



**THE RELATIONSHIP OF E<sub>2</sub>/T RATIO AS AN INDICATOR OF THE  
AROMATASE ACTIVITY WITH LEVELS OF ESTRADIOL, TESTOSTERONE  
AND BMI IN SUDANESE WOMEN WITH POLYCYSTIC OVARY SYNDROME.**

Mustafa Abdelgadir Khandgawi<sup>\*1</sup>, Adel Nasr Morsi<sup>2</sup> and Liza Hamdi Mohamed<sup>3</sup>

<sup>\*1,2,3</sup>Department of Chemical Pathology, Faculty of Medical Laboratory Sciences, University of Khartoum – Sudan.

**\*Corresponding Author: Mustafa Abdelgadir Khandgawi**

Department of Chemical Pathology, Faculty of Medical Laboratory Sciences, University of Khartoum – Sudan.

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**ABSTRACT**

**Background:** Determination of E<sub>2</sub>/T ratio provides necessary data regarded to aromatase activity which significantly plays a vital role and directly associated with the generation and metabolism of sex hormone for girls of reproductive age. Our aim was to explain the relationship between aromatase activity with levels of Estradiol (E<sub>2</sub>), Testosterone (T) levels and Body mass index (BMI) in Sudanese women with PCOS or without PCOS.

**Methodology:** A total of 40 PCOS cases diagnosed according to Rotterdam criteria 2003 and 40 ovulatory normal – non PCOs, healthy, age-matched women as control. Serum Estradiol (E<sub>2</sub>) and Testosterone (T) on the third day of the menstrual cycle were measured using manual ELISA technique. Both E<sub>2</sub>/T ratio and Body Mass Index (BMI) were calculated. The Data management and analysis were done by SPSS version 22. **Results:** E<sub>2</sub>/T ratio, E<sub>2</sub> were highly significantly lower (P < 0.01) while T levels was highly significantly higher (P < 0.01) in PCOS patients. However, no significant difference was observed in BMI of either PCOS or control. **Conclusion:** Our study suggests that higher testosterone levels in the ovary shut down the activity of the aromatase enzyme and improving aromatase activity may become an optimized approach for remedy options for PCOS women.

**KEYWORDS:** PCOS, Armatase enzyme, Estradiol, Testosterone.

**INTRODUCTION**

Polycystic ovary syndrome (PCOS) is the one of the most common typical endocrinopathy in women at childbearing age with a prevalence of up to 5-10%.<sup>[1]</sup>

This syndrome characterized by hyperandrogenism and chronic an ovulation associated with a huge range of medical and biochemical points, together with hirsutism, acne, menses irregularities, blubber, infertility, hyperinsulinemia, glucose intolerance and dyslipidemia.<sup>[2]</sup>

About 50% of PCOS ladies are overweight or obese and maximum of them have the abdominal blubber phenotype.<sup>[3]</sup>

There is proof that a history of weight gain precedes the onset of clinical manifestations of PCOS and blubber PCOS ladies have a lot of severe hyperandrogenism which leads to dyslipidemia and a considerably higher incidence of an ovulatory cycles, oligomenorrhea and/or hirsuteness compared to normal weight women.<sup>[2]</sup>

It has been proposed that PCOS may just outcome from lowered aromatase activity.<sup>[4]</sup>

Aromatase enzyme is a product of the CYP19 gene is a member of the cytochrome P450 superfamily which catalyzes the biosynthesis of androgens (androstenedione and testosterone) from estrogens (estrone and estradiol) produced by granulosa cells.<sup>[5, 6, 7, 8]</sup>

Consequently, the ratio of estrogen (E<sub>2</sub>) to Testosterone (T) has been used to determine expression of aromatase activity.<sup>[9, 10]</sup>

There are many studies have reported a dysfunctional P450-aromatase activity in PCOS women and the interaction between gonad aromatase activity and PCOs in ladies has been arguable.<sup>[11]</sup>

However, whether or not the abnormality is caused by hyperfunction or insufficiency of this enzyme and impact of weight gain on aromatase activity as well as E<sub>2</sub> levels is unknown.<sup>[12, 13]</sup>

The present study is designed to evaluate the relationship between E2/T ratio as an indicator of aromatase activity with levels of estradiol (E2), testosterone (T) and Body Mass Index (BMI) in Sudanese women with or without PCOS.

### MATERIALS AND METHODS

The present study was designed as a case control study, conducted at different fertility centers in Khartoum state from February to April 2016.

The study included 40 PCOS women within reproductive age diagnosed with PCOS based on Rotterdam criteria 2003.<sup>[14]</sup> were selected as patient group and 40 ovulatory normal- non PCOs, healthy, with no history, age-matched women as control.

Women with congenital Adrenal hyperplasia, cushing's syndrome, hyperprolactinaemia, androgen – secreting tumor, hypothyroidism were excluded.

After a written informed consent from all participants.

BMI was calculated using the following formula weight in kilograms divided by the sq. of height in meters ( $\text{kg}/\text{m}^2$ ).

Five ml of blood was collected using standard phlebotomy technique in plain containers and serum was obtained till analysis.

Serum Estradiol (E2) Testosterone (T) measured on the third day of the menstrual cycle by ELISA technique.

Then the data were analyzed by SPSS, version 22 (IBM).

### RESULTS

In the present study there was no significance difference between the Mean  $\pm$  SD of age in study group= 27.20 $\pm$ 7.090 years compared to 25.73 $\pm$ 6.824 in control group ( $p=0.346$ ).

**Table 1:- Shows the comparison of BMI, E2, T, E2/T ratio.**

Parameters	PCOS Group N=40	Control group N=40	P - value
BMI ( $\text{kg}/\text{m}^2$ )	25.70 $\pm$ 4.732	24.53 $\pm$ 5.391	0.308
E2 (pmol/L)	42.654 $\pm$ 17.4528	56.366 $\pm$ 26.5076	0.0008**
T (nmol/L)	1.185 $\pm$ .6655	0.785 $\pm$ .5540	0.005**
E2/T	43.5735 $\pm$ 27.89013	65.2120 $\pm$ 30.29187	0.001**

\*\*p value <0.01 considered as highly significant.

**Table 2:- shows the correlation of E2/T ratio with BMI, E2 and T.**

parameters	Mean $\pm$ SD	Pearson coefficient (r)
BMI ( $\text{kg}/\text{m}^2$ )	25.70 $\pm$ 4.732	0.075
E2 (pmol/L)	42.654 $\pm$ 17.4528	0.230
T (nmol/L)	1.185 $\pm$ .6655	-0.653**

Correlation is significant at p.value <0.05 (2-tailed).

### DISCUSSION

In our study PCOS patients have low E2, high T and low E2/T ratio when compared with age – matched healthy ladies and there are significant differences between groups.

These observations suggest that there is a strong inverse relationship between E2/T ratio as an indicator of aromatase activity and levels of testosterone.

E2/T ratio was not related to E2, BMI.

Moreover, a modern, study suggested that common variation at the aromatase enzyme is related to both androgen excess (including increased circulating testosterone concentrations) and with variation in PCOS symptom score in younger women.<sup>[16]</sup>

Overall, however, there are too few studies in terms of aromatase activity in women with PCOS to attract any organization conclusions concerning its role within the aetiology of PCOS.<sup>[17]</sup>

### CONCLUSION

It seems higher levels of testosterone in the ovary shut down the activity of the aromatase enzyme that converts the testosterone to estradiol which is was not related to BMI.

Consequently improving aromatase may become an optimized approach for remedy options for PCOS women.

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