Comparison of Lipid Profile in Women Suffering from Polycystic Ovarian Syndrome and Healthy Women: A Cross Sectional Study

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Abstract:

Introduction: Polycystic ovary syndrome (PCOS) is the most common endocrinopathy in reproductive age women and is associated with both reproductive and metabolic abnormalities. Recent studies have demonstrated an early onset of abnormal cardiovascular risk profile in women with PCOS. Abnormal lipid profile patterns are common in women with PCOS, and these abnormalities are not uniform in all populations. This study is aimed to compare Lipid profile levels in PCOS patients with healthy controls.

Aim and Objective: To evaluate and compare serum lipid profile levels in PCOS patients and age matched healthy controls.

Material and Methodology: Cross-sectional study was conducted in Department of Biochemistry SMS Medical College in association with department of Gynecology Mahila Chikitsalaya, Jaipur. 80 diagnosed cases of PCOS were included; Serum TG, Cholesterol, HDL, LDL and VLDL levels were compared with healthy controls.

Results: When compared to healthy controls women with PCOS had significantly higher levels of TG, Cholesterol, LDL, VLDL and significantly lower levels of serum HDL levels (p<0.0001).

Conclusion: Estimation of lipid profile in PCOS patients can be used as cardiovascular risk marker in PCOS patients for early prediction of disease. So it should be assess routinely.

Keywords: PCOS (polycystic ovarian syndrome), Triglycerides, Cholesterol, Low density lipoprotein, High density lipoprotein

Introduction

Background: In accordance 2012, the World Health Organisation (WHO) estimates that 116 million women globally had Polycystic ovary syndrome or PCOS. PCOS prevalence is quite variable, ranging from 2.2% to 26%. [1] Because of the use of several diagnostic standards, prevalence is highly varied. The prevalence rate is increasing in India as a result of the way of life that people have chosen. In our country, the majority of prevalence reports are based in hospitals. However, in recent years, studies have been conducted in schools with adolescents, and among them, the prevalence of PCOS ranges from 9.13% to 36%. [2,3] Although the precise pathophysiology of PCOS is complex and unknown, genetic and environmental variables may be important in the disease's etiopathogenesis. PCOS may be brought on by a number of additional causes, including obesity and disturbances of the hypothalamic-pituitary-ovarian (HPO) axis. [4] The main factor contributing to PCOS development is stress.

Chronic psychosocial stress promotes elevated cortisol levels, insulin resistance, and excessive fat deposition in the viscera, which is referred to as abdominal obesity, according to studies done in mammals like monkey models and humans. [5,6] HPO axis and sympatho-adrenal system are primarily responsible for controlling stress response. The excessive and protracted production of cortisol and catecholamines is caused by repeated or otherwise persistent activation of the HPO axis. Stress is therefore a risk factor for sympathetic activation that cannot be controlled.

Many of these women develop abnormal glucose and lipid metabolism, hypertension, obesity, insulin resistance and other features suggestive of systemic inflammatory response. [7] Because of the higher rates of prevalence of these risk factors, the symptoms of majority of the women with PCOS also fit into metabolic syndrome, which is a known risk factor for cardiovascular disorders. [8] The elevation of risk factors in young women with

PCOS may, therefore, put them at an increased risk of developing accelerated atherosclerosis resulting in an early onset of coronary artery disease (CAD). [9,10] A close correlation was observed between adiposity and the severity of symptoms in women with PCOS. Various studies have demonstrated abnormal lipid profile patterns in women with PCOS, and these abnormalities were not uniform in all populations. [11,12] Few studies are available on the lipid profile pattern with PCOS. Because PCOS shares many of the metabolic risk factors of cardiovascular disorders (CVD), this study was undertaken to estimate the lipid profile in women with PCOS.

Materials and Methods

A Hospital-based comparative study was conducted in department of Biochemistry SMS Medical College in association with department of Gynecology Mahila Chikitsalaya, Jaipur. 80 Non-pregnant women with PCOS were included as a case and compared with age matched normal healthy women and evaluated for Serum lipid profile levels(TG, Cholesterol, HDL,LDL,VLDL). Non-pregnant women between 18 to 40 years of age with history of oligomenorrhoea / amenorrhea, hyperandrogenism, diagnosed as PCOS by ultrasound and gave informed consent were included in this study while female with Age < 18 yrs and > 40 yrs, Patients with diabetes mellitus, hypertension, thyroid disorder, renal diseases, cardiovascular diseases, Pregnant or lactating women, Female on OCPs or hormonal medication within the previous six weeks were excluded from this study.

Results

Total 80 patients of PCOS were included in this study and Serum TG, Cholesterol, HDL, LDL, VLDL were estimated and compared with normal healthy females. Mean age in PCOS patients was 24.36 ± 4.85 years and in controls it was 25.68 ± 4.30 years. Difference was statistically non-significant (p=0.70).

Table 1: Comparison of Different variables between PCOS cases and Control

Variables	Cases(80)	Controls(80)	p value*
Age(years)	24.36+4.85	25.68+4.30	0.07
BMI (kg/m2)	28.13+7.14	19.56+3.34	<0.0001
TG (mg/dl)	210.00+84.64	104.11+30.84	<0.0001
Chol. (mg/dl)	307.35+67.73	155.7+32.55	<0.0001
HDL (mg/dl)	36.73+13.39	45.49+7.64	<0.0001
LDL (mg/dl)	228.6+64.88	88.50+27.58	<0.0001
VLDL (mg/dl)	42.03+16.99	20.81+6.25	<0.0001

p value <0.05 is significant.

Mean BMI in patients with PCOS was 28.13 ± 7.14 kg/m^2 and in controls mean BMI level was 19.56 ± 3.34 kg/m^2. This difference was statistically significant (p<0.0001). Mean Triglyceride, Cholesterol in patients with PCOS was 210.00 ± 84.64 mg/dl, 307.35 ± 67.73 mg/dl respectively and in controls it was 104.11 ± 30.84 mg/dl, 155.7 ± 32.55 mg/dl respectively. This difference was statistically significant (p<0.0001).

Mean HDL, LDL and VLDL in patients with PCOS was 36.73 ± 13.39 mg/dl, 228.6 ± 64.88 mg/dl and 42.03 ± 16.99 mg/dl respectively while in controls it was 45.49 ± 7.64 mg/dl, 88.50 ± 27.58 mg/dl and 20.81 ± 6.25 mg/dl respectively. This difference was statistically significant(p<0.0001).

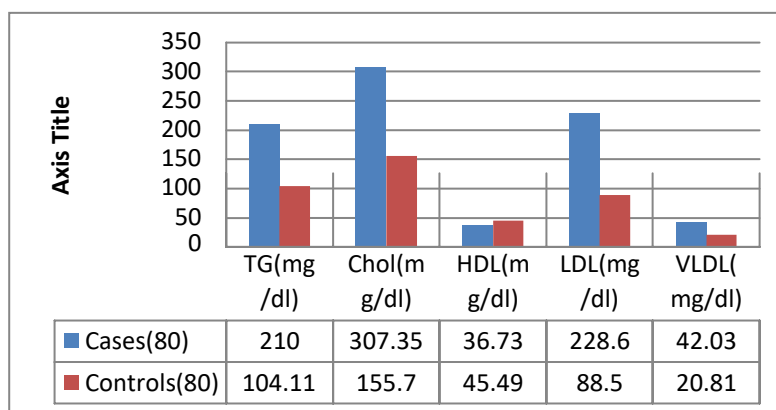|	TG(mg/dl)	Chol(mg/dl)	HDL(mg/dl)	LDL(mg/dl)	VLDL(mg/dl)
Cases(80)	210	307.35	36.73	228.6	42.03
Controls(80)	104.11	155.7	45.49	88.5	20.81

Figure 1: Comparison of Lipid profile between PCOS cases and Control group

Table 2: Correlation of BMI vs Triglycerides and Cholesterol levels

Parameters	Correlation coefficient (r)	P-value
BMI vs TG	0.37	<0.0001
BMI vs Chol	0.42	<0.0001

There was significant positive correlation between Triglyceride and BMI (p<0.0001). There was positive correlation between Cholesterol and BMI (p<0.0001).
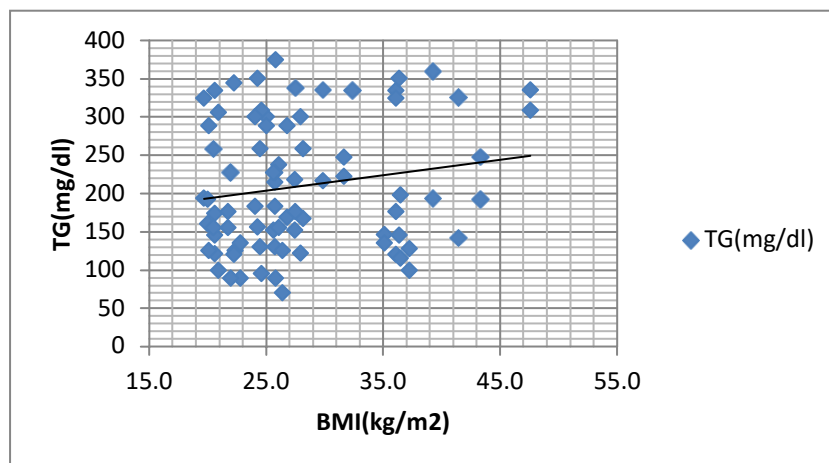
Figure 2: Correlation of BMI vs Triglycerides levels [r = 0.370; P <0.0001]
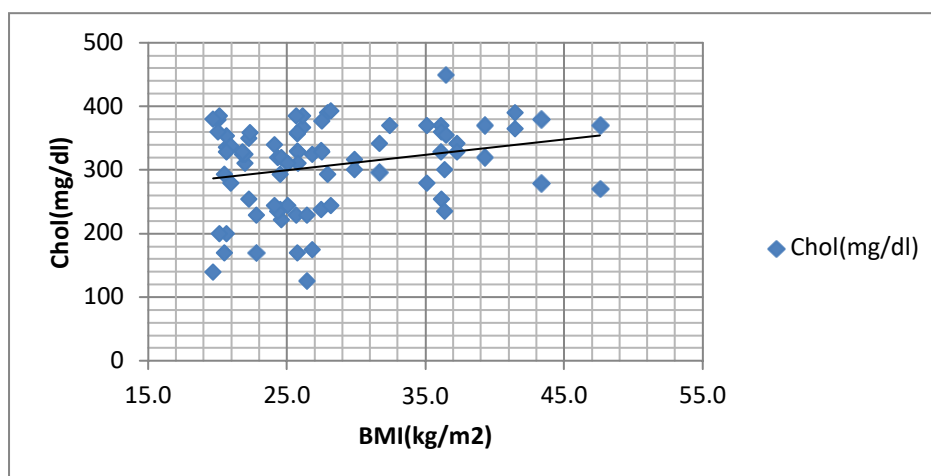
Figure 3: Correlation of BMI vs Cholesterol levels [r = 0.42; P <0.0001]

Discussion:-

Polycystic ovary syndrome (PCOS) is a common endocrine disease [13], affecting between 6 to 22% of women worldwide. Its cardinal features include ovulatory dysfunction, hyperandrogenism (HA), and polycystic changes in the ovary [14]. It is often diagnosed in the reproductive phase of life when women with PCOS are confronted with infertility, irregular menstruation, or symptoms of hyperandrogenism, including acne, androgenic alopecia, and hirsutism. In addition, dyslipidemia is increasingly common in young adult women with PCOS [15]. Retrospective and prospective cohort studies further indicate an increase in coronary atherosclerotic cardiopathy risk in PCOS [16]. However, the potential interactions of endocrine disorders and metabolic abnormalities on lipid profiles in PCOS patients have not been studied extensively. So our aim in this study was to investigate the lipid profile in PCOS patients and compare them with healthy controls. Mean age of patients with PCOS which was called as cases was 24.36±4.85 years and for normal healthy controls it was 25.68±4.30 years. There was no statistically significant (p=0.70) difference between both groups which shows our study is age matched in respect of cases and controls.

In this study we found mean BMI in PCOS patients 28.13±7.14kg/m^2 and in controls 19.56±3.34kg/m^2. BMI was significantly high in PCOS patients in comparison to healthy controls.(p<0.001)Results of our study correlated with SASMITA MISHRA et al [17] in 2018 showed BMI was more in PCOD patients in comparison to healthy controls. This

difference was statistically significant(p<0.05). Another similar study by Amir Ziaee et al [18] in 2013 showed raised BMI in PCOD patients in comparison to controls. This difference was statistically significant. Similar results were found in study conducted by Arti A et al [19] in 2008. Possible explanation for this may be Reproductive disturbances are more common in obese women regardless of the diagnosis of PCOS. Obese women are more likely to have menstrual irregularity and anvolatory infertility than normal-weight women. In reproductive-age women, the relative risk of anovulatory infertility increases at a BMI of 24 kg/m2 and continues to rise with increasing BMI. [20] Consistent with a pathophysiologic role for obesity, weight reduction can restore regular menstrual cycles in these women.

In this study we found mean TG, Cholesterol levels in patients with PCOS was 210.0±84.64mg /dl, 307.35±67.73 mg/dl respectively and in controls it was 104.11±30.84 mg/dl and 155.70±32.55mg/dl . it shows significantly high(p<0.001) levels of TG and cholesterol levels in cases in comparison to controls. Results of our study correlates with study conducted by Panda SR et al [21] in 2016 shows that the mean±sd of total cholesterol level in the study and control group is 202.12±40.18 mg/dl and171.48±17.74 mg/dl respectively and this is statistically highly significant (p-value<0.0001). Similarly the mean±sd of triglyceride level in cases and controls is 162.38±70.40 mg/dl and 131.46±27.16 mg/dl respectively which is also statistically significant (pvalue = 0.0046). Results also correlates with study conducted by Cristian-Ioan IUHAS et al [22] in 2012 when they Compared with healthy women, women with PCOS presented higher total cholesterol levels mean difference = 27.5 mg/dl for total cholesterol, p = 0.004) but they found contrast results for the TG levels they found No significant difference between patients and controls (p>0.05). Another similar study conducted by JAHAN S et al [23] in 2018 found Mean total cholesterol was found 217.7±21.8 mg/dl in group I(cases of PCOS) and 180.5±17.7 mg/dl in group II(Healthy controls). The mean total cholesterol was significantly (p value-0.001) higher in group I. Similar results were found in the study conducted by Manjunatha et al [24]. (2014)

In this study we found mean LDL and HDL levels in patients with PCOS was 228.60±64.88mg /dl, 36.73±13.39 mg/dl respectively and in controls it was 88.50±27.58 mg/dl and 45.49±7.64mg/dl . it shows significantly high(p<0.001) levels of LDL in cases in comparison to controls and significantly low (p<0.001) levels of HDL in cases in comparison to controls. Results of our study correlates with study conducted by Cristian-Ioan IUHAS et al [22] in 2012 when they Compared

with healthy women, women with PCOS presented higher LDL-cholesterol (mean difference = 38.1 mg/dl, p < 0.001). HDL-cholesterol displayed lower levels in PCOS patients compared with healthy women (mean difference = 6.1mg/dl, p = 0.02). Another study conducted by JAHAN S et al [23] in 2018 found Mean LDL-cholesterol was 171.0±21.0 mg/dl in cases of PCOS and 117.6±28.4 mg/dl in control group which was significantly (p-value 0.001) higher in cases. In his study, they observed that the mean HDL-cholesterol was not significantly (p>0.05) associated with PCOS. Comparable results were found in the study conducted by Manjunatha et al [24] (2014), Wild et al [25] (2010), Moran et al [26] (2010). However, some other studies showed contrast results Bickerton et al [27] (2005) found that there were no significant differences in lipid or lipoprotein concentrations between the women with PCOS group and controls. Yilmaz et al [28] (2005) found no difference in serum TC, LDLC, TG, levels between PCOS and control groups, whereas HDL-C was lower. Vrbikova et al [29] (2003) showed serum TC and TG did not differ significantly between PCOS and healthy women groups while HDL-C was lower and LDL-C was higher in PCOS than in controls.

In this study we found positive and statistically significant correlation of BMI with Cholesterol and TG (p<0.0001). It shows as BMI increases TG levels and Cholesterol levels also increases significantly in PCOS patients. Similar finding showed in study conducted by Ramzi J et al [30] 2017, Guddanti Rajeswary et al [31] 2016 They found positive and statistically significant correlation between cholesterol and BMI in patients with PCOS. (p <0.001).

We can say that Women suffering from PCOS are considered to be at high risk for dyslipidemia and mechanism of this be due to elevated androgen levels and frequent association of this syndrome with obesity. [32] Furthermore, since these patients are often hyperinsulinemic and insulin resistant, it would also be expected to be at increased risk for the dyslipidemia associated with insulin resistance. [33] Hypertriglyceridemia, increased levels of very low-density lipoprotein (VLDL) and LDL cholesterol, and decreased levels of HDL-cholesterol [34] predispose patients to vascular disease in the polycystic ovary syndrome. Both insulin resistance and hyperandrogenemia contribute to this atherogenic lipid profile. Testosterone decreases lipoprotein lipase activity in abdominal fat cells, and insulin resistance impairs the ability of insulin to exert its antilipolytic effects. [35]

Conclusion

Results of our study show that women with PCOS have altered lipid profile, with higher Triglyceride, Cholesterol ,LDL and VLDL levels and lower HDL-cholesterol compared with healthy women. Furthermore, these lipid parameters were associated with the presence of PCOS and correlates with BMI so the evaluation of the lipid profile should be compulsory for the global cardiovascular risk assessment in women with PCOS.

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