Ministry of Higher Education
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# Assessment of total Antioxidants capacity in patients with polycystic ovary syndrome

**A Research**

**submitted to Council of the College of science for women/University of Babylon in Partial Fulfillment of the Requirements for the Degree of bachelor's degree of Science in Biology**

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بسمِ اللهِ الرحمنِ الرحيمِ

﴿اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ ﴿١﴾ خَلَقَ الْإِنسَانَ مِنْ عَلَقٍ ﴿٢﴾ اقْرَأْ وَرَبُّكَ الْأَكْرَمُ ﴿٣﴾ الَّذِي عَلَّمَ بِالْقَلَمِ ﴿٤﴾ عَلَّمَ الْإِنسَانَ مَا لَمْ يَعْلَمْ ﴿٥﴾

صَدقَ اللهُ العليُ العظيمُ

سُورةُ العلق

# إهداء

**إلى والدينا وعائلتينا الحبيبة**

**إلى أساتذتنا الأفاضل**

**و إلى كل من علمنا حرفاً**

**و لكل من ساهم لإتمام هذا البحث**

**ولم يدخر فيه جهداً**

**الشكر الجزيل والامتنان الوافر**

مها ميامي

## Summary

Polycystic ovary syndrome (PCOS) is the most common endocrinological syndrome among reproductive-age women. Total antioxidant protects the cell from the harmful impacts of free radicals. The present study involved collection of sera from 20 female patients with Polycystic ovary syndrome (PCOS) and 20 healthy females as a control group. The patients were distributed according to their age into three age groups: 1st age group 19-22 year, 2nd age group 23-26 year, and 3rd age group 27-30 year. The highest percentage was within the 1st age group 19-22 year, while the lowest percentage was 3rd age group 27-30 year. The current study also included examining the patients' blood group, the majority of patients (38%) had A+ groups followed by O+ (25%) and AB+ (22%), while patients with blood group B+ were the lowest percentage (15%). The distribution of patients according to their population cities showed that the highest percentage of patients was in the province of Babil, with a rate of 60%, followed by the province of Karbala, with a rate of 25%, while the lowest percentage was in the provinces of Najaf and Baghdad, (10%) and (5%) respectively. Serum levels of total antioxidant capacity (TAC) were measured. The assessment of TAC levels in studied population revealed that the concentration of TAC showed a significant ($P<0.05$) decrease in patients $2.28 \pm 0.61$ as compared with control $4.06 \pm 0.49$. The results of the statistical analysis showed that there were non-significant ($P> 0.05$) differences in the distribution of tac according to the age groups of each of the patients.

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# Chapter one

# Introduction

## 1.1 Introduction

Polycystic ovary syndrome (PCOS) is a common gynecological endocrinopathy that affects 8-13% of women in the reproductive age (Kakoly *et al*., 2019). Although, the cause of PCOS is still not fully understood, there are several possibilities. Main of them included: Hypothalamic/ pituitary dysregulation contributes to a rise in the ovarian androgen production and Hyperandrogenism leads to insulin resistance that results to PCOS (Nadjarzadeh *et al*., 2013). It is characterized by (1) chronic anovulation, (2) biochemical and/or clinical hyper-androgenism, and (3) polycystic ovarian morphology (Rudnicka *et al.* 2021). Diagnosis of this syndrome is based on the Rotterdam criteria in 2003 when two out of three characters were found, while other etiology has been excluded (ESHRE/ASRM 2004).

PCOS has an important clinical implications and could lead to health problems related to insulin resistance, hyperandrogenemia, chronic inflammation, cardiovascular diseases, obesity, and cancers and is the leading cause of chronic anovulation and infertility (Rudnicka *et al*. 2022).

Hyperinsulinemia resulting from insulin resistance is one of the causes of accelerated ovarian androgen production, which leads to polycystic ovary syndrome (Barbieri *et al*., 1986; Cara and Rosenfield, 1988).

Researches have showed that oxidative stress could contributes to the development of PCOS, infertility and hyperandrogenism (Var *et al*., 2003; Fenkci *et al*., 2003). Most important factors that boost the oxidative stress in PCOS are insulin resistance and hyperglycemia (Zuo *et al*., 2016). Oxidative stress is a state where oxidative powers exceed the antioxidant systems, serum's ability to reduce the free radical's formation and protect the cell from oxidative stress (Faris *et al*., 2023).

The diminish of oxidative stress is positively associated with further matured oocytes in the infertile PCOS women (Combelles *et al*., 2009). Oxidative stress causes widespread atherosclerosis lesions in the ovarian arteries (Sirmans and Pate, 2013; Legro *et al*., 2013). Thus, the use of antioxidant agents has become an increasingly popular method in the PCOS management (Aquino and Nori, 2013). Studies revealed that higher total antioxidant capacity (TAC) is associated with lower weight and abdominal fat gain (Besagil *et al*., 2020). Furthermore, higher dietary TAC is related to greater improvement in the heart disease risk factors and reduced risk of pancreatic cancer (Kim *et al*., 2016; Zhong *et al*., 2020).

Unfortunately, there is a shortage of data on the evaluation of TAC in PCOS Iraqi patients. Thus, this finding encouraged us to design a case-control study to examine the levels of TAC PCOS Iraqi patients.

## 1.2 Aim of study

The aim of present study is to evaluate the antioxidant status in patients with PCOS and compared it with control subjects with regard to some demographic factors.

# Chapter two

## Literature reviews

# 2. Literature review

## 2.1 Polycystic ovary syndrome

### 2.1.1 Definition of Polycystic ovary syndrome

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders, which is involved in the multi-system disease, and its etiology is still not clearly understood (Maha, 2016).

PCOS is a gynecological endocrine disorder afflicting female of fertile age. PCOS has always attracted researcher attention due to high incidence; since it is the most frequent endocrine/metabolic disorder in the female population and cardiovascular/oncological risk in the affected cohort of patients (Murri *et al*., 2013).

Polycystic ovary syndrome (PCOS) is a common, highly heritable complex disorder of unknown aetiology characterized by hyperandrogenism, chronic anovulation and defects in glucose homeostasis. Increased luteinizing hormone relative to follicle stimulating hormone secretion, insulin resistance and developmental exposure to androgens are hypothesized to play a causal role in PCOS (Hayes *et al*., 2015). About 3% of PCOS have a related isolated functional adrenal hyperandrogenism. The remaining PCOS cases are mild and lack evidence of steroid secretory abnormalities; most of these are obese, which we postulate to account for their atypical PCOS. Approximately half of normal women with polycystic ovarian morphology have subclinical functional ovarian hyperandrogenism-related steroidogenic defects (Rosenfield and Ehrmann, 2016).

Generally the etiology of this syndrome remains largely unknown, but mounting evidence suggests that PCOS might be a complex multigenic disorder with strong epigenetic and environmental influences (Escobar, 2018).

Treatment of PCOS is mainly aimed at lowering insulin resistance levels, restoration of fertility & regular menstruation, treatment of hirsutism/ acne & prevention of endometrial hyperplasia & endometrial cancer though the optimal treatment is still doubtful (Campbell and Monga, 2000).

## 2.1.2 Historical Background of Polycystic ovary syndrome

Although Stein and Leventhal are regarded as the first investigators of polycystic ovary syndrome (PCOS), it was Vallisneri, an Italian medical scientist, physician and naturalist, who in 1721 described a married, infertile woman with shiny ovaries with a white surface and the size of ovaries as pigeon eggs (Vallisneri, 1990). Another report can be found in 1844, when Chereau and Rokitansky described fibrous and sclerotic lesions in t ovaries of a degenerative character with hydrops follicle (Chereau and Achilles, 1844; Rokitansky, 1855). Bulius and Kretschmar described hyperthecosis for the first time (Bulius and Kretschmar, 1897). Tait (1879) presented the need for bilateral oophorectomy for the treatment of symptomatic cystic degeneration of the ovaries. Partial resection of the ovaries was soon proposed (Martin, 1891).

In 1902 von Kahlden published a review on the pathology and clinical implications of these ovaries (von Kahlden, 1902). Because of many critical voices regarding ovarian resection, McGlinn (1916) suggested puncturing “those cysts which are upon the surface” rather than resorting to ovarian resection. In 1935 Stein and Leventhal presented a group of 7 women with common features: menstruation disturbances, hirsutism and enlarged ovaries with the presence of many small follicles (Stein and Leventhal, 1935). They were also the first to

describe the lack of menstruation in women with increased volume of ovaries and to suggest using ovarian wedge resection. After this surgical intervention regular menstrual cycles returned in all 7 patients and 2 of them became pregnant. After a bilateral ovarian wedge resection, menstruation returned in almost 90% of women and 65% of them became pregnant (Stein *et al*., 1948). However, as medical treatment became available with the use of clomiphene citrate, follicle stimulating hormone (FSH) and urinary source, surgical treatment became less often used (Kovacs *et al*., 1989).

It was not until the early 1990s at a National Institute of Health (NIH) sponsored conference on PCOS that formal diagnostic criteria were proposed and afterwards largely utilized. Many scientists tried to explain the pathophysiology of PCOS and many studies were made. It is now accepted that it is multifactorial, partly genetic; however, a number of candidate genes have been pos- tulated. Insulin resistance has been noted consistently among many women with PCOS, especially in those with hyperandrogenism, but it is not included in any of the diagnostic criteria. Now there is strong evidence that cardiovascular disease risk factors and disturbances in carbohydrate metabolism are all increased in patients with PCOS compared to the healthy population. The criteria established by a group of experts dur- ing a conference in Rotterdam held in 2003 are obligatory (The Rotterdam ESHRE/ASRM – Sponsored PCOS Consensus Workshop Group). The subsequent "Rotterdam criteria" incorporated the size and morphology, as determined by an ultrasound, of the ovary into the diagnostic criteria.. It was not until the early 1990s at a National Institute of Health (NIH) sponsored conference on PCOS that formal diagnostic criteria were proposed and afterwards largely utilized. Many scientists tried to explain

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## 2.1.2 Dignosis of Polycystic ovary syndrome

The diagnosis of PCOS is based on Rotterdam criteria since hyperandrogenism, chronic oligo- or anovulation, and echographic pattern of polycystic ovaries are the main features, differently combined in the various phenotypes of the syndrome (Fauser, 2004; Ladrón *et al*., 2014). The role of hyperandrogenism is stressed for its relation to metabolic derangement; therefore, the AE-PCOS Society maintains hyperandrogenism as mandatory for diagnosis, coupled with chronic oligo-anovulation or polycystic ovaries (Azziz *et al.*, 2009). It has been also proposed that PCOS without hyperandrogenism should be excluded from the syndrome as they are based on different etiologies (Azziz *et al*., 2006). The different criteria used for diagnosis can have consequences on epidemiological and clinical studies; moreover, different geographical areas can show a different prevalence of the syndrome, according to

different diagnostic parameters. Therefore, in 2012 National Institute of Health (NIH) (Johnson *et al*., 2012) recommended using a phenotypical classification, previously proposed by Azziz *et al*.(2006)

## 2.2 Oxidative stress

Oxidative stress is a general term used to describe the steady state level of oxidative damage to a cell, tissue, organ, caused by the Reactive oxygen species (ROS) (Agarwal *et al*., 2006). ROS are Free radicals derived initially from oxygen which are formed as intermediary products and are a class of powerful oxidants in the human body (Agarwal and Allamaneni, 2004). There is a complex interaction of proxidants and antioxidants that modulates the generation of oxidative stress (Agarwal *et al*., 2006). Oxidative stress has been suggested to be causative in etiologies such as endometriosis, tubal, peritoneal and unexplained infertility and even polycystic ovary syndrome PCOS (Ota *et al*., 1998). Anovulatory infertility comprises about one quarter of patients attending an infertility clinic. The PCOS is the commonest endocrine disturbance leading to anovulatory infertility and oligomenorrhoea. The morphology of polycystic ovary has been redefined as an ovary with 12 or more follicles measuring 2-9mm in diameter and/or increased ovarian volume (>10cm3) (Adam, 2012). The decreased antioxidant status and the elevated Oxidative stress levels may contribute to the increased cardiovascular (CV) morbidity in these patients (Agarwal *et al*., 2006). Elevated insulin resistance and hyperhomocysteinemia have been proposed to be caused by Oxidative stress in patients with PCOS (Gonzalez *et al*., 2006). Stimulation of reactive oxygen species (ROS)

generation from mononuclear cells (MNCs) by hyperglycemia may play a role in inflammation through the release of TNF-α from circulating MNCs. There is both an increase in oxidative stress and decreased antioxidant status in androgen excess women with PCOS (Sabuncu *et al*., 2001).

## 2.3 Total antioxidant capacity

Total antioxidant capacity (TAC) is a parameter to estimate the status of all antioxidants present in plasma/serum and other body fluids (Rubio *et al*., 2016). It also provides overall information regarding the capacity of reactive oxygen species in the body (ROS) (Manafa *et al*., 2017).

Human antioxidants contain two main parts; nonenzymatic molecules such as glutathione, vitamins A, C, and E), and enzymatic systems like superoxide dismutase (SOD) and catalase (CAT) (Fernando *et al*., 2020). The existing body of research on SOD suggests that it is the most powerful antioxidant enzyme and plays a key role in proper respiratory function (Poggi *et al*., 2014). The SOD detoxifies two molecules of superoxide anion radicals ($O^{2}\bullet-$) by converting them to ($H_2O_2$) and oxygen molecules ($O_2$) (Ighodaro *et al*., 2018). Then, CAT uses oxygen molecules to degrade $H_2O_2$.

Aside from scavenging ROS, both enzymes are also essential factors for natural surfactants (Dani *et al*., 2009). Antioxidant molecules prevent or inhibit the harmful reactions of reactive oxygen species (Young and Woodside, 2001). Serum (or plasma) concentrations of different antioxidants can be measured in

laboratories separately, but the measurements are time-consuming, labor-intensive, costly, and require complicated techniques. Because the measurement of different antioxidant molecules separately is not practical and their antioxidant effects are additive, the total antioxidant capacity of a sample is measured, and this is called total antioxidant capacity (Miller *et al*., 1993), total antioxidant activity (Koracevic *et al*., 2001), or other synonyms.

# Chapter three

## Material and methods

# 3. Material and methods

## 3.1 Subjects and samples collection

Participants of present study composed of 20 female patients with PCOS and 20 healthy females as a control group. All participants were taken consent before starting to collect blood samples. Venous blood samples were drawn from patient and control subjects by using disposable syringes (5mL) in the sitting position. Five ml of blood were obtained from each subject by vein puncture. Whole blood pushed into tubes containing separating gel and allowed to clot at room temperature for (10-15 minutes) and then centrifuged at (2000 × g) for approximately (10-15 minutes), and stored the obtained serum at -200C for TAC analysis.

## 3.2 Assay to Measure Total antioxidant capacity

- **Principle**

The cupric ion reduction antioxidant capacity (CUPRAC) method has been used to estimate TAC which is based on the ability of an antioxidant in the reduction of an oxidant (Apak *et al.*, 2005). The sample or standard reduces $Cu^{2+}$ to $Cu^{+}$. This reduced copper form will appear selectively as a 2:1 complex with a chromogenic reagent. Generally, this stable complex is reads at a maximum absorption of 450 nm.

Antioxidants + $Cu^{2+}$ ⟶ $Cu^{+}$

$Cu^{+}$ + 2,9-dimethyl-1,10-phenanthroline ⟶ complex ($\lambda_{max}$ at 450 nm)

- **Procedure**

Allow R1, R2, and the stop solution to balance the room temperature for about 30 minutes before to work. Samples and standard have been

diluted 1:4 in the supplied dilution buffer (e.g., 15 µL serum + 585 µL buffer).

1. About 200 µL of diluted samples or standard have been added per each well. Reagents blank should be dilution buffer provided in the case of absence of the sample or standard.
2. Plate has been read at 450 nm for the sake of reference measurement.
3. Cu solution (50 µL) has been added to each well, and then it was incubated for 3 minutes at room temperature.
4. Then 50 µL of stop solution has been placed.
5. The plate was read a second time at 450nm.

**Calculation**

Total antioxidant capacity mmol/l $= A_{sample}/A_{standard} \times$ conc. of standard

## 3.3 Statistical analyses

Statistical analysis was performed by using statistical package of social science (SPSS) version 26. The data were expressed as (mean ± SD). Statistical comparison between groups were made using student's – test and a P value of $\leq 0.05$ was considered significant (Duncan *et al.*, 1983).

# Chapter Four

## Results and discussion

# 4. Results and discussion

## 4.1 Distribution of polycystic ovary patients according to age groups

Figure (1) shows the distribution of patients according to age groups, the patients were distributed according to their age into three age groups: 1st age group 19-22 year, 2nd age group 23-26 year, and 3rd age group 27-30 year. The highest percentage was within the 1st age group 19-22 year, while the lowest percentage was 3rd age group 27-30 year**.**

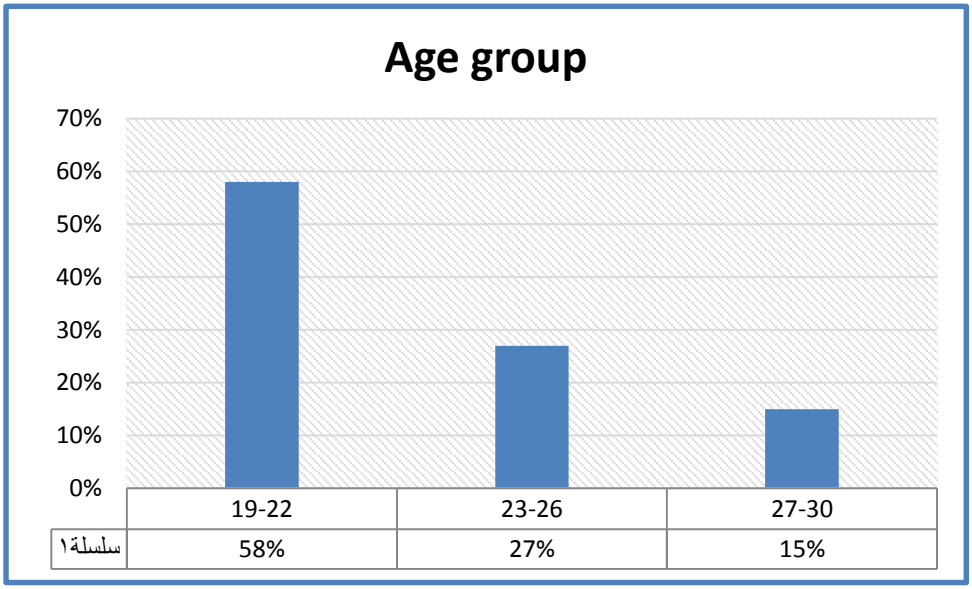


**Figure (1): Distribution of study population according to Age group**

Polycystic ovary syndrome (PCOS) is one of the most common endocrine disorders in women of reproductive age, with a reported prevalence ranging from 4% to 21% depending on the diagnostic criteria used and the population studied (Lizneva *et al*., 2016).

The results of the current study showed that the percentage of ovarian cysts was in the younger age groups compared to the older ones, and this is consistent with what was mentioned by other studies that

showed that PCOS manifests typically during early reproductive years (Conway *et al*., 2014). PCOS is considered a life-long disorder; however, it is not clear whether associated health consequences extend beyond the reproductive age and contribute to the overall health burden of peri- and postmenopause (Helvaci and Yildiz, 2021).

## 4.2 Distribution of polycystic ovary patients according to blood groups

Figure (2) shows the distribution of patients according to blood groups, the majority of patients (38%) had $A^+$ groups followed by $O^+$ (25%) and $AB^+$ (22%), while patients with blood group $B^+$ were the lowest percentage (15%).

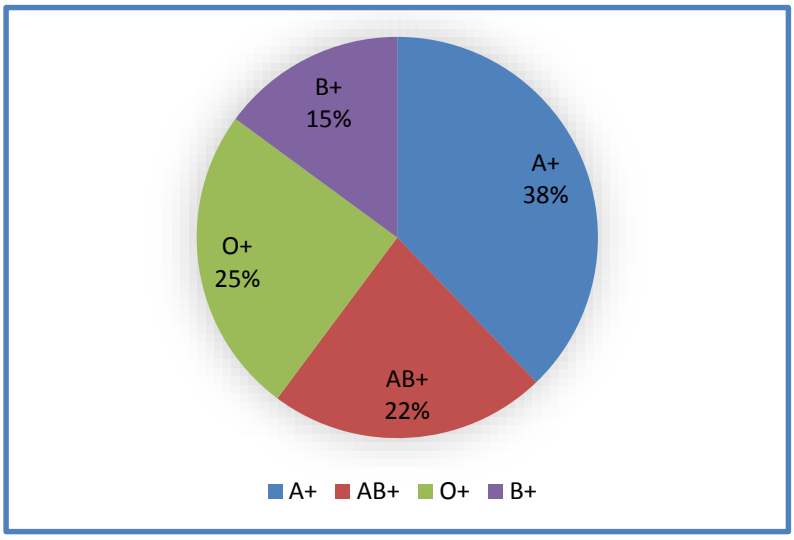


**Figure (2): Distribution of study population according to Blood group**

The most commonly used blood group systems in humans are ABO & Rh systems due to their importance in blood transfusion & association with various diseases (ESHRE/ASRM, 2003). The data of current study revealed that the highest risk of PCOS was observed in females with blood

group ‘$A^+$’ followed by ‘$O^+$’ positive. Our study also suggests that Rh negative individuals didn’t show any association with PCOS. The results of present study suggest that ‘$A^+$’ females, are more prone to PCOS. The results of the current study are consistent to some extent with the study which showed that $O^+$ followed by the $B^+$ groups had the highest incidence of PCOS.

Literature surveys shows that blood group substances have significant association with the causation of disease, e.g., blood group A with arterial hypertension & myocardial infarction, blood group O & peptic ulcer, etc., (Ghai, 1999). A previous study conducted on blood group &breast cancer showed no relation exists with the Rh factor &breast cancer (Khattak *et al*., 2008; Yuj *et al*., 2012).

## 4.3 Distribution of polycystic ovary patients according to city

The distribution of patients according to their population cities is summarized in Figure (3), Through the results of the current study, it is clear that the highest percentage of patients was in the province of Babil, with a rate of 60%, followed by the province of Karbala, with a rate of 25%, while the lowest percentage was in the provinces of Najaf and Baghdad, (10%) and (5%) respectively.

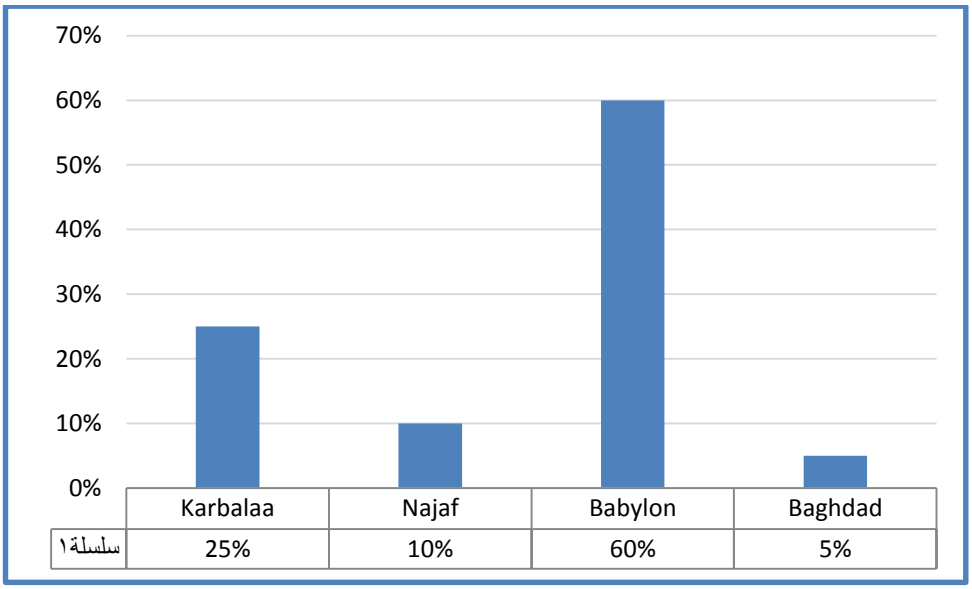


**Figure (3): Distribution of study population according to** their population cities

The prevalence of PCOS is conventionally estimated at 4% to 8% of all reproductive age female, from studies performed in Spain, Greece and the USA (Alvarez-Blasco *et al*., 2006; March *et al*., 2010). The prevalence of PCOS world has recently been shown to be 18% in the first community-based prevalence study based on current Rotterdam diagnostic criteria (Azziz *et al*., 2005), while in our study the prevalence of PCOS in Iraqi women in AL-Hilla city was estimated about 60%, which is higher than the percentage in the world.

## 4.4 Estimation of total antioxidant capacity in polycystic ovary patients and control subjects

The assessment of total antioxidant capacity levels in studied population illustrated in figure (4), the concentration of total antioxidant capacity showed a significant ($P<0.05$) increase in patients 4.06 ±0.49 as compared with control 2.28 ± 0.61.

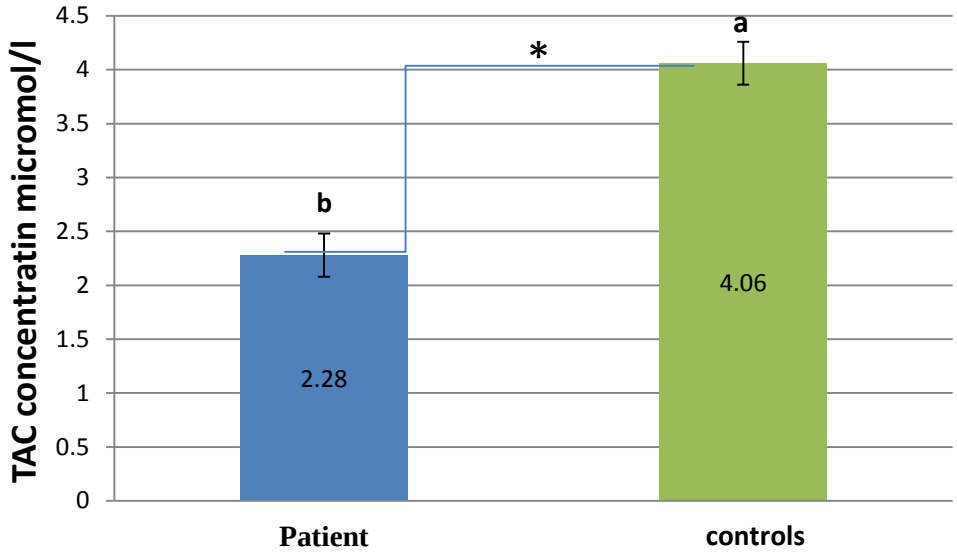


**Figure (4): Estimation of total antioxidant capacity in polycystic ovary patients and control**

Oxidative stress has been suggested to be causative in etiologies such as endometriosis, tubal, peritoneal and unexplained infertility and even polycystic ovary syndrome PCOS (Ota *et al*., 1998). It has been shown that PCOS is associated with excessive oxidative stress (Sabuncu et al., 2001).

Total antioxidant capacity considers the synergistic interactions of antioxidant nutrients and can be used to assess the relationship between dietary intake and several chronic disorders. Verit *et al*. (2007) found that TAC was the most important prediction element to PCOS. An imbalance between the antioxidant and free radical production in the ovaries can cause negative effects on the oocyte quality, productivity, development, and growth of the placenta. Lowered oxidative stress is related to better prognosis of PCOS. PCOS can lead to a decrease in the quality of life, especially if it is accompanied by chronic diseases like type 2 diabetes mellitus, obesity, dyslipidemia, hypertension, heart disease in which

oxidative stress may intensify complications of these diseases Antioxidants have a relationship with apoptosis in the ovarian tissue via different mechanisms. These are connected with proper growth and action of interstitial cells (Nargeskhatoon *et al*., 2022)

The current study revealed a significant decrease in TAC in PCOS patients compared with control subjects, this may be due to the depletion of antioxidants in the equation of the harmful effect of increased free radicals in PCOS patients. The study results agree with Kanafchian *et al*. (2020), they concluded that TAC is decreased in the PCOS patients. Enechukwu *et al*. (2019) showed that decreased TAC correlates with the cause of PCOS in these patients. However, Ghowsi *et al*. ( 2018) found that there were not any significant differences in the serum TAC in the PCOS patients and the healthy control group.

### 4-5 Effect of age on the levels of total antioxidant capacity in patients and control

The effect of age on total antioxidant capacity levels is summarized in Table (1), the results of the statistical analysis showed that there were non-significant (P> 0.05) differences in the distribution of TAC according to the age groups of each of the patients.

**Table (1): effect of age on the levels of total antioxidant capacity in patients and control**

| Sample type | Age group | Concentration of TAC | | P *value* (≤ 0.05) |
|---|---|---|---|---|
| | | Mean | SD | |
| **Control** | 19-22 | 3.02 [a] | 0.88 | 0.12 [NS] |
| | 23-26 | 4.56 [a] | 0.45 | |
| | 27-30 | 4.68 [a] | 0.91 | |
| **Patients** | 19-22 | 2.81[a] | 0.42 | 0.072[NS] |
| | 23-26 | 2.15 [a] | 0.61 | |
| | 27-30 | 1.76 [a] | 0.11 | |
| **NS :non-significant difference under P *value* (P≤ 0.05) by One way ANOVA test** | | | | |

In general, there were no significant differences in the levels of TAC among the age groups of patients and control, the reason may be attributed to the high levels of free radicals in the bodies of patients due to infection, regardless of their age. As for the slight decrease in the elder age groups, it is due to chronic diseases that these age groups have, such as Diabetes, which may constitute another burden on the body in the increase of free radicals, which in turn is reflected in the decrease in TAC.

## 5.conclusion

A significant decrease in TAC levels was observed in the patients compared with control subjects, which could explain in part the role of antioxidants in controlling the disease, which can be a predictive factor for the development of the patient's health.

# Chapter five

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## الخلاصة

متلازمة المبيض المتعدد الكيسات هي متلازمة الغدد الصماء الأكثر شيوعًا بين النساء في سن الإنجاب. مضادات الأكسدة الكلية تحمي الخلية من التأثيرات الضارة للجذور الحرة. تضمنت الدراسة الحالية جمع الأمصال من ٢٠ مريضة مصابة بمتلازمة تكيس المبايض و ٢٠ من الإناث الأصحاء كمجموعة سيطرة. تم توزيع المرضى حسب أعمارهم على ثلاث فئات عمرية: الفئة العمرية الأولى ١٩-٢٢ سنة، الفئة العمرية الثانية ٢٣-٢٦ سنة ، الفئة العمرية الثالثة ٢٧-٣٠ سنة. وكانت أعلى نسبة ضمن الفئة العمرية الأولى ١٩-٢٢ سنة، بينما كانت أقل نسبة للفئة العمرية الثالثة ٢٧-٣٠ سنة. تضمنت الدراسة الحالية أيضًا فحص فصيلة دم المرضى، وكان لدى غالبية المرضى (٣٨٪) تمتلك فصيلة دم $A^+$ تليها $O^+$ 25)٪ ( و 22) $AB^+$٪ (، بينما كان المرضى من فئة الدم $B^+$ أقل نسبة (١٥٪ ). اظهر توزيع المرضى حسب مدنهم السكنية ان اعلى نسبة للمرضى كانت في محافظة بابل بنسبة ٦٠٪ تليها محافظة كربلاء بنسبة ٢٥٪ بينما كانت اقل نسبة في محافظتي النجف وبغداد بنسبة (١٠٪) و (٥٪) على التوالي. تم قياس مستويات المصل من إجمالي قدرة مضادات الأكسدة. أظهر تقييم مستويات TAC في المجتمع المدروس أن تركيز TAC أظهر انخفاض معنوي ( ($P < 0.05$ في المرضى 2.28 ± ٠,٦١ مقارنة مع السيطرة ٤,٠٦ ± ٠,٤٩. اظهرت نتائج التحليل الاحصائي وجود فروقات غير معنوية ($P < 0.05$ ) لتوزيع مضادات الاكسدة الكلية حسب الفئات العمرية لكل من المرضى والاصحاء

وزارة التعليم العالي والبحث العلمي

جامعة بابل

كلية العلوم للبنات

قسم علوم الحياة

# تقييم مضادات الأكسدة الكلية لدى النساء المصابات بتكيس المبايض المزمن

بحث

مقدم الى مجلس كلية العلوم للبنات / جامعة بابل في كجزء من متطلبات شهادة البكالوريوس في علوم الحياة

من قبل

مها فؤاد حسن

ميامي عامر مجيد

بإشراف

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