

# The Relation of Metabolic Markers with Serum Insulin in Women with Polycystic Ovary Syndrome

Sidra Binte Saleem<sup>1</sup>, Yar Muhammad Nizamani<sup>2</sup>, Aamir Hussain<sup>3</sup>, Hafsa Usman Shaikh<sup>4</sup>, Salma Farrukh Memon<sup>5</sup>, Kishwar Lakhia<sup>6</sup>

<sup>1</sup>Lecturer, Department of Physiology, BMC/LUMHS Jamshoro

<sup>3</sup> Associate Professor, Department of Physiology, Bilawal Medical College for boys, LUMHS Jamshoro

<sup>4</sup> Lecturer, Department of biochemistry, Bilawal medical college, LUMHS Jamshoro

<sup>5</sup> Professor, Physiology Department, Liaquat University of Medical & Health Sciences Jamshoro, Sindh Pakistan

<sup>6</sup> Lecturer, Department of Physiology Bilawal Medical College for boys @ LUMHS Jamshoro

**Correspondence:** Dr. Sidra Binte Saleem

Lecturer, Department of Physiology, BMC/LUMHS Jamshoro

[sidrah\\_qujar@yahoo.com](mailto:sidrah_qujar@yahoo.com)

## Abstract

**Objective:** Polycystic ovarian syndrome (PCOS) is a serious endocrinopathy that affects a large number of women during their reproductive years, although it is often underappreciated as a major health problem globally. The current study intends to investigate the relationship between metabolic indicators and blood insulin levels in women with polycystic ovarian syndrome

**Methodology:** A cross-sectional study was carried out in the obstetrics/gynecology department with the help of the Department of Physiology at LUMHS Jamshoro, data was collected from patients visited the OPD at LUMHS Jamshoro/Hyderabad.

**Results:** The mean levels of serum insulin among premenopausal diabetic women with normal weight was  $27.6 \pm 2.27$  MiU/L, where as in over weight females the levels were  $31.45 \pm 2.71$  MiU/L. Among obese female the mean levels of serum insulin were raised to  $34.72 \pm 3.65$  MiU/L, hence revealing that increase BMI is associated with increased levels of serum insulin. Further to determine the association between increase Body Mass Index and Serum insulin level Pearson regression test was applied that suggested non-significant correlation (Multiple R=0.108, R Square = 0.011, p=0.45) between the two variables

**Conclusion:** The findings of a study examining the relationship serum insulin levels in women with PCOS, blood insulin levels differed significantly between individuals with normal BMI and those who were overweight or obese, but there was no linear relationship between BMI and insulin levels.

**Keywords:** Obesity, Insulin, polycystic ovarian syndrome

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## Introduction

Polycystic ovarian syndrome (PCOS) is a serious endocrinopathy that affects a large number of women during their reproductive years, although it is often underappreciated as a major health problem globally<sup>1</sup>. PCOS, which affects 4% to 20% of women of reproductive age worldwide, poses complicated issues in terms of diagnosis, etiology, treatment, therapeutic practices, psychological effect, and prevention<sup>2</sup>. The multifaceted nature of PCOS contributes to the enigma surrounding many aspects of the illness, resulting in an urgent need for more awareness, education, and research to address this common women's health

problem. Although the exact cause of PCOS is uncertain, it is typically associated with insulin resistance, which causes the ovaries to produce more testosterone<sup>3-4</sup>. This hormonal imbalance creates a number of symptoms, including irregular menstrual cycles, weight gain, acne, hirsutism (excess hair growth), and reproductive problems. Physical examinations, blood tests, and ultrasound imaging are frequently used to diagnose PCOS<sup>4-6</sup>. Treatment methods vary according to the individual's needs and symptoms and may include food and activity modifications, hormone medications, and assisted reproductive treatments<sup>7-8</sup>. PCOS prevalence varies by

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region, with estimates ranging from 5% to 20% among women of reproductive age<sup>9</sup>. PCOS is a prevalent hormonal disease that affects 5% to 10% of women in the United States. The illness is not unique to the United States; it affects a huge number of women worldwide.<sup>10</sup>

According to one study, 22.5% of women of reproductive age in India had PCOS<sup>11</sup>. Similarly, the prevalence in China is estimated to be 6% to 15%, with higher rates in urban areas<sup>12</sup>. In Europe, the prevalence of PCOS varies by countries. In Greece, for example, it is believed to be as high as 21.2% among women of reproductive age<sup>13</sup>. A study of women seeking infertility treatment in Italy discovered a PCOS incidence of 19.6%<sup>14</sup>. These findings show the global impact of PCOS and emphasize the importance of paying attention to and developing appropriate management options for various populations. Elevated blood insulin and cholesterol levels are typical features of polycystic ovarian syndrome (PCOS) and can have a substantial influence on the well-being and health of afflicted women.<sup>15-16</sup> Insulin resistance and hyperinsulinemia can lead to androgen hormone overproduction, affecting regular menstrual cycles and causing infertility<sup>17</sup>. Furthermore, elevated lipid levels, such as cholesterol and triglycerides, might increase the risk of cardiovascular disease in women with PCOS<sup>18</sup>. As part of PCOS therapy, it is critical to appropriately address these metabolic irregularities<sup>19</sup>. Despite multiple studies revealing the link between PCOS and high levels of blood insulin and lipids, there has been little study particularly exploring the relationship between these metabolic indicators and PCOS in Pakistan. As a result, the current study intends to investigate the relationship between metabolic indicators and blood insulin levels in women with polycystic ovarian syndrome.

## Methodology

A cross-sectional study was carried out in the obstetrics/gynecology department with the help of the Department of Physiology at LUMHS Jamshoro, data was collected from patients visited the OPD at LUMHS Jamshoro/Hyderabad. The data was collected from a total 189 diagnosed female PCO patients who presented to the LUMHS Civil/ Jamshoro OPD in the age group of 15-45 years. While patients with a hysterectomy history; and any female who reached menopause in the specific age group for whatever reason were excluded. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. All participants provided written informed consent prior to

enrollment in the study, and their confidentiality was maintained throughout the study. The study protocol was approved by the institutional review board prior to initiation. Every participant in the research got a complete physical examination as well as a detailed medical history evaluation. Anthropometric data including height, weight, and body mass index (BMI) were also recorded. Only those who satisfied the particular inclusion and exclusion criteria were invited to participate in the study, and they were given thorough information on the study's goal and objectives. To gather demographic information and other pertinent characteristics for the investigation, detailed questionnaires were administered. In addition, a 5cc blood sample was drawn from every participant, to determine levels of lipid profile and serum insulin using ELISA kits (DiaSorin, Still Water, MN, USA). All the relevant data was collected via study proforma and SPSS version 26 was used for its analysis.

## Results

The mean age of the participants included in the study was found to be  $34.8 \pm 4.59$  years where as average height, weight and BMI were found to be  $1.26 \pm 0.23$  kg/m<sup>2</sup>,  $73.08 \pm 9.57$  kg and  $29.45 \pm 4.98$  kg/m<sup>2</sup> respectively. Particularly 20% of the women were with normal weight, 23% were overweight and 57% were obese. Table I

Variables	Mean Value 'μ'	Standard Deviation 'SD'
Age in years	34.8	4.59
Height in meters	1.26	0.23
Weight in kg	73.08	9.57
BMI in kg/m <sup>2</sup>	29.45	4.98

On the analysis of serum insulin among premenopausal diabetic women based on BMI revealed that levels of serum insulin was significantly  $p < 0.001$  higher in obese ( $34.72 \pm 3.65$  MiU/L) and overweight population ( $31.45 \pm 2.71$  MiU/L) as compared to population whom were found within normal BMI range ( $27.6 \pm 2.27$  MiU/L). Table II

Further to determine the association between increase Body Mass Index and Serum insulin level Pearson regression test was applied that suggested non-significant correlation (Multiple R=0.108, R Square = 0.011,  $p=0.45$ ) between the two variables. Table III

**Table II: Analysis of Variance between BMI and levels of Insulin**

Variables	Number of cases 'n'	Mean levels of Serum Insulin MiU/L±SD	Degree of Freedom df	F	F-crit	Level of Significance
Normal BMI	38	27.6±2.27	2	19.07	3.19	p<0.0001
Over Weight	43	31.45±2.71				
Obese	108	34.72±3.65				

**Table III: Analyses of Regression between BMI and Serum Insulin Levels**

Variables	Multiple R	R <sup>2</sup>	SE	df	F	Levels of Significance
BMI	0.108	0.011	6.466	1	0.57	0.45
Serum Insulin Levels						

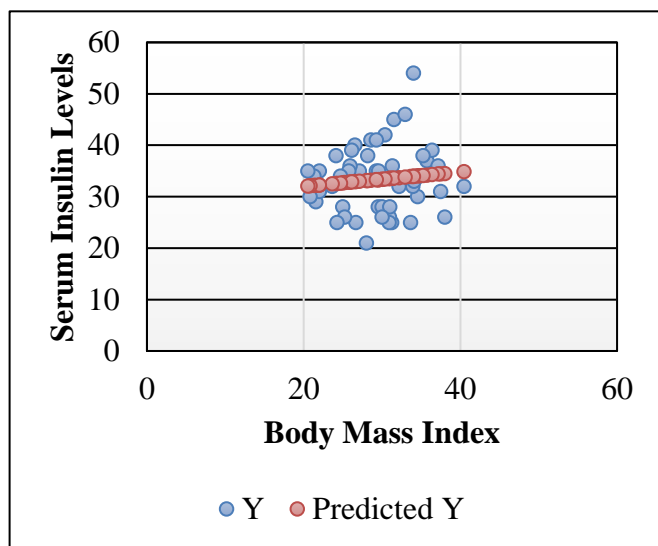


Figure. 1. Represents graphical illustrations between BMI and Serum insulin levels.

## Discussion

The research comprised 189 individuals with an average age of 34.84.59 years. The average height, weight, and BMI were determined to be 1.260.23 meters, 73.089.57 kg, and 29.454.98 kg/m<sup>2</sup>. 57% of individuals with polycystic ovarian syndrome were obese, 23% were overweight, and 20% had a BMI within the normal range.

Inferential statistics were used to determine serum insulin levels in premenopausal diabetic women. The data demonstrated that blood insulin levels were considerably p0.001 higher in obese and overweight people compared to the group with a normal BMI range. The mean blood insulin levels in premenopausal diabetic women of normal weight were 27.62.27 MiU/L, but the values in overweight females were 31.452.71 MiU/L. The mean serum insulin levels in obese females were 34.723.65 MiU/L, indicating that an increase in BMI is related with an increase in serum insulin levels. The Pearson regression test, however, revealed a non-

significant relationship (Multiple R=0.108, R Square = 0.011, p=0.45) between BMI growth and blood insulin level. These findings reveal that, whereas blood insulin levels differ considerably between the normal BMI range and the overweight/obese populations, there is no linear relationship between the two variables. The findings have important implications for premenopausal women's diabetes prevention and treatment. Maintaining a healthy BMI, according to the research, can assist regulate blood insulin levels and minimizing the chance of developing diabetes mellitus. Furthermore, the study emphasizes the need of monitoring blood insulin levels on a regular basis in premenopausal women with diabetes, particularly those who are overweight or obese. The findings support prior study that found higher blood insulin levels in overweight and obese people.<sup>2</sup>

This study found a significant difference in blood insulin levels between the normal BMI range population and the overweight/obesity populations, with the obese group having the highest values<sup>20</sup>. These findings are consistent with a meta-analysis that found a positive link between BMI and blood insulin levels<sup>21</sup>. The study did, however, reveal a non-significant link between increased BMI and blood insulin levels. This conclusion is similar with prior research, which found a weak or non-significant relationship between BMI and blood insulin levels. These findings imply that variables other than BMI may possibly play a role in serum insulin control. The findings have substantial implications for diabetes prevention and management in premenopausal women.

According to the findings, keeping a healthy BMI can help manage blood insulin levels, lowering the risk of getting diabetes. Furthermore, the study emphasizes the significance of frequent blood insulin level assessment in premenopausal women with diabetes, particularly those who are overweight or obese. In addition to that the researchers of this study identified strength and weakness and that were the relatively high sample size

of n=189 individuals in the study exploring the relationship of metabolic indicators with blood insulin in women with PCOS is one of its strengths. A bigger sample size increases the generalizability of the findings and improves the study's statistical power. The study's main limitation was that no association was discovered between metabolic indicators and blood insulin levels.

This might imply that additional factors or variables not examined in the study may had a major impact on blood insulin levels in women with PCOS. Future study should look at other aspects or variables to acquire a more complete picture of the link between metabolic markers and serum insulin in this cohort.

## Conclusion

Study revealed that there was a relationship between metabolic markers and serum insulin levels in women with PCOS, blood insulin levels differed significantly between individuals with normal BMI and those who were overweight or obese, but there was no linear relationship between BMI and insulin levels. These findings have significant implications for diabetes prevention and management in premenopausal women, emphasizing the necessity of maintaining a healthy BMI in order to control insulin levels and lower the risk of diabetes. Regular blood insulin monitoring is especially important for diabetic women who are overweight or obese.

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