Section A-Research paper

Evaluation of Various Biochemical Parameters in Polycystic Ovary Syndrome

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Abstract

Background: Polycystic Ovarian Syndrome (PCOS) is one of the most significant endocrinological disorder among adolescent women. Several biochemical characteristics tend to vary in such patients. It gives a great need in identification and early diagnosis and also benefits in therapeutic outcomes of the patients. **Aim and Objectives:** The aim of this study is to evaluate various biochemical parameters in PCOS. The objective of this study is to understand the association between bio chemical parameters such as Fasting blood sugar, glycated heamoglobin and lipid profile. **Methodology:** A cross sectional study was carried out in tertiary care hospital and analysed using case control model. Women above 18 years of age are diagnosed with PCOS using Rotterdam criteria were included in the study. Patients with severe comorbidities were excluded from the study. **Results:** After initial screening 80 patients were included in control group while 80 patients were cases (PCOS). The mean age was around 21.23±3.14 and average BMI was 27.32±2.16. PCOS patients have an elevated glycemic profile($P<0.0001^*$), increased LDL ($P<0.0001$) and triglyceride levels ($P<0.0001^*$) indicating PCOS impact on entire human system. **Conclusion:** Early detection, monitoring and management of all the biochemical parameters can help in restricting the complications of this condition

Keywords: Polycystic ovarian syndrome

Introduction

PCOS is one of the most prevalent female endocrine disorders, affecting 5%–10% of women between the ages of 12 and 45 who are fertile. It is considered to be among the main reasons

for female infertility.[1] Teenage girls could have PCOS in up to 50% of cases. It is the most frequent reason for infertility and irregular menstruation.

Stein and Levinthal first identified PCOS in 1935, but it wasn't until much later that the existence of sclerocystic ovaries was acknowledged. In addition to reproductive health problems like obesity, insulin resistance, hypertension, cardiovascular disease, and mental disorders, PCOS also has its share of challenges. Sweeping of issues can make women feel anxious about PCOS and lower their quality of life.[2,3]

Young adults who have the most severe form of PCOS are more likely to be overweight, be prone to acne, have unusually thick body hair—often on their faces, breasts, and inside of their legs—as well as mood swings.[4] The primary pathophysiology of PCOS is increased insulin resistance, which leads to an elevated LH/FSH ratio, a decreased SHBG (sex hormone binding globulin), anovulation, and hyperandrogenism in females. Hyperinsulinism or hyperinsulinemia can result from insulin resistance. It also serves as a risk factor for type 2 diabetes. It is uncertain and difficult to demonstrate how insulin resistance and hormonal imbalance are related at the biomolecular level. Insulin resistance affects 75% of PCOS patients, and 10% of them will go on to acquire diabetes by the time they are 40.[5] A population-associated collection of risk factors for cardiovascular disease is known as the metabolic syndrome (MBS). Independent of obesity, insulin resistance (IR), glucose intolerance, dyslipidemia, hypertension, and central obesity, hyperandrogenemia is a risk factor for MBS.[6]

There are numerous suggested PCOS diagnosis standards. The following suggestions were put forth by the National Institutes of Health (NIH) Evidence-based Methodology Workshop Panel on Polycystic Ovary Syndrome in 2012. It is necessary to: (1) rename the condition to more accurately reflect the intricate interactions between the hypothalamus, pituitary, ovary, and adrenal glands that define the syndrome; and (2) maintain the inclusive, inclusive diagnostic criteria of Rotterdam Androgen Excess and PCOS Society while also specifically identifying each of the sub-phenotypes in research and clinical initiatives.[7]

Aim and Objectives

Aim

The aim of the study is to evaluate the various biochemical parameters in patients with Poly Cystic Ovary Syndrome (PCOS) as the variations can be an ideal tool for the prognostic features.

Objectives

The objective of this study is to understand the association between bio chemical parameters such as Fasting blood sugar, glycated heamoglobin and lipid profile

Materials and Methods

Study Site

This study was carried out in a tertiary care hospital in the department of obstetrics and gynaecology and department of biochemistry.

Sample Size:

The following formula is also used to calculate the size of the required sample

$N = (Z)^2 p (1-p) / d^2$

Where, n = sample size

Z = level of confidence according to the standard normal distribution

For the level of confidence 95%, we have used a standard variate Z = 1.96

p = estimated proportion of the population variance from previous data =0.5

d = degree of precision or margin of error (5%) = 0.05

New S.S = S.S / 1+ (S.S-1)/Pop

Pop = 250
Sample size = 160

Group	No of Patients
Control – Healthy Individuals	80
Case- Patients with PCOS	80

Study Design

The study design used in this is cross-sectional survey Prospectively and analysed using a case control model. Each of the parameters were assessed using the following methods.

S.No	Test	Kit
1.	FBS/RBS	GOD-POD method
2.	HbA1C	CVS Health A,C test kit
3.	Vitamin D- 25 hydroxy Vitamin D	Calciferol/25 hydroxycholecalceferol test
4.	Sr. Uric acid	CLIA method
5.	Lipid profile	Lipid profile A S enterprises test

Patient Selection

Inclusion Criteria:

1. Women above 18 years are included
2. Patients were included based upon clinical diagnosis as confirmed by Rotterdam criteria

According to the Rotterdam consensus, polycystic Ovary syndrome (PCOS) is defined by the presence of two of three of the following criteria: oligo- anovulation, hyperandrogenism and polycystic ovaries (≥ 12 follicles measuring 2- 9 mm in diameter and/or an Ovary volume > 10 mL in at least one ovary).

Exclusion Criteria

1. Patients below 18 years of age
2. Patients who have already initiated therapy especially oral contraceptives
3. Patients who did not provide informed consent
4. Patients diagnosed with established comorbidities such as Diabetes Mellitus, Hyperlipidemia, cervical cancer are excluded.
5. Smokers and alcoholics are excluded from the study

Statistical Analysis

The results are expressed as mean SD. Statistical significance was evaluated by one was analysis of variance (ANOVA) using SPSS version (17.0) and the individual comparisons were obtained by the Dunnet's Test. A value of $p< 0.05$ is considered significant.

Results

Initially 257 participants were screened and out of which 164 participants fulfilled selection criteria. After taking informed consent 80 patients were assigned to Case group and 80 healthy volunteers were assigned to Control group.

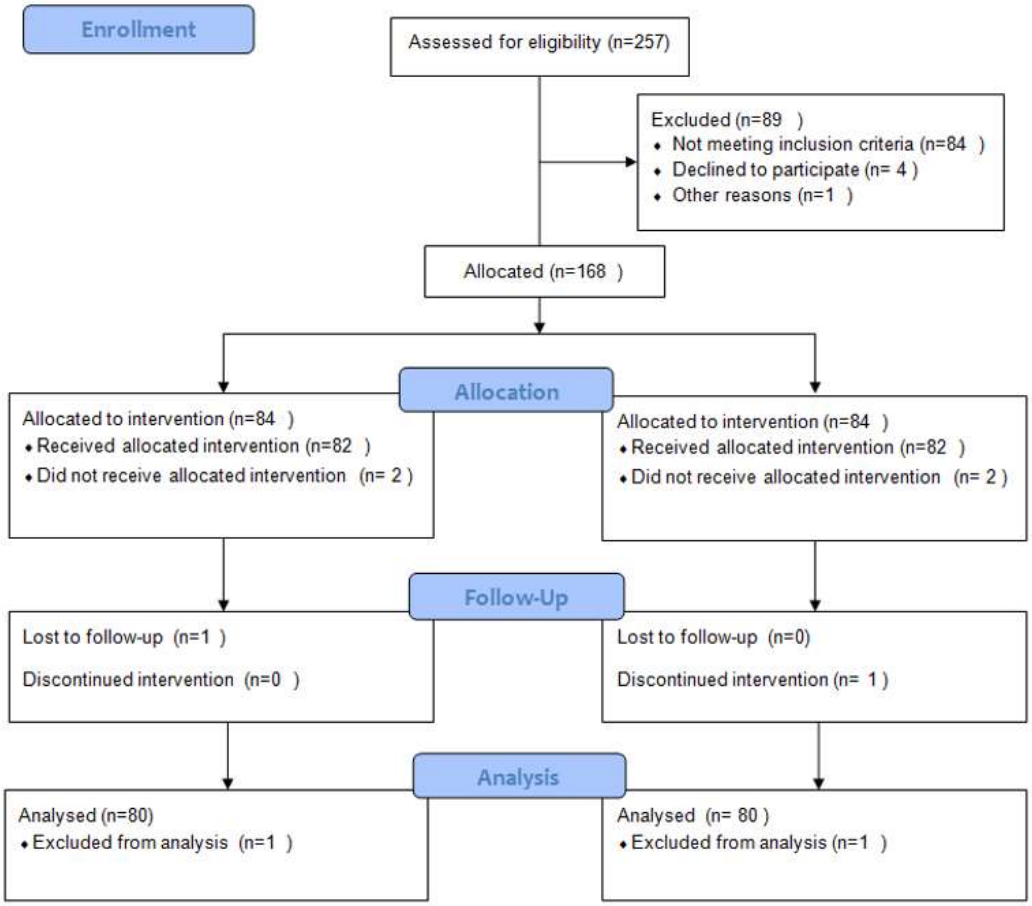


Figure 1: Patient Selection and analysis.

Table 1: Age Distribution

Age Group in Years	Case (n=80)	Control (n=80)
18-25	42	40
26-35	24	29
36-45	14	11
Mean Age Mean±SEM	21.23±3.14	24.26±2.76

All values are n(%) unless otherwise mentioned.

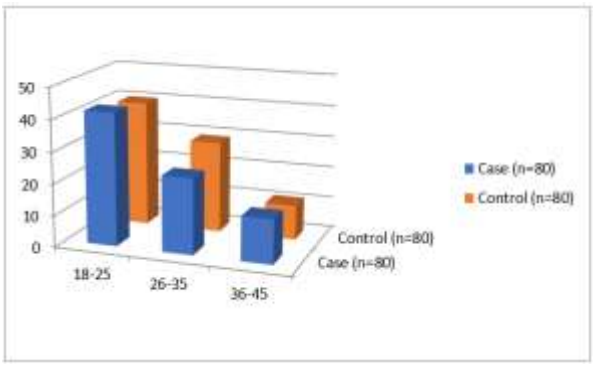


Figure 1: Age Distribution

From Table 1 and Fig 1 it can be clearly seen that women belonging to age group of 18 - 25 years are highly prone to developing of Polycystic Ovary Syndrome.

Table 2: BMI

BMI	Case (n=80)	Control (n=80)
>18.5	8	6
18.5-25	15	12
25-30	40	39
39	16	21
>40	1	2
Mean BMI Mean±SEM	27.32±2.16	26.12±3.72

All values are n(%) unless otherwise mentioned.

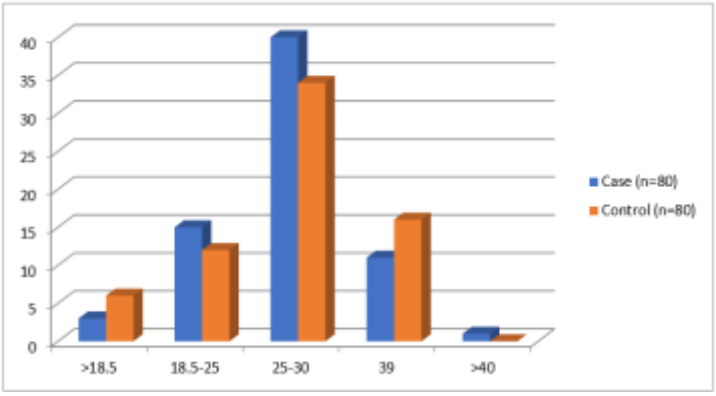


Figure 2: BMI

Fig 2 and Table 2 clearly shows that most of the PCOS patients are overweight in nature indicating body weight as one of the risk factors.

Table 3: Baseline Characteristics

Baseline Characteristics	Case (n=80)	Control (n=80)
Age (Mean±SEM)	21.23±3.14	24.26±2.76
BMI (Mean±SEM)	27.32±2.16	26.12±3.72
No. of Follicles (Mean±SEM)	10.6 ±1.4	11.2±0.9

All values are n(%) unless otherwise mentioned.

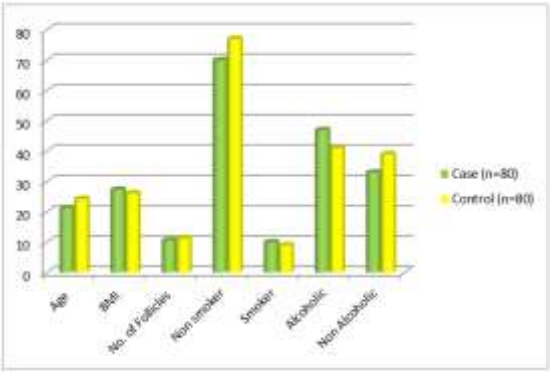


Figure 3: Baseline Characteristics

Table 4: Diabetic Profile

Parameters	Case (n=80)	Control (n=80)

FBS	132.14±11.2*	96.2±2.79
PPBS	159.36 ± 7.16*	121.42±3.76
HBA1C	7.1 ±0.32*	5.9±2.76

All values are (Mean±SEM) unless otherwise mentioned. *p<0.05 is considered significant. On performing inferential analysis it is evident that fasting blood sugar, post prandial blood sugar and Glycated haemoglobin levels are significantly higher in the Polycystic Ovary Syndrome patients.

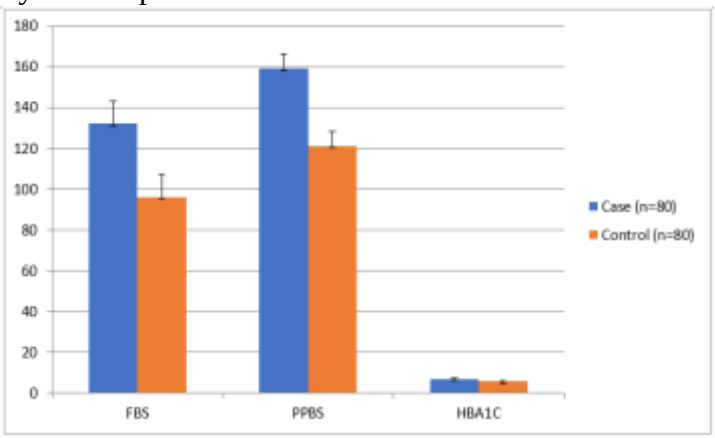


Figure 4: Diabetic Profile

Table 5: Blood pressure

BP	**Case (n=80)**	**Control (n=80)**
SBP	137.24±10.6*	96.2+2.79
DBP	91.26±7.2	78.32±6.2

All values are (Mean±SEM) unless otherwise mentioned. . *p<0.05 is considered significant. On performing inferential analysis it is evident that Systolic Blood Pressure are significantly higher in the Polycystic Ovary Syndrome patients however diastole levels were not statistically higher

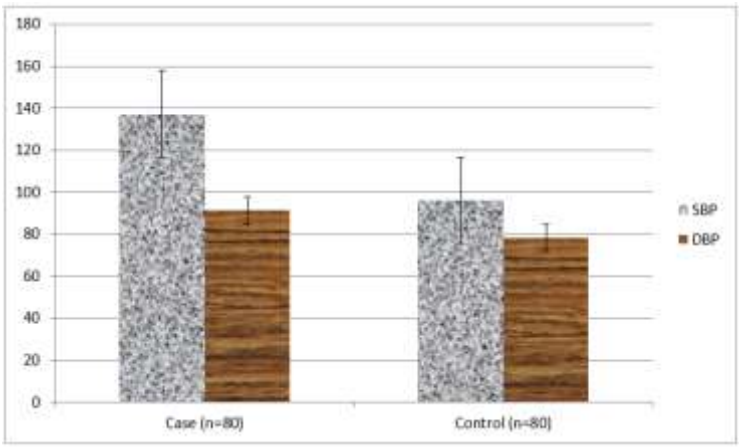


Figure 5: Blood pressure

Table 6: Lipid profile

LIPID PROFILE	**Case (n=80)**	**Control (n=80)**
TC	217.2±3.2*	164.12±1.67
TG	206.4±7.16**	137.23±7.14
LDL	139.72±16.32*	98.67±1.39
HDL	37.61±3.72*	51.24±3.76

All values are (Mean±SEM) unless otherwise mentioned. *p<0.05 is considered significant. **p<0.0001 is considered extremely significant

On performing inferential analysis it is evident that total cholesterol, Triglycerides, Low Density Lipoprotein, High Density Lipoprotein are significantly higher in the Polycystic Ovary Syndrome patients

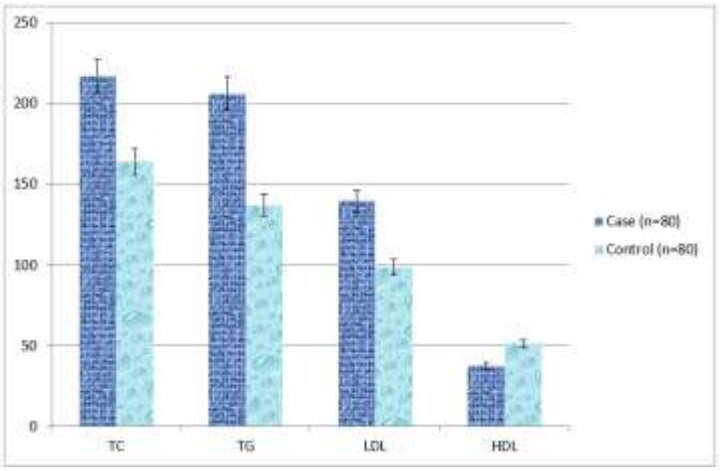


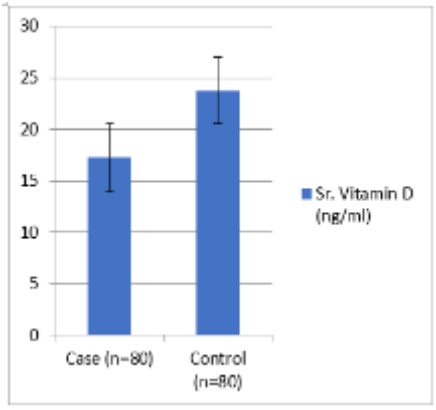
Figure 6: Lipid profile

Table 7: Serum Vitamin D and Serum Uric Acid

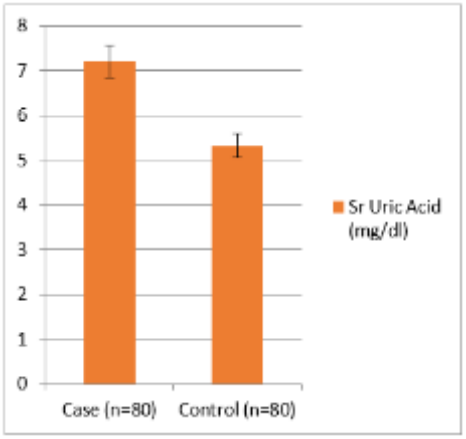
Parameters	**Case (n=80)**	**Control (n=80)**
Sr. Vitamin D (ng/ml)	17.29±2.52*	23.76±3.16
Sr Uric Acid (mg/dl)	7.21±1.06	5.32±2.13

All values are (Mean±SEM) unless otherwise mentioned. *p<0.05 is considered significant. **p<0.0001 is considered extremely significant

On performing inferential analysis it is evident that Serum Vitamin D is significantly lower in the Polycystic Ovary Syndrome patients



Sr. Vitamin D (ng/ml)



Sr Uric Acid (mg/dl)

Figure 8: Serum Vitamin D and Serum Uric Acid

Discussion

Increased Ovary and adrenal androgen secretion, hyper androgenic metabolic syndrome symptoms such hirsuitism, acne and/or alopecia, irregular menstruation, and polycystic ovaries are all characteristics of PCOS. Insulin resistance is reported to be more common in women with PCOS. Consequently, there is more glucose circulating in the blood that is waiting to be taken into the cells, leading to glucose tolerance.[7]

It is seen that the fasting blood sugar (FBS), post-prandial blood sugar (PPBS), and glycated hemoglobin levels (HbA1c) are significantly higher in the PCOS patients compared to the controls. PCOS is known to be associated with insulin resistance, which can lead to impaired glucose uptake and higher blood glucose levels. The increased insulin levels may stimulate the ovaries to produce more androgens, which in turn can lead to insulin resistance, creating a vicious cycle. This can result in higher fasting and post-prandial blood sugar levels and ultimately lead to higher HbA1c levels.

Systolic blood pressure (SBP) is significantly higher in the PCOS patients compared to the controls, while the diastolic blood pressure (DBP) did not show a significant difference between the two groups. High levels of androgens can cause an increase in salt and water retention, leading to an increase in blood volume and ultimately, blood pressure.

Serum vitamin D levels are significantly lower in the PCOS patients compared to the controls. This indicates that PCOS patients are at a higher risk of developing vitamin D deficiency, which is associated with various health problems such as bone disorders, immune system dysfunction, and increased risk of cancer. There is evidence to suggest that women with PCOS may have lower levels of vitamin D due to various reasons, including decreased sun exposure, inadequate dietary intake, and altered metabolism. Low vitamin D levels have been associated with insulin resistance, inflammation, and obesity, which are all common features of PCOS. In addition, PCOS is also associated with higher uric acid levels, which could be due to the presence of insulin resistance and the associated inflammation.

The characteristics and indicators discussed in this study can be used to test women for PCOS susceptibility. Additionally, the screening should target as many women in the sensitive age group as possible given the ethnic and geographic variations in PCOS prevalence that have been identified. The study's sample size, which only comprised a small number of people, is one of its limitations. Future studies should concentrate on early detection of the risk factors that contribute to the development of PCOS, including long-term studies with the aim of changing environmental factors to greatly lower the risk. We will be able to better understand the multisystem cross-talk underlying the aetiology of PCOS by using Systems Biology techniques in the analysis of biochemical networks.

Conclusion

PCOS patients are at a higher risk of developing various metabolic and cardiovascular disorders. The study highlights the importance of early diagnosis and intervention to prevent the long-term health consequences associated with PCOS. Further studies are needed to explore the underlying mechanisms of these abnormalities and to develop effective strategies for the prevention and management of PCOS and its associated comorbidities.

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