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Lipid peroxidation and super oxide dismutase levels variation in polycystic ovarian syndrome

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ABSTRACT

Polycystic ovarian syndrome is a condition enlarged ovaries with small cysts present on the outer edges of ovary. It is a hormonal imbalance occurs in few of woman in the 18-30 years of age group. This hormonal imbalance due to poly cysts can cause the oxidative stress which aggravates the condition worse and causes other health problems. 60 subjects were selected from the outpatient department of Saveetha Dental College and Hospitals. They were separated into two groups; control group and PCOS group. 5 ml of venous blood was collected from the participants and blood was distributed in the plain collection tube and centrifuged in 2500 rpm for about 10 minutes. The Serum was isolated separately and analyzed for Malondialdehyde and Super-oxide dismutase by TBARS method and Pyrogallol Autoxidation method using ERBA CHEM 5 plus analyzer. There is a significant increase in (MDA) Malondialdehyde ($p < 0.005$) as well as there is significant decrease in (SOD) super oxide dismutase ($p < 0.001$) in PCOS patients. Our study disclosed that there is an imbalance of antioxidant status in women having PCOS. Increased oxidative stress and decreased antioxidant capacity may bring about the increased risk of CVD in women with PCOS. Further research on oxidative stress in PCOS is needed.

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INTRODUCTION

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders among reproductive-aged women and it is very common in 5-21% of the population. (Roe AH *et al.*, 2011, Goodarzi MO *et al.*, 2011) PCOS is associated with a wide spectrum of issues in different health problems. (Teede HJ *et al.*, 2011, Sekhon LH *et al.*, 2010, Murri M *et al.*, 2013) Like reproductive hyperandrogenism, hirsutism, infertility, and menstrual

disturbance, obesity and diabetes mellitus, cardiovascular risk, and psychological features. (Abbott DH *et al.*, 2002) Oxidative stress and antioxidant decrease caused by PCOS may cause these women to experience increased risk of cardiovascular disease, insulin resistance, hypertension, central obesity, and dyslipidemia like health problems. (Fertil Steril 2004, Nielsen F *et al.*, 1997) Reproductive cells and tissues will only remain steady when antioxidant and oxidant status are in balance. (Taylor BS *et al.*, 1997) Some other features of PCOS such as obesity and abdominal adiposity, androgen excess, and insulin resistance can cause the development of oxidative stress in these patients. (Gonzalez F *et al.*, 2006, Zhang D *et al.*, 2008)

MDA is a marker concerning lipid peroxidation and will increase within oxidative stress. Increased reactive oxygen species (ROS) might also motive intracellular harm inflicting an increase in MDA levels. Total antioxidant capacity is the potential of the serum to quench free radical production, defending the cell structure out of molecular damage.

(Behrman HR *et al.*, 2001) This evaluation estimates the combined antioxidant capacity over all its factors which includes vitamins, proteins, glutathione, lipids, uric acid, etc. SOD is accountable for catalyzing the transformation of superoxide to oxygen and hydrogen peroxide. (Dunaif Andrea., 1997)

This variation is referred to as dismutation, therefore the enzyme's name. Dismutation is a reaction within two same molecules in which one is decreased and the other is oxidized. Therefore, here two molecules of superoxide anions have been transformed into hydrogen peroxide and molecular oxygen. Low-grade inflammation is another potential issue resulting in PCOS. Heredity is additionally a factor. Finally, even conditions before birth in the mother's womb are a factor contributive to PCOS. (Ruksana Sheik J *et al.*, 2015) Few researchers stated that super-imposed on this developmental process are interacting genetic and environmental factors that may alter phenotypic expression of PCOS during adult life, particularly the susceptibility to anovulation. (Wiener-Megnazi Z *et al.*, 2004, Carbone MC *et al.*, 2003)

METHOD AND MATERIALS

60 subjects were selected from the outpatient department of Saveetha Dental College and Hospitals. They were divided into two groups.

Group I (Control group) – Normal healthy individuals – 30 in numbers

Group II (Study group) – PCOS patients – 30 in numbers

Inclusion Criteria

1. Normal healthy individual with normal BMI (19.9-249)
2. PCOS Patients

Exclusion Criteria

1. Subjects with systemic diseases like Diabetes Mellitus, CVD, Hypertension and endocrine disorders.
2. Immunocompromised persons

Sample collection and procedure

5 ml of venous blood was collected from the participants and blood was distributed in the plain collection tube and centrifuged in 2500 rpm for 10 minutes. The Serum was isolated and analyzed for Malondialdehyde and Superoxide dismutase by

TBARS method and Pyrogallol Autoxidation method using ERBA CHEM 5 plus analyzer.

RESULTS AND DISCUSSION

The levels of MDA in PCOS patients 4.66 ± 1.12 were significantly high when compared with the healthy controls 1.54 ± 0.81 and the significance value is $p < 0.005$. As well as there is significant decrease in SOD in PCOS 95.63 ± 27.99 when compared with healthy controls 195.95 ± 22.66 and the significance value is $p < 0.005$.

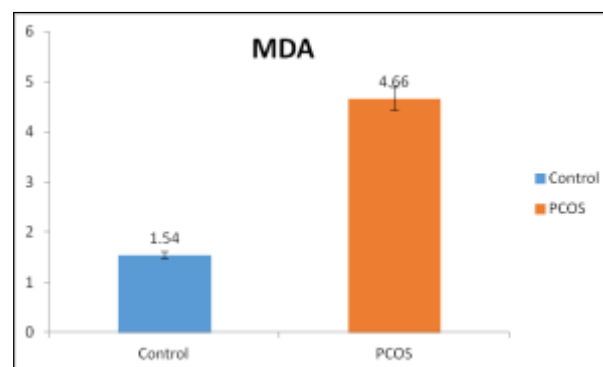


Figure 1: Levels of MDA in control and PCOS

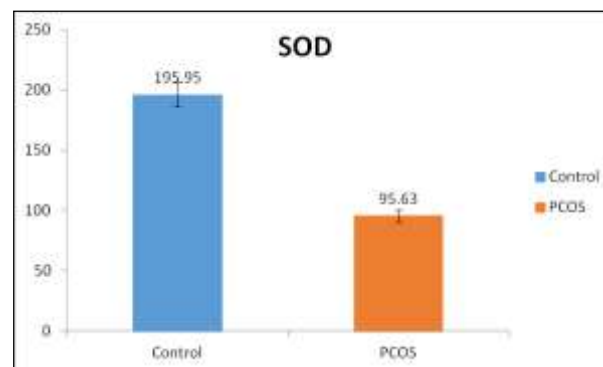


Figure 2: Levels of SOD in control and PCOS

In this study, we measured the level of MDA, to determine lipid peroxidation level. MDA had very harmful effects on the cells. (Matos L *et al.*, 2009) The assessment of the oxidant status was done by the determination of the Malondialdehyde concentration, while the position of antioxidant was evaluated by the determination of superoxide dismutase. (Combelles CMH *et al.*, 2010) We found higher MDA levels in PCOS group. It has been found that MDA levels are higher in men compared to women (Iris F.F. Benzie and J.J. Strain., 1996) Although, the exact mechanism has not been clearly comprehended, hyperandrogenemia in PCOS may be the cause for these higher MDA levels. There are conflicting studies in the literature analyzing this hypothesis. (Pasquali R *et al.*, 2006)

Table 1: Mean, SD and Significance value of Control and Study groups

| Parameters | Controls | PCOS patients | p-Value |
|------------|--------------------|-------------------|-----------|
| MDA | 1.54 ± 0.81 | 4.66 ± 1.12 | < 0.005 |
| SOD | 195.95 ± 22.66 | 95.63 ± 27.99 | < 0.005 |

It has been shown that increased production of ROS in PCOS may lead to tissue damage. (Yilmaz M *et al.*, 2005) In the current study, there was a statistically high significant decrease ($p < 0.001$) in the mean serum SOD activity in PCOS than the control group. (Kuscu NK *et al.*, 2009) SOD is the important antioxidant enzyme which has an antitoxic effect against super oxide anion. (Surapaneni krishna mohan *et al.*, 2009) This systemic decrease in SOD activity may be due to usage of SOD in response to augmented production of ROS caused by both hyperglycemia and excess free fatty acids. Also, decreased SOD activity has been found to influence cell functions by decreasing the levels of the second messenger cGMP.

CONCLUSION

Our findings state that patients with PCOS are screened for the antioxidants status will help to prevent in many long-term complications. Antioxidant supplementation may be useful to improve insulin sensitivity and other health threatening conditions in women having PCOS. There is need in further studies to prove the antioxidant supplementation benefits in PCOS.

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