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Original Article

Correlation Between BMI And LH Level and LH/FSH Ratio-A Cross-Sectional Study

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Abstract

Background: Polycystic ovarian syndrome is the most common reproductive endocrinopathy of women during their childbearing age. Elevated LH/FSH ratio, abnormally high androgen level and relatively high endogenous estrogen production are indicative of PCOS. The diagnosis of polycystic ovarian syndrome remains controversial with some considering transvaginal sonography with the combination of clinical criteria for diagnosis. In this study, we tried to determine whether there is any impact of BMI on LH or LH/FSH ratio in PCOS for better management in the future.

Materials and Methods: This is a cross-sectional study. Those clinically presented as obese, hirsute, and with menstrual disturbances were non-smokers and had not been on any medications for the last three months before the study. Age groups <20 and >40 years, non-PCOS with infertility, and nonobese patients were excluded from the study.

Results: Among the total 58 patients, BMI in the range of 25-28 kg/m 2 was found in the highest frequency in 44 cases (75.9%), high LH level group in 33 cases (56.9%). LH/FSH ratio >2 found in 27 cases (46.66%). The correlation between BMI and LH/FSH ratio showed the highest frequency in 21 cases in the BMI group (25-28kg/m 2) (p <0.009). Random LH level amplitude was found higher in low BMI (25-28kg/m 2) than lower in higher BMI (28-34kg/m 2) (p <0.003).

Conclusion:Assessments of basal LH levels and the LH/FSH ratio in hyperandrogenic anovulatory women would be clinically meaningful when BMI is taken into account.

Keywords: Polycystic ovary, Androgen, Endocrinopathy, Hyperinsulinemia.

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Introduction

Polycystic ovarian syndrome (PCOS), previously known as Stein-Leventhal syndrome, is the most common reproductive endocrinopathy of women of childbearing age, with a reported prevalence of 4-8%.1,2 The majority of women with WHO group-II anovulatory infertility have polycystic ovarian syndrome (PCOS), of whom at least 40-50% are overweight.[3,4] Obesity is common but not universal.[5] Obesity is not a prerequisite to PCOS development as approximately 50% of PCOS women are not obese.[6] Three endocrine findings are usually considered to be indicative of PCOS: elevated luteinizing hormone/ follicle-stimulating

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hormone (↑LH/FSH) ratio, abnormally high androgen (androstenedione and/or testosterone) value, and persistent relatively high and endogenous estrogen production.[7,8,9] The most widely accepted clinical definition of PCOS is the association of hyperandrogenism with chronic anovulation in women without specific underlying diseases of the adrenal or pituitary glands.[10]

The diagnosis of the polycystic ovarian syndrome remains controversial, with some considering that transvaginal diagnosis of PCOS is usually made on the basis of a combination of clinical criteria. Ultrasound to be the "Gold standard.[11,12] In contrast, others suggest that the evidence of androgenemia or an elevated concentration of luteinizing hormone (LH) is needed to support the diagnosis of PCOS.[13,14] However, normal serum concentration of luteinizing hormone (LH) does not rule out the diagnosis. The criteria for diagnosis of PCOS based on ultrasonographic data include bilateral ovarian enlargement (>9 cm in maximum diameter), ten or more follicles, 2 to 10 mm in diameter per ovary, and increased density and area of the stroma.[15]

Although the exact etiology is not clear, PCOS is an abnormality of the hypothalamic-pituitary-ovarian system. In PCOS, LH is tonically elevated throughout the menstrual cycle, FSH is normal or low, and the LH/FSH ratio is often greater than 3 (>3).[16] In obesity (high BMI), excessive fat tissue mass causes chronic hyperinsulinemia and/or insulin resistance leading to stimulation of theca cells and excessive ovarian androgen production, which in turn inhibits sex hormone-binding globulin (SHBG) production. As a result, there is an increased free testosterone level, which is changed to estrogen by peripheral conversion in fat or brown tissues. The excessive estrogen level alters the synaptic and postsynaptic membrane function in the arcuate nucleus and possibly other centers in the brain. This results in a disturbed LH secretion pattern.[17] In this study, we have measured LH/FSH ratio in relation to the BMI of PCOS women who are infertile.

In clinical practice, it is difficult to use a single measurement of LH to diagnose PCOS because LH is secreted in a pulsatile manner, and the normal range of serum LH concentration decreases with increasing BMI.[18] In addition, nomograms for interpreting the impact of BMI on LH levels are not widely available in clinical practice. A recent study suggests an inverse relationship between LH and BMI in PCOS as modified by BMI.[19]

Materials and Methods

This cross-sectional study was conducted from January 2007 to July 2007 for six months in the obstetrics and gynecology department, DMCH, Bangladesh. a total number of 58 patients were included in the final analysis. About 25 patients were selected from DMCH, and the rest of the patients selected from the BSMMU infertility clinic was enlisted for the study. Those clinically presented as obese, hirsute, and menstrual disturbances. They were non-smokers and had not been on any medications for the last three months before the study. Age groups <20 and >40 years, non-PCOS with infertility, and non-obese patients were excluded from the study. Mean, SD, t-test, p-value, and correlation were measured for statistical analysis. Data analysis will be done by SPSS. Hormone analysis was done by Radio Immunoassay (RIA) method.

Results

Among the total 58 patients selected in the final analysis, BMI in the range of 25-28 kg/m^2 BSA in the highest frequency in 44 cases (75.9%) and 31-34 kg/m^2 BSA in 5 cases (6.6%).

Table-1: Frequency distribution of study subjects with BMI.

BMI- In kg/m^2 BSA	Frequency	Percentage(%)
25-28	44	75.9
29-31	09	15.5
32-34	05	8.6
Total	**58**	**100**

Average BMI= 27.48±2.25

Table-2: shows that out of 58 cases normal LH level group had 25 cases (43.1%), and the high-level group had 33 cases (56.9%)

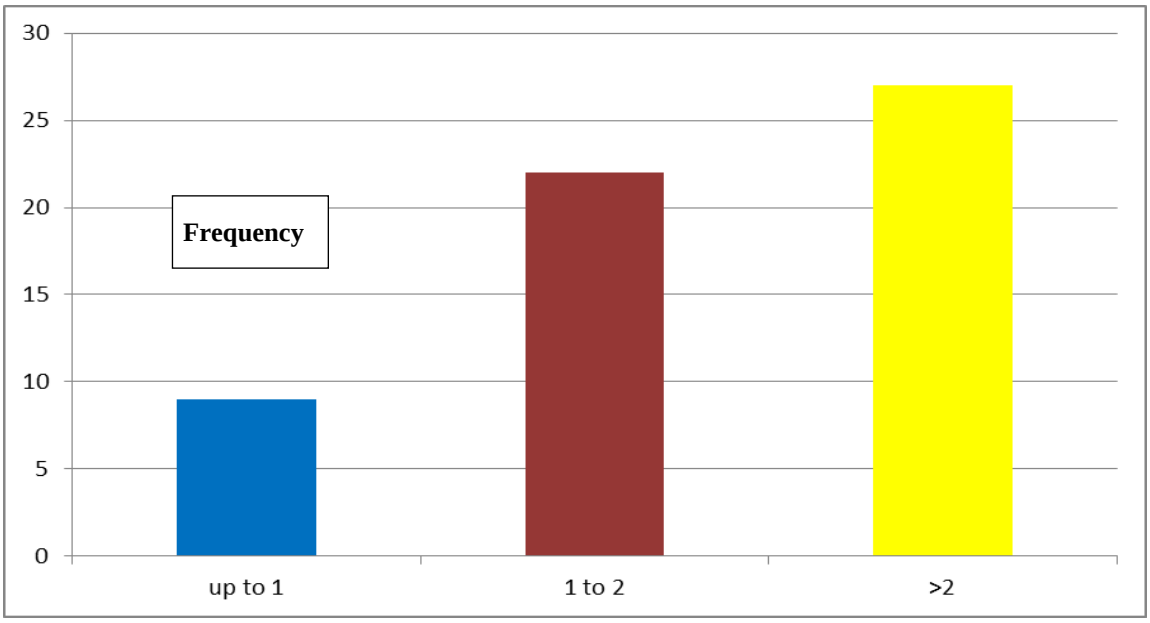
Table-2: Distribution of study subjects with LH level.

LH level group	Frequency	Percentage(%)
Normal LH group	25	43.1
High LH group	33	56.9
Total	**58**	**100**

In table-3 and fig.1showed, out of 58 patients LH/FSH ratio >2 in 27 cases (46.66%), 1 to 2 in 22 cases (37.9%) and upto 1 in 9 cases (15.5%).

Table-3: Distribution of study subjects with LH/FSH ratio.

LH/FSH ratio	Frequency	Percentage (%)
Up to 1	09	15.5
1 to 2	22	37.9
> 2	27	46.6
Total	**58**	**100**



LH/FSH Ratio

Figure-1: Column graph showing the frequency of study subjects with LH/FSH ratio

The correlation between BMI and LH showed in Fig. 2 as a graph. LH amplitude in a single measurement randomly showed at BMI group 25-28 kg/m2, a higher level is obtained, though many of the cases show lower levels higher than average compared to higher BMI groups (e.g., 28-34 kg/m2 groups). LH amplitude is inversely dependent on BMI (γ=0.218, P<0.003).

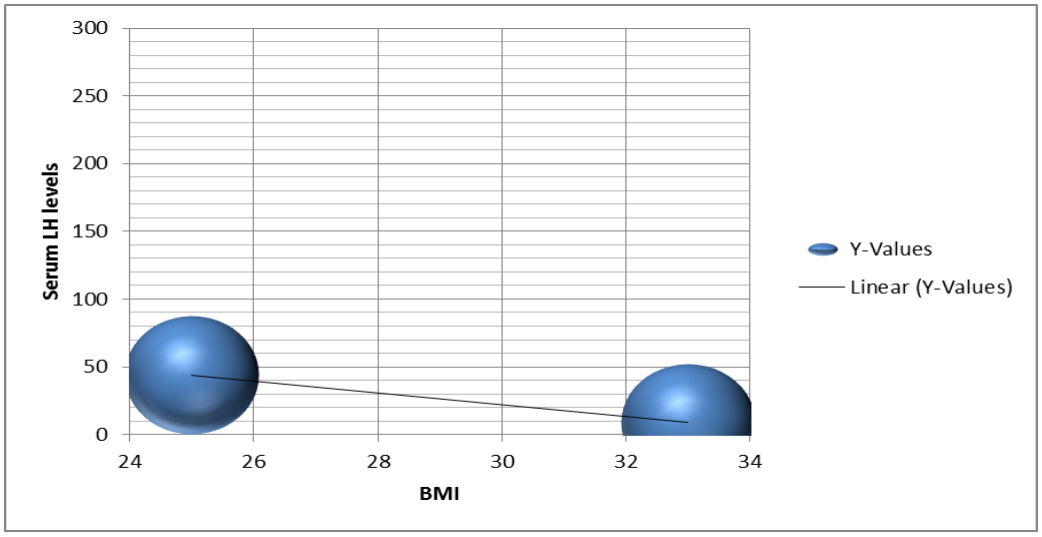


Figure-2. Graph showing the correlation between BMI and LH level.

Table 4 shows a correlation between BMI and LH/FSH ratio. BMI group and LH/FSH ratio cross-tabulation are done. Here BMI group 25-28 showed LH/FSH ratio >2 in 21 cases in 28-31 group 4 cases and 31-34 group only 2 cases. LH/FSH ratio was inversely correlated with BMI for PCOS women (γ=0.21, P<0.009).

Table-4: Correlation between BMI group and LH/FSH ratio.

BMI group kg/m^2	LH:FSH ratio			Total	Value(ɣ)
	Up to 1	1-2	>2		
25-28	7	16	21	21	**-0.21**
28-31	2	3	4	4	
31-34	0	3	2	2	
	9	22	27	58	

Discussion

This study was carried out to determine BMI, blood LH level, LH: FSH ratio, and correlation of BMI with LH and LH: FSH ratio in USG-diagnosed PCO patients. PCOS patients with features of gaining weight, hirsute and menstrual problems at a time or any of these features are regarded as for inclusion criteria. Polycystic ovarian syndrome clearly includes a spectrum of diseases. In our study, the study subjects did not show all the classical manifestations in every case of PCO given by Stein and Leventhal (1935) at a time. More than 20% of cases show all three classical manifestations in this study. The prevalence age in our study is 20-30 years (77.6%) which is the common age of presentation according to literature.[20]

LH/FSH ratio is considered normal up to 1. In this study, 46.6% of cases showed LH/FSH ratio>2 (Table-1), which is consistent with many studies done in our country and abroad.[21] About 84.5% of the subjects had an LH level more than the FSH level. BMI is a marker of obesity. More than 25kg/m^{2}is regarded as overweight, and >27kg/m^2 BSA is considered obesity. In our study, we had chosen the cases who were gaining weight. Here 75.9% of cases showed BMI in the range of 25-28 kg/m^2 BSA, and only 8.6% of patients were in the range of 31-34 kg/m^2 BSA. The average was 27.48±2.25, and they were obese. This finding is consistent with the many studies done abroad as obesity is a common finding[22] as well as in our country, though the limitation here is that only weight gainers were included.

The elevated mean serum concentration of luteinizing hormone (LH) is common in all reported series of women with polycystic ovary syndrome[..9,23] LH is secreted in a pulsatile manner. No single measurement in 24 hours can predict the original result. Though wide variations in its blood level at different times (range 1.2-2.5 min/m^2), which was our limitation as a cross-sectional study and randomized collection of LH levels. LH pulse amplitude in 24 hours could not be measured in our country due to high cost as well as time-consuming. But we found that 56.9% had high levels, and 43.1% of cases had normal levels. This is consistent with other studies.[24] This result would be less important because of the pulsatile nature of LH secretion for identifying PCOS as a marker than the LH/FSH ratio.

The blunting effect of BMI on amplitude (Graph-1) in PCOS women showed inversely related (ɣ=-0.218, P<0.003). This may explain the heterogeneity of inappropriate gonadotropin secretion observed in the previous studies.[10,13,23] The present study showed that with a BMI of 25kg/m^2, mean LH pulse amplitude was elevated approx. 27 fold than that BMI of 30kg/m^2. Though a single measurement is a limitation and there is no control group, the result would not have been appropriate, but we saw the result consistent with the previous studies.[25]

FSH levels for PCO women were not taken into account as they have little value. The decline of LH/FSH ratio (Table-4) with increasing adiposity (ɣ=-0.21, P<0.009) suggests an inverse influence of BMI, and the elevated LH will not be consistently disclosed in PCOS women with BMI greater than 30kg/m^2. Though the study subjects

were small, the results are consistent with the previous studies. However, we propose that measurements of LH and FSH remain clinically meaningful if the negative influence of BMI is taken into account.

Conclusion

Assessments of basal LH levels and the LH/FSH ratio in hyperandrogenic anovulatory women would be clinically meaningful when BMI is taken into account.

Conflict of interest: None declared

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