e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2023; 13(12); 361-366

Original Research Article

Study of Serum Lipoprotein (A) and Lipid Profile in Polycystic Ovarian Syndrome

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Received: 10-11-2023 / Revised: 12-11-2023 / Accepted: 06-12-2023

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Conflict of interest: Nil

Abstract:

Background: With an incidence of 5%–10% in women of reproductive age, polycystic ovarian syndrome (PCOS) is the most frequent endocrine disease and metabolic problem in teenage and reproductive women, and the primary cause of female infertility. Dyslipidemia is linked to polycystic ovary syndrome (PCOS), which puts afflicted women "at risk" for cardiovascular disease. In addition to dyslipidemia, lipoprotein (a) [Lp (a)] is an independent risk factor for the development of atherosclerosis and may raise the risk of cardiovascular disease. In this context, PCOS patients' lipid profiles and Lp (a) levels are evaluated. The conditions that verify the prevalence of PCOS include ovarian polycystic abnormalities detected by ultrasound examination in the clinic, hyperandrogenism, and chronic anovulation. While the exact causes of PCOS remain unknown, prior research has demonstrated a strong correlation between the problem of lipid metabolism and insulin resistance.

Aim: The study's objective was to investigate lipid profiles and serum lipoprotein (a) in patients with polycystic ovarian syndrome. To determine how women with PCOS's lipid metabolism differ and how much obesity affects lipid parameters.

Material and Method: Thirty PCOS patients and thirty non-PCOS controls who visited the outpatient biochemistry department participated in the study. We acquired informed consent from each individual. The patients were between the ages of 18 and 35, and none of them had ever taken medication that affected how fat and glucose were metabolized. As controls, thirty young, healthy women between the ages of 18 and 35 who did not exhibit signs of polycystic ovarian syndrome or clinical hyperandrogenemia and had a regular menstrual cycle were chosen. Exclusions from the study were patients having a history of diabetes mellitus, hypertension, liver and kidney failure, patients on systemic medications, particularly those that lower cholesterol, and patients with other endocrine disorders that affect lipid profiles. Additionally, study participants who were on hormonal or non-hormonal medication were not allowed to participate. Both the controls and the patients gave their informed consent.

Results: The goal of the current investigation is to determine the role that blood lipid and lipoprotein(a) levels play in polycystic ovarian syndrome. For the study, 30 PCOS cases were taken into account. As controls, 30 healthy adults who were age-matched were selected. There is no statistical significance in the mean age difference between the cases and controls. Age and BMI did not differ statistically significantly between cases and controls. There was no discernible difference between the case and control groups for total cholesterol, TG, LDL cholesterol, HDL cholesterol, VLDL cholesterol, TC/HDL cholesterol, or LDL cholesterol/HDL cholesterol.

Conclusion: The goal of the current study was to determine how polycystic ovarian syndrome affected the lipid profile, particularly lipoprotein (a), one of the lipid characteristics that is most likely to cause atherosclerosis. The study group had higher levels of all the indicators, including TC, TG, LDL, VLDL, TC/HDL ratio, LDL/HDL ratio, and TG/HDL ratio, as well as lower HDL levels. The aforementioned abnormalities verify that polycystic ovarian syndrome raises the patient's chance of developing metabolic syndrome and aids in the development of an atherogenic lipid profile.

Keywords: Polycystic Ovary Syndrome, Lipid Profile, Lipoprotein-(A) and Dyslipidemia.

Introduction

The disorder known as polycystic ovarian syndrome is multifactorial and polygenic. The polycystic ovary (PCO) morphology, hyperandrogenism, and/or anovulation are the hallmarks of this ovarian dysfunction condition. 6–7% of women who are of reproductive age have PCOS, one of the most prevalent endocrinopathies in women. For many years, the condition known as the Stein-Leventhal syndrome was the result of the 1935 discovery by Stein and Levinthal that amenorrhea and bilateral polycystic ovaries are related. The triadic diagnosis of obesity, amenorrhea, and hirsutism was once the basis for clinical diagnosis. It has now been established that the etiology of PCOS is complex and has a highly variable clinical presentation. [1]

One of the most prevalent endocrinopathies in women, PCOS affects 6%–7% of those who are of reproductive age. The triadic diagnosis of obesity, amenorrhea, and hirsutism was once the basis for clinical diagnosis. The Rotterdam criteria, which include the presence of any two of the following: (i) chronic anovulation; (ii) clinical/biochemical markers for hyperandrogenism; and (iii) polycystic ovaries on ultrasonography, are used to diagnose PCOS. [2] Numerous risk factors, such as obesity, insulin resistance, dyslipidemia, endothelial dysfunction, and the existence of metabolic syndrome, have been examined in relation to PCOS. [3,4] Surprisingly, a retrospective cohort analysis of PCOS-afflicted women did not find increased coronary heart disease, given the high prevalence of cardiovascular risk factors in this population.. [5] It has been speculated that women with PCOS may be exposed to a protective factor, such as prolonged exposure to estrogens.

The conditions that verify the prevalence of PCOS include ovarian polycystic abnormalities detected by ultrasound examination in the clinic, hyperandrogenism, and chronic anovulation. While the exact causes of PCOS remain unknown, prior research has demonstrated a strong correlation between the problem of lipid metabolism and insulin resistance. [6,7] Obesity of the android type was present in more than 50% of PCOS patients, indicating a higher risk of diabetes mellitus and cardiovascular disease (CVD). [8] Insulin resistance affects 40–50% of patients, particularly obese women. [9] In addition to being referred to as polycentric ovaries, sclerotic ovarian illness, Stein–Leventhal syndrome, chronic anovulatory syndrome, and polycystic ovarian disease (PCOD), Stein and Leventhal originally characterized the PCOS that deserves special attention in 1935. [10] Women with PCOS are observed to have abnormal lipid levels. According to a recent study, women with PCOS typically have moderate hypercholesterolemia. [11] PCOS is associated with distinct lipid patterns, such as elevated triglycerides (TG), total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and significantly greater lipoprotein concentrations, along with low levels of HDL-C. [12,13] While it has long been recognized that PCOS is linked to reproductive morbidity, diabetes mellitus, ovarian, and endometrial cancer, a plethora of new research has also demonstrated that women with PCOS have an elevated risk of cardiovascular disease. [14] A modified type of LDL known as lipoprotein (a) [Lp-(a)] is created when apo A-1 is linked to apo B. It differs from LDL in terms of metabolism, has genetically established values, and maintains a constant concentration over the course of an individual's life. An elevated risk of CVD is associated with changes in the patient's plasma lipid and Lp(a) composition. Elevated lipoprotein (A) levels have been associated with a higher risk of myocardial infarction, stroke, and coronary heart disease. They are an independent risk factor for cardiovascular events. [15] The development of cardiovascular disease may be halted by early screening for modifiable cardiovascular risk factors. Our research aims to determine whether dyslipidemia and an increased Lp(a) level are associated with PCOS. The study's goal was to evaluate the levels of lipid profile and Lp(a) in PCOS-affected women.

Material and Methods

Thirty PCOS patients and thirty non-PCOS controls who visited the outpatient biochemistry department participated in the study. We acquired informed consent from each individual. The patients were between the ages of 18 and 35, and none of them had ever taken medication that affected how fat and glucose were metabolized. As controls, thirty young, healthy women between the ages of 18 and 35 who did not exhibit signs of polycystic ovarian syndrome or clinical hyperandrogenemia and had a regular menstrual cycle were chosen.

Exclusions from the study were patients having a history of diabetes mellitus, hypertension, liver and kidney failure, patients on systemic medications, particularly those that lower cholesterol, and patients with other endocrine disorders that affect lipid profiles. Additionally, study participants who were on hormonal or non-hormonal medication were not allowed to participate. Both the controls and the patients gave their informed consent.

During the baseline visit, a research assistant performed a thorough physical evaluation on each participant using a standard procedure. Body mass index was calculated using the following metrics: height, weight, hip circumference (HC), waist

circumference (WC), diastolic blood pressure (DBP), and systolic blood pressure (SBP). The level halfway between the iliac crest and the lowest rib border was used to assess waist circumference. (BMI) was computed using the following formulas based on height and weight:

BMI = weight (kg)/height(m)^2.

Statistical Analysis: All the collected was analyzed by using SPSS version 20. Mean and SD was calculated for numerical data and frequencies were calculated for categorical data. $P \leq 0.05$ was considered significant**.** The Student's T-test was used to compare the mean values of both groups. ANOVA was used to determine the statistical significance of the difference between these groups. Logistic regression analysis was used to correct the confounding variables. X2 test was used to compare prevalence rates between different groups. Pearson correlation analysis was performed to define the correlations between lipid levels and various characteristics of PCOS. A comparison of the proportions of parameters was done using the Chi-square test. The correlation was tested using Pearson's correlation coefficient.

Result

The goal of the current investigation is to determine the role that blood lipid and lipoprotein (a) levels play in polycystic ovarian syndrome. For the study, 30 PCOS cases were taken into account.

As controls, 30 healthy adults who were age-matched were selected. There is no statistical significance in the mean age difference between the cases and controls.

Table 1: Comparison of basic characteristics, Lp-(a), and lipid profile between controls and cases

Parameter	Controls (n = 30)	Cases (n = 30)
Age (years)	23.2 ± 2.3	22.3 ± 2.1
BMI (kg/m2)	22.5 ± 1.3	23.4 ± 2.3
Total cholesterol (mg/dL)	144.1 ± 28.0	154.1 ± 27.0
TG (mg/dL)	110.0 (89.0-146.5)	111.4 (91.8-188.2)
LDL cholesterol (mg/dL)	88.1 ± 24.4	96.4 ± 15.5
VLDL cholesterol (mg/dL)	17.3 (17.0-30.0)	23.0 (19.0-34.0)
HDL cholesterol (mg/dL)	35.9 ± 10.7	36.3 ± 8.5
TC/HDL cholesterol (mg/dL)	2.1 ± 1.0	2.5 ± 1.3
LDL/HDL cholesterol (mg/dL)	1.2 ± 0.4	1.4 ± 0.8
Lp-(a) (mg/dL)	14.3 (10.7-24.0)	20.2 (106-40.6)

Age and BMI did not differ statistically significantly between cases and controls.

There was no discernible difference between the case and control groups for TC, TG, LDL cholesterol, HDL cholesterol, VLDL cholesterol, TC/HDL cholesterol, or LDL cholesterol/HDL cholesterol. Patients with PCOS had median Lp-(a) levels that were comparable to those of control participants. The mean difference is not statistically significant, although the mean Lp-(a) in cases is higher than in controls.

Patients with PCOS had a higher percentage of patients with Lp-(a) than 30 mg/dL when compared to control controls.

Table 2: Comparison of mean Glucose, Urea, and Creatinine between the two groups

Group	Controls	Cases
Glucose	91.33±11.22	92.5±11.66
Urea	18.23±2.60	18.77± 1.74
Creatinine	0.91±0.14	0.88±0.16

The mean glucose between cases and controls is not statistically significant. Mean urea between cases and controls is not statistically significant. Mean creatinine between cases and controls is not statistically significant.

Table 3: Association between Lp(a) and the groups

Lp(a)	Controls		Cases		Total
	n	%	n	%	
≤30 mg/dl	26	90%	20	67%	46
>30 mg/dl	4	10%	10	33%	14
Total	30	100%	30	100%	60

Lp-(a) levels > 30 mg/dl are found to be more in cases than in controls. This association is statistically significant.

Discussion

The most prevalent endocrine condition affecting women is PCOS. It is a complicated genetic condition that causes infertility in women of reproductive age by causing hyperandrogenism and amenorrhea or oligomenorrhea. Chronic anovulation, clinical or biochemical hyperandrogenism, obesity, and polycystic ovaries are the main characteristics of PCOS. To identify the blood lipid abnormalities associated with polycystic ovarian syndrome and evaluate the importance of lipoprotein (a) levels in the condition, we conducted a study involving 30 PCOS cases and 30 healthy controls. It was discovered that changes in the lipid profile are linked to polycystic ovarian syndrome.

The mean age between cases and controls in our study is not found to be statistically significant. This is in agreement with studies by Shou Kui Xiang et al2012 [16] and Ahmed M Mohamadin 2013 [17] who found no difference in age between PCOS and control groups. Higher mean levels of TC, TG, and LDL were found in PCOS cases than in controls in our study. This is in agreement with a study by Olivier et al.2008 [18], which shows that there is an elevation of triglycerides, cholesterol, and LDL-C in combination with decreased HDL-C and apoA-I.

More recently, Slowinska-Srzednicka et al.1991 [19] have drawn attention to the role of insulin in the lipid abnormalities observed in hyperandrogenic women with PCOS. Researchers contrasted 27 women with PCOS with 22 eumenorrheic control subjects (obese and nonobese). Women with PCOS showed significantly higher levels of TGs and apo-B and significantly lower levels of HDL2. This agreed with the results of a study done by Pirwany2009 [20] who concluded that women with PCOS show increased hepatic lipase activity and LDL relative to BMI-matched controls with normal menstrual rhythm and normal ovaries. Furthermore, these metabolic disturbances appeared to be related more closely to abnormal insulin metabolism and circulating androgen levels.

A study conducted by Berneis et al.2007 [21] showed low HDL-C is commonly found in PCOS cases but hypertriglyceridemia was relatively uncommon. Conversely, they also discovered that not all PCOS groups had an increase in LDL-C, the most well-known lipid change that determines cardiovascular risk. The CV risk may be directly impacted by the quality of LDL in addition to total LDL-C concentrations. Small, dense low-density lipoprotein (LDL) is acknowledged as an emerging cardiovascular risk factor by the National Cholesterol Education Program Adult Treatment Panel III, which states that it carries a roughly three-fold increased risk for coronary artery disease. Hypertriglyceridemia causes low HDL cholesterol and elevated LDL cholesterol through the reverse cholesterol transport mechanism. Early androgen priming of adipocytes increases the risk of dyslipidemia, which is linked to PCOS. On the other hand, it's also feasible that a greater number of adipocytes with increased metabolic activity lead to hyperandrogenemia. [22] By increasing hepatic lipase activity, which is involved in the breakdown of HDL particles, hyperandrogenism may potentially have an impact on lipid metabolism. Reduced levels of HDL cholesterol and elevated levels of LDL cholesterol and TG have been linked to insulin resistance. An elevated risk of CAD has been linked to this. [23] Unfavorable lipoprotein patterns, an increased risk of developing CVD in women with PCOS, and a larger number of carotid plaques and carotid intima-media thickness have all been observed in a number of studies. However, a long-term follow-up study conducted in the UK was unable to detect a rise in cardiovascular events. The question of whether PCOS-afflicted women have protective factors in addition to CVD risk factors has been brought up by this observation. The mean age of the UK group was 58 years, and it is not until the seventh and eighth decades that women experience a rise in the occurrence of cardiovascular events. [16]

Burghen et al.1980 [24] described the correlation between hyperandrogenism and hyperinsulinemia in women with PCOS and insulin resistance also in non-obese women with PCOS. Legro et al.2001 [23] reported a sevenfold increased risk of type II diabetes mellitus among young women with PCOS compared to control women of comparable age and weight. Ehrmann et al.2006 [4] showed an annual conversion rate from impaired glucose tolerance to type II diabetes of 6% in women with PCOS. Women with PCOS have substantial peripheral insulin resistance and pancreatic β-cell dysfunction, which increases their chance of developing glucose intolerance. Coronary artery disease is predicted with hyperinsulinemia.

The non-reproductive components of PCOS have drawn more attention in recent years. There has been a lot of interest in follow-up and intervention studies due to the long-term effects of the metabolic changes linked to the illness on women's health. Lp-(a) and LDL cholesterol increases concurrently may have a synergistic effect on raising cardiovascular risk. Additionally, Lp-(a) did not correlate with insulin resistance or levels of insulin, indicating that dyslipidemia may result from distinct metabolic pathways. Future prospective studies are necessary because it is currently unknown how much these various types of dyslipidemia may increase the cardiovascular risk associated with PCOS.

Conclusion:

The present study was done to see the effect of polycystic ovary syndrome on Lipid profile especially the Lipoprotein (a) which is one of the most atherogenic lipid parameters.

The various parameters like TC, TG, LDL, VLDL, TC/HDL ratio, LDL/HDL ratio, and TG/HDL ratio were elevated in the study group and also there was a reduction in the HDL levels in the study group. Lp-(a) levels were found to be >30mg/dl in a higher number of cases than in controls.

All the above derangements confirm that polycystic ovary syndrome contributes to the development of an atherogenic lipid profile and places the patient at a higher risk of metabolic syndrome.

Further studies are however required with the higher number of cases to confirm the contribution of polycystic ovary syndrome to the alterations in the lipoprotein(a) levels and a more detailed exploration of issues such as education, parity, physical activity, social class, and family history has to be considered.

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