Comparison of Serum Luteinizing Hormone, Follicle-Stimulating Hormone and Testosterone in Healthy Women and Polycystic Ovarian Syndrome Patients

Asma Hoque[1*] Md. Rafiq Uddin[2] Pijush Karmakar[3]

Abstract

Background: Polycystic Ovarian Syndrome (PCOS) is the most frequent endocrinopathy among young women. PCOS causes menstrual dysfunction, infertility, hirsutism, acne, obesity, and hormonal imbalance. The study will evaluate LH, FSH, and Testosterone levels in polycystic ovarian syndrome patients and healthy Chattogram women.

Materials and methods: This cross-sectional comparative study was conducted in Chittagong Medical College Hospital's Biochemistry and Gynaecology and Obstetrics Departments from July 2016 to June 2017. Purposive sampling chose hundred (100) 20-35-year-old women who met enrollment criteria. In addition to 50 polycystic ovarian syndrome patients, 50 healthy reproductive females were present. Both case and control had been tested serum FSH, LH and Testosterone levels.

Results: The average age of patients with Polycystic Ovary Syndrome (PCOS) was 30.6±0.65 years. In this study, 54% of the patients had obesity, 92% had oligomenorrhea, 8% had amenorrhoea and 22% had hirsutism. There were notable disparities in the blood LH and testosterone levels between the cases and controls. In addition, the serum FSH level was lower in the patients compared to the control group. However, the differences in serum FSH levels between the cases and controls did not reach statistical significance.

Conclusions: Polycystic Ovarian Syndrome (PCOS) is the predominant kind of persistent an ovulation that is linked to excessive levels of androgens. Regular monitoring and timely control of serum androgen levels would be highly beneficial in preventing problems associated with PCOS.

Key words: Amenorrhoea; Hormonal imbalance; Polycystic ovary.

1. Associate Professor of Biochemistry
Institute of Applied Health Science, Chattogram.
2. Assistant Professor of Endocrinology
Chittagong Medical College, Chattogram.
3. Associate Professor of Biochemistry
Eastern Medical College, Cumilla.

***Correspondence:** **Dr. Asma Hoque**
Cell : 01711 14 96 84
E-mail: asmasumicmc@gmail.com

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Introduction

Endocrine and metabolic disorders are prevalent in women of reproductive age and Polycystic Ovarian Syndrome (PCOS) is one of them.[1] This enduring and diverse condition presents itself as irregular menstruation cycles, inability to conceive, excessive hair growth, skin breakouts and excessive body weight.[2] The diagnosis of this condition typically occurs only after difficulties arise, leading to a severe decline in the patient's quality of life. These complications may include hair loss, alopecia, acne and issues connected to infertility.[3] Based on the results of a comprehensive screening of women using the diagnostic standards established by the National Institutes of Health (NIH) it is estimated that between 4 and 10 percent of women of reproductive age across the world have Polycystic Ovary Syndrome (PCOS).[4] The high incidence of PCOS, in addition to its association with problems in ovulation and menstruation, infertility, hair loss, and metabolic difficulties, highlights the tremendous financial burden that is associated with all of these conditions.[2,3] In spite of the fact that the precise reason for this multifactorial disease is not understood, it is believed that an interaction of genetic and environmental variables is the key contributor to the condition. A hormonal imbalance, persistent low-grade inflammation, insulin resistance, and hyperandrogenism are the primary factors that contribute to the pathophysiology of Polycystic Ovary Syndrome (PCOS). These factors all have an adverse effect on folliculogenesis.[5] There are a variety of environmental variables that may be contributing to the development, incidence and management of Polycystic Ovary Syndrome (PCOS). These factors include location, diet and nutrition, socioeconomic status and chemicals found in the environment.[6] In addition to being one of the most common causes of infertility, Polycystic Ovary Syndrome (PCOS) can also be a risk factor for other health problems, such as type 2 diabetes

mellitus, psychiatric disorders, cardiovascular illnesses and a variety of gynaecological malignancies, such as endometrial and ovarian cancer by the time the issue has progressed to a more severe state.[7] At the time of the Rotterdam Consensus Meeting in 2003, the present definition of PCOS was established. Specifically, it defines the condition as the presence of any two of the three criteria that are listed below:[8,9]

i) Menstrual disruption; infrequent or absent menstruation.

ii) Presence of clinical and/or biochemical indicators of excessive androgen levels, such as acne and hirsutism, after excluding other potential sources of elevated androgen levels.

iii) The ultrasound image shows a polycystic ovary, characterised by the presence of at least one ovary with 12 or more follicles measuring 2-9 mm in size and a volume greater than 10 ml.

PCOS is characterised by the co-occurrence of oligomenorrhea and hyperandrogenism. Among these women, 75% exhibit an LH level that surpasses the established normal range for women in the early follicular phase. Furthermore, 94% of these women have an elevated LH to FSH ratio.[10] However, the Rotterdam standards are now recognised on a global scale by several organisations, including the National Institutes of Health (NIH) the recommendations of Australia and European organisations. The National Institutes of Health (NIH) in 1990 provided the diagnostic criteria that is the most widely accepted. They defined it as hyperandrogenism and chronic anovulation in cases where secondary causes (Such as adult-onset congenital adrenal hyperplasia, hyperprolactinemia and androgen secreting neoplasm) have been ruled out possible causes.[11] So, the aim of the study is to assess the serum Luteinizing Hormone (LH) Follicle-Stimulating Hormone (FSH) and Testosterone levels in polycystic ovarian syndrome patients and compare the levels with healthy Women in Chattogram City.

Materials and methods

This cross-sectional comparative study was carried out in the Department of Biochemistry and Department of Gynaecology and Obstetrics of Chittagong Medical College Hospital from July 2016 to June 2017. Permission for the study was taken from the ethical review committee of CMC and concerned departments. After fulfilling the enrollment criteria, a total of hundreds (100) female with the age range of 20-35 years were selected by purposive sampling. Inclusion criteria were PCOS patient diagnosed based on Revised Rotterdam Consensus 2003 criteria, patient having 2 out of 3 following criteria:

i. Chronic anovulation or amenorrhea

ii. Clinical or biochemical hyperandrogenism

iii. Polycystic ovary (By USG).

Exclusion criteria

- Type 2 Diabetes Mellitus
- Hyperprolactinemia
- Thyroid disorder
- Refuse to give consent.

Among them fifty (50) were diagnosed polycystic ovarian syndrome patients and another fifty (50) were normal healthy reproductive females. Serum FSH, LH and Testosterone were measured by Advia Centaur XP analyzer. All the data were processed and analyzed using SPSS version 20. Confidence level was fixed at 95% and p value <0.05 was considered statistically significant. Comparison between two groups was determined by Students 't' test. Results were presented in the form of tables and figures.

Results

In this cross-sectional comparative study, a total of hundreds (100) female with the age range of 20-35 years were selected. Among them fifty (50) were PCOS cases and fifty (50) were control. The mean age was 30.6 ± 0.65 years in cases and 30.42 ± 0.55 years in controls (Table I). Figure-1 demonstrated that obese, oligomenorrhea, amenorrhea and hirsutism were present in 27 (54%), 46 (92%), 4 (8%) and 11 (22%) cases respectively in this study cases.

There were significant differences of serum LH and testosterone level between cases and controls. Besides serum FSH level was decreases in cases than control but the differences of serum FSH level between cases and controls were not statistically significant (Table II, III & IV).

Table I Distribution of study population (n = 100)

Groups	Population	Frequency (%)
Cases	Sonographically diagnosed polycystic ovarian syndrome (Mean age: 30.42 ± 0.55 years)	50 (50%)
Controls	Normal healthy females with reproductive age (Mean age: 30.6 ± 0.65 years)	50 (50%)
Total		100 (100%)

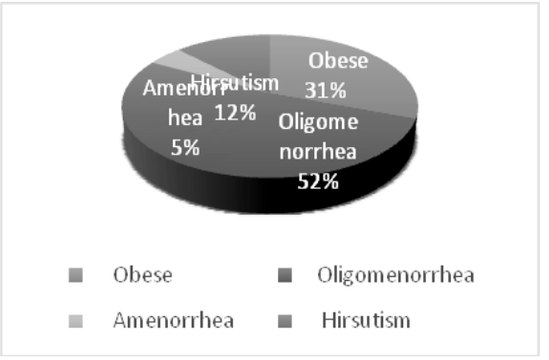

Figure 1 Clinical manifestations of the study cases (n=50)

Table II Comparison of serum Luteinizing Hormone (LH) amongst cases and controls (n=100)

	Serum LH (mIU/ml)		
Study Groups	Frequency (n)	Mean±SEM (Range)	p-value (Significance)
Cases	50	8.78 ± 0.62 (2.18 – 16.2)	p <0.0001 (Significant)
Controls	50	5.44 ± 0.34 (2.31 – 11.2)	

Table III Comparison of serum Follicle Stimulating Hormone (FSH) amongst cases and controls (n=100)

	Serum FSH (mIU/ml)		
Study Groups	Frequency (n)	Mean±SEM (Range)	p-value (Significance)
Cases	50	4.77 ± 0.26 (1.33-10.2)	p =0.059 (Not significant)
Controls	50	5.67 ± 0.39 (1.33-11.2)	

Table IV Comparison of serum testosterone amongst cases and controls (n=100)

	Serum Testosterone (mIU/ml)		
Study Groups	Frequency (n)	Mean±SEM (Range)	p-value (Significance)
Cases	50	3.79 ± 0.64 (0.13 – 17.5)	p =0.003 (Significant)
Controls	50	1.92 ± 0.21 (1.33 – 11.2)	

Discussion

Polycystic Ovary Syndrome (PCOS) is a metabolic disorder characterised by the presence of persistent anovulation, hyperandrogenism, and polycystic ovaries. It may or may not be accompanied by obesity. While hyperinsulinemia/ insulin resistance is often considered the main characteristic of PCOS, other researchers have suggested that hyperandrogenism may be the predominant trait.[12] The study had a total of fifty (50) cases of Polycystic Ovary Syndrome (PCOS) and an equal number of fifty (50) healthy control subjects. Both groups consisted of individuals between the ages of 20 and 35. The majority of prior research focussed on comparable age cohorts. Nasr et al. conducted a study on infertile women who experience irregular menstrual periods, focusing on patients between the ages of 21 and 35.[13] Sharquie et al. conducted a research that included individuals between the ages of 15 and 39.[14] Oligomenorrhea was present in 92% of the participants in the research, followed by obesity (54%) hirsutism (22%) and amenorrhoea (8%). Oligomenorrhea was the most prevalent clinical symptom. Adil et al. did a research on polycystic ovarian syndrome and discovered that 79% of patients had oligomenorrhea.[15] Hassa et al. carried out a research designed to investigate the hormonal and clinical characteristics of polycystic ovarian syndrome. This study was a retrospective investigation. Among the patients who participated in their research, 46 (or 46%) experienced oligomenorrhea.[16] Razzak et al. carried out a research and discovered that 63.55 percent of patients were obese, and 64.49 percent of patients were hirsute.[17]

This study examined the hormonal pattern of individuals who suffered from polycystic ovarian syndrome as determined by ultrasonography. The analysis of their biochemical data revealed that women with polycystic ovaries had greater levels of both Luteinizing Hormone (LH) and total testosterone than women with normal ovaries.[11] Shah et al. demonstrated that individuals with Polycystic Ovary Syndrome (PCOS) had significantly elevated levels of Luteinizing Hormone (LH) (7.82 ± 6.11) compared to the control group (3.41 ± 0.70).[18] In 2016, Saucedo de la Llata et al. demonstrated that PCOS patients

had a significantly elevated level of LH (6.36 ± 4.61) compared to the control group (4.34 ± 2.12).[19] During the early gonadotropin stage, an excess of androgens stimulates the development of primordial follicles and an increase in antral follicles.[20] The generation of Gonadotropin-Releasing Hormone (GnRH) by the hypothalamus is what causes the pituitary gland to cause the release of gonadotropin hormones. The LH receptor is activated by Luteinizing Hormone (LH) which causes an increase in the amount of androgen that is produced by ovarian theca cells. The follicle-stimulating hormone, often known as FSH, is responsible for activating the FSH receptor in ovarian granulosa cells. This allows the hormone to convert androgens into oestrogens, which in turn stimulates the formation of follicles. It is believed that an imbalance in the Hypothalamic–Pituitary–Ovarian (HPO) axis which is caused by the dysregulation of the neuroendocrine system, ultimately results in an excess of gonadotropin. The increase in GnRH drives the production of LH rather than FSH, which leads to a significant increase in the ratio of LH to FSH in women who have Polycystic Ovary Syndrome (PCOS).[21] Elevated LH and LH/FSH prevalence varies from 35% to 77% in PCOS patients.[22,23]

High testosterone levels are responsible for the many physical symptoms of PCOS such as facial and body hair growth, acne and hair loss.[24] This study found that PCOS patients had higher serum testosterone levels compared to healthy females. Prior research has also demonstrated that blood testosterone levels were elevated in 57.7% and 70% of cases.[25,26] In a study conducted by Yousouf R et al. it was shown that individuals with Polycystic Ovary Syndrome (PCOS) had significant differences when compared to females who were in good health. In their investigations, they determined that total testosterone is the most effective hormonal marker for the illness and the most reliable diagnostic test. Luteinizing Hormone (LH) activates several steroidogenic enzymes in the theca cells of the ovary, resulting in the growth of theca cells and an increase in testosterone synthesis. Due to a lack of Follicle-Stimulating Hormone (FSH) testosterone is not fully converted and broken down by the granulosa cells.[27]

Limitations

Our study was limited by a lower sample size.

Conclusion

Polycystic Ovarian Syndrome (PCOS) is the prevailing kind of persistent anovulation linked to excessive testosterone levels. Regular monitoring and timely control of serum androgen levels would be highly beneficial in preventing problems associated with PCOS. Healthcare practitioners should reassess the methods used to standardise the LH/FSH ratio.

Recommendation

It is advisable to do more research that involves bigger sample sizes and classifies study participants using various diagnostic criteria.

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Contribution of authors

AH-Conception, acquisition of data, data analysis, drafting & final approval.

MRU-Design, interpretation of data, critical revision & final approval.

PK-Data analysis, critical revision & final approval.

Disclosure

All the authors declared no conflict of interest.

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