Assessment of Metabolic Profile in Relation with Polycystic Ovary Syndrome

Wasan Wajdi, Intesar Jabbar Khadum

1M.B.Ch.B., F.I.B.M.S, C.A.B.O.G, Consultant Obstetrician and Gynaecologist, Baghdad Medical College, University of Baghdad, Baghdad Teaching Hospital, Iraqi Board for Medical Specialization, 2M.B. Ch.B., Baghdad Teaching Hospital, Iraqi Board for Medical Specialization

Abstract

Polycystic ovary syndrome (PCOS) is a common endocrinopathy that, by the most strict definition, affects 5 to 10% of women of reproductive age. There is not complete consensus about the definitive criteria for the diagnosis of PCOS, which necessitates the searching for new biomarkers for definitive diagnosis. This study is a case/control study carried on one hundred (100) women divided into two groups: 50 women with PCOS, and 50 women were with absent features of PCOS represent a control group who were attending the outpatient clinic of Gynecology department at Baghdad Teaching Hospital during the period from March to September, 2018. A fasting blood sample was obtained from all women during the early follicular phase (days 2–4 of the spontaneous cycle). Lipid profile, fasting blood glucose and fasting blood insulin, luteinizing hormone (LH), follicular stimulating hormone (FSH), and testosterone were analyzed by immune chemiluminescence method. There were no significant differences between the two groups regarding total cholesterol, low density lipoprotein -cholesterol, high density lipoprotein -cholesterol and fasting blood glucose. On the other hand, PCOS patients showed higher serum concentration of triglycerides and insulin resistance than controls.

Key words: Polycystic ovary syndrome, insulin, Lipid profile

Introduction

Polycystic ovary syndrome (PCOS) is one of the most common endocrine illnesses in women of reproductive age. It is characterized by chronic oligo-or anovulation, hyperandrogenism and polycystic ovaries, and is associated with several long-term health consequences, such as infertility, obesity, hypertension, dyslipidemia, insulin resistance and type II diabetes mellitus [1]. There are three main definitions for PCOS. The Rotterdam definition is the most widely used which proposes that PCOS can be diagnosed in any woman presenting with at least two of the three hyperandrogenism, ovulatory dysfunction and polycystic ovarian morphology (PCOM). By contrast, the 2006 Androgen Excess and PCOS Society (AE–PCOS) Position Statement requires the presence of hyperandrogenism, which must be accompanied by evidence of ovarian dysfunction in the form of ovulatory dysfunction and/or PCOM [2].

Each individual criterion used to define PCOS has clinical consequences by itself. Androgen excess might result in cutaneous manifestations, such as hirsutism, acne and alopecia; ovulatory dysfunction and chronic oligomenorrhoea might result in infertility and endometrial hyperplasia and/or carcinoma; and isolated PCOM is associated with a risk of ovarian hyperstimulation syndrome only during ovulation induction [3]. The pathophysiology of PCOS is far from fully understood. However, over the last decades potential underlying mechanisms have been proposed. An increased GnRH pulse frequency resulting in LH hypersecretion has been reported. LH stimulates the ovarian theca cells to produce androgens, such as testosterone. Because of a relative FSH deficiency,
testosterone is incompletely aromatized by the granulosa cells, resulting in hyperandrogenemia. Moreover, although the ovaries are the main source of androgen excess in PCOS, also the adrenal glands contribute to the existing hyperandrogenism\(^4\).

In PCOS, hyperandrogenism, hyperinsulinemia and altered intraovarian paracrine signaling can disrupt follicle growth. Moreover, FSH does not seem to increase to the threshold levels which are required to stimulate normal follicular maturation resulting in follicular arrest. The accumulation of small antral follicles result in elevated AMH levels. These increased AMH levels seem to add to the anovulation in PCOS by reducing both primordial follicle growth and follicle sensitivity to FSH\(^5\).

Materials and Methods

1: The Study Population: This study is a case/control study carried on one hundred women all are married who were attending to the outpatient clinic of Gynecology department at Baghdad Teaching Hospital during the period from March to September, 2018. The study sample divided into two groups: Group I: fifty women with PCOS and Group II: fifty women were healthy matched for age and BMI with absent features of PCOS represent a control group.

All women were subjected to the following:

1-Verbal consent was obtained from each subjects included after explaining aims and dimensions of the study.

2-Socio-demographic information about age, weight, height, obstetric and gynecological history also obtained

3-General physical, vital signs, abdominal examination have been performed to all women.

4-Transabdominal ultrasound done by senior doctor (Radiologist) by ultrasound machine (Philips HD 11xE) using the curvilinear probe.

2: Biochemical Assays: Serum levels of glucose, total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-c) were measured by the enzyme-calorimetric methods. Low-density lipoprotein-cholesterol (LDL-c) levels were calculated by using Friedwald et al.\(^6\) equation as follows: \(\text{LDL-c (mg/dl)} = \text{TC} - \text{HDL-c} - (\text{TG}/5)\).

3: Enzyme-calorimetric method was used for measurement of fasting blood insulin with a commercial ready kit according to the manufacturer’s instructions.

4: Homeostasis Model of Assessment-Insulin Resistance (HOMA-IR) index for the assessment of insulin resistance was measured by calculation using Matthews et al.\(^7\) equation as follows:

\[
\text{HOMA-IR} = \left[\frac{\text{glucose (mg/dl)} \times \text{insulin (IU/ml)}}{405}\right]
\]

Insulin resistance (IR) was accepted as HOMA-IR\(\geq 2.5\)

5: Hormone analyzes: Luteinizing hormone (LH), follicular stimulating hormone (FSH), and testosterone were analyzed by immune chemiluminescence method (Roche-Hitachi Modular Analytics E-170, Indianapolis, IN, USA)

6: Statistical Analysis

Statistical package for Social Sciences (SPSS version 20) was used for data analysis, and Microsoft Excel to generate graphs. Continuous variables were expressed as a mean± standard deviation (SD). The student test (t-test) was used to compare means of these variables. The statistical tests were two sided, and a P\(\leq0.05\) was considered statistically significant.

Results and Discussion

1: Anthropometric Data and Hormonal Status of the Study Population:

Table (1) shows the anthropometric data and hormonal status of PCOS patients and controls. The
two groups were comparable in age, BMI, W/H ratio as well as FSH concentration with no significant differences. However, PCOS patients showed higher serum concentration of LH (7.12±1.91 IU/L) than controls (4.42±1.44 IU/L) with a highly significant difference (p<0.001). Accordingly the LH/FSH ratio was significantly higher in PCOS patients (1.51±0.08) than controls (1.04±0.4)(p=0.016). Likewise, PCOS patients showed higher serum testosterone than controls (0.84±0.27 ng/mL vs. 0.44±0.18 ng/mL) with a highly significant difference (p<0.001).

Table 1: The anthropometric data and hormonal status of PCOS patients and controls

<table>
<thead>
<tr>
<th>Variables</th>
<th>PCOS patients</th>
<th>Controls</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>27.3 ± 7.1</td>
<td>24.51 ± 5.29</td>
<td>0.881</td>
</tr>
<tr>
<td>BMI (kg/m2)</td>
<td>26.3 ± 7.0</td>
<td>26.7 ± 6.4</td>
<td>0.932</td>
</tr>
<tr>
<td>W/H ratio</td>
<td>0.76±0.06</td>
<td>0.73±0.03</td>
<td>0.711</td>
</tr>
<tr>
<td>FSH(IU/L)</td>
<td>4.81 ± 1.32</td>
<td>4.29±2.11</td>
<td>0.622</td>
</tr>
<tr>
<td>LH (IU/L)</td>
<td>7.12±1.91</td>
<td>4.42±1.44</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LH/FSH ratio</td>
<td>1.51±0.08</td>
<td>1.04±0.4</td>
<td>0.016</td>
</tr>
<tr>
<td>Testosterone (ng/mL)</td>
<td>0.84±0.27</td>
<td>0.44±0.18</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD. BMI, body mass index; W/H: waist/ hip; FSH: follicular stimulating hormone, LH: luteinizing hormone.

The hormonal profile of PCOS patients and controls revealed a significant elevation in LH, LH/FSH ratio in patients compared with the controls. Such results were frequently reported by several previous studies (8,9). In fact, LH is an essential player in the pathophysiology of PCOS. Increased levels of LH (with consequence increased LH/FSH) ratio is caused by pulsatile release of GnRH from the hypothalamus. However, some other studies reported no significant differences in serum levels of LH between PCOS patients and controls (10). Likewise, testosterone levels were found to be significantly elevated in PCOS women compared with controls. This results also agree with vast majority of previous studies (11,12). However, total serum testosterone cannot be a reliable markers for PCOS because about 65% of testosterone % is bound to SHBG. This is particularly important for obese women with IR because they are very likely to have low SHBG levels.

2. Metabolic Status Data of the Study Population

The metabolic status data of PCOS patients and controls are listed in table (2). There were no significant differences between the two groups regarding total cholesterol, LDL-cholesterol, HDL-cholesterol and fasting blood glucose. On the other hand, PCOS patients showed higher serum concentration of
triglyceride than controls (89.12±9.81mg/dL vs. 77.41±8.44, p=0.038).

Likewise, PCOS patients had significantly higher concentration of HOMA-IR than controls (2.12±1.04 vs. 1.1±0.92, p=0.041).

### Table 2: The metabolic status data of PCOS patients and controls.

<table>
<thead>
<tr>
<th>Variables</th>
<th>PCOS patients</th>
<th>Controls</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol (mg/dL)</td>
<td>179.61±21.13</td>
<td>163.39±14.38</td>
<td>0.391</td>
</tr>
<tr>
<td>Triglycerides (mg/dL)</td>
<td>89.12±9.81</td>
<td>77.41±8.44</td>
<td>0.038</td>
</tr>
<tr>
<td>LDL-cholesterol (mg/dL)</td>
<td>106.4±11.71</td>
<td>101±13.92</td>
<td>0.449</td>
</tr>
<tr>
<td>HDL-cholesterol (mg/dL)</td>
<td>48.17±6.88</td>
<td>55.84±7.18</td>
<td>0.297</td>
</tr>
<tr>
<td>Fasting glucose (mg/dL)</td>
<td>87.52±11.43</td>
<td>84.18±12.82</td>
<td>0.761</td>
</tr>
<tr>
<td>HOMA-IR</td>
<td>2.12±1.04</td>
<td>1.1±0.92</td>
<td>0.041</td>
</tr>
</tbody>
</table>

Data are presented as mean ± SD. LDL: low density lipoprotein, HDL: high density lipoprotein, HOMA-IR: Homeostatic model assessment-Insulin resistance.

The metabolic profile analysis in the present study revealed a significant higher TG and HOMA-IR levels than controls. These results are comparable with many previous studies. In one study including 166 women with PCOS and 277 controls, Chae et al. (38) reported an elevation of TG (≥150 mg/dL) in 26.7%, of PCOS patients versus 1.0% among controls (P < 0.001); prevalence of low HDL-C (<50 mg/dL) 30.0% among patients and 3.0% among controls (P = 0.004). More recently, Lath et al. (13). studied lipid profile in 80 women with PCOS and other 40 healthy women. They found that each of TC, TG and LDL-c were significantly higher in patients with PCOS than controls. Dyslipidemia is common in PCOS compared to weight matched controls, with higher triglycerides and lower high density lipoprotein cholesterol (14). Several mechanisms have been proposed to explain this disorder mainly attributed to IR which present in 50%-70% of PCOS. For example, Resistance to the action of insulin on lipoprotein lipase in peripheral tissues may contribute to elevated TG levels. The significantly higher value of HOMA-IR in PCOS group compared with controls has also been reported frequently (15,16).

**Ethical Clearance:** The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

**Conflict of Interest:** The authors declare that they have no conflict of interest.

**Funding:** Self-funding

**References**

2. Edmonds K, editor. Dewhurst’s textbook of


5. Saxena R. Textbook for MrCoG-1: Basic sciences in obstetrics and gynaecology.


