

Serum Insulin and Lipid Profile in Polycystic Ovary Syndrome

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Abstract: Polycystic ovarian syndrome (PCOS) has been one of a major public health problem in Sudan that leads to medical consequences. It causes multifactorial in etiology such as menstrual dysfunction, hyperandrogenism, hirsutism, dyslipidemia and obesity which increased risk of diabetes mellitus and cardiovascular disease. **Objective:** The aim of this study was to investigate the concentration and potential role of insulin and lipid levels in Sudanese women with PCOS. **Materials and Methods:** This study was a descriptive, analytic, cross-sectional and hospital-based study, carried in Khartoum- State- Sudan; it was carried out in March 2013 to May 2014. 200 women with PCOS were enrolled in this study, they compared with 100 healthy women as control group, all of them were age- and weight-matched. Samples were taken after overnight fasting then serum insulin and lipid levels were analyzed using ELISA technique and enzymatic colorimetric methods. Data management and analysis was done by using Microsoft excel and SPSS software, version 20.00. **Results:** The patients with PCOS, having a mean age of 29.61 ± 5.4 years and mean age 31.23 ± 4.93 years of control group, were included in the study, lipid profile parameters in PCOS group the (mean $\pm$ SD) of serum insulin, triglyceride, total cholesterol, HDL and LDL were 11.06 ± 6.21 μ IU/ml, 89.89 ± 33.36 mg/dl, 166.95 ± 46.9 mg/dl, 43.83 ± 20.75 mg/dl and 104.55 ± 52.209 mg/dl, respectively while that of control group, the (mean $\pm$ SD) of serum insulin, triglyceride, total cholesterol, HDL and LDL were 4.52 ± 1.60 μ IU/ml, 82.13 ± 26.51 mg/dl, 145.14 ± 31.019 mg/dl, 51.02 ± 14.81 mg/dl, and 72.62 ± 30.04 mg/dl, respectively. There was statistically significant increased levels of triglyceride, total cholesterol and LDL-C in PCOS group when compared to the control group ($P < 0.05$). With decreased level of HDL-C. **Conclusion:** PCOS patients had significant increased levels of serum insulin and altered lipid profile; there was hyperinsulinemia, which may be feature of insulin resistance (IR), and dyslipidemia which is associated with obesity and cardiovascular disease.

Keywords: PCOS, Insulin, triglyceride, total cholesterol, HDL-C, LDL-C, Sudanese

1. Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrine disease and metabolic disorder in adolescence and reproductive women, which is the first reason for female infertility, with the incidence of 5-10% of women of reproductive age [1]-[2]. It is characterized by chronic an ovulation, hyperandrogenism, and ovarian polycystic changes under ultrasound in clinic. The etiology of PCOS is still not very clear, but previous studies have shown that PCOS is closely related to lipid metabolism disorder and insulin resistance [3]-[4]. 50% of PCOS patients have obesity that to android obesity with an increased risk of diabetes mellitus and cardiovascular disease [5]. Insulin resistance is present in 40-50% of patients, especially in obese women [6]. As an entity the polycystic Ovarian Syndrome (PCOS) deserves special consideration, although first described in 1935 by Stein and Leventhal, this condition is also known as Polycentric Ovaries, Sclerocystic Ovarian Disease, Stein-Leventhal Syndrome, Chronic Anovulatory Syndrome and Polycystic Ovarian Disease (PCOD) [7]. In the past the clinical diagnosis rested on the triad of hirsutism, amenorrhea and obesity. The diagnosis of PCOS is based on the Rotterdam criteria: presence of any two of (i) chronic an ovulation (ii) clinical/ biochemical parameters for hyperandrogenism; and (iii) polycystic ovaries on ultrasonography [8]. Insulin resistance, hyperandrogenism and dyslipidaemia are likely to be the major risk factors for cardiovascular diseases (CVD) in women with PCOS [9]-[10]. Insulin resistance and dyslipidaemia seem to have an important role on the risk of cardiovascular pathology in women with PCOS. It is still not known to what degree dyslipidaemia contributes to this risk [11]. Dyslipidemia is the most common abnormality in PCOS [12], with elevated

total cholesterol, triglycerides, and low-density lipoprotein (LDL), and low levels of high-density lipoproteins (HDL) [5]-[13]. Talbott reported increased level of LDL-Cholesterol in PCOS patients [14] and Conway reported, the most characteristic lipid alteration is decreased levels HDL-C [15]. Although abnormalities in lipid and lipoprotein levels have been widely reported in women with PCOS, several studies have reported conflicting views with regard to the features of dyslipidemia [16]- [17]. Some studies have described elevated total cholesterol concentrations, while other previous investigators have been fairly consistent in their reports of hypertriglyceridemia [18]-[19]. Other researchers have demonstrated significantly lower levels of HDL-cholesterol in women with PCOS compared with weight- matched controls [18]-[20]. Nevertheless several studies, investigators have failed to find differences in circulating lipid levels in women with PCOS as compared with weight- matched controls women [20]-[21]. There are few studies done to know the alteration in serum insulin and lipid profile in PCOS patients, thus we have undertaken this study to know the lipid profile variation in women with PCOS.

Table 1: Baseline characteristics of patients with PCOS and controls

Variable	Test group	Control group
Age/years	$29.61 \pm 5.41^*$	$31.23 \pm 4.93^*$
Weight/Kg	$72.83 \pm 10.88^*$	$68.03 \pm 11.31^*$
Hight/Cm	160.00 ± 6.00	162.60 ± 5.52
BMI/Kg/m ²	$29.76 \pm 4.24^*$	$24.14 \pm 3.76^*$

* The means is a significant difference between different values, ($P < 0.05$).

Table 2: Mean $\pm$ SD of fasting insulin and lipid parameters in the test group and control group.

Parameters	Test group	Control group
Serum insulin (μ IU/ml)	11.06 $\pm$ 6.21*	4.52 $\pm$ 1.60*
Serum triglycerides (mg/dl)	89.89 $\pm$ 33.36*	82.13 $\pm$ 26.51*
Serum cholesterol (mg/dl)	166.95 $\pm$ 46.94*	145.14 $\pm$ 31.019*

Serum HDL (mg/dl)	43.83 $\pm$ 20.75*	51.02 $\pm$ 14.81*
Serum LDL (mg/dl)	104.55 $\pm$ 52.209*	72.62 $\pm$ 30.04*

* The means is a significant difference between different values, ($P < 0.05$).

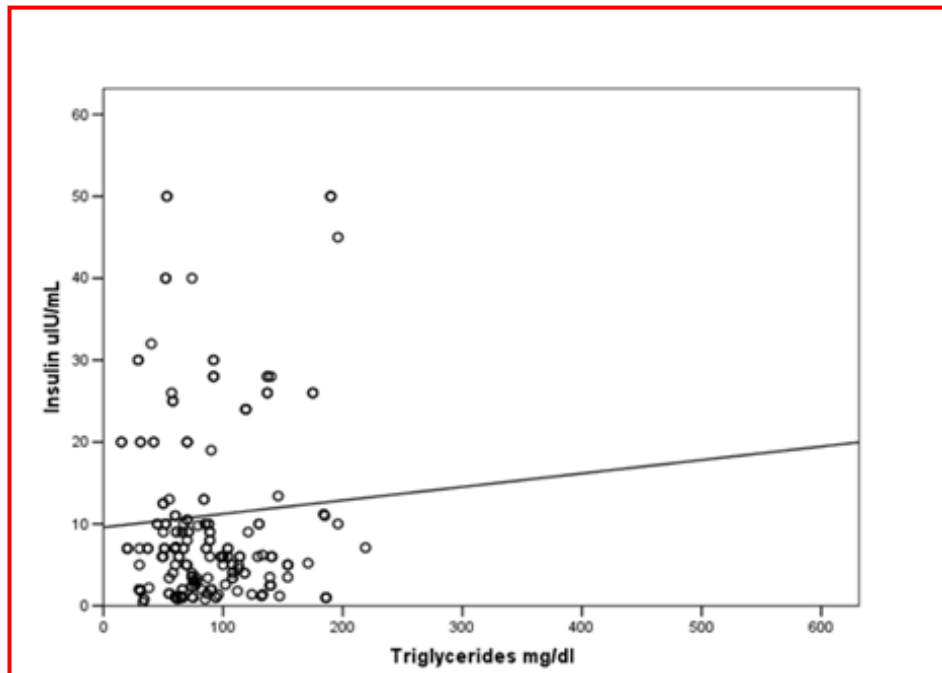


Figure 1: Ascatter plot shows correlation between triglyceride and insulin in the study group($r = 0.06$, $p = 0.38$)

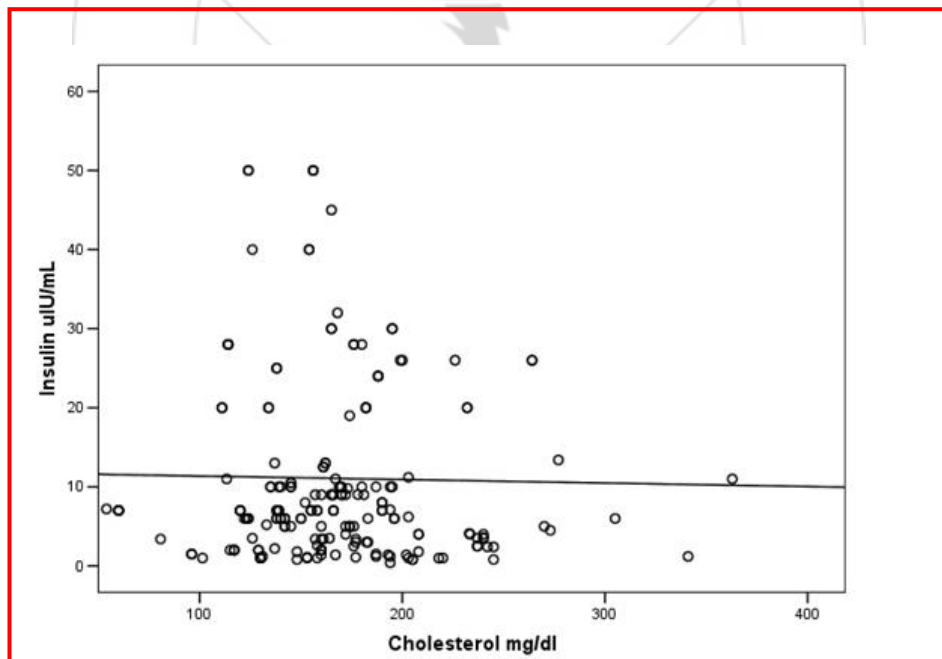


Figure 2: A scatter plot shows correlation between cholesterol and insulin in the study group($r = 0.06$, $p = 0.38$)

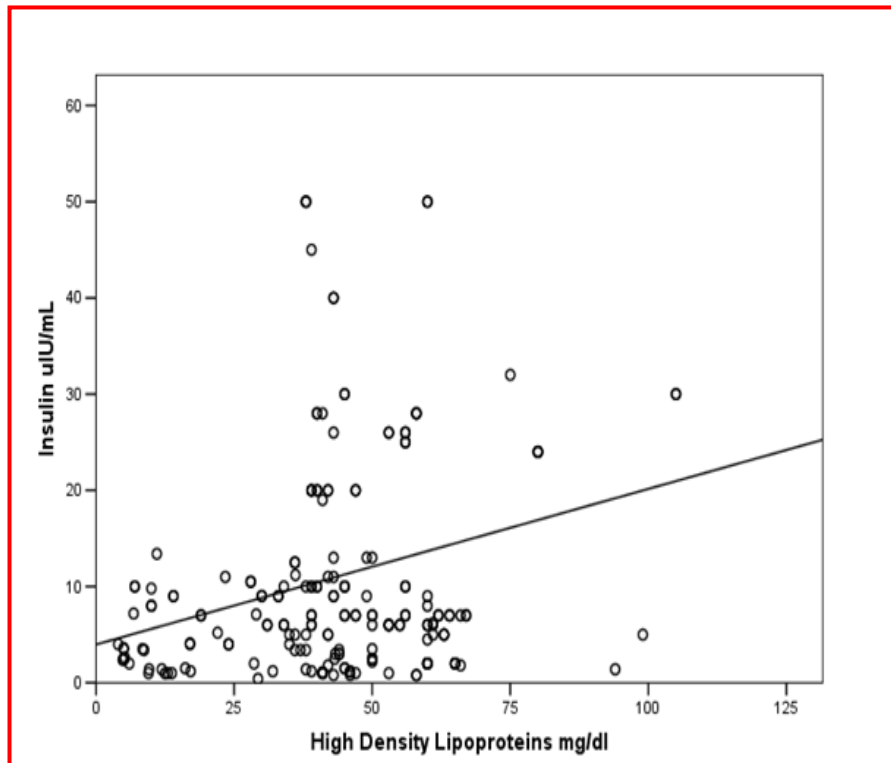


Figure 3: A scatter plot shows correlation between HDL and insulin in the study group($r = 0.06$, $p = 0.38$)

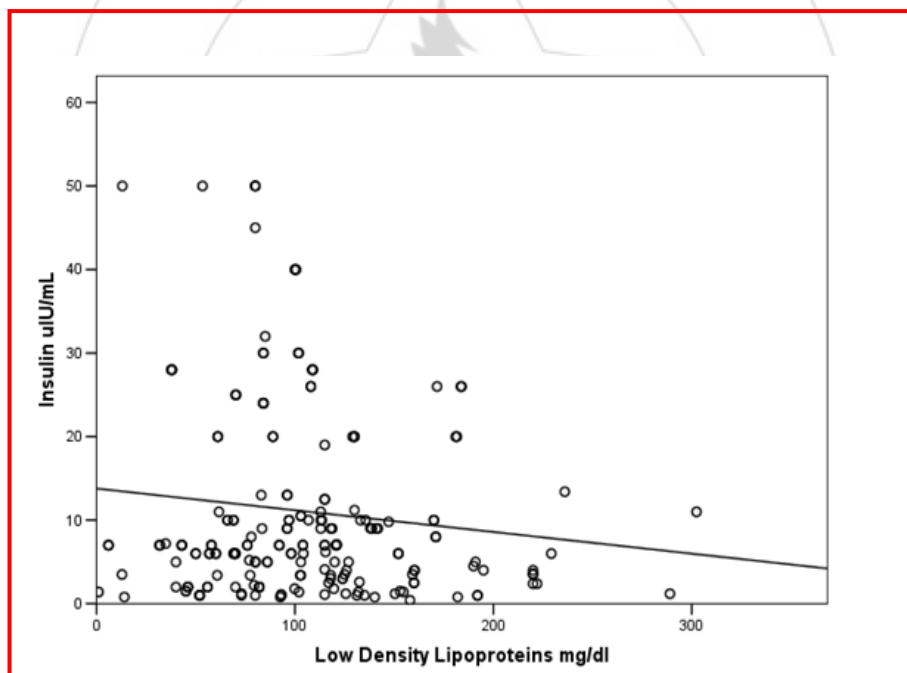


Figure 4: A scatter plot shows correlation between LDL and insulin in the study group($r = 0.06$, $p = 0.38$)

2. Materials and Methods

The present study is descriptive, analytic, cross-sectional and hospital-based study, it was carried out in educational hospitals of Khartoum State, Sudan. From March 2013 to May 2014, all patients selected had a history of PCOS. 200 patients diagnosed with PCOS were enrolled in this study. and 100 healthy women who had no history of drugs affecting lipid metabolism (with normal menstrual cycle and sex hormone level, no evidence of polycystic ovary) were selected as controls, written informed consent was obtained from all participants, all of them were age and weight-

matched, Blood was obtained to determine levels of serum insulin and lipid parameters. The blood samples were drawn after overnight fasting in the morning (between 0800 and 1100 h). Five ml of blood from each individual of study population were collected from both cases and control, the blood was centrifuged at 3000 rpm for 10 minutes and serum was obtained, samples were stored in +4 C until analyzed during the same day. ELISA techniques used for determine insulin level and enzymatic colorimetric methods used to determine total cholesterol, TGS, HDL-C and LDL-C Levels. All these parameters were investigated, recorded, and then a comparison was made between PCOS patients

and control participants. Later, the results were collected and presented in graphs and tables, showing the values as mean $\pm$ standard deviation. Data were analyzed by computer program (SPSS) version IBM 20. Student T. test was used for the Calculation. $P \leq 0.05$ was considered significant. All chemical reagents were purchased from Bio system company (Spine Company for Analytical material and chemical Reagents).

3. Results

Total 200 patients with PCOS were included in the study, with a mean age of 29.61 ± 5.41 years. And 100 healthy women, with a mean age of 31.23 ± 4.93 years, and others basic characteristics of the study participates, body mass index (BMI) of the PCOS patients is statistically significantly increased, compared with control group [Table 1]. Lipid profile parameters in PCOS group the (mean $\pm$ SD) of serum insulin, triglyceride, total cholesterol, HDL and LDL were 11.06 ± 6.21 μ IU/ml, 89.89 ± 33.36 mg/dl, 166.95 ± 46.94 mg/dl, 43.83 ± 20.75 mg/dl and 104.55 ± 52.209 mg/dl, respectively while that of control group, the (mean $\pm$ SD) of serum insulin, triglyceride, total cholesterol, HDL and LDL were 4.52 ± 1.60 μ IU/ml, 82.13 ± 26.51 mg/dl, 145.14 ± 31.019 mg/dl, 51.02 ± 14.81 mg/dl, and 72.62 ± 30.04 mg/dl, respectively [Table 2]. There was statistically significant increased levels of triglyceride, total cholesterol and LDL-C in PCOS group when compared to the control group ($P < 0.05$). With decreased level of HDL-C [Table 2]. In our study, there were correlations between serum insulin and lipid parameters in the study group.

[Figure 1] shows significant, strong positive correlation between insulin and the serum levels of triglycerides. ($r = 0.70$, $p = 0.2$).

[Figure 2] shows insignificant, very weak negative correlation between insulin and the serum levels of cholesterol. ($r = 0.02$, $p = 0.82$).

[Figure 3] shows significant, very weak positive correlation between insulin and the serum levels of high density lipoprotein. ($r = 0.27$, $p = 0.00$).

[Figure 4] shows significant, very weak negative correlation between insulin and the serum levels of low density lipoprotein. ($r = 0.11$, $p = 0.13$).

4. Discussion

The study was conducted to evaluate changes for lipids profile parameters in Sudanese polycystic ovarian syndrome (PCOS) patients and healthy women as control group. Polycystic ovarian syndrome is one of the important endocrine disorder causing reproductive abnormalities in women, which has heterogeneous clinical features and multifactorial in etiology [22]. Obesity and insulin resistance occur frequently in association with this syndrome. Cardiovascular risk factors seem to cluster in women with PCOS compared with general population [23]. Dyslipidemia is one of the important risk factor associated with PCOS. Abnormal lipid metabolism is one of the main metabolic characteristics of PCOS patients. The result of this study

showed that PCOS patients had higher TC, LDL-C, and TG and lower HDL-C when compared with age-matched healthy females [Table 2] are similar to the results were observed in PCOS patients in another study [24] also in agreement with some studies suggest that PCOS patients are hyperlipidemic with higher total cholesterol, LDL-Cholesterol and triglycerides concentrations lower HDL-cholesterol levels than control [25]-[26]. On other hand, our results are disagree with the study done by Bickerton et al [27]. Have demonstrated that there are no significant differences in lipid or lipoprotein concentrations between patients with PCOS and weight matched control. our present study demonstrated that serum insulin level significantly increased in patients with polycystic ovary syndrome when compared to the age- weight matched control group [Table 1], this agrees with a study done by Burghen et al [28] who reported association of (PCOS) with hyperinsulinemia. It has become clear that the syndrome has major metabolic as well as reproductive effects. Kierland et al [29] reported insulin-resistant diabetes mellitus in patients with (PCOS). These lipid abnormalities were closely related to insulin resistance independent of obesity [30]-[22]. The increase in triglycerides may be due the accumulation of triglycerides, which may occur due to the increased lipogenesis, due to decreased clearance or reduced oxidation of fatty acids. Increased secretion of VLDL particles by the liver results elevated plasma triglycerides concentration. This may occur due to insulin resistance, which is seen in PCOS patients. Insulin resistance also contributes more catabolism of HDL-C particles and formation of LDL-C [31]. Hyperandrogenism also contributes for altered lipid profile, Hyperandrogenism has been associated with increased hepatic lipase activity has role in catabolism of HDL-C particles. Increased serum concentrations of triglycerides (TGs) have also been recognized as a risk factor for cardiovascular disease. [32] The present study showed significant, strong positive correlation between insulin and the serum triglycerides [Figure 1]. This study shows that women with polycystic ovary syndrome had significantly decreased serum levels of HDL- cholesterol (HDL-C) compared with the control subjects our results in agreements with a study done in 1985, by Wild and colleagues [33]-[25] found that women with PCOS had lower HDL levels, higher LDL/HDL ratios, and higher triglyceride levels than regularly menstruating women. More recently, Slowinska-Szrednicka et al [34] have drawn attention to the role of insulin in the lipid abnormalities observed in hyperandrogenic women with PCOS. These investigators compared 27 women with PCOS and 22 eumenorrheic control subjects stratified by weight (obese and no obese). Women with PCOS had significantly lower levels of HDL₂ and higher levels of apoB and triglycerides.

This study demonstrates that women with polycystic ovary syndrome had higher significant increase in the serum levels of low density lipoprotein (LDL) as compared with the control subjects, these results agree with a study done by Imran et al [35].

The current study shows insignificant, correlation between insulin and the serum level of cholesterol [Figure 2]. this agrees with results of a study done by Imran et al [35] who concluded that women with polycystic ovary syndrome have

increased hepatic lipase activity and low density lipoprotein concentration relative to body mass index matched controls with normal menstrual rhythm and normal ovaries. Further, these metabolic disturbances appear related more closely to abnormal insulin metabolism and circulating androgen levels.

This study shows that women with polycystic ovary syndrome had significantly decreased serum levels of HDL-cholesterol (HDL-C) compared with the control subjects this result agrees with a study done by Wild et al [36] in 1985 who found that women with (PCOS) have lower serum levels of HDL-C in comparison with healthy control subjects. Recently, Slowinska -Srzednicka et al [34] have drawn attention to the role of insulin in the lipid abnormalities observed in hyperandrogenic women with PCOS. when compared 27 women with PCOS and 22 eumenorrheic control subjects stratified by weight (obese and non-obese), they found that women with PCOS had significantly lower levels of HDL. Also the study showed significant, very weak positive correlation between insulin and the serum levels of high density lipoprotein. [Figure 3]. In the present study women with polycystic ovary syndrome had significantly increased serum levels of total cholesterol compared with the control subjects. Our study, shows significant, very weak negative correlation between insulin and the serum level of low density lipoprotein. [Figure 4]

5. Conclusion

PCOS patients had significant increased levels of serum insulin and altered lipid profile, with higher levels of triglycerides, total cholesterol and LDL-C) and low serum level of HDL-C, there was hyperinsulinemia, which may be feature of insulin resistance (IR), and dyslipidemia which is associated with obesity and cardiovascular disease. Further studies are needed to clarify the role of insulin and lipids in these patients.

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