Wasit Journal for Pure Science

Journal Homepage: https://wjps.uowasit.edu.iq/index.php/wjps/index
e-ISSN: 2790-5241 p-ISSN: 2790-5233

# Study the Effect of Polycystic Ovarian Syndrome on the Ferriman-Gallwey Score and Some Anthropometric and Demographic Criteria on Women in Al-Ramadi City

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DOI: https://doi.org/ 10.31185/wjps.438
Received 01 June 2024; Accepted 14 July 2024; Available online 30 September 2024

**ABSTRACT:**
**Introduction:** Polycystic ovarian syndrome (PCOS) is one of the most common complex endocrine disorders that affect females at reproductive age, can cause obesity, the appearance of excess hair on the body, acne, menstrual irregularities and infertility.
**Aim:** This study aimed to identify the extent to which some anthropometric and demographic criteria are affected by PCOS compared to healthy women
**Method:** The study included 50 volunteer women divided into two groups, the first group included 25 women with polycystic ovarian syndrome, and 25 healthy women were considered as a control group, women treated with medication and those with other diseases were excluded.
**Result:** The current study found that there was a significant increase in body mass index BMI for women with PCOS compared with the control group. It also found that there was a significant increase in Ferriman-Gallwey score as a measure of hirsutism, in the patient group compared to the control groupof .
The study also found that the rate of infertility was closely associated with polycystic ovarian syndrome, also confirmed that there was a significant increase in women suffering from menstrual irregularities compared with the control group, while the family history of the disease had no influence on the development of the disease in the study sample.
**Conclusion:** We observed that obesity and hirsutism are associated with polycystic ovarian syndrome, and polycystic ovarian syndrome can lead to menstrual irregularities, which usually ends with infertility.

**Keywords:** polycystic ovarian syndrom, Ferriman-Gallwey score, anthropometric and demographic criteria

## 1. INTRODUCTION

Polycystic ovarian syndrome (PCOS) is one of the metabolic diseases related to the endocrine glands, where approximately 10-5% of women are exposed to this condition due to a metabolic defect that leads to excessive accumulation of fat in the abdomen [1]. It is characterized by the presence of multiple cysts on the ovaries, irregular or absent menstrual periods, and high levels of male hormones

(androgens). Other symptoms may include weight gain, acne, and excess hair growth on the face and body (hairsutism) [2].

Hirsutism is an excessive amount of terminal hair distributed in a masculine pattern in women, Which can be estimated by the screening method developed by Ferriman and Gallwey known as the Ferriman-Gallwey scoring [3]. Hirsutism is one of the most prominent features of polycystic ovary disease, Which is caused by hyperandrogenism the main feature in women with polycystic ovarian syndrome, Ultimately, abnormal hair growth in the face, chest, and back [4].

Obesity is a major global health issue associated with increased rates of disease pathogenesis and death defined as an abnormal and excessive build-up of fat in the body that results from the interplay of several genetic, environmental, metabolic, lifestyle, and to behavioral factors [5].Body mass index is use as an indicator of obesity, It give monitoring on the levels of overweight and obesity depending on the height and weight of a person [6]. Women with polycystic ovarian syndrome always have high BMI compared with non, These could contribute to symptoms of polycystic ovarian syndrome worse since obesity can increase insulin resistance, which can aggravate hormonal imbalances and cause more weight gain [7].

This prospective research sought to investigate the severity of hirsutism in polycystic ovarian syndrome on Iraqi women depending on the Ferriman-Gallwey visual grading system, as well as studying the impact of some demographic and anthropometric criteria (age, BMI, fertility, and family history) on the development of polycystic ovaries in patient women.

## 2. PATIENTS AND METHODS

### 2.1 Study design

Women of reproductive age (20 to 35) years old who had a documented case of PCOS as defined by the 2003 Rotterdam Criteria [8] were chosen for a prospective case-control study that took place between December 2023 and May 2024, Samples were collected from Ramadi Women's and Children's Teaching Hospital. The criteria mentioned that women with hyperandrogenism, ovulatory dysfunction, and/or polycystic ovaries had to have two of the three conditions. This research did not include women with Cushing's syndrome, adrenal hyperplasias, hormone imbalances, thyroid abnormalities, or other endocrine conditions.

Women who were taking medications to treat PCOS or any others were excluded. Participants were divided into two groups: Group I consisted of 25 healthy women without PCOS, while Group II comprised 25 individuals with PCOS syndrome.

During their clinical interview, the anthropometric and demographic data of each individual participant, including age, height, weight, family history, menstruation regularity and fertility, were collected. This was then tested and compared to the findings of an ultrasound scan for polycystic ovaries, which measured the amount of ovarian fluid and the number of follicles, and endometrial thickness in PCOS participant individuals. The BMI was calculated using the formula shown below: BMI = Weight (kg) / Height (meters)$^2$ [9]. While hirsutism was calculated using a screening method developed by Ferriman and Gallwey known as Ferriman-Gallwey scoring [3].

### 2.2 Statical analysis

Statistical analyses were performed using SPSS version 26. The t student test for independent samples and a Chi-square test were performed to determine the differences between the two groups.

### 2.3 Ethical approval

The current study was approved by Ethical Approval by the University of Anbar Ethical Approval Committee (Ref:26 in 20-2-2024).

## 3. RESULTS

The current study included 50 samples of single and married women divided into 25 samples of women with polycystic ovaries and 25 samples of healthy women with an average age range of patients (27.5± 5.6) and healthy (26.0 ±5.1).

The results in Table (1) indicate that there is significant increase at a significant value (P 0.05) in body mass index in the PCOS group (28.02 ± 6.3) compared to the control (22.96 ± 3.33), these findings were agreed with a lot of studies that indicate to overweight and high body mass index is the most important phenotypic signs of polycystic ovaries syndrome [10] [11].

**Table (1) of comparison of body mass index and hirsutism values between the two study groups (n = 50)**

| | PCOS (n=25) (mean ± S.D) | Healthy (n=25) (mean ± S.D) | P value 0.05 |
|---|---|---|---|
| Age | 27.5± 5.6 | 26.04 ± 5.1 | N.S |
| BMI (kg / m$^2$) | 28.02 ± 6.3 | 22.96 ± 3.33 | 0.01 * |
| Hirsutism | 20.48 ± 6.5 | 7.2 ± 2.7 | 0.000 ** |

The results of our current study as shown in figure (1) also showed that there was a significant difference in Ferriman-Gallwey scoring for hirsutism scoring between the two study groups at significance level (p 0.05), It was (20.48 ± 6.5) in patients group while its value was 7.2 ± 2.7 in the group of healthy women, These finding consistent with what has been proven by many previous studies that found that the scale of hirsutism is higher for women with polycystic ovaries syndrome[10] [12] [13], where hirsutism is simultaneous with the development of polycystic ovaries and it one of the initial phenotypic features of hyperandrogenism [4].

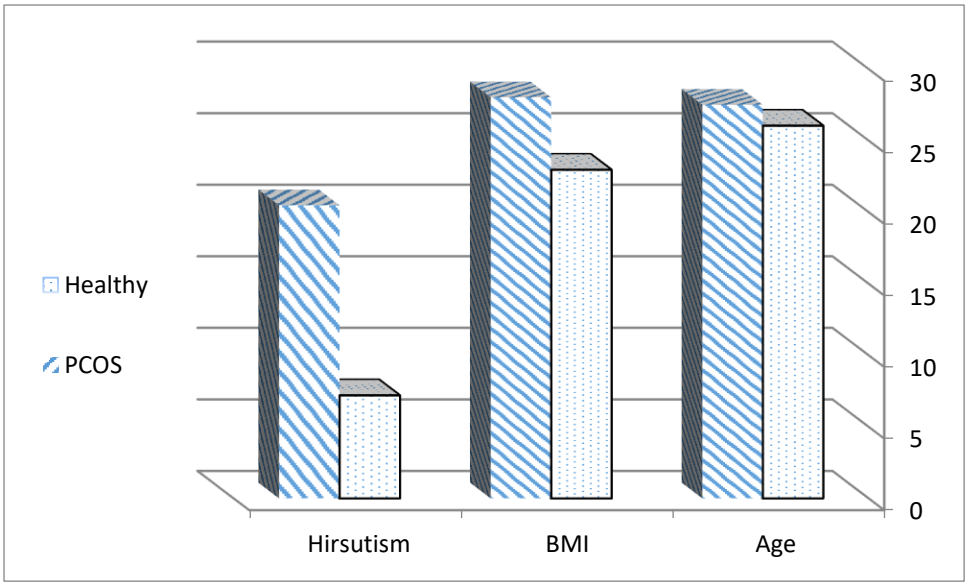


**Figure (1) of comparison of age, body mass index and hirsutism values between the two study groups**

In the other side the current study focused on find relation between some variables and the study groups. The results of our study show in table (2) showed an insignificant difference in the influence of the family history (genetic factor) on the development of polycystic ovary disease, as show the

study found that (26%) of the patients had first-degree relatives with the disease, while (24%) of them had no relatives with the disease, The group of healthy women's results revealed that (22%) of them had first-degree relatives but did not exhibit signs of the syndrome, and (28%) had no family history of the condition.

**Table (2) compared between patients with polycystic ovarian syndrome and healthy control depending on some criteria**

| Variables | PCO (N=25) | Healthy (N=25) | | |
|---|---|---|---|---|
| | N (%) | N (%) | $x^2$ | P value (0.05) |
| **Family history** | | | | |
| Yes | 13 (26%) | 11 (22%) | 0.321 | 0.571 |
| No | 12 (24%) | 14 (28%) | | |
| **Menstruation regularity** | | | | |
| Yes | 7 (14%) | 20 (40%) | 13.507 | 0.00022 ** |
| No | 18 (36%) | 5 (10%) | | |
| **Fertility** | | | | |
| Yes | 6 (14%) | 22 (44%) | 20.779 | 0.000005*** |
| No | 19 (38%) | 3 (6%) | | |

Table (2) shows that women with polycystic ovaries suffer from irregular menstruation, It shows that there was a significant association between polycystic ovarian syndrome and menstrual irregularities compared with healthy group.
Also, we found, as shown in Table (2), there was a significant increase in infertility in patients with polycystic ovaries compared to healthy uninfected women.

## 4. DISCUSSION

The study findings agree with a lot of studies that indicate to overweight and high body mass index is the most important phenotypic signs of polycystic ovaries syndrome [10] [11].
Obesity is a more common feature in women with PCOS, In 2021 Neubronner and his colleagues referred to obesity as a result of increased secretion of male hormones, they pointed out that about 45.2 % of women with polycystic ovaries are obese [14], These are can be due to hyperandrogenism, which contributes to the formation of visceral adipose tissue in women with PCOS [15].
Excessive obesity plays a fundamental role in the functional and reproductive changes of polycystic ovaries syndrome patients because of the ability of adipose tissue to synthesize effective androgens in the body, the more obesity lead to a higher level of the androgen hormone, due to the transformation of cholesterol by a series of metabolic processes into testosterone, which is an additional source of this hormone in this case in addition to what the ovaries produce [10] [16][17].
The distribution of fat in the body is affected by both androgens and insulin resistance, as obesity can lead to the development of PCOS, and one of its clinical symptoms is insulin resistance and hyperandrogenism, in fact, most of the factors that affect endocrine disorder and metabolic disorder in women with PCOS, can lead to an increase in body mass index to more than 25 [14].
In 1999 Huber and his group observed that obese women with PCOS who suffer from low or no ovulation can regain their ability to ovulate by losing weight, which not only leads to recovery of their ability to ovulate, but also to an increase in insulin performance [18]
Because loss of body weight can lead to lower level of testosterone and also activates the production of Sex hormone-binding globulin (SHBG), regularity of menstruation, increased pregnancy rates and reduced the likelihood of miscarriage [19].

Regarding hirsutism, The study finding is consistent with what has been proven by many previous studies that found that the scale of hirsutism is higher for women with polycystic ovaries syndrome [12] [13] [10], where hirsutism is simultaneous with the development of polycystic ovaries and it one of the initial phenotypic features of hyperandrogenism [4].
The main reason for the appearance of excess terminal hair, known as hirsutism, in patients with polycystic ovarian syndrome is due to the high level of testosterone secreted by the ovaries as a result of the high secretion of the Luteinizing hormone LH from the pituitary gland compared to the level of the Follicular stimulating hormone FSH, which in turn causes a disorder in the ovarian follicles, producing male testosterone in a greater proportion than female estrogen [20], Or may be due to an increase in androgens secreted from the adrenal gland [21] or those formed as a result of an increase in adipose tissue in patients with this syndrome [16].

On the other side, the current study focused on finding the relation between some variables and the study groups. The results of our study shown in table (2) showed an insignificant difference in the influence of the family history (genetic factor) on the development of polycystic ovary disease, as show the study found that (26%) of the patients had first-degree relatives with the disease, while (24%) of them had no relatives with the disease, The group of healthy women's results revealed that (22%) of them had first-degree relatives but did not exhibit signs of the syndrome, and (28%) had no family history of the condition.
Khan and his group in 2019 pointed that there were many genes that have a role in the etiology of PCOS, and mutations in the genes involved in the disease can cause the disease's events to be passed down through the affected families [22].
However polycystic ovary syndrome is usually a polygenic and multifactorial disorder, so additional variables may also be involved in the progression of the condition. Therefore, it is important to note that the genetic component is not the only dependable for the disease's occurrences. Singh and his team noted in 2023 that polycystic ovary syndrome is a multi-causal syndrome, meaning that factors other than genetics may also contribute to the disease's development [23], and gene - gene interactions, or interactions between genes and the environment might affect a person’s propensity to develop PCOS [24].
There were numerous studies in these field found that there was a close link between exposure to environmental pollutants and the etiology of polycystic ovarian syndrome. Numerous studies have demonstrated the substantial negative effects that environmental contaminants, including pesticides, heavy metals, and endocrine-disrupting chemicals (EDCs) on human health and reproduction [25] In fact, there is growing proof that environmental toxins have a role in PCOS development, Researchers discovered that the levels of serum Bisphenol A (BPA) were higher in hyperandrogenic PCOS women compared with non-hyperandrogenic PCOS women and healthy controls [26], Another study found that there were an increase in blood BPA levels was positively correlated with serum testosterone levels in PCOS women as compared to healthy women [27].
In addition to the pollutants role in the etiology of the syndrome, Sedentary lifestyles and high-calorie diets may be contributing factors to the progression of PCOS, Causing modifying the gut flora, leading to chronic inflammation, raising insulin resistance, and improving androgen production, Also high-sugar diets may be linked to PCOS causing gaining weight and becoming obese enhance the syndrome's characteristic traits [28] [29].
Interestingly, recent studies have found that there are hyperlink between changes in the gut microbiota and PCOS development [30]. These studies showed that the gut microbiota compositions of PCOS patients and healthy controls differed significantly. Studies suggest that insulin resistance, sex hormone levels, and obesity may have an effect on the variety and structure of the gut microbiome in women with PCOS [31]. PCOS is closely related to gut flora and its metabolites. Significant variations were observed in the number of species and metabolites produced between PCOS and the

control group. These differences were primarily attributed to a decline in microbial diversity, which was characterized by an increase in pathogenic bacteria (Escherichia and Shigella) and a decrease in beneficial bacteria (Lactobacilli and Bifidobacteria) [32] [33]. The DOGMA theory suggests that a poor diet-induced imbalance of the gut microbiota may increase the permeability of the gut mucosa, hence increasing the amount of Lipo PolySaccarides (LPS) that enter the bloodstream from Gram-negative colonic bacteria. As a result, the immune system becomes activated, impairing the action of insulin receptors and raising blood insulin levels, androgen synthesis in the ovaries, and proper follicle development [34].

Regarding menstruation irregularity,The study findings agree with many previous studies that have found that irregular menstruation almost inherent with PCOS [35] [36]. Imbalance in hormone levels plays a critical role in menstrual cycle irregularity, as the increase in the level of androgens above the normal limit leads to the occurrence of those disorders that begin with ovulation disorder, menstrual cycle irregularity ends in infertility [37]. Also, an imbalance in levels of estrogen and progesterone in polycystic ovarian syndrome patients leads to an endometrium thickness, which causes irregular menstruation, Which develops into endometrial hyperplasia, which may lead to uterine sarcoma [38] [39].
Also we found, as shown in Table (2), There was a significant increase in infertility in patients with polycystic ovaries compared to healthy uninfected women. This result is consistent with the results of many previous studies that confirmed the association of infertility with polycystic ovaries, Melo and his group found in 2015 that 80 % of women with cysts suffer from infertility and lack of ovulation [40].
Infertility in polycystic ovarian syndrome (PCOS) can be caused by various factors, Obesity is the major reason for infertility, It is associated with insulin resistance, hirsutism and elevated testosterone levels, Which ultimately with increased rates of infertility [41]. So Elevated LH hormone concentrations (one of PCOS features) also lead to disorders that begin with ovulation disorder, menstrual cycle irregularity end to infertility [42]. Ovulation is disrupted by hormonal abnormalities associated with polycystic ovarian syndrome (PCOS), which can result in irregular or nonexistent menstrual periods and infertility [43].
Furthermore, excessive androgen levels in PCOS might impact the quality and development of the ovum, which contributes to infertility [44].

## 5. CONCLUSION

We observed that obesity and hirsutism are associated with a polycystic ovarian syndrome, and polycystic ovarian syndrome can lead to menstrual irregularities, which usually end with infertility, also there was a finding that trying to lose weight and healthy nutrition can promote recovery from that condition.

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