International Journal of Biochemistry Research & Review
9(1): 1-6, 2016, Article no.IJBcRR.21676
ISSN: 2231-086X, NLM ID: 101654445

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LH/FSH, BMI and Clinical Profile in Polycystic Ovarian Syndrome: A Correlative Study

Hifsa Mobeen[1*], Hamdan Hamid[1], Almina Shafiq[1], Muhammad Adil[1], Muhammad Kashif[1] and Noshin Wasim Yousuf[2]

[1]Department of Immunology, University of Health Sciences Lahore, Pakistan.
[2]Department of Pathology, Allama Iqbal Medical College Lahore, Pakistan.

Authors' contributions

This work was carried out in collaboration between all authors. Authors HM and NWY designed the study. Authors HH, MK and HM, wrote the protocol and wrote the first draft of the manuscript. Authors HH, HM, MA and AS managed the literature searches, analyses of the study. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJBCRR/2016/21676
Editor(s):
(1) Chunying Li, Department of Biochemistry and Molecular Biology Wayne State University School of Medicine, Detroit, USA.
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Reviewers:
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(3) Anonymous , Erzincan University, Turkey.
Complete Peer review History: http://sciencedomain.org/review-history/12208

Original Research Article

Received 28th August 2015
Accepted 20th October 2015
Published 9th November 2015

ABSTRACT

Background and Objectives: Polycystic ovarian disease (PCOS) is probably the most prevalent endocrinological disorder affecting females and is the most common cause of menstrual disturbance during the reproductive age. It is characterized by polycystic ovaries on ultrasound and/or clinical and biochemical signs and symptoms of hyperandrogenism and/or oligo- anovulation. Therefore, this study was designed to determine relationship among LH/FSH ratio, BMI and the clinical profile of females suffering from PCOS.
Materials and Methods: Blood samples from 50 study subjects were taken after getting informed consent for hormone profile (FSH and LH) by ELISA kit of Kamiya Biomedical company. Body Mass index (BMI) and Ultra-sonogram related findings of polycystic ovarian syndrome patients were recorded. Statistical analysis was done by using SPSS-20.

**Corresponding author: E-mail: Hifsamobeen035@gmail.com;*

Results: LH/FSH values were significantly higher among infertile and fertile females (P=0.05). BMI was also significantly correlated statistically in female patients with and without hirsutism (P=0.005). BMI (P=0.00) and LH/FSH (P=0.004) were also found to be associated significantly with obesity in patients with PCOS.
Conclusion: Since FSH was significantly correlated with obesity and infertility while BMI was associated with obesity and hirsutism among the clinical profiles, lifestyle interventions to decrease the overweight and obesity would be able to reduce the unwanted clinical symptoms of infertility and hirsutism in females with polycystic ovary syndrome.

Keywords: Polycystic ovarian syndrome; FSH; LH; BMI; polycystic ovaries; obesity; hirsutism; oligomenorrhea; amenorrhea.

1. INTRODUCTION

Polycystic Ovarian Syndrome (PCOS) is probably the most prevalent endocrinological disorder affecting females and it is the most common cause of menstrual disturbance during the reproductive age. It is characterized by presence of polycystic ovaries on ultrasound and/or clinical & biochemical signs of hyperandrogenism and/or oli-anovulation [1].

PCOS was first described by Stein and Leventhal in 1935 in women with of PCOS is multifactorial and complex. The disease has genetic basis affected by environmental factors [2,3].

Obesity is an important risk factor for PCOS. Literature review shows that 30-70% of PCOS females are obese, though disease is also seen in females of normal weight but with less frequency. The presence of obesity markedly modifies the clinical and biochemical expression of disease and makes the management of the syndrome very difficult [4].

World Health Organization (WHO) and National Institute of Health (NIH) criteria defined obesity; underweight as body mass index (BMI) < 18.5, normal weight as BMI between 18.5-24.9, overweight as BMI between 25-29.9 and obesity as a BMI of 30 or greater. Obesity is further divided into class 1 (BMI 30-34.9), class ll (BMI 35-39.9) and class lll (BMI > 40) [5].

When defined by the presence of oligomenorrhea and hyperandrogenism, 75% of women with PCOS have an LH level that is above the normal range for women in the early follicular phase and 94% have an increased LH to FSH ratio [6].

However, further studies have demonstrated an inverse relationship between LH and body weight that is continuous across a wide spectrum of body weights in PCOS patients, supporting the model of an intrinsic neuroendocrine abnormality in all oligomenorrheic PCOS patients that is modified by obesity [7,8].

Moreover, manifestations of PCOS may include menstrual irregularities, obesity and elevated serum LH levels [9].

The characteristic increase in LH relative to FSH release, have long been appreciated in PCOS. Because of the pulsatile nature of their release, a single test fails to detect an increased LH/FSH ratio. This, as well as its lack of specificity, has led to the recommendation that LH/FSH ratios not be included in the diagnostic criteria for PCOS [10,11].

Approximately half of PCOS women are obese or overweight and obesity has important role in the development of the Hyperandrogenic state [12] [13]. Even those with normal BMI, PCOS sufferers tend to have android body type with waist to hip ratio greater than 0.8 [14].

The study is designed to demonstrate a correlation/ association among LH/FSH ratio, BMI, and the clinical profile of females suffering from PCOS.

2. MATERIALS AND METHODS

2.1 Subjects

It was a comparative study, carried out in the Department of Pathology, Allama Iqbal Medical College Lahore after approval of Ethical Review Committee. The samples were taken from Infertility clinic of Obstetrics and Gynaecology Department of Jinnah Hospital, Lahore. Purposive sampling technique was used and a total of 50 subjects were recruited for this study after an informed consent. The study included all diagnosed cases of females of reproductive age,

married or unmarried presenting with clinical features of PCOS confirmed on Ultrasound. Patients with hyperandrogenism and anovulation other than PCOS like Cushing syndrome, un-treated hypo or hyperthyroidism, ovarian tumors and adrenal hyperplasia/tumors were excluded from the study.

At the time of sample collection, relevant details of each participant such as age, sex, and clinical features of disease were noted. The detail about their ultrasonic findings and BMI was also noted. Samples were processed for fertility hormone profile by sandwich ELISA technique of Kamiya Biomedical Company with sensitivity of 0.48 miu/ml and high specificity without cross reactivity.

Statistical analysis: The data was entered and analyzed using IBM SPSS 20.0. Mean±SD was used for quantitative variables. Qualitative variables were expressed as frequencies, percentages and graphs. For normally distributed data one way ANOVA and for not normally distributed data Kruskal-Walis test was applied. Post Hoc Tukey test was applied to observe which group means differ in various groups. A p-value of ≤ 0.05 was considered as statistically significant.

3. RESULTS

When BMI, FSH and LH were compared between fertile and infertile femles, FSH was significantly correlated with infertility shown in Table 1.

Table 1. Comparison of BMI, FSH, LH b/w fertile and infertile females

		N	Mean±SD	P- value
BMI	Infertility	25	27.52±5.39	0.55
	Fertility	5	26.48±6.70	
FSH	Infertility	25	8.49±3.98	0.05
	Fertility	25	6.60±2.63	
LH	Infertility	25	10.40±7.98	0.09
	Fertility	25	14.24±7.80	

When BMI, FSH and LH were compared between menstrually disturbed and undisturbed females, there was no significant difference between two groups shown in Table 2.

When BMI, FSH and LH were compared between females with hirsutism and without hirsutism, BMI is significantly associated with hirsutism shown in Table 3.

When BMI, FSH and LH were compared between females with oligomenorrhea and without oligomenorrhea, there was no significant difference between two groups shown in Table 4.

Table 2. Comparison of BMI, FSH, LH b/w menstrually disturbed and undisturbed females

	History of menstrual disturbance	N	Mean±SD	P-value
BMI	No disturbance	1	23.9±6.09	0.609
	Disturbance	49	27.06±6.09	
FSH	No disturbance	1	10.50±3.48	0.397
	Disturbance	49	7.48±3.48	
LH	No disturbance	1	21.4±8.02	0.259
	Disturbance	49	12.13±8.02	

Table 3. Comparison of BMI, FSH, LH b/w females with hirsuitism and without hirsutism

	Hirsutism	N	Mean±SD	P- value
BMI	No hirsutism	19	23.98±4.60	0.005
	Hirsutism	31	28.85±6.13	
FSH	No hirsutism	19	6.93±3.30	0.331
	Hirsutism	31	7.92±3.58	
LH	No hirsutism	19	9.78±7.79	0.081
	Hirsutism	31	13.87±7.43	

When BMI, FSH and LH were compared between females with amenorrhea and without amenorrhea, there was no statistically significant difference between two groups shown in Table 5.

When BMI, FSH and LH were compared between females with menopause and without menopause, there was no statistically significant difference between two groups shown in Table 6.

When BMI, FSH and LH were compared between females with acne and without acne, there was no statistically significant difference between two groups shown in Table 7.

When BMI, FSH and LH were compared between females with and without obesity, BMI and FSH were significantly correlated with obesity shown in Table 8.

Table 4. Comparison of BMI, FSH, LH and oligomenorrhea

	Oligomenorrhea	N	Mean±SD	P- value
BMI	No	20	27.58±6.29	0.586
	oligomenorrhea	30	26.62±5.95	
FSH	No	20	8.18±3.10	0.298
	oligomenorrhea	30	7.12±3.69	
LH	No	20	13.77±8.42	0.302
	oligomenorrhea	30	11.35±7.78	

Table 5. Comparison of BMI, FSH, LH and amenorrhea

	Amenorrhea	N	Mean±SD	P-value
BMI	NO	47	26.9±5.99	0.810
	amenorrhea	3	27.8±8.31	
FSH	NO	47	7.70±3.51	0.200
	amenorrhea	3	5.03±1.33	
LH	No	47	12.45±8.16	0.643
	amenorrhea	3	10.20±6.97	

When BMI, FSH and LH were compared between patients with and without regular menstrual periods, there was no statistically significant difference between two groups shown in Table 9.

Table 6. Comparison of BMI, FSH, LH and menopause

	Menopause	N	Mean±SD	P-value
BMI	No	49	26.98±6.10	0.870
	Yes	1	28.00±6.10	
FSH	No	49	7.58±3.50	0.617
	Yes	1	5.80±3.50	
LH	No	49	12.41±8.10	0.559
	Yes	1	7.60±8.10	

Table 7. Comparison of BMI, FSH, LH b/w patients of acne and without acne

	Acne	N	Mean ±SD	P- value
BMI	No	20	27.34±6.63	0.75
	Acne	30	26.78±5.73	
FSH	No	20	8.50±4.09	0.112
	Acne	30	6.90±2.90	
LH	No	20	11.05±7.92	0.368
	Acne	30	13.16± 8.15	

4. DISCUSSION

In the current study, FSH, LH and BMI were compared among different groups of PCOS categorized on the basis of fertility, menstrual disturbance, hirsutism, oligomenorrhea, amenorrhea, menopause, acne, obesity and regular menstrual periods. FSH was significantly correlated with obesity and infertility while BMI was associated with obesity and hirsutism.

Table 8. Comparison of BMI, FSH, LH b/w patients with obesity and without obesity

	Obesity	N	Mean±SD	P- value
BMI	No	15	20.6±3.85	0.00
	Obesity	35	29.7±4.63	
FSH	No	15	6.06±2.96	0.04
	Obesity	35	8.18±3.52	
LH	NO	15	11.82±7.88	0.77
	Obesity	35	12.53±8.22	

Table 9. Comparison of BMI, FSH, LH b/w patients with regular menstrual periods and without regular menstrual periods

	Regular menstrual period	N	Mean±SD	P-value
BMI	No	49	26.9±6.10	0.870
	Yes	1	28.00±6.10	
FSH	No	49	7.58 ±3.50	0.617
	Yes	1	5.80±3.50	
LH	No	49	12.41±8.10	0.559
	Yes	1	7.600±8.10	

The current study is partially in agreement with the studies of Olooto et al. (2012) [15] who find statistical significant difference in FSH (P=0.00) and LH (P=0.00) but not in BMI (P=0.554) between fertile and infertile females. In our study only FSH is statistically significant between infertile and fertile females (P=0.05).

When FSH, LH and BMI were compared between females with and without menstrual disturbance, there was no statistically significant difference between two groups. The current study is in accordance with the studies of Abdulrazak et al. [16] and Dimitrios Panidis et al. (2015) but is partially in agreement with the study

conducted by Manal Ibrahim Mahmoud et al. (2015) who find statistical significant difference in BMI (P=0.006) but not in FSH and LH.

BMI is significantly different between females with and without hirsutism (P=0.005) that is not in agreement with the studies of Farid-ur-rehman et al. [17] (P>0.05). FSH and LH values are insignificant between these groups that is also not in accordance with the studies of Shazia Rasool et al. [18] (P<0.05).

FSH, LH and BMI were compared between females with and without oligomenorrhea, no statistically significant difference is found that is partially in accordance with the studies of Singer et al. [19] whose studies FSH and LH were significantly higher in patients with oligomenorrhea (P<0.001) but no significant difference in BMI that is similar to current study. The current study is also partially in agreement with the study conducted by Manal Ibrahim Mahmoud et al. (2015) who find significant difference in BMI (P=0.006) but not in FSH and LH.

The current study is partially in agreement with the study of Shazia Rasool et al. [18]. FSH and LH were significantly different between females with and without amenorrhea that is not similar to the current study. BMI was not significantly different between these groups that is similar to the current study.

According to Ewenighi Chinwe et al. [20] BMI, FSH and LH were statistically significant (0.000) between these groups with and without menopause that is not in accordance with current study.

The current study is in agreement with the study of Sayera Begum et al. [21] who also found no difference in LH, FSH and BMI (P>0.05).

BMI (P=0.00) and FSH (P=0.04) are statistically significant between females with and without obesity but no difference is found in LH that is partially in agreement with the study of Abdulrazak et al. [16] who could not found any statistically significant difference in FSH, LH and BMI and study of Manal Ibrahim Mahmoud et al. (2015) who find significant difference in BMI (P=0.006), FSH (P=0.048) and LH (P=0.036).

According to Abdulrazak et al. [16] there was no statistically significant difference in LH, FSH and BMI in females with and without regular menstrual periods that is in accordance with the current study.

5. CONCLUSIONS

Since FSH was significantly correlated with obesity and infertility while BMI was associated with obesity and hirsutism among the clinical profiles, lifestyle interventions to decrease the overweight and obesity would be able to reduce the unwanted clinical symptoms of infertility and hirsutism in females with polycystic ovary syndrome.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/12208