ESTIMATION OF REACTIVE OXYGEN SPECIES AND TOTAL ANTIOXIDANT CAPACITY IN SERUM OF IRAQI FEMALES WITH PCOS

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ABSTRACT

Background: Polycystic ovary syndrome (PCOS) is one of the most common hormonal disorders, occurring in 5–10% of women of reproductive ages. Despite a long history of studies on PCOS, its etiology is still unknown. Oxidative stress is now recognized to play a central role in the pathophysiology of many different disorders, including PCOS. Although intracellular reactive oxygen species (ROS) production and propagation are controlled by highly complex antioxidant enzymatic and non-enzymatic systems, understanding of mechanisms that oxidative stress is important to develop strategies for the prevention and therapy of PCOS. This study showed a highly significant increase in ROS and LH values, while there was no significant difference in FSH levels for the PCOS group compared with the control group. TAC level was significantly reduced in PCOS women compared to control. In addition, the PCOS group was significantly overweight compared to the control group.

Keywords: Polycystic Ovary Syndrome, Reactive Oxygen Species, Total Antioxidant Capacity.

I. INTRODUCTION

Polycystic Ovarian Syndrome is a various endocrine condition caused by ovarian cyst manifestations, anovulation, and endocrine variations that have a serious effect on a woman's life. Reproductive hormone disturbances such as LH, FSH, estrogen and testosterone disrupt the normal menstrual cycle and result in oligomenorrhea [1]. The World Health Organization (WHO) estimates that around the world PCOS affects over 100 and sixteen million women (3.4%) [2]. Although there are substantial differences between individuals, PCOS is defined by hyperandrogenism, menstrual irregularities, and differing cyst sizes in the ovaries. This situation is generally found in teens at greater risk of developing multiple comorbidities and obesity, diabetes type II, infertility, endometrial dysplasia, cardiovascular and psychotic disorders [3-5]. The term "reactive oxygen species" (ROS) refers to a group of free oxygen radicals and reactive molecules derived from molecular oxygen, which includes superoxide anion (O₂⁻), hydroxyl radical (HO•), hydrogen peroxide (H₂O₂), and singlet oxygen (O₂) [6, 7]. ROS have long been known to cause cell damage by negatively modifying biological molecules such as lipids, proteins, and nucleic acids; thus, reports of ROS are commonly associated with ageing and a variety of distinct human diseases such as chronic inflammation, neurological disorders, cancers, and cardiovascular disease [8, 9]. To counter the effect ROS, an efficient system of antioxidants are existed and comprises dietary antioxidants and endogenous antioxidants [10]. Antioxidants of endogenous origin includes; glutathione peroxidase, catalase, superoxide dismutase, glutathione, uric acid, bilirubin, coenzyme Q10 and other substances, while the most important dietary antioxidants are vitamin C and E, carotenoids and polyphenolic compounds [11].

Due to dysfunction in IR conditions, ROS can play an important role in many medical cases [12, 13]. Indeed, PCOS patients have been shown to have a higher risk of developing metabolic syndrome, which is linked to oxidative stress and cardiovascular events [14]. Obesity in women has previously been linked with oxidative stress [7, 15, 16] and insulin resistance [17]. However, even in lean PCOS women, a few other studies have found an increase in oxidative stress [18, 19]. In these women, oxidative stress has also been implicated as a cause of hyperandrogenism [20].
II. MATERIALS AND METHODS

In this study, 100 samples were collected from females, whose age ranged from 18 to 40 years, and were divided into 60 samples from patients with PCOS (patients group) and 40 healthy subjects (control group). As the samples were collected at Kamal Al-Samarrai for Fertility and Infertility Hospital, with the help of specialized doctors, located in Baghdad city body mass index (BMI). The glucose level was estimated for normal and all patients, also the level of hormones were tested by enzyme-linked immunosorbent assay (ELISA) method and these included: serum Luteinizing hormones (LH), Follicle-stimulating hormone (FSH), testosterone and ROS, while total antioxidant capacity (TAC) has determined by using Erel method [21].

III. RESULTS

The results of this study, represented in Table 1, are expressed as mean ± standard deviation (SD) and range (minimum and maximum value). There are no significant differences ($P > 0.05$) in age between controls (28.93 ± 6.80) and PCOS (29.38 ± 5.72) female groups. The results of body mass index in Kg.m$^{-2}$ showed a highly significant differences ($P < 0.01$) between control (22.74 ± 2.14) and PCOS (26.84 ± 1.91) female groups.

There are a highly significant differences ($P < 0.01$) in LH concentration between control (4.07± 2.06) and PCOS (9.60± 2.84) groups. FSH concentration showed no significant differences ($P > 0.05$) in between controls (6.11 ± 1.95) and PCOS (6.53 ± 2.02) groups. The results of LH/FSH showed a highly significant differences ($P < 0.01$) between control (0.73 ± 0.38) and PCOS (1.69 ± 0.94) groups. Testosterone showed a highly significant differences ($P < 0.01$) between control (0.57±0.27) and PCOS (2.79±0.86) groups.

The results of ROS showed a significant difference ($P<0.01$) (see Fig 1) between control (270.32±106.73) and PCOS (346.34±137.11) groups, in which PCOS patients have elevated levels of ROS in serum. On the other hand TAC was significantly (P≤0.001) reduced in PCOS women (1.13±0.19) compared to healthy control (1.33±0.19).

<table>
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<tr>
<th>Table 1. Outcomes of patients and control</th>
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<td><strong>Parameters</strong></td>
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<tr>
<td><strong>Age (year)</strong></td>
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<tr>
<td><strong>BMI (kg.m$^{-2}$)</strong></td>
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<tr>
<td><strong>ROS (pg/mL)</strong></td>
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<td><strong>LH (mIU/mL)</strong></td>
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<td><strong>FSH (mIU/mL)</strong></td>
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<td><strong>LH/FSH</strong></td>
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<td><strong>Testosterone (ng/mL)</strong></td>
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<td><strong>TAC (µmol Vit C. Eq./L)</strong></td>
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* Significant at $P \leq 0.05$ by using Independent sample t-test.
Figure 1. Level of ROS in serum of control and PCOS subjects

IV. DISCUSSION

This study found that age is not associated with PCOS in addition to Body mass index is the first line to observe total obesity in people, by which obesity divided into three classes [22], class I which refers to mild obesity (30 ≤ BMI ≤ 34.99), class II which refers to moderate obesity (35 ≤ BMI ≤ 39.99), and class III which refers to severe obesity 63 (BMI ≥ 40) [23]. Obesity is a common feature of most health problems all over the world. The probability of PCOS is not ruled out by this observation. The majority of the research included in this report, however, were unable to determine whether PCOS induced obesity or vice versa. Obesity, as a significant factor, may be used to predict PCOS, according to significant points raised in the literature. Overweight or obese females had a higher risk of PCOS than normal-weight females, although this does not rule out the possibility of PCOS and its complications in normal-weight females.

According to these studies, which agree with this one, obesity and PCOS are related in their pathogenesis. In contrast, it was discovered that women with PCOS, regardless of their BMI, had elevated F. Lean PCOS subjects had higher DI values when OGTTs were calculated. In addition to body weight, insulin hypersecretion can play a role in the pathogenesis of PCOS. Women with PCOS, regardless of their BMI, can benefit from early detection of insulin action, which could help them prevent serious metabolic problems [24]. Others discovered that when it comes to the amount of insulin secreted in response to blood glucose levels, people with PCOS, both obese and overweight, have a lower product of insulin sensitivity than weight-matched healthy women [25]. Being overweight or obese, on the other hand, is a significant contributory factor that exacerbates PCOS symptoms in women.

Due to dysfunction in IR conditions, ROS can play an important role in many medical cases [12, 13]. Indeed, PCOS patients have been shown to have a higher risk of developing metabolic syndrome, which is linked to oxidative stress and cardiovascular events [14]. Our findings support the notion that PCOS is linked to a rise in ROS production, and that this ROS production is linked to the existence of IR. In this study, we discovered that ROS levels are higher in PCOS patients, and that this increase is even more pronounced when IR is present. Our findings are consistent with those of Ribeiro et al., who found elevated MPO levels in IR PCOS patients [26]. Obesity in women has previously been attributed to oxidative stress [15, 16]. However, even in lean PCOS women, a few other studies have found an increase in oxidative stress [18, 19]. In these women, oxidative stress has also been implicated as a cause of hyperandrogenism [20]. Blair et al. reported a reduction of TAC in PCOS women and suggest that PCOS is risk factor for oxidative stress development [19]. Also, TAC was in agreement with Jeelani et al. who reported similar results [27]. But a disagreement found with Yilmaz et al. [28].

The current study's findings indicate a substantial difference in serum LH levels between patients and controls, but no significant difference in FSH levels. Our findings are consistent with those of a previous study by Ashok et al [29], which found a significant difference in LH levels between patients and controls. However, the same study also found a significant difference in FSH levels between patients and controls, which contradicts our findings. Omer et al. [30] observed no major differences in FSH between patients and the control group, which
matched our findings. The diagnostic utility of LH and the LH: FSH ratio in PCOS is hotly debated in the literature. According to the Rotterdam consensus criterion, LH played no part in the diagnosis [31]. Two studies back up this claim: First, Cho et al. [32] discovered that the LH:FSH ratio has low within-person reproducibility in women with or without proven PCOS; second, Escobar-Morreale et al. [33] found that LH and FSH had virtually no diagnostic utility in women with or without proven PCOS, despite samples being taken at random times during the menstrual cycle. These two reports contradict our results, which show that LH/FSH levels are significantly higher. This may be due to the fact that thin and obese women with PCOS have different endocrine pathologies. Hyperandrogenism in slim women is caused by episodic pituitary LH hypersecretion, while in obese women, elevated LH is caused by hyperinsulinemia.

V. CONCLUSION

Obesity has been linked to high PCOS. ROS levels and testosterone levels can be an indicator of PCOS. Likewise, levels of both testosterone and LH are an important indicator by which to predict PCOS in women and take the necessary solutions to treat it. The reduced level of TAC in PCOS women reflects the impairment of antioxidant system due to this disorder and suggest supplementation of dietary antioxidants in order to overcome this depletion.

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