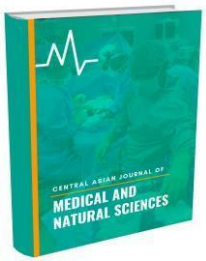

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Article

Evaluation of Sex Hormones in Women with Polycystic Ovarian Syndrome

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Abstract: This study investigates the potential influence of the KISS1 gene polymorphism on Polycystic Ovary Syndrome (PCOS) and its associated hormonal parameters, including kisspeptin, testosterone, luteinizing hormone (LH), follicle-stimulating hormone (FSH), and the LH/FSH ratio. PCOS affects 5% to 20% of women of reproductive age, and while genetic factors may play a role, the specific contributions of the KISS1 gene remain unclear. The study involved 200 women aged 17 to 40, with 100 diagnosed with PCOS and 100 in a control group. Blood samples were analyzed for hormone levels. Results indicated significantly elevated levels of kisspeptin, LH, testosterone, and the LH/FSH ratio in women with PCOS compared to controls, although FSH levels showed no significant differences. These findings suggest that elevated sex hormone levels may impact ovarian function in PCOS, highlighting the need for further research into the genetic mechanisms underlying this condition.

Keywords: PCOS, Sex Hormones, Hormonal parameters, Kisspeptin, Reproductive health

1. Introduction

Polycystic ovarian syndrome, also known as PCOS, is a hormonal condition that is characterized by hyperandrogenism and affects a considerable number of women who are of reproductive age [1]. The first time that this endocrine ailment was identified was in 1935, when Stein and Leventhal found a condition that affected women and was defined by anomalies in their menstrual periods [2]. Polycystic ovarian syndrome, also known as PCOS, is characterized by a wide variety of symptoms and indicators shown by females. Obesity, hyperandrogenism (which includes hirsutism, alopecia, acne, and increased blood testosterone levels), and major menstrual irregularities such as oligomenorrhea or amenorrhea are all included in this category. This spans a wide range of diseases. Anovulatory infertility and hirsutism are two conditions that can be caused by polycystic ovarian syndrome (PCOS), which affects around five percent to twenty percent of women of reproductive age [3].

PCOS, also known as polycystic ovarian syndrome, is a hormonal disorder that causes women to produce an abnormally high amount of androgens, which is far more than what is considered to be normal. In addition to causing menstrual abnormalities and infertility, this hormonal imbalance can also have a role in the development of major long-term health problems, such as diabetes, cardiovascular disease, endometrial cancer, and mental disorders [4]. The polycystic ovarian syndrome (PCOS) has a convoluted pathophysiology that is caused by a number of factors that are not fully understood. The

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growth in the prevalence of polycystic ovarian syndrome (PCOS) has been attributed to a wide variety of potential factors. It is now clear that high androgens and insulin resistance are factors that lead to a basic hormonal imbalance. This is the case despite the fact that there is no data that can definitively support any of the aforementioned theories. Polycystic ovarian syndrome (PCOS) is a condition that can be caused by a hormonal imbalance that can have both inherited and environmental components [5]. This imbalance can also be caused by a combination of the two.

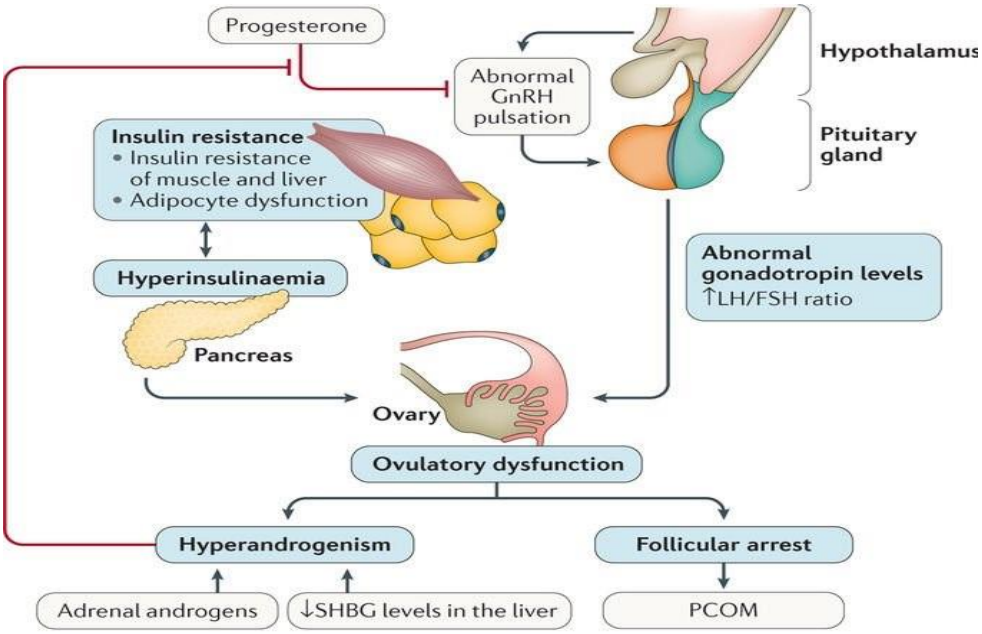

Figure 1. The pathophysiology of PCOS.

Figure 2. A: An ultrasound image depicting a standard polycystic ovary [6]. B. Ultrasound image depicting a typical ovary [7].

2. Materials and Methods

Sample Collection

Between January and June of 2024, a research was carried out in the Thi-Qar Governorate, which is located in southern Iraq. The study included one hundred women who had been diagnosed with polycystic ovarian syndrome (PCOS) and one hundred healthy women (mean age: 17–39) who did not have menstrual abnormalities. On days three to five of their menstrual cycles, blood samples were acquired from both groups by puncturing their veins using a sterile disposable syringe with the intention of collecting blood samples. Individual gel and EDTA tubes were used to hold each blood sample that was collected.

In order to assist the formation of a clot, a gel tube was left to remain at room temperature for ten minutes. After that, the gel tube was centrifuged at 5000 revolutions per minute for five minutes in order to separate the serum into Eppendorf tubes. If the serum was not immediately tested, it was kept at a temperature of -20 degrees Celsius until the hormonal parameters were evaluated. The levels of FSH, LH, and testosterone in the serum were measured using the Cobas e411 autoanalyzer.

Statistical Analysis

This data was analysis by SPSS version 26 based in using independent sample t test at p. value <0.05.

3. Results

Evaluation of Sex Hormones in PCOS Women and Control Group

The levels of kisspeptin, testosterone, and luteinizing hormone (LH) in patients were considerably greater ($p<0.001$) when compared to the values seen in the control group. In spite of this, there were no discernible variations in the levels of follicle stimulating hormone (FSH) between the group of patients and the group of control individuals ($p>0.05$). However, as compared to the control group, the ratio of luteinizing hormone to follicle stimulating hormone (FSH) was considerably greater in the patients ($p<0.001$). Table 3 provides a comprehensive breakdown of the hormonal parameters that were measured in both the patient group and the control group.

A number of patients were examined in order to determine the nature of the connection that exists between kisspeptin and FSH, LH, and testosterone. Based on the statistical research, it was shown that there is a significant positive association ($P<0.01$) between the amounts of kisspeptin and the levels of LH, FSH, and testosterone found in the body.

Table 1. The results of a hormonal parameter in the patients and control groups

Hormones	Control No. 100	Patients No. 100	p. value
	Mean ± SD		
Kisspeptin ng/l	151.86±64.92	205.53±107.75	<0.001
LH IU/ml	5.47 ± 1.88	12.47 ± 4.57	<0.001
FSH IU/ml	5.80 ± 2.04	5.44 ± 1.95	>0.05
LH/ FSH Ratio	0.93±0.18	2.28±0.73	<0.001
Testosterone ng/ml	0.16 ± 0.75	0.53±0.13	<0.001

Table 2. Correlation of kisspeptin with FSH, LH and testosterone in a patents group

Variable		FSH	LH	Testosterone
Kisspeptin	R	0.378	0.647	0.303
	P value	0.001	<0.001	0.002

Table 3. Correlation of BMI with Kisspeptin, FSH, LH and testosterone in patient group

Variable		Kisspeptin	FSH	LH	Testosterone
BMI	R	0.185	0.266	0.280	0.228
	P value	0.046	0.007	0.005	0.023

4. Discussion

An examination of the data revealed that the levels of kisspeptin were elevated in patients who were diagnosed with polycystic ovary syndrome (PCOS). Nevertheless, a considerable amount of heterogeneity was found in the collected information. It is possible that these findings are connected to the fact that patients who have polycystic ovary syndrome (PCOS) display significant variations in clinical, biochemical, and ultrasonographic parameters. There is a significant amount of variation in kisspeptin levels among women who have polycystic ovary syndrome (PCOS), and it is essential to take into account the potential causes of PCOS as potential contributors to this variation. Lizneva and others, the authors [8].

Data show that neuroendocrine abnormalities in PCOS interfere with the coupling of kisspeptin and LH pulses, probably becoming more evident as the disease develops in patients with PCOS [9]. There is a lack of comprehensive information on the pathophysiology of polycystic ovarian syndrome (PCOS), which underscores the significance of discovering effective biomarkers for this frequent endocrine illness, particularly among persons of reproductive age who are experiencing infertility. It is vital to take into consideration the clinical evaluation of kisspeptin levels in the near future since it is a potential biomarker for the diagnosis and monitoring of polycystic ovarian syndrome (PCOS) [10].

It was discovered during the research that women who suffered from polycystic ovarian syndrome (PCOS) had higher levels of kisspeptin than those who did not have the condition. The findings of previous investigations, such as the one carried out by Albalawi et al. [11], which revealed that the levels of kisspeptin are greater in pregnant women than in healthy women, are given more weight as a result of this discovery. Panidis et al. [12] reported that women with PCOS had lower levels of kisspeptin compared to healthy women. This study challenges those findings by demonstrating that these levels are higher in women with PCOS. In the majority of premenopausal women, the ratio of LH to FSH is approximately equal to one.

It is possible for the amount of LH to be higher than that of FSH in women who have been diagnosed with PCOS [13]. In light of the fact that increased levels of LH may be indicative of the presence of polycystic ovarian syndrome (PCOS), further testing is necessary [14]. A ratio of luteinizing hormone (LH) to follicle-stimulating hormone (FSH) that is more than 2:1 or 3:1 is representative of polycystic ovarian syndrome (PCOS), which is a condition that affects the ovary. According to the findings of our investigation, the levels of luteinizing hormone (LH) were found to be considerably raised, although the levels of follicle stimulating hormone (FSH) remained within the normal range. Because of this, the ratio of luteinizing hormone to follicle stimulating hormone (LH/FSH) was shown

to be much higher than normal. In contrast to the findings of Banaszewska et al. [15], which claimed that the mean LH/FSH ratio did not demonstrate a statistically significant difference between those with PCOS and those without, our findings are in agreement with a number of research, including is one of the studies that supports our findings. Nevertheless, they are in direct opposition to the findings of the scientific research that was discussed before.

Neuroendocrine dysfunction resulting in higher LH pulse frequency and amplitude contributes to ovarian hyperandrogenism and anovulation. At the moment, levels of luteinizing hormone (LH) are usually raised, but levels of follicle stimulating hormone (FSH) are either normal or lowered in contrast to those in women who ovulate on a regular basis. This results in an increased ratio of luteinizing hormone to follicle stimulating hormone (FSH) in the majority of patients. The increased LH pulse frequency that is observed in people who have polycystic ovary syndrome (PCOS) is a reflection of a concurrent rise in the pulse frequency of gonadotropin-releasing hormone (GnRH), which is indicative of hypothalamic dysfunction [16].

Follicle stimulating hormone (FSH) and luteinizing hormone (LH) are the hormones that are responsible for controlling the development of ovarian follicles [17]. The ovarian response is started when the levels of FSH exceed a particular threshold. Levels of follicle stimulating hormone (FSH) fluctuate during the follicular phase due to the development of follicles and their response to dietary cues. LH is responsible for stimulating ovulation, which in turn participates in the formation of the corpus luteum, which is essential for the process of steroidogenesis. It is possible for increasing concentrations of it to inhibit the efficacy of aromatase, which ultimately leads to anovulation [18].

This can also restrict the development of ova if it is present in sufficient quantities. According to the findings of the present research, the levels of testosterone hormone in the patients are much higher than those found in the group that was used as the control. The results suggested that high testosterone levels in women with PCOS contribute to excessive hair growth, which is recognized as the second most severe symptom of the illness. Polycystic ovarian syndrome (PCOS) is the most prevalent cause of hirsutism, which is defined by an unusually high rate of hair growth in females. Hirsutism is a condition that affects many women. It is generally accepted that increased levels of testosterone are the root cause of this illness [19].

According to the findings, there was a positive link between kisspeptin and FSH, LH, and testosterone in the patient cohort. This was discovered through the collection of data. Kisspeptin is responsible for the generation of gonadotropin-releasing hormone (GnRH) into the hypothalamic-hypophyseal-portal circulation, which ultimately results in the production of luteinizing hormone (LH) and follicle stimulating hormone (FSH) from gonadotropes [20]. [21] Research has shown that women who have high levels of kisspeptin also have high levels of luteinizing hormone (LH), which can result in irregular menstrual cycles of the female reproductive system.

It was discovered that there was a positive correlation between the body mass index (BMI) and the hormonal parameters of kisspeptin, follicle stimulating hormone (FSH), luteinizing hormone (LH), and testosterone in the patient cohort. It was demonstrated by Umayal et al. [22] that women who had PCOS had a median body mass index that was much greater than that of their healthy counterparts. It is probable that some of the causes that lead to the increasing prevalence of body mass index (BMI) in women include hormonal imbalances, bad eating habits, and a lack of enough physical activity. According to the findings of a number of studies, the presence of traits that are linked with polycystic ovarian syndrome (PCOS) may be indicated by a higher body mass index (BMI), as well as higher levels of luteinizing hormone (LH) and ratios of luteinizing hormone to follicle stimulating hormone (FSH). [23]

The results of other studies indicate that there is no significant link between the body mass index (BMI) and the examination of hormone markers among the population [24]. A

negative correlation was found between LH and BMI in women who had polycystic ovary syndrome (PCOS), as demonstrated by Meier [25]. On the other hand, Kiddy et al. [24] found an inverse correlation between FSH and BMI in obese women who had PCOS. In each of these studies, the participants were women who were diagnosed with PCOS. The body mass index (BMI) may be affected by hyperandrogenism [26], which is characterized by an increase in visceral adiposity at the abdominal region.

5. Conclusion

The article investigates the relationship between sex hormones and polycystic ovarian syndrome (PCOS) in women, focusing on the roles of kisspeptin, luteinizing hormone (LH), follicle-stimulating hormone (FSH), and testosterone levels. The study found that women with PCOS exhibit significantly higher levels of kisspeptin, LH, testosterone, and the LH/FSH ratio compared to a control group, indicating disrupted hormonal balance. This imbalance may contribute to PCOS symptoms, such as menstrual irregularities, infertility, and hyperandrogenism. The findings suggest that kisspeptin could serve as a biomarker for PCOS, aiding in diagnosis and monitoring, while also highlighting the complex neuroendocrine factors that impact PCOS pathophysiology.

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