



## A Cross Sectional Study of Metabolic Derangements in Adolescents with Polycystic Ovary Syndrome in a Tertiary Care Hospital

Shadiya C, Usha S

Department of General Medicine, Government Coimbatore Medical College, Coimbatore.

### Abstract

Polycystic ovary syndrome is a commonest endocrinopathy of women. The prevalence of metabolic syndrome in women with PCOS appears to be significantly higher than their age matched controls. The consequence of PCOS extend beyond the reproductive age group. The burden of metabolic disturbance in adolescents with PCOS is yet to be explored. In this light of knowledge a cross sectional study of 50 adolescents with PCOS, recruited from gynecological outpatient department of Coimbatore medical college hospital was done for a period of 6 months. The adolescents within the age group of 16-18 years were selected according to Rotterdam criterion. They were compared with age and BMI matched controls. Aim of this study was to investigate the metabolic abnormalities in adolescent with PCOS and to evaluate the role of obesity as an independent indicator for the development of metabolic abnormalities in adolescents with PCOS. The results showed that the prevalence of pre-diabetes, insulin resistance, hyperinsulinemia, dyslipidemia and metabolic syndrome in adolescents with PCOS were more when compared to their age and BMI matched counterparts. PCOS subjects with BMI  $\geq$  85th centile had high prevalence of pre-diabetes, insulin resistance, hyperinsulinemia, dyslipidemia and metabolic syndrome when compared with PCOS subjects with BMI  $<$  85th centile. Adolescents with PCOS had more metabolic abnormalities than their age- and BMI-matched non-PCOS counterparts. Obesity could worsen insulin resistance, hyperinsulinemia and metabolic syndrome in PCOS adolescents.

### Introduction

- Polycystic ovary syndrome (PCOS) is a heterogeneous endocrine disorder that affects about 6%-8% women. The consequences of the PCOS extend beyond the reproductive axis.

- Women with PCOS are at substantial risk for developing metabolic abnormalities including pre-diabetes, dyslipidemia and metabolic syndrome.
- There are few studies on the metabolic disturbances in adolescents with PCOS.

### Aim

- To investigate the characteristics of metabolic abnormalities in adolescents with PCOS.
- To explore Obesity as a single potent risk factor for the development of metabolic abnormalities in PCOS.
- To determine whether screening of adolescents for metabolic abnormalities would benefit.

### Methodology

Cross sectional study (n = 50) involving adolescent girls attending the OPD of Coimbatore Medical College Hospital during a period of January 2016 to November 2016. PCOS was defined by the Rotterdam 2003 criteria. PCOS subjects should present at least two of the following criteria:

- oligo- and/or anovulation (  $\geq$  8 menstrual periods/year or cycles  $>$  35 days)
- clinical hyperandrogenism (Ferriman- Gallwey scores  $\geq$  8) and/or biochemical hyperandrogenism. (Serum Total testosterone  $\geq$  2.6 nmol/l, free testosterone (FT)  $\geq$  6.0 pg/ml.

- Polycystic ovaries (i.e. the presence of 12 follicles in each ovary)

## Results

Out of 50 adolescents diagnosed as PCOS according to the Rotterdam criteria.

- 95 % presented with oligomenorrhea or amenorrhea, all persisting for 2 years post menarche;
- 80% presented with USG appearance of polycystic ovaries;
- 75% presented clinical and/or biochemical hyperandrogenism.

**Table 1 Demographic characteristics of adolescents with and without PCOS**

Number of subjects = 50

VARIABLE	CONTROL GROUP	PCOS
Age(yr)	19 (17-19)	18.5 (17-19)
Menarche(year)	12.5 (11-14)	12.4 (11-15)
Gynecological age (year)	6.0 (4-7)	6.0 (5-7)
BMI(kg/m <sup>2</sup> )	19.6 (18.5-21.7)	20.2(18.8-28)
WHR	0.78(0.75-0.81)	0.85(0.75-0.89)
SBP(mmHg)	100(92-108)	114(96-130)
DBP(mmHg)	65(60-80)	75(65-85)

Subjects with PCOS had increased WHR, higher systolic and diastolic blood pressure.

**Table 2 Hormonal and metabolic features of adolescents with and without PCOS**

METABOLIC FEATURE	CONTROL GROUP	PCOS
FSH(IU/L)	5.3 (4.4-6.6)	5.6 (4.5-6.9)
LH(IU/L)	5.1 (3.6-7.5)	11.0 (5.9-16.1) **
TT(IU/L)	1.7 (1.5-2.4)	2.5 (2.0-3.2) **
FASTING GLUCOSE(Mmol/L)	4.7 (4.5-4.8)	4.8 (4.5-5.0)
2-HOURLY GLUCOSE(Mmol/L)	5.6 (5.0-6.3)	6.3 (5.1-7.1) *
FASTING INSULIN(Mu/Ml)	5.7 (4.4-8.3)	8.8 (5.7-13.2) **
2- HOURLY INSULIN(Mu/Ml)	48.1 (35.5-82.4)	72.7 (46.5-131.9)*
HOMA-IR	1.2 (0.9-1.8)	1.9 (1.2-2.9) **
TG(mmol/L)	0.9 (0.7-1.2)	1.2 (0.8-1.4)*
HDL(mmol/L)	1.6 (1.4-1.7)	1.6 (1.4-1.9)
LDL(mmol/L)	2.6 (2.1-2.9)	2.5 (2.1-3.1)
CHOL(mmol/L)	4.2 (3.7-4.7)	4.5 (4.1-5.1)

Subjects with PCOS displayed significantly higher LH, TT, FT, 2-h glucose, fasting insulin, 2-h insulin, TG and HOMA-IR, but there were no significant differences in FSH, fasting glucose, CHOL, LDL and HDL between the PCOS and the control groups.

**Table 3 Prevalence of various metabolic abnormalities in adolescents with and without PCOS**

METABOLIC FEATURE	CONTROL(%)	PCOS(%)
IFG	0	2
IGT	0	20
PRE-DIABETES	0	22
HIN	8	22
IR	16	32
ELEVATED LDL	2	6
LOWHDL	12	14
RAISED TGL	8	26
CENTRAL OBESITY	6	20
RAISED BP	4	18
METABOLIC SYNDROME	4	12

**Table 4 Prevalence of metabolic abnormalities in adolescents with PCOS categorized by different BMI**

METABOLIC FEATURE	BMI < 85 <sup>th</sup> CENTILE (N=32)	BMI > 85 <sup>th</sup> CENTILE(N=18)
IFG	0	2
IGT	5	15
PRE-DIABETES	5	17
HIN	8	14
IR	12	20
ELEVATED LDL	3	4
LOW HDL	6	8
RAISED TGL	5	21
CENTRAL OBESITY	0	20
RAISED BP	0	18
METABOLIC SYNDROME	0	12

## Discussion

PCOS can have multiple metabolic disturbances, such as insulin resistance and compensatory hyperinsulinemia, impaired glucose tolerance, dyslipidemia and metabolic syndrome. Concerning the long term health risk, it is necessary to identify such metabolic disorder in those adolescents with PCOS as early as possible.

Our data showed that adolescents with PCOD showed increased waist hip ratio, systolic blood pressure, diastolic blood pressure and increased BMI as compared to the control groups.

The value of luteinising hormone in patients with PCOS is 11 IU/L (5.9-16.1) while it is 5.1(3.6-7.5) in control group. Total testosterone is 2.5(2-3.2) in PCOD group and 1.7(1.5-2.4) in control group. 2 hourly glucose was 5.6 mmol/L, fasting insulin 5.7 McgU /ml, 2 hourly insulin is 48.1 McgU /ml in PCOS group while it was 5.6, 5.7, 48.1 respectively in control groups.

HOMA IR is 1.9(1.2-2.9) in PCOS group and it is 1.2 (0.9-1.8) in control group. Triglyceride value is 1.2(0.8-1.4) in PCOS group while it is 0.9 (0.7-1.2) in control group.

Impaired glucose tolerance was present in 20% of PCOS group, 22% were prediabetic, hyperinsulinemia was present in 22% of PCOS and 8% of control population. Insulin resistance was 32% in PCOS group while it is 16 % in control group.

Raised triglyceride level was present in 26% with PCOS, 8% without PCOS. Central obesity in 20% with PCOS and 6 % without PCOS. Hypertension was present in 18% with

PCOS and 4% without PCOS. Metabolic syndrome was present in 12% in PCOS group and 4% in control group.

Prevalence of impaired glucose tolerance, pre diabetes, hyper insulinemia, raised triglycerides, central obesity, hypertension, metabolic syndrome is significantly high in PCOS group who are >85<sup>th</sup> centile for BMI.

## Conclusion

- Adolescents with PCOD showed similar anthropometric and demographic characteristics except for increased waist hip ratio, systolic and diastolic blood pressure, Ferriman Gallwey score when compared with their control group.
- Hormonal assays showed increased levels of luteinizing hormone, total testosterone, and free testosterone values in
- PCOD adolescents. Other hormonal assays (prolactin, FSH, estradiol, SHBG, DHEAS, TSH) were comparable between two groups.
- Lipid profile values showed similar trend except for the triglyceride levels which was significantly elevated in our study group.
- No diabetes mellitus was detected in both study and control group.
- Adolescent PCOD group showed increase in fasting insulin, 2h post prandial insulin, and HOMA –IR values when compared with their age and BMI matched control group.
- Major proportion of adolescents with PCOD were found to be fitting the International Diabetes Federation criteria for metabolic syndrome (12/50, 25%).
- The risk of hyperinsulinemia, insulin resistance and dyslipidemia were high in BMI >85<sup>TH</sup> centile group, when compared with the BMI <85<sup>TH</sup> centile group with PCOD.
- Metabolic Syndrome was only detected in group with BMI >85<sup>TH</sup> centile group.