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RESEARCH ARTICLE

Association of body mass index (BMI) and reproductive hormones with polycystic ovary syndrome in Iraqi patients

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Abstract

Polycystic ovarian syndrome (PCOS) is one of the most common endocrine diseases in women. This syndrome is characterized by hyperandrogenism, chronic an ovulation, infertility and obesity. In this prospective study, blood samples from two groups of females patients PCOS (70) and control were taken for estimation of levels of testosterone (T), luteinizing hormone (LH), follicle-stimulating hormone (FSH), LH/FSH clinical symptoms of PCOS. Body mass index (BMI) and other parameters were also recorded. The data obtained from hormonal study revealed that significant levels were detected in LH, LH\FSH and testosterone in patients (5.78 ± 0.42 , 1.165± 0.08 and 0.491 ± 0.07 respectively) comparing to healthy control (2.78 ± 0.26, 0.693 ± 0.10 and 0.205 ± 0.04 respectively) with non-significant level in FSH hormone among patients (5.41 ± 0.37). These results were not significant according to age groups. On the other hand, body mass index of patients were with significant prevalence of overweight\obesity (0.0033 ± 0.0001). This could be due to the androgen excess detected in patients.

Introduction:

Polycystic ovary syndrome (PCOS) is a common hormonal disturbance in women affecting between 7-10% of reproductive-age (**Kaiser, 2011**). The syndrome is often associated with obesity, insulin resistance and metabolic syndrome **(Balen and Michelmore, 2002; Kaiser, 2011)**. It has been recognized that PCOS has a genetic and environmental basis **(Kandarakis *et al*., 2006).**

The level of hypothalamic gonadotropin-releasing hormone (GnRH) regulate the secretion of pituitary luteinizing hormone (LH) and follicle-stimulating hormone (FSH) which vary throughout the menstrual cycle and regulate (**King, 2006**). Therefore, the levels of FSH and LH are critical for follicular development and subsequent ovulation (**Hillier, 2001**). The understanding of the underlying PCOS pathogenity is still not clear because the heterogeneity of this disorder (**King, 2006**). An increase in gonadotropin releasing hormone (GnRH) secretion which results in increased (LH) secretion is one of the reasons could be behind POCS arising **(Tsilchorozidou *et al*., 2004**). The increase in LH could be the primary factor driving the increase in testosterone secretion in PCOS (**Hill, 2003**). The obese and overweight PCOS women also found to correlate with the increase levels of T hormone and LH **(Benson *et al*.2008).** The high prevalence of overweight/obesity in PCOS women was found to associate with another factors such as insulin resistance, decreased SHBG in addition to increase in circulating testosterone **(Freytag, 2003 ; Azziz *et al*. ,2004; Chang,2004).** The aim of the current work is to find the association between reproductive hormones and obesity in Iraqi POCS patients.

Materials and Methods

Seventy PCOS patients and 20 healthy females (aged between 20 to 40 years) were included in the current study. Venous blood sample (5 ml) was collected from each woman of both PCOS and healthy control. The serum obtained

by putting the blood samples in a clean dry plain plastic tube and allowed to clot at 37C for 30 minutes. The tubes centrifuged at 5000 rpm for 5 minutes, serum was collected and kept in freezer until used. Hormonal analysis was performed by using Addendum-Mini VIDAS apparatus (VIDAS) 12 mode l0, 1992, BioMerieux Company, France, through an enzyme linked fluorescent assay (ELFA) technique. Body Mass Index (BMI) for each female was also estimated. PCOS patients and healthy control with other diseases were excluded.

Statistical Analysis

The Statistical Analysis System- SAS (2010) and least significant difference –LSD test were used to analyze different factors include in the study.

Results and Discussion

The data obtained from hormonal study revealed that significant levels were detected in LH, LH\FSH and testosterone in patients (5.78 ± 0.42 , 1.165± 0.08 and 0.491 ± 0.07 respectively) comparing to healthy control (2.78 ± 0.26, 0.693 ± 0.10 and 0.205 ± 0.04 respectively) with non-significant level in FSH hormone among patients (5.41 ± 0.37) (Table I).

Table 1: The hormonal and BMI profiles of PCOS patients and healthy control.

Parameters	Mean ± SE		LSD
	Patients (n=70)	Healthy (control) (n=20)	
FSH (IU/ml)	5.41 ± 0.37	4.44 ± 0.23	1.404 NS
LH (IU/ml)	5.78 ± 0.42	2.78 ± 0.26	1.576 *
LH/FSH (IU/ml)	1.165± 0.08	0.693 ± 0.10	0.352 *
Testosterone (ng/ml)	0.491 ± 0.07	0.205 ± 0.04	0.267 *
BMI (Kg/m^2)	0.0033 ± 0.0001	0.0026 ± 0.0001	0.0004 *

*** (P<0.05), NS: non-significant**

These results were not significant according to age groups (Table II). On the other hand, body mass index of patients were with significant prevalence of overweight\obesity (0.0033 ± 0.0001). This could be due to the androgen excess detected in patients. PCOS develops when the ovaries overproduce androgens (eg, testosterone). Androgen overproduction often results from overproduction of LH (luteinizing hormone) which is produced by the pituitary gland. Excess of LH will stimulate ovaries to produce more testosterone when insulin level in the blood is high (**Yousouf *et al*., 2012)**. That is, the combination of having ovaries which are responsive to insulin and high insulin levels in the blood, can result in the overproduction of testosterone. Such association between androgen hormones and obesity was detected by others. Low level of FSH in PCOS patients was also detected by **Beydoan *et al*. (2009),** and **Liou *et al*.,(2009)** while the obese and overweight PCOS women who had increase levels of T hormone and LH was detected by **Benson *et al*.(2008).** Others reported that there was a high prevalence of overweight/obesity in PCOS women which associated with insulin resistance and correlated with decreased SHBG which caused an increase in circulating testosterone (**Chang,2004**). Obesity is defined as a body mass index (BMI) exceeding 25 or 27. It is estimated that 50% or more of women with PCOS are obese, which is higher than the prevalence rate of obesity in the general population (**Franks,1995; Azizz *et al*.,2004).** This may due to metabolic abnormalities. These are often associated with many factors such as hyperandrogenism, IR, dyslipidaemia and glucose intolerance. Others proposed that the metabolic consequences of obesity may precipitate a genetically susceptible individual to express the PCOS phenotype (**Laitinen *et al*., 2003; Ehrmann, 2005; Yildiz *et al*., 2008**).

Table 2: The hormonal and BMI profiles of PCOS patients and healthy control according to age groups.

Parameters	Age group (year)			LSD
	Less than 25	25-30	More than 30	
FSH(mIU/ml)	5.13 ± 0.34	5.06 ± 0.34	6.02 ± 0.98	1.822 NS
LH(mIU/ml)	6.27 ± 0.67	6.01 ± 0.75	5.06 ± 0.74	2.041 NS
LH/FSH	1.35 ± 0.18	1.19 ± 0.13	0.953 ±0.13	0.435 NS
Testosterone(ng/ml)	0.487 ± 0.11	0.441 ±0.11	0.541 ± 0.14	0.350 NS
BMI (Kg/m^2)	0.0034±0.0002	0.0031±0.0001	0.0032±0.0001	0.0005 NS

*** (P<0.05), NS: non-significant**

The association between high level of androgens- hyperandrogenaemia- and obesity was also detected by **Lee *et al.*, (1988), Dnuaif, (1997) and Freytag (2003)** who suggested that hyperandrogenaemia possibly causes android fat-adrenocortical obesity- after hirsutism in PCOS women. Results obtained revealed that there is a no significant FSH level in all age groups of PCOS in relation to control groups as shown in Tables 1&2**.** The current results agreed with **Nawras, (2010)** who showed that no significant differences (p>o.05) in level of FSH. The reduction levels of FSH can be explained by the increase of the conversion of androstenedione in adipose tissue which additionally stimulates LH and inhibits FSH **(Marx and Mehata, 2003)**. High levels of inhibin and Follistatin have been found in the PCOS women which leads to FSH reduction and increase of ovarian androgen production **(Karkanaki *et al*., 2011).** On the other hand, the FSH/LH ratio was significantly high in PCOS patients comparing to healthy group. In contrast the ratio was not significant between POCS age groups and healthy control. This is in agreement with **Taylor *et al*., (1997) and Mukherjee *et al*., (1996)** and **Nawras, (2010)** who detect non significant FSH\LH ratio and in contrast with **Taylor *et al*., (1997)** who suggested an increased FSH:LH ratio may predict an elevation in FSH alone.

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