

Association of Adiponectin Levels with Polycystic Ovarian Syndrome

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ABSTRACT

Objective: To measure the levels of adiponectin in women with PCOS having high body mass index.

Methodology: A cross-sectional study including 96 study participants was conducted in Services Hospital, Lahore in December 2020 out of 96 study participants 48 were enrolled as cases having polycystic ovarian syndrome compared with 48 healthy women as controls. Detailed information about age, duration of menstrual cycle, body mass index (BMI), and clinical features like obesity, infertility, acne and hairs on face were noted. A total 5ml venous blood was collected by using aseptic techniques and then centrifuged immediately; serum was separated and stored at -20 °C after proper labeling. Samples were analyzed for estimation of serum adiponectin by using enzyme linked immunosorbent assay. Statistical analysis was carried out by statistical package for social sciences (SPSS) 21. The p-value < 0.05 was considered to be statistically significant.

Results: In this study level of adiponectin was decreased in PCOS women as compared to healthy women. Mean \pm SD of adiponectin in PCOS women was $2.08 \pm 0.70 \mu\text{g/ml}$ which was lower than in control group $9.71 \pm 5.35 \mu\text{g/ml}$. Median/Inter Quaitel Range of PCOS women was 2.00/0.78 which is lower in comparison with the Median/IQR of adiponectin in healthy women 8.60/9.63, p-value of adiponectin was significant ($p = 0.00$).

Conclusion: Adiponectin is important variable present in circulation. Its levels are changed in response to disease process as occurs in PCOS.

KEY WORDS: Adiponectin, BMI, Healthy women, Polycystic Ovarian Syndrome.

INTRODUCTION

Polycystic ovarian syndrome (PCOS) was initially described in 1935 by Stein and Leventhal as a syndrome comprising of decrease flow of menstruation, acne, growth of facial hair and anovulation in association with enlarged polycystic ovaries because small cysts develop in ovary that's why it is called Polycystic Ovarian Syndrome¹. Few clinicians refer it as a syndrome of hyper androgenic chronic anovulation. In fact, the studies of Polycystic Ovarian Syndrome conducted before focused on morphological findings of ovaries and were taken as an important criterion for diagnosis². It is most common disorder in females of 20-40 years of age affecting 5% to 10% of pre-menopausal women. The underlying mechanism is not yet clear but it can occur due to failure of ovaries to ovulate due to presence of ovarian cysts, hyperandrogenism and increase in body mass index. One of the important biochemical changes which occurs in Polycystic Ovarian Syndrome is volume of ovary is increased up-to 10cm^3 with multiple small follicles³. Women with PCOS have increased insulin resistance, which can occur due to defect in the metabolism of adipocytes, abnormal fatty acid oxidation and decrease uptake of glucose due to decreased glucose utilization.

It is also thought to be a common endocrinopathy of women and main cause of infertility and usually miscarriages in early pregnancy⁴. If it is left untreated then the chances of developing type 2 diabetes mellitus (DM) are increased along with any cardiovascular disease⁴.

Genetic factors, lifestyle and cousin marriages are the important risk factors leading to the development of PCOS. When the cells of pancreas are resistant to the action of insulin blood sugar level is raised. Inflammatory effect can lead to increased level of androgen and decreased level of estrogen which can interfere with signals from brain and cause anovulation^{5, 6}.

Adipocytes release chemical messengers including resistin, leptin and adiponectin⁵. Adiponectin is a protein hormone. Its deficiency is well recognized in the pathology of metabolic syndrome and a development of inflammatory reactions leading to abnormal vascular deposition of lipids⁷.



Adiponectin reduces the level of triglyceride in tissues and up regulates the insulin signaling pathway. Adiponectin increases the expression of molecules involved in the utilization of fatty acid such as CD36 and acyl-coenzyme A oxidase. These changes can lead to the decrease in the content of triglyceride in skeletal muscle⁸. The levels of adiponectin in circulation ranges between 2-30ug/ml⁹. Normal levels of adiponectin are helpful for the regression of inflammation and preservation of endothelial function. Levels are increased or decreased depending upon endothelial pathology^{9, 10}.

A study¹¹ showed the level of adiponectin was disturbed in patient of PCOS as compared to the normal healthy women whereas in PCOS fat tissues and insulin resistance is increased. But sometimes the level of adiponectin is independent of adiposity and it is suggested that adiponectin receptors upregulate in the adipose tissue of PCOS bearing women which being a compensatory mechanism to counter with insulin resistance. Serum adiponectin concentrations inversely correlate with the severity of insulin resistance¹². Objective of this study is to evaluate the levels of adiponectin in Polycystic ovarian syndrome women and healthy women and it was used to evaluate the role of serum adiponectin in early detection and prevention of associated metabolic disorders and complications.

METHODOLOGY

The research was authorized by the Ethical Committee of the University of Health Sciences Lahore. It was conducted in the Services Hospital, Lahore in December 2020. Out of 96, study participants 48 were enrolled as cases having polycystic ovarian syndrome compared with 48 healthy women as controls. Sample size was calculated from WHO calculator.

Adiponectin and BMI were used for this study. Design of study was Cross-sectional and samples were collected randomly from ultrasonographically and clinically diagnosed patients of PCOS. A total of 5 ml of venous blood sample was collected in gel tube. The centrifugation of samples was carried out for 5 min at 5000 rpm. Samples were analyzed for estimation of serum adiponectin by utilizing ELISA (enzyme linked immunosorbent assay) kit through standard procedure. Human Invitrogen kit was used to estimate the levels of adiponectin in controls and patients.

Sample selection:

Inclusion criteria:

1. Clinically and ultrasonographically diagnosed patients of PCOS as cases
2. Women of age 20 to 40 years (reproductive age group)
3. Married and unmarried
4. Women having Body Mass Index (BMI) less than 30 or >30 kilogram/m² for cases
5. Women having BMI <30 kg /m² for controls
6. Healthy women without PCOS

Exclusion criteria:

1. Menopausal women
2. Familial obesity
3. Medical problems (exclude after taking history e.g metabolic syndrome, diabetes-mellitus, cardiovascular diseases and other endocrinopathy).
4. Pregnancy

Statistical Analysis

Statistical Package for Social Sciences (SPSS) version 21 was utilized for entering and analyzing data. The mean \pm standard deviation (SD) was given for the normally distributed quantitative variables and the variables that are not distributed normally median and inter-quartile range (IQR) was given. According to Shapiro Wilk test, BMI and adiponectin levels were normally distributed and independent t test was applied to get the results. P-value more than 0.05 was considered significant.

RESULTS

In this study, the levels of adiponectin were considerably low ($p = 0.00$) in females having PCOS (Table 1). BMI of PCOS group was higher as compared to the control group. Median/Inter Quartile Range (IQR) of PCOS women was 2.00/0.78 which

is lower in comparison with the Median/IQR of adiponectin in healthy women 8.60/9.63, p-value of adiponectin was significant (p = 0.00).

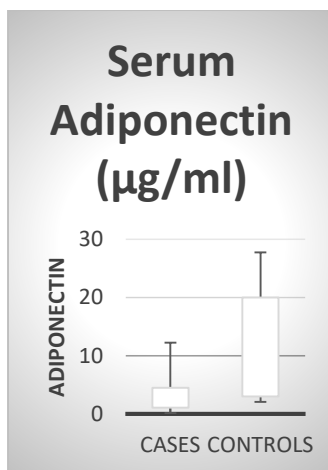


Figure 1: Level of serum adiponectin in PCOS and control

Table 1: Comparison of BMI & Adiponectin values

Parameters	Patients (n-48)	Controls (n=48)
	Mean±SD	Mean±SD
BMI	30.50±1.52	24.40±2.48
Adiponectin	2.08±0.70	9.71±5.35

DISCUSSION

Polycystic ovarian syndrome (PCOS) is an endocrinological disorder consisting of decrease flow of menstruation, acne, growth of facial hair and anovulation in association with enlarged polycystic ovaries because small cysts develop in ovary that why it is called Polycystic Ovarian Syndrome¹³. PCOS can lead to increase susceptibility of high blood pressure, metabolic syndrome and cardiovascular disorder. The most common complications of PCOS is primary infertility and early miscarriages. Hyperandrogenemia and insulin resistance clusters in PCOS families consistent with genetic susceptibility to these abnormalities leading to failure of maturation of ovarian follicles.

Some studies suggested that insulin resistance, hyperinsulinemia and increase glucose intolerance occurs in PCOS which basically occur due to defect in beta cell functions and action of insulin and women reported to be obese or overweight which strongly support the evidence of increase BMI in PCOS patients, with all these biochemical changes level of testosterone is increased and decrease in binding capacity of this hormone which is significantly associated with obesity in PCOS women²⁰. In recent study higher BMI in PCOS group with p-value was .02 which is consistent with some earlier studies which reported that PCOS is more common in obese women¹⁴. Certain environmental factors like more calorie intake and lack of exercise also play major role in the disease¹⁵. We can say that higher BMI is an important factor in development of disease and it can be overcome by removing the predisposing factors from the environment.

Abnormalities in adiponectin may reflect alteration in body fat distribution and endothelial dysfunction associated with inflammation. Adiponectin is a protein which is secreted by adipocytes⁵ and decrease in it can lead to increase chances of development of metabolic syndrome and cardiovascular disease. Several clinical studies show that adiponectin levels are decreased in ischemic heart disease and it is associated with end stage renal disease and high level of adiponectin is indicative of lower risk of developing heart disease. It occurs due to caloric restrictions to provide resistance against Myocardial infarction¹⁶. Adiponectin is cardio-protective, decrease level of adiponectin can lead to increase fibrosis, hypertrophy and decrease angiogenesis resulting increase in inflammatory response under pathologic conditions leading to endothelial dysfunction.



CONCLUSION

Adiponectin is important variable present in circulation. Its levels are changed in response to disease process as occurs in PCOS. Alteration in serum levels of adiponectin might lead to inflammatory response at cellular level. In this study serum adiponectin levels were reduced in PCOS as compared to healthy women. It may be helpful in evaluation of complications associated with PCOS.

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Conflict of Interests

The authors declare that they have no conflict of interests.

Financial Disclosure

None

Authors' Contribution

NL: Study concepts, data collection, designing, draft paper writing. MBB: Study finalizing, paper refining, statistical analysis. All authors read and approved the final manuscript.

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