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Original Research Article

A correlation study on testosterone level with luteinizing hormone to follicle stimulating hormone ratio among women with PCOS in reproductive age

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ABSTRACT

Background: Polycystic ovarian syndrome (PCOS) is a female specific endocrinological condition. Traits of PCOS include menstrual irregularity, excess hair growth, elevated luteinizing hormone: follicle stimulating hormone (LH-FSH) ratio. The purpose of this study was to investigate any potential correlation between LH-FSH ratio and total testosterone levels in women with PCOS who were of reproductive age.
Methods: This cross-sectional study included 50 women with PCOS based on analysis of testosterone, luteinizing hormone, follicle stimulating hormone who have shown PCOS symptoms. The primary emphasis of this investigation was to testing blood samples for hormone levels (LH, FSH, total testosterone). Abott ARCHITECT Ci4100 was used to analyse the blood samples using chemiluminescent microparticle immunoassay (CMIA) chemiflex method.
Results: In this study 100 subjects between age 19-45 were taken; 50 were selected as tests and 50 were selected as controls. It has significantly showed a positive correlation with rising testosterone and LH/FSH ratio.
Conclusions: Among women with PCOS, the LH-FSH ratio was found to be substantially linked with total testosterone. This aid in a better understanding of the pathophysiology and management of hyperandrogenemia in PCOS women. PCOS cause irregularities of the menstrual cycle, the appearance of clinical manifestations, especially changes of LH/FSH ratio. This ratio can be used to support or confirm PCOS diagnosis along with other tests.

Keywords: LH/FSH ratio, PCOS, Total testosterone

INTRODUCTION

PCOS is an endocrine condition that results in tiny and enlarged cysts in the ovaries. The follicles don't consistently release eggs.[1] It is still unknown what specifically causes PCOS. Polycystic ovaries develop when ovaries are stimulated to produce excessive number of androgenic hormones.[2,3] The release of excessive luteinizing hormone (LH) by the anterior pituitary gland. There is no cure for PCOS. Changing one's lifestyle to lose weight and exercise may be part of treatment.[4]

According to a study, lowering insulin resistance can lower serum testosterone, hirsutism and acne symptoms.[5] The concept that PCOS is a systemic syndrome is supported by new findings regarding interactions between muscle, fate, brain and ovary tissues. WHO supports the generation of statistics on how common infertility and its causes are (such as PCOS).[6,7] Typically, in healthy women the ratio of LH-FSH ranges from 1 to 2. In PCOS women this ratio is reversed to 2 or 3. Ovulation does not occur in PCOS individuals due to elevated LH/FSH ratio. Research has indicated that a higher baseline LH/FSH ratio in PCOS affected women was linked to worse ovulatory response;

nevertheless, these women had a high chance of becoming pregnant and giving birth than those with normal LH/FSH ratios.[8] Serum LH/FSH ratio and androgenemia also strongly correlate in PCOS affected women. Some findings have suggested a dependance of insulin, LH and testosterone in initiating the hormonal imbalances in PCOS.[9,10]

METHODS

This was an observational study with a cross-sectional design. The data was analysed between October 2023 to December 2023.Additionally, data from 2022 and 2021 were gathered from Cooperative Hospital Vadakara, Kerala. The inclusion criteria were women with PCOS between age group 19-45. The exclusion criteria were women above 48 years of age.

Statistical analysis

The collected data were summarized by using the descriptive statistics: frequency, percentage; mean and SD. The independent sample "t" test was used to compare testosterone, FSH and LH between test and control groups. To find the relation between testosterone, FSH and LH, the Pearson correlation coefficient ("r") was used. The association between LH/FSH ratio and serum testosterone was tested using spearman's correlation test. The p value <0.05 was considered as significant. Data were analysed by using the SPSS software (SPSS Inc.; Chicago, IL) version 29.0.10.

RESULTS

The study included 100 women diagnosed with PCOS all within the age range of 19-45 years.

Table 1: The age distribution of participants.

Age group (years)	Number of participants (n=100)
19-25	30
26-35	50
36-45	20

Table 2: Comparison of testosterone, FSH and LH between test and control groups.

		Mean	SD	t	P value
Testosterone (ng/ml)	Test	1.61	1.25	6.81	<0.001*
	Control	0.39	0.18		
FSH (mIU/ml)	Test	7.47	1.53	14.78	<0.001*
	Control	3.53	1.10		
LH (mIU/ml)	Test	12.70	7.58	6.56	<0.001*
	Control	5.20	2.80		

("t" = Independent sample "t" test * Significant)

The independent sample "t" test was used to compare testosterone, FSH and LH between test and control groups. There was a difference ($p<0.05$) in testosterone, FSH and LH between test and control groups.

Table 3: Relation between testosterone, FSH and LH of groups.

Correlations		Groups	
		"r"	P value
Testosterone (ng/ml)	FSH (mIU/ml)	0.417	<0.001*
	LH (mIU/ml)	0.214	0.033*
FSH (mIU/ml)	LH (mIU/ml)	0.665	<0.001*

("r" = Pearson correlation coefficient; *Significant)

The Pearson correlation coefficient ("r") was used to find the relation between testosterone, FSH and LH irrespective of groups. There was a positive correlation ($p<0.05$) between testosterone, FSH and LH.

Table 4: Relation between total testosterone and LH-FSH ratio.

	LH-FSH ratio		Total	P value
TT (ng/ml)	**Normal**	**High**		
Mean (SD)	118.3	256.2	216.3	0.000
Median (SEM)	86	270	184	

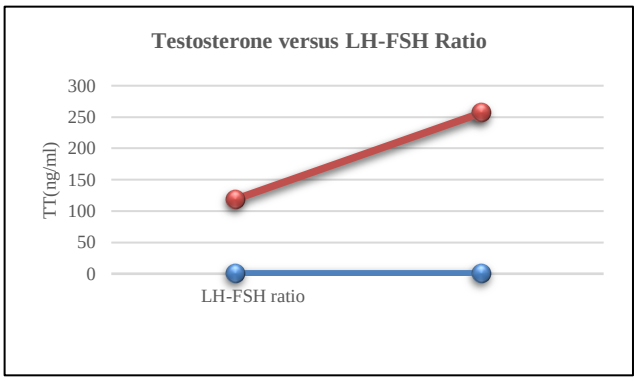

Figure 1: Serum testosterone versus LH-FSH ratio.

The Table 4 and Figure 1 clearly show that serum testosterone and LH-FSH ratio are significantly correlated. Women with LH-FSH ratio >1 had significantly increased serum total testosterone level.

DISCUSSION

The relationship between the total testosterone level and serum LH-FSH ratio was examined in this study using a cross-sectional approach. In healthy women, the ratio of LH-FSH was 1:1. An excess of LH over FSH in PCOS leads to arise in ovarian androgen production and ovulatory failure.[11,12] Findings showed that women with PCOS had an abnormal LH-FSH ratio. PCOS women may be distinguished by their LH-FSH ratio, among other traits.[13]

The imbalance in LH-FSH causes proliferation of ovarian theca cells leading to increased steroidogenesis, and it leads to hyperandrogenemia in PCOS women.[14] The LH-FSH ratio and total testosterone have an independent relationship that is in line with other research.[15] There was a study conducted on Sudanese women by Mohammed and team.[16] Their study revealed that serum LH-FSH ratio and total testosterone have a strong relationship. LH-FSH ratio van be used to distinguish between hyperandrogenic and non-hyperandrogenic PCOS women.[17,18]

Body mass index is not correlated with increased LH-FSH ratio was exhibited by previous studies. The ratio was found to be same in normal BMI women.[19,20] Other than LH-FSH ratio there were several other studies. Free testosterone levels were analyzed to get information about hirsutism.[21]

The study has limitations that several other factors were not considered in this study as it is done in small scale.[22] The study was conducted on 100 participants, which may limit the generalizability of the findings. The study included women aged 19-45, but there was a higher representation of participants in the 26-35 age group. This age distribution might not fully represent the hormonal variation seen in younger or older women with PCOS, potentially influencing the results. According to common understanding, PCOS patients with higher body weights tend to have higher levels of LH or other symptoms. However, research has refused this notion.[23,24] Moreover, a correlation was found with LH-FSH ratio and insulin resistance.[25] Additionally, there was lack in particular data to dig deeper into PCOS and its correlations.

CONCLUSION

The LH-FSH ratio was found to be significantly correlated with toral testosterone in women with PCOS. As there is an increase in serum testosterone level (in PCOS women) it shows a direct relationship with LH-FSH ratio. PCOS also causes other irregularities along with abnormality in LH-FSH ratio. Therefore, this ratio can be used to support diagnosis of PCOS.

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