

Content available at: <https://www.ipinnovative.com/open-access-journals>

International Journal of Clinical Biochemistry and Research

Journal homepage: <https://www.ijcbr.in/>

Original Research Article

Study of lipid profile and insulin resistance in polycystic ovarian syndrome

Vasudha Deepak Patil^{1,*}, Gajanan Belwalkar¹, Nitin Nagane¹, Sushma Dhonde¹¹Dept. of Biochemistry, Bharati Vidyapeeth Deemed to be University, Sangli, Maharashtra, India

ARTICLE INFO

Article history:

Received 24-05-2022

Accepted 29-07-2022

Available online 27-09-2022

Keywords:

Polycystic ovary

Insulin resistance

Lipid profile

ABSTRACT

Introduction: Polycystic ovarian syndrome (PCOS) is the most common metabolic and endocrine disorder in women of reproductive age group. It is the first leading cause of infertility in females with incidence of 5-10%. Polycystic ovarian syndrome encloses a spectrum of clinical and metabolic diseases that are associated with cutaneous excess androgen status which includes acne resistant to treatment, hirsutism, male or female pattern baldness, ovulatory and menstrual disturbances such as irregular bleeding, amenorrhea, oligomenorrhea, polycystic ovaries, obesity and insulin resistance.

Aim and Objectives: To study lipid profile and insulin resistance in polycystic ovarian syndrome women.

Materials and Methods: The present study included 60 diagnosed PCOS women in the age group of 16-40 years. Lipid profile (TC, TG and HDL) was done on fully automatic Meril 400 biochemistry analyzer. LDL was calculated from TC, TG and HDL cholesterol as per Friedewald calculation. Fasting plasma glucose done in semiautoanalyser and serum insulin is measured by CLAI. Insulin resistance (IR) was calculated by using HOMA model (HOMA IR).

Observations and Results: Deranged serum lipids in the present study was mainly in the form of decreased HDL levels. Serum TC, TG and LDL levels were within normal range in most of the cases. Insulin resistance was prevalent in 75% PCOS cases in the present study.

Conclusion: The women with PCOS should be screened for lipid profile which can be helpful in assessing the risk of cardiovascular disease.

This is an Open Access (OA) journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License](https://creativecommons.org/licenses/by-nc-sa/4.0/), which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprint@ipinnovative.com

1. Introduction

Polycystic ovarian syndrome (PCOS) is the most common metabolic and endocrine disorders in women of reproductive age group. It is the first leading cause of infertility in females with incidence of 5-10%.¹

The cause of polycystic ovarian syndrome is indefinite but a few genetic factors triggered by certain environmental and behavioral factors have been suggested in various reports.² In some studies, insulin resistance secondary to obesity is strongly correlated to PCOS as causal factor.³

Insulin resistance plays a key role in pathophysiology of polycystic ovarian syndrome by stimulating lipolysis and alteration of hepatic lipase and lipoprotein lipase.⁴

In PCOS subjects there is relative inadequacy of insulin receptors binding to insulin which causes inappropriate transfer of glucose to intracellular compartment and this lead to relative hyperglycemia, despite raised insulin producing beta cells.¹

Dyslipidemia is most common malformation seen in most of PCOS women characterized by lower levels of high density lipoproteins and high triglycerides. In PCOS the causes for dyslipidemia are multi-factorial and this altered lipid profile is a crucial risk element for progression of cardiovascular pathology in women with PCOS.⁵

* Corresponding author.

E-mail address: vasudhapatil2016@gmail.com (V. D. Patil).

The clinical diagnosis of PCOS was rested on trio of amenorrhea, obesity and hirsutism in earlier studies.⁶ As per Rotterdam criteria (2003) the diagnosis of PCOS is defined by the presence of any two of the following three criteria i) Chronic oligo or anovulation. ii) Polycystic ovaries by ultrasonography with exclusion of other related disorders. iii) Clinical or biochemical signs of hyperandrogenism.^{1,5}

Women with PCOS are often obese and at increased risk of developing diabetes mellitus and cardiovascular diseases. With this background the present study was undertaken to study lipid profile in polycystic ovarian syndrome women in order to anticipate early diagnosis of complications and its management.

2. Materials and Methods

This observational study was carried out over a period of six months from November 2019 to April 2020 at Department of Biochemistry in association with Department of Gynecology of a tertiary care hospital after approval of Ethics Committee.

The present study included 60 diagnosed PCOS women in the age group of 16-40 years.

Women under treatment of diabetes mellitus, renal diseases, thyroid disorders, hypertension, cardiovascular diseases, pregnant or lactating women, women on drugs like oral contraceptives or lipid lowering drugs, hypoglycemic agents and on hormonal medicines within six weeks were excluded from the study.

An appropriate informed consent from the patient was taken.

After overnight fasting, the blood samples were collected in plain and fluoride bulbs for analysis. Fasting plasma glucose was measured by GOD POD method by semiautoanalyser. Serum fasting insulin was measured by chemiluminescence immunoassay in Maglumi 800. Lipid profile (TC, TG and HDL) was done on fully automatic Meril 400 biochemistry analyzer. LDL was calculated from TC, TG and HDL cholesterol as per Friedewald calculation.¹

LDL cholesterol = Total cholesterol – HDL cholesterol – Triglycerides/five The values were expressed in mg/dl

Adult treatment panel III considers levels of LDL below 100 mg/dl as optimal and 100 to 129 mg/dl as near optimal, TG below 150 mg/dl as normal, TC below 200 mg/dl as desirable and HDL more than or equal to 50 mg/dl as normal for women.

Dyslipidemia levels includes LDL as borderline high (130 to 150 mg/dl), high (160 to 189 mg/dl) and very high (more than or equal to 190 mg/dl); TG as borderline high (150 to 199 mg/dl), high (200 to 499 mg/dl) and very high (more than 500mg/dl); TC as borderline high (200 to 239 mg/dl), high (more than or equal to 240 mg/dl); HDL (below 50 mg/dl) is considered as a risk factor in women.⁷

Insulin resistance (IR) was calculated by using HOMA model (HOMA-IR)¹ with the formula

$$\text{HOMA-IR} = \text{Fasting plasma glucose (mg/dl)} \times \text{Fasting serum insulin } (\mu\text{iu/ml}) / 405$$

If HOMA-IR > 2.7, the patient was considered to be insulin resistant.

Data was analyzed using descriptive statistics. The values were expressed as Mean \pm Standard deviation. Frequency was calculated in terms of percentage. Pearson's correlation coefficient was calculated to assess the correlation HOMA IR and lipid profile.

3. Observations and Results

The Table 1 shows that mean serum levels of TC, TG, LDL and HDL were 160.65 ± 24.72 , 110.21 ± 28.66 , 99.44 ± 21.47 , and 38.76 ± 4.36 respectively.

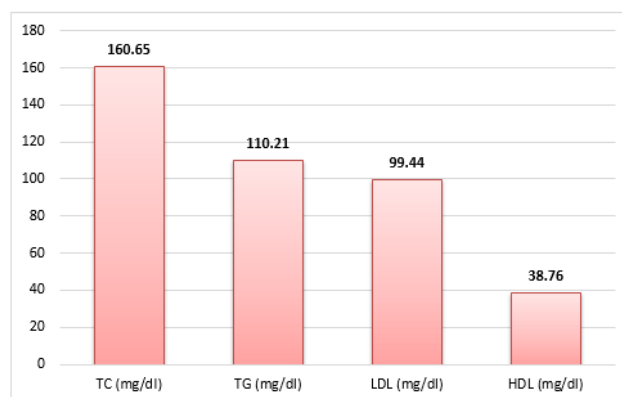


Fig. 1: Showing mean values of TC, TG, LDL and HDL in PCOS women

This Table 2 shows mean level of FBG as 100.53 ± 19.24 , mean level of serum insulin as 14.39 ± 3.76 .

3.1. Prevalence of insulin resistance in women with PCOS

The mean level of HOMA - IR in the present study was 3.57 ± 1.17 . Out of 60 PCOS women, 45 women had HOMA-IR value of more than 2.7. Insulin resistance was prevalent in 75% PCOS cases in the present study.

The Table 3 shows significant positive correlation between HOMA IR and TC, TG and LDL cholesterol in women with PCOS and the correlation is significant at the 0.01 level (2-tailed) where as we observed no correlation between HOMA IR and HDL cholesterol.

4. Discussion

In 1935, for the first time Irving F. Stein and Michael L. Levental stated a symptom complex – polycystic ovarian syndrome. PCOS is a major public health issue now a

Table 1: Showing mean values of lipid profile in PCOS women

Parameters	Minimum	Maximum	Mean	Standard Deviation
TC (mg/dl)	120	230	160.65	24.72
TG (mg/dl)	46.32	190	110.21	28.66
LDL (mg/dl)	60	169	99.44	21.47
HDL (mg/dl)	22.89	54	38.76	4.36

(TC - Total cholesterol, TG - Triglycerides, LDL - Low density lipoprotein, HDL - High density lipoprotein.)

Table 2: Mean values of fasting blood glucose (FBG) and Serum insulin in PCOS women

Parameters	Minimum	Maximum	Mean	Standard deviation
FBG	72	150	100.53	19.24
Serum Insulin	10	28	14.39	3.76

Table 3: Showing correlation between HOMA IR and lipid profile in women with PCOS

	TC	TG	LDL	HDL
Pearson correlation	.614**	.537**	.557**	0.119
P value	0	0	0	0.367

days and the incidence is increasing because of high stress level and change in the life style. It is also becoming a very common problem in adolescents developing after puberty. 20% women are attributed to anovulation caused by PCOS amongst infertile women. Some women who develop Type II diabetes, hypertension, cardiovascular disease, endometrial cancer later in life appear to have suffered from PCOS in earlier years.⁶ Insulin resistance is the central key point in the genesis of PCOS. Obesity is important cause of insulin resistance and compensatory hyperinsulinemia. Since the exact cause of PCOS is still not known, we cannot cure this disease completely. This syndrome can only be controlled and the symptoms can be reduced or eliminated by lifestyle modification and some effective drugs but not the pathology of it.

Altered lipid profile is very common metabolic malformation in women with PCOS. Insulin resistance is the principal pathogenesis of PCOS, thus deranged lipid profile in PCOS patient may be persistent with those found in an insulin resistant state. In PCOS women TG, LDL cholesterol levels were higher and HDL cholesterol level was on lower side.⁸

The mean value of serum TC in present study was 160.65 ± 24.72 with range from 120 to 230. The mean value of serum TG level in present study was 110.21 ± 28.66 with range from 46.32-190. The mean value of serum LDL was 99 ± 21.47 with range from 60 to 169. The findings were comparable to Koppalli S et al who reported mean value of TC, TG and LDL as 159.11 ± 26.95 , 117.34 ± 33.86 and 94.66 ± 26.74 , respectively.

The mean value of serum HDL level in present study was 38.76 ± 4.36 with range from 22.89 to 54. The findings were consistent with those reported by Singh G et al (2017) and Halasawadekar NR et al (2016). Singh G et al (2017) reported HDL levels of 38.16 ± 4.838 . Halasawadekar NR et

al (2016) reported HDL levels of 39 ± 4.7 respectively.

A deranged serum lipid in the present study was mainly in the form of decreased HDL levels. 96.67% women had lower serum HDL levels. Serum TG levels was raised in 16.6% women, serum TC level in 6.67% and serum LDL in 8.33% PCOS women in the present study.

The main reason for lowered HDL levels may be due to insulin resistance, which is seen in PCOS women. Insulin resistance results in more catabolism of HDL particles and LDL particles are formed. Cholesterol ester transfer protein may play role in this process.

PCOS is frequently associated with altered lipid profile as reported in various studies. The pattern of alteration of lipid profile is not alike in all populations. This is due to influence of age, BMI, insulin resistance, hyperandrogenism, genetics and environmental factors.⁹

Insulin resistance resulting in hyperinsulinemia is associated with diverse adverse effects on regulating lipid metabolism in PCOS subjects. Hyperinsulinemia appears to be a leading factor for development of cardiovascular diseases.⁵

Insulin plays a crucial role in triglyceride metabolism. In insulin resistant cases, insulin hormone fails to suppress synthesis of large very low density lipoprotein particles. Insulin resistance is also associated with increased flow of FFA (free fatty acid) to liver, increased synthesis of lipid in the liver and clearance of VLDL particles decreased, all these resulting in elevated concentration of VLDL in plasma and this lead to elevated plasma TG concentration. By the activity of cholesterol ester (CE) transfer protein triglycerides are transferred for cholesterol esters. The above process lead in HDL enriched with triglyceride that are catabolised rapidly and VLDL enriched with cholesterol ester converted in to LDL particle.¹⁰

5. Conclusion

PCOS is frequently associated with dyslipidemia. In the present study, dyslipidemia was mainly in the form of deranged serum HDL. HOMA-IR was increased in the present study which indicates presence of insulin resistance in PCOS women. Hence, the women with PCOS should be screened for lipid profile which can be helpful in assessing the risk of cardiovascular disease. Also, counseling should be conducted on routine basis of PCOS women for diet and lifestyle modification.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Ambiger S. Study of Insulin Resistance and Lipid profile in Polycystic Ovarian Syndrome. *IJSRP*. 2016;6(2):2250–3.
2. Green KI. The impact of BMI on the plasma glucose and lipid status of women with polycystic ovary syndrome. *Int J Res Med Sci*. 2018;6(12):3832–7.
3. Singh G, Afroz N, Saeed N. Study of Lipid Profile in Patients of Polycystic Ovarian Syndrome Before and After Metformin Therapy. *Ann Pathol Lab Med*. 2017;4(4):415–8.
4. Lath R, Shendye R, Jibhkate A. Insulin resistance and lipid profile in polycystic ovary syndrome. *Asian J Biomed Pharm Sci*. 2015;5(47):30–5.
5. Mohamed S. Serum Insulin and Lipid Profile in Polycystic Ovary Syndrome. *J Diabetes Metab Dis Cont*. 2015;4(5):1785–90.
6. Padubidri VG. Disorders of the Ovary and Benign Tumours. In: Shaw's text book of Gynaecology; 2010. p. 369–72.
7. Halasawadekar NR, Ramanand JB, Ramanand SJ, Raparti GT, Patil PT, Shah RD, et al. Serum lipid profile in non-polycystic ovary syndrome and polycystic ovary syndrome women: a comparative and correlational study. *Int J Basic Clin Pharmacol*. 2016;5(1):105–11.
8. Kim JJ, Choi YM. Dyslipidemia in women with polycystic ovary syndrome. *Obstet Gynecol Sci*. 2013;56(3):137–42.
9. Donthu K, Kothapalli K, Yalamanchali H, Sriharibabu M, Madhuri GLJ, Venu S. Correlations Between Anthropometry and Lipid profile in women with PCOS. *J Hum Reprod Sci*. 2017;10(3):167–72.
10. Valkenburn O, Steegers-Theunissen RPM, Smedts HPM, Huberdina P. A more atherogenic serum lipoprotein profile is present in women with PCOS. *J Clin Endocrinol Metab*. 2008;93(2):470–6.

Author biography

Vasudha Deepak Patil, Tutor

Gajanan Belwalkar, Associate Professor

Nitin Nagane, Professor and HOD

Sushma Dhonde, Professor

Cite this article: Patil VD, Belwalkar G, Nagane N, Dhonde S. Study of lipid profile and insulin resistance in polycystic ovarian syndrome. *Int J Clin Biochem Res* 2022;9(3):272-275.