6. Statistical Methods

In the statistical analysis, a descriptive analysis of the study variables was performed. For the continuous variables, we used the mean and median values as central tendency measures and the standard deviation (SD) to measure dispersion. Initially, in the univariate analyses, the quantitative variables' normality assumptions were evaluated with the Kolmogorov-Smirnov test. A comparison of the variables among the four phenotypes of PCOS was performed using the analysis of variance (ANOVA) test, when the normality and homogeneity assumptions were accepted, and, in the absence of normality, by the Kruskal-Wallis non-parametric test.

3. Results

This study was carried out in the outpatient clinic of the Gynecology department of the Faculty of Medicine, Fayoum University. The study group included 100 females. Their age ranged from 18 to 39 years. It revealed no statistically significant difference between PCOS Phenotypes regarding age (*P>0.05*) (Table 1 and Figure 1).

Table 1: Comparison between PCOS Phenotypes regarding age.

	PCOS Phenotypes				**F ratio**	***P-value***
	A (n=25)	B (n=25)	C (n=25)	D (n=25)		
Age	28.32±1.32[a]	28.52±1.35[a]	26.4±1.65 [a]	29±1.40 [a]	1.08	0.388

n: number.

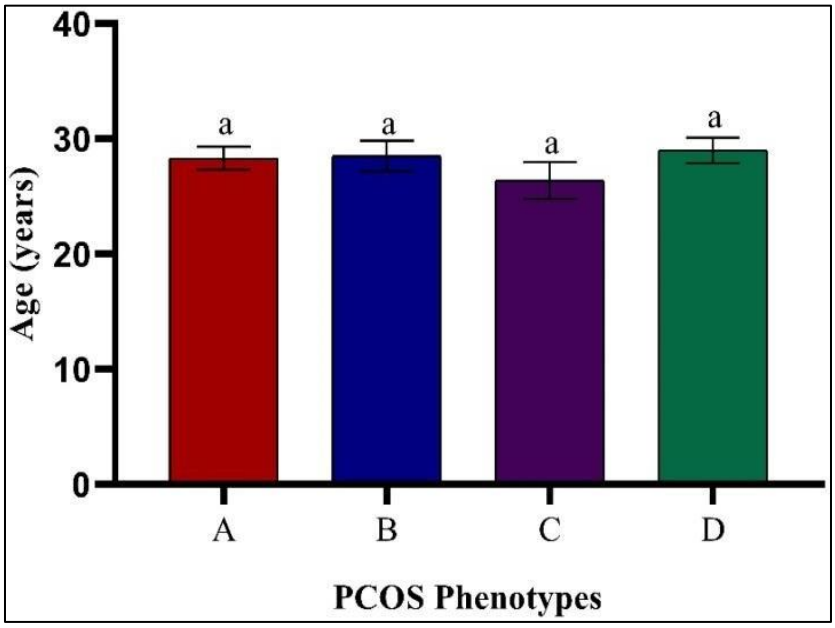

Figure 1: comparison between PCOS Phenotypes regarding age.

According to Tukey's test, means with the different letters are significantly different at the 0.05 level among treatments. It revealed a statistically significant difference between PCOS Phenotypes regarding BMI (*P<0.05*) (Figure 2). The mean BMI was the highest (32.50±1.5) in phenotype A, followed by phenotype B (30.08±2.1), then phenotype D (29.28±1.21), and phenotype C (29.08±1.15).

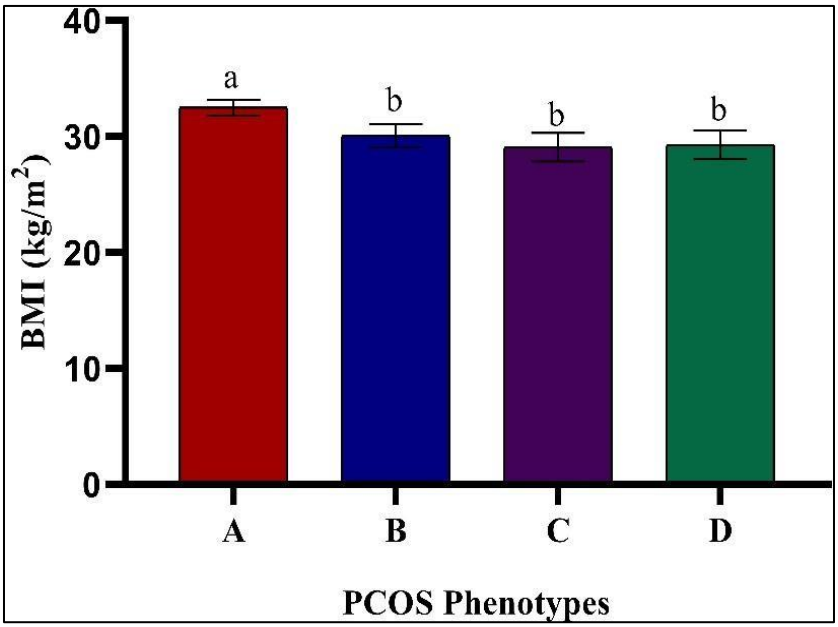

Figure 2: comparison between PCOS phenotypes regarding BMI.

According to Tukey's test, measurements are considered significant at *P<0.05*. It revealed a statistically significant difference between PCOS Phenotypes regarding abdominal circumference (*P<0.05*), with the highest prevalence of increased abdominal circumferences, group A (mean 94.64±2.75) and the least in phenotype D (mean 86.16±2.77).

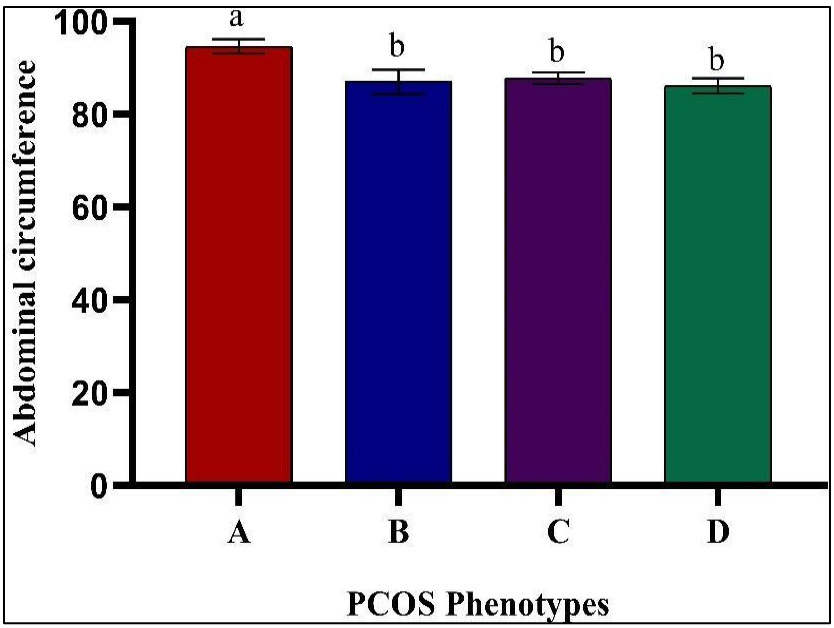

Figure 3: comparison between PCOS Phenotypes regarding abdominal circumference.

Table 2: Comparison between PCOS Phenotypes regarding duration infertility.

	PCOS Phenotypes				**F ratio**	***P-value***
	A (n=25)	B **(n=25)**	C **(n=25)**	D **(n=25)**		
Duration infertility	3.56±0.45[a]	3.24±0.46[a]	3.64±0.71a[a]	4.12±0.23[a]	1.16	0.328

4. Discussion

Polycystic ovary syndrome (PCOS) is one of the most common endocrine and metabolic disorders in women of reproductive age. The exact etiology of PCOS is unknown, but it is suggested to be related to multiple factors. Both reproductive and metabolic disorders may be present. A metabolic syndrome is a group of metabolic disorders, such as impaired glucose tolerance, dyslipidemia, and hypertension, that were present in the majority of women with PCOS. Infertility also is frequently present in PCOS as a consequence of chronic anovulation. The current study was designed to assess the prevalence of metabolic syndrome in different PCOS phenotypes, and furthermore, identify if the pregnancy rate is variable in these phenotypes or not [5].

The relative prevalence of the different PCOS phenotypes varies according to many factors. The most important is the mean body weight of the population and also the ethnic group. Our study found that the classic PCOS phenotype (A and B) is the most common type representing about 60 % of PCOS patients. The ovulatory phenotype (phenotype C) was common, with almost 27% of PCOS patients presenting this phenotype. In comparison, the normal-androgenic phenotype (D) is relatively uncommon, only in <13% of the patients. Previous studies showed that the classic phenotype (A+B) was the most frequent phenotype representing about 90% of PCOS patients [6].

BMI is a screening tool that can indicate whether a person is underweight, excess weight, or obese. Our study has revealed that there is a statistically significant difference between PCOS Phenotypes as regarding BMI (*P<0.05*), the mean BMI was the highest (32.50±1.5) in phenotype A, followed by phenotype B (30.08±2.1). Phenotype D (29.28±1.21) and phenotype C (29.08±1.15), A previous study had noted that the phenotype A group also presented with the highest BMI. As previously mentioned, the particularly visceral type was highly associated with hyperandrogenism and insulin resistance, and subsequent higher metabolic disorders [7].

Our study has found that the pregnancy rate in different PCOS Phenotypes has no statistically significant difference (*P<0.05*). A previous study done by Legro et al., 2014 had shown similar results (8)

5. Conclusion

The current study showed a difference in the prevalence of the PCOS phenotypes. The classic PCOS phenotypes (A and B) were the most frequent, representing about 60 % of patients, followed by the ovulatory phenotype (phenotype C) and phenotype (D) in 27% and 13% of patients, respectively. It also revealed a statistically significant difference between four groups of PCOS regarding the presence of metabolic syndrome ($P<0.05$), with a higher prevalence associated with phenotype A.

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Ethical Approval Statement: The protocol was approved by the Ethical Committee of Fayoum Faculty of Medicine, Fayoum, Egypt. The researcher informed the participants about the objectives of the study, the examination, investigations that were done, the confidentiality of their information, and their right not to participate in the study.

Informed Consent Statement: Written informed consents were obtained from all patients.

Conflicts of Interest: All authors declare no conflict of interest.

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