

# The Correlation of Lipid Profile with Serum Insulin Among Women with Polycystic Ovarian Syndrome

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## Abstract

**Objective:** To determine the correlation of lipid profile with serum insulin among women presenting with polycystic ovarian syndrome.

**Methodology:** A prospective cross-sectional study was conducted in the obstetrics/gynecology department at LUMHS Jamshoro from June 2023-Dec 2023. Female patients aged 18 to 45 years, diagnosed with PCOS and presenting at the OPD of LUMHS Civil/Jamshoro, were enrolled in the study. A 5cc blood sample was collected from each participant for lipid profile measurements, which were conducted using ELISA kits. All the data was collected according to the intended proforma and statistical analysis was performed using SPSS software, version 26.0.

**Results:** Mean age of the women was 37.4±3.65 years. The study found weak and statistically insignificant correlations between serum insulin levels and cholesterol, triglycerides, and HDL, with R<sup>2</sup> values of 0.5%, 0.3%, and 1.2%, respectively. However, a stronger and statistically significant correlation was observed between serum insulin levels and LDL, with an R<sup>2</sup> of 14.1% (p = 0.007).

**Conclusion:** Study revealed that among women having PCOS, serum insulin levels significantly correlate with LDL cholesterol including with a less impact on other lipid profile components like cholesterol, triglycerides, and HDL.

**Keywords:** Serum insulin, PCO, Cholesterol, LDL, HDL Triglyceride.

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## Introduction

Polycystic ovarian syndrome (PCOS) is a disorder that affects women of reproductive age due to hormonal imbalance. The characteristic feature includes the presence of multiple cysts in the ovaries that causes hormonal abnormalities along with various other symptoms.<sup>1</sup> The specific etiology of PCOS is unknown; however, it is thought to be connected to (Insulin Resistance) IR, which can cause the ovaries to generate excessive testosterone. This can result in a number of symptoms such as irregular periods, weight gain, acne, excessive hair growth, and infertility.<sup>2</sup> Physical examinations, blood testing, and ultrasound imaging are commonly used to diagnose PCOS. Treatment methods vary according on the individual and their symptoms, but may include dietary and activity adjustments, hormonal medicines, and fertility

therapies.<sup>3</sup> The global prevalence of PCOS varies, with estimates ranging from 5-20% of reproductive-aged women.<sup>4</sup> PCOS is commonly diagnosed if the individual has infertility, cycle disruptions, or hyperandrogenism symptoms including acne, hirsutism, acne and androgenic alopecia.<sup>5</sup> Insulin resistance (IR) is a common characteristic in many women with PCOS, and its severity typically worsens as body mass index (BMI) increases. Anthropometric measures like BMI and hip circumference are crucial factors linked to lipid profiles in overweight or obese PCOS patients.<sup>6</sup> Furthermore, dyslipidemia is becoming more prevalent among women having PCOS.<sup>5,7</sup>

The relationship between lipid profiles and blood insulin levels in PCOS women deserves additional exploration. According to studies, lipid disorders, defined as low

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(HDL) and increased (TG), is common in PCOS women, especially those having diabetes and insulin resistance.<sup>8-10</sup> A research indicated that 75% of PCOS women had resistance to insulin, which was linked to altered lipid profiles such as elevated TG and decreased HDL levels.<sup>9</sup> Furthermore, particular fatty acids have been connected to metabolic risk factors, such as insulin-related parameters, indicating a complicated interaction between lipid metabolism and insulin sensitivity.<sup>11</sup> However, existing studies frequently focus on several limitations, emphasizing the need for bigger, more diversified studies to explain these associations and their significance for cardiovascular health in women with PCOS.<sup>10,12</sup> However this study has been done to determine the association of lipid profile with Serum Insulin among Women with Polycystic Ovary Syndrome.

## Methodology

A prospective cross-sectional study was conducted in the obstetrics/gynecology department at LUMHS Jamshoro from June 2023-Dec 2023. Female patients aged 18 to 45 years, diagnosed with PCOS and presenting at the OPD of LUMHS Civil/Jamshoro, were enrolled in the study. Women younger than 15 years and older than 45 years were excluded, as PCOS is a disease of reproductive age; therefore, patients below puberty and after menopause, as well as those with a history of hysterectomy or early menopause for any reason, were not included. The study received approval from the LUMHS Jamshoro ethics committee before participants meeting the inclusion criteria were enrolled.

Informed consent was obtained from all subjects prior to their participation. Detailed medical histories, physical examinations, and complete anthropometric measurements were collected for each participant. The purpose and objectives of the study were clearly explained to the participants who met the inclusion and exclusion criteria. Data collection was carried out using detailed questionnaires to gather all study variables and demographic information. A 5cc blood sample was collected from each participant for lipid profile measurements, which were conducted using ELISA kits (DiaSorin, Still Water, MN, USA). There were no financial costs to the research subjects. The study-maintained relevance and focus on its goals, with data collected according to the intended proforma. Appropriate exclusion criteria were applied to minimize bias. Statistical analysis was performed using SPSS software, version 26.0. Descriptive statistics

summarized the clinical and demographic characteristics of the research participants. The relationship between blood insulin levels and lipid profile was assessed using Pearson's correlation coefficient and analysis of variance. Multiple linear regression analysis was also conducted to identify independent predictors of serum insulin levels in women with PCOS. Statistical significance was determined with a p-value of 0.05.

## Results

A total number of 189 participants that had given their consents to include in this study with mean age of  $37.4 \pm 3.65$  years. Mean pulse rate and blood pressure (Systolic and Diastolic Blood Pressure) of the participants were found to be in the normal range  $76 \pm 3.6$  beats per minute and  $125 \pm 5.2$  (SBP),  $85 \pm 1.2$  (DBP) respectively. However, 68.2% of the participants had complained for menstrual cyclic disorder, 51.8% complained for acne and 35.9% had complained for hirsutism. Table I.

Parameter	Value
Mean age	$37.4 \pm 3.65$ years
Systolic blood pressure	$125 \pm 5.2$ mmHg
Diastolic blood pressure	$85 \pm 1.2$ mmHg
Anemia	42.8%
Cyclic Disorder	68.2%
Acne	51.8%
Hirsutism	35.9%
Infertility	13.2%

The descriptive statistics of the lipid profile for the 189 participants revealed that the mean cholesterol level was  $223.62 \pm 12.57$  mg/dl, average triglyceride level was  $229.66 \pm 33.45$  mg/dl, mean LDL level was  $145.18 \pm 7.87$  mg/dl, while the mean HDL level was  $34.16 \pm 2.45$  mg/dl. Additionally, the cholesterol/HDL ratio had a mean of  $6.58 \pm 0.62$ , and the LDL/HDL ratio had a mean of  $4.27 \pm 0.37$ . Table II

On The analysis of the correlation between serum insulin levels and various lipid profile components revealed different levels of association. The correlation between serum insulin levels and cholesterol showed a low multiple correlation coefficients (R) of 0.07, with

LIPID PROFILE	Mean	SD
Cholesterol (mg/dl)	223.62	12.57
Triglycerides (mg/dl)	229.66	33.45
LDL (mg/dl)	145.18	7.87
HDL (mg/dl)	34.16	2.45
Cholesterol/HDL	6.58	0.62
LDL/HDL ratio	4.27	0.37

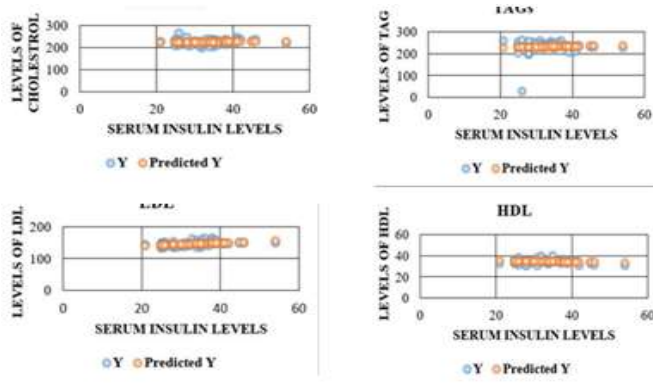
an R<sup>2</sup> value of 0.005, indicating that only 0.5% of the variation in cholesterol levels could be explained by serum insulin levels. Correlation between serum insulin levels and TGAs also demonstrated a weak association, with an R of 0.057 and an R<sup>2</sup> of 0.003, explaining only 0.3% of the variation in triglyceride levels. Correlation between serum insulin levels and HDL demonstrated a weak association, with an R of 0.11 and an R<sup>2</sup> of 0.012, explaining only 1.2% of the variation in HDL levels. However above correlations were not statistically significant (p>0.05). In contrast, the correlation between serum insulin levels and LDL showed a stronger association, with an R of 0.37 and an R<sup>2</sup> of 0.141, indicating that 14.1% of the variation in LDL levels could be explained by serum insulin levels. This relationship was statistically significant, with an F-value of 7.92 and a p-value of 0.007. Table III

years. According to another study by Baqai Z et al<sup>16</sup> reported that the mean age of women having PCO was 27±8 years. The difference in mean age across studies may be due to variations in the study sample and differences in sample selection. Furthermore, women in different regions or cultural contexts may present with PCOS at varying ages due to factors such as lifestyle, diet, and access to healthcare. Furthermore demographically in this study out of all 68.2% of the participants had complained for menstrual cyclic disorder, 51.8% complained for acne and 35.9% had complained for hirsutism. These findings were in aligns to other studies by Kim JH et al<sup>17</sup> and Wang TM et al<sup>18</sup>.

In this study the mean cholesterol level was 223.62±12.57 mg/dl, average triglyceride level was 229.66±33.45 mg/dl, mean LDL level was 145.18±7.87 mg/dl, while the mean HDL level was 34.16±2.45

**Table III: Analysis of Correlation between Serum Insulin levels and lipid Profile. (n=189)**

Variables		Multiple R	R <sup>2</sup>	SE	Df	F	Level of Significance
SerumInsulin Levels	Cholesterol	0.07	0.005	12.67	1	0.26	0.609
	TGAs	0.057	0.003	33.74		0.15	0.69
	LDL	0.37	0.141	7.36		7.92	0.007
	HDL	0.11	0.012	2.46		0.59	0.44



**Figure 1. Correlation between and Serum insulin levels**

## Discussion

Polycystic ovarian syndrome (PCOS) is an endocrine condition that primarily affects women of reproductive age. This disease is associated with a higher risk of developing dyslipidemia compared to those without the condition.<sup>13</sup> This study has been done to evaluate the correlation of lipid profile with serum insulin among women presenting with polycystic ovarian syndrome, included 189 women with an overall mean age of 37.4±3.65 years. Consistently Naeem K et al<sup>14</sup> reported that the mean of women with PCO was 37.38±13.78 years. Mean age of this study was higher compared to the study by Marbaniang RS et al<sup>15</sup> as 26.38±4.85

mg/dl. Additionally, the cholesterol/HDL ratio had a mean of 6.58±0.62, and the LDL/HDL ratio had a mean of 4.27±0.37. In aligns to this study Marbaniang RS et al<sup>15</sup> reported that the average cholesterol was 203.40±54.20 mg/dl, mean triglyceride was 163.26±69.49 mg/dl and mean LDL was 132.82±50.39 mg/dl. In the study by Priya R et al<sup>19</sup> reported that the mean cholesterol was 208.5±35.6 mg/dl, mean triglyceride was 165.3±50.3 mg/dl, mean LDL was 125.2±25.6 mg/dl and mean HDL was 38.9±8.5 mg/dl among women with PCO.

In this study on the analysis of the correlation between serum insulin levels and various lipid profile components revealed different levels of association. The correlation between serum insulin levels and cholesterol showed a low multiple correlation coefficients (R) of 0.07, with an R<sup>2</sup> value of 0.005, indicating that only 0.5% of the variation in cholesterol levels could be explained by serum insulin levels. Correlation between serum insulin levels and TGAs also demonstrated a weak association, with an R of 0.057 and an R<sup>2</sup> of 0.003, explaining only 0.3% of the variation in triglyceride levels. Correlation between serum insulin levels and HDL demonstrated a weak association, with an R of 0.11 and an R<sup>2</sup> of 0.012, explaining only 1.2% of the variation in HDL levels. However above correlations were not statistically

significant  $p > 0.05$ ). In contrast, the correlation between serum insulin levels and LDL showed a stronger association, with an  $R$  of 0.37 and an  $R^2$  of 0.141, indicating that 14.1% of the variation in LDL levels could be explained by serum insulin levels. This relationship was statistically significant, with an  $F$ -value of 7.92 and a  $p$ -value of 0.007. In aligns to this study a study discovered that 75% of PCOS patients had insulin resistance, which was linked to reduced high-density lipoprotein (HDL) levels as well as increased TG and LDL concentrations, specifically among individuals having overweight and resistance to insulin.<sup>20,21</sup> Additional study found that particular fatty acids, which include myristic and oleic acids, have been linked to insulin linked variables, implying that dyslipidemia in PCOS may worsen metabolic risks.<sup>22</sup> Additionally, women having hyperandrogenic phenotypes had considerably higher levels of insulin and atherogenic dyslipidemia, showing a complex relationship between the resistance to insulin and the metabolism of lipids.<sup>23</sup> Ultimately, these data highlight the necessity of monitoring lipid profiles in PCOS patients to reduce the morbidities including cardiovascular risks linked with resistance to insulin.

## Conclusion

As per the study observations, women having PCOS, serum insulin levels significantly correlate with LDL cholesterol, while the level of insulin showed a weak and insignificant correlation with other lipid profile components. This suggests that while insulin may play a role in influencing LDL cholesterol, its impact on other lipid parameters in women with PCOS is limited. However, basis on study limitations specifically small sample size, may affect the findings, therefore further studies with larger, more diverse populations are recommended to better understand the relationship between serum insulin levels and lipid profiles in women with PCOS.

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