

# Insulin and Blood Glucose Levels in Sudanese Women with Polycystic Ovary Syndrome

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**Abstract:** *In view of the increasing number of patients with polycystic ovary syndrome (PCOS) among Sudanese women, and its impact in infertility and other complications, this study was conducted to determine and to evaluate insulin and glucose profiles changes that may help and facilitate the diagnosis and flow up of this disease. Objectives: The aim of this study was to investigate the concentration and potential role of insulin and glucose levels in Sudanese women with PCOS. Materials and Methods: descriptive, analytic, cross-sectional and hospital-based study included Sudanese women from Khartoum- State- Sudan, in period from March 2012 to May 2014. A total of 200 Sudanese women with PCOS were compared with 100 women without PCOS as control group, all of them were age-and weight-matched, Samples were taken after overnight fasting then plasma insulin and glucose levels were analyzed using ELISA technique and colorimetric methods. Results: The (mean ± SD) plasma insulin and glucose in women with PCOS were  $11.06 \pm 6.21 \mu\text{IU/ml}$ ,  $95.72 \pm 22.53 \text{mg/dl}$  respectively, while that of women with no PCOS control group, the (mean ± SD) of plasma insulin and glucose, were  $4.52 \pm 1.60 \mu\text{IU/ml}$  mg/dl,  $80.35 \pm 11.76 \text{mg/dl}$ , respectively. Plasma level of insulin, and glucose is significant elevated in women with PCOS when compared with control group ( $P < 0.05$ ). Conclusion: Patients with PCOS have significant increase levels of plasma insulin and glucose there was hyperinsulinemia may be feature of insulin resistance (IR), which is associated with obesity.*

**Keywords:** Polycystic Ovary Syndrome, Insulin, Glucose, Sudanese

## 1. Introduction

Polycystic ovary syndrome is one of the most common female endocrine (hormonal) disorders affecting approximately 5%-10% of women of reproductive age (12-45 years old) and is one of the leading causes of infertility [1,2,3,4,5,6]. It is characterized by chronic anovulation with oligo-menorrhea which occurs in up to 80 per cent of patients. It is the commonest cause of anovulatory sub fertility and recurrent miscarriage. PCOS is seen in around 50-60 per cent of women with more than three early pregnancy losses [6], typical sonographic infertility, appearance of the ovaries with multiple small follicles distributed around the ovarian periphery or throughout the echodense stroma [7], and the syndrome is characterized by hyperandrogenic chronic anovulation; recently, IR has been recognized as a significant finding [8]. Clinical or biochemical hyperandrogenism insulin resistance is present in 40-50% of patients, especially in obese women [9]. As an entity the 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) [10]. It is widely accepted in medicine that PCOS is one of the most common reproductive endocrinological disorders in women [11]. PCOS is a prediabetic state, associated with a 31-35% prevalence of impaired glucose tolerance (IGT), and a 7.5-10% prevalence of type 2 diabetes mellitus [12]. The conversion rate from IGT to overt type 2 diabetes is increased 5-10 fold in women with PCOS [13]. In a study of 34 women with a history of gestational diabetes mellitus (GDM), Holte, et al [14], reported a higher rate of ultrasonographic, clinical, and endocrine signs of PCOS

compared to 36 matched controls with previous uncomplicated pregnancies. Five women (15%) in the GDM group had developed manifest diabetes. The authors concluded that women with PCOS and previous GDM form a distinct sub group from women with normal ovaries and previous GDM characterized by a greater susceptibility to insulin resistance syndrome. Many other researchers reported similar results [15, 16]. Glucose tolerance testing (GTT) instead of fasting glucose can increase diagnosis of increased glucose tolerance and frank diabetes among patients with PCOS according to a prospective controlled trial [17]. While fasting glucose levels may remain within normal limits, oral glucose tests revealed that up to 38% of asymptomatic women with PCOS (versus 8.5% in the general population) actually had impaired glucose tolerance, 7.5% of those with frank diabetes according to American Diabetes Association (ADA) guidelines [17].

A ratio of fasting glucose (G) to fasting insulin (I) has been qualified as a simple and useful predictor of insulin resistance in women with PCOS [18].

This information supports and justifies conducting this study to determine the factors behind biochemical abnormalities indicators of early stage of some chronic metabolic diseases in Sudan. It is important that these factors should be addressed in any coordinated strategy to tackle the problem of PCOs and related diseases. The aim of our study is to investigate the level of fasting and fasting blood glucose level in Sudanese patients with PCOS.

## 2. Materials and Methods

### 2.1 Reagents

All chemical reagents were purchased from Bio system company (Spine Company for Analytical material and chemical Reagents).

### 2.2 Subjects and Study Population

The present study was descriptive, analytic, cross-sectional and hospital-based study, carried out in Khartoum State educational hospital, Sudan. 200 hundred women with PCOS and 100 healthy women, all of whom were age and weight-matched, were studied. Blood samples were obtained after an overnight fast for measurement of Insulin and Glucose levels.

### 2.3 Samples Collection and Preparation

The blood samples were drawn after overnight fasting in the morning (between 0800 and 1100 h). Five ml 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 plasma was obtained. Blood glucose samples were stored in +4 C until analyzed during the same day. Serum insulin samples were stored in -20 C and were analyzed within 7 d of sampling. Using ELSIA technique and colorimetric methods to determine insulin and glucose levels.

### 2.4 Statistical Analysis

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.

## 3. Results

In this study all participants were 20-45 years of age. Table 1 showed the baseline characteristics of patients with PCOS and control group. Insulin and glucose levels were higher ( $P < 0.01$ ) in women with PCOS as shown in Table 2. Fasting insulin and glucose levels in both the PCOS and control group, were significantly correlated with BMI. Figure

(1) and (2), respectively, the P. values for both correlation were ( $P = 0.03$  in the PCOS group;  $P = 0.01$  in controls). Figure 3 showed a positive correlation between fasting insulin and fasting glucose level among PCOS patients ( $P < 0.01$ , and  $P = 0.01$ , respectively).

### Fasting serum insulin

Table (2) shows a highly significant difference between the means of serum insulin of the test group and the control group Mean  $\pm$  SD (11.06  $\pm$  6.21) versus (4.52  $\pm$  1.60)  $\mu$ IU/ml,  $P = 0.001$ . Figure (1) shows insignificant, very weak positive correlation between the body mass index (BMI) and the serum levels of Insulin, ( $r = 0.06$ ,  $p = 0.38$ ) Figure (3) shows insignificant, very weak positive correlation between the insulin and the plasma levels of Glucose ( $r = 0.04$ ,  $p = 0.60$ ). In the current study, 70 subjects with PCOS (35%) had abnormal high serum levels of Insulin.

### Fasting plasma glucose

Table (2) shows a significant difference between the means of fasting plasma glucose of the test group and the control group. Mean  $\pm$  SD : ( 95.72  $\pm$  22.53) versus (80.35  $\pm$  11.76) mg/dl,  $P = 0.025$ . Figure (2) shows insignificant, very weak negative correlation between the body mass index (BMI) and the plasma levels of Glucose, ( $r = 0.02$ ,  $p = 0.50$ ). In this study, 14 subjects (7%) had abnormal high plasma levels of fasting plasma glucose.

**Table 1:** Baseline characteristics of patients with polycystic ovarian syndrome and control

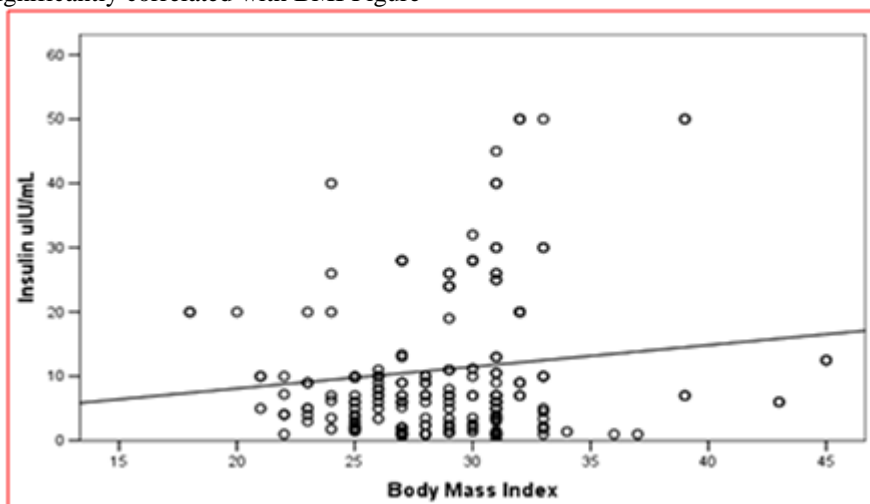
Variable	Test group	Control group
Age/years	29.61 $\pm$ 5.41*	31.23 $\pm$ 4.93*
Weight/Kg	72.83 $\pm$ 10.88*	68.03 $\pm$ 11.31*
Height/Cm	160.00 $\pm$ 6.00	162.60 $\pm$ 5.52
BMI/Kg/m <sup>2</sup>	29.76 $\pm$ 4.24*	24.14 $\pm$ 3.76*

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

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

Parameters	Test group	Control group
F.B.Gmg/dl	95.72 $\pm$ 22.52*	80.35 $\pm$ 11.76*
F.Insulin $\mu$ IU/ml	11.06 $\pm$ 6.21*	4.52 $\pm$ 1.60*

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



**Figure 1:** Scatter plot shows correlation between Body Mass Index (BMI) and insulin in the study group ( $r = 0.06$ ,  $p = 0.38$ )

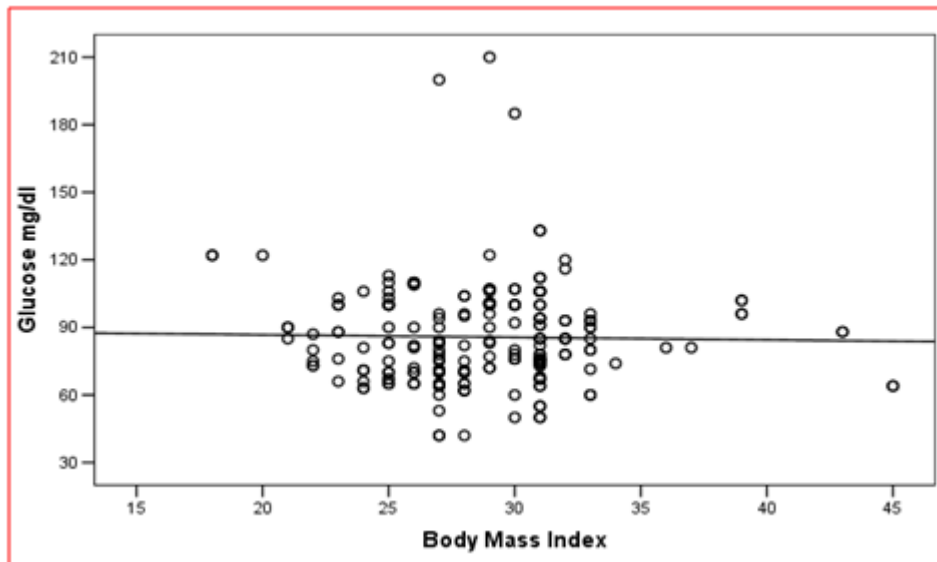


Figure 2: Ascatter plot shows correlation between Body Mass Index (IBM) and glucose in the study group( $r = 0.02$ ,  $p = 050$ )

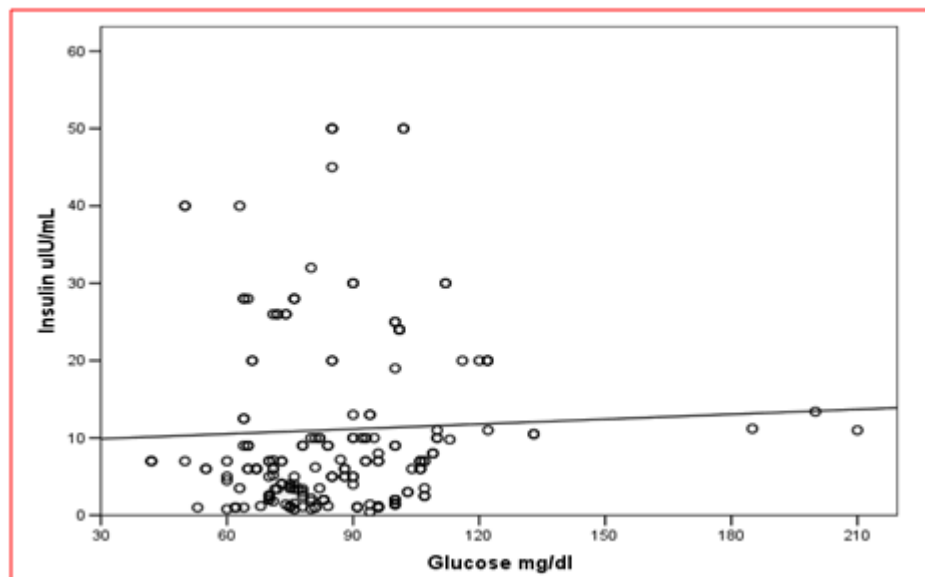


Figure 3: Ascatter plot shows correlation between insulin and glucose in the study group( $r = 0.04$ ,  $p = 060$ )

#### 4. Discussion

It has long been recognized that syndromes characterized by extreme insulin resistance are associated with ovarian hyperandrogenism. In the past decade, however, attention has focused on women who present with the polycystic ovary syndrome rather than on those with the typical phenotype of syndromes involving insulin resistance. Women with the polycystic ovary syndrome have a greater frequency and degree of both hyperinsulinemia [19, 20], and insulin resistance [21, 22], than weight-matched controls. Insulin resistance is independent of the effect of obesity; both lean and obese women with the polycystic ovary syndrome have evidence of decreased insulin sensitivity, but insulin resistance is most marked where there is an interaction between obesity and the syndrome [23, 24]. In our study hyperinsulinemia was observed according to data of statistic analysis there was significant increased Serum insulin level in patients with PCOS when compared to the control group. This agrees with a study done by Burghen, et

al [25]. in 1980 who reported that there was association of PCOS with hyperinsulinemia. It has become clear that the syndrome has major metabolic as well as reproductive morbidities. Hyperinsulinemia caused higher level of androgen which is one feature of PCOS. Hyperinsulinemia in women with the polycystic ovary syndrome appears to reflect the hypersecretion of insulin itself, rather than of proinsulin and its split products. [26]. The cellular mechanism of insulin resistance in the polycystic ovary syndrome remains controversial. Results from studies of blood cells have suggested reduced binding of insulin to its receptor [27], whereas two recent studies [28], using peripheral adipocytes (recognized target cells for insulin action) have shown normal binding but reduced insulin-mediated glucose transport, suggesting a post receptor defect. This hyperinsulinemia may also lead to impaired lipolysis in adipocytes, which in turn may contribute to obesity often seen in PCOS patients [29, 30]. Present study shown insignificant and very weak positive correlation between the body mass index and insulin level in PCOS Patients (figure 1), 36.6% were obese (BMI > 30 Kg/m<sup>2</sup>)

The presence of hyperinsulinemia in PCOS women, independent of obesity, was confirmed by a number of groups worldwide [31].

In the present study, fasting plasma glucose levels in patients with PCOS significantly increased as compared to the control subjects (table 1), this result agrees with a study done by Burghen, et al[25], who reported that the elevation of fasting plasma glucose was associated with hyperinsulinemia also Kierland, et al[32], reported that there was insulin-resistant diabetes mellitus in patients with PCOS. The practical implication of these findings is that the polycystic ovary syndrome may be a marker of insulin resistance and dyslipidemia[33,34] Impaired glucose tolerance and frank type II diabetes mellitus are more prevalent in obese young women with the polycystic ovary syndrome than in weight-matched controls[19,22]. Recently published long-term follow-up studies of women with the syndrome show that the prevalence of type II diabetes is seven times higher in that group than in the reference population[35]. These women have hyperlipidemia and a greatly increased risk of cardiovascular disease[36].

The study showed insignificant and weak positive correlation between the body mass index and the plasma glucose levels (figure 2). Figure 3 showed a positive correlation between fasting insulin and fasting glucose level among PCOS patients. This is due to metabolic abnormalities caused by hyperinsulinemia

## 5. Conclusion

The current study demonstrated that the, PCOS causes significant increases of serum insulin and Plasma glucose in women and high body mass index. Weight reduction in obese women with the polycystic ovary syndrome should be encouraged [37] in an effort to limit the risk of hyperinsulinemia, type II diabetes and long-term cardiovascular disease. More investigations should be done to demonstrate the relationship between hyperinsulinemia, elevated glucose level, and insulin resistance obesity in PCOS patients especially glucose intolerance test, glucose insulin ratio, glucose clamp and other tests addition to the elevated BMI increases the risk for IR, IGT, and DM. Aggressive lifestyle interventions should be a priority in the

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