

A STUDY TO CORRELATE CLINICAL FEATURES WITH ENDOCRINOLOGICAL PARAMETERS IN ULTRASOUND DIAGNOSED POLYCYSTIC OVARIES

Vinaya G¹, Surekha S M², Dhanalakshmi¹, Shivaganga Chiniwal³

¹Assistant Professor, Department of OBG, Koppal Institute of Medical Sciences, Koppal, Karnataka, India

²Associate Professor, Department of OBG, Koppal Institute of Medical Sciences, Koppal, Koppal, Karnataka, India

³DNB Faculty and Consultant, Taluka Hospital Gangavathi, Karnataka, India

Received : 15/03/2023
Received in revised form : 23/04/2023
Accepted : 27/05/2023

Keywords:

Correlation, Clinical Features, Endocrinological Parameters, Ultrasound Diagnosed Polycystic Ovaries

Corresponding Author:

Dr. Shivaganga Chiniwal,

Email: shivagangachiniwal@gmail.com

DOI: 10.47009/jamp.2023.5.3.201

Source of Support: Nil,

Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5(3); 977-982



Abstract

Background: Polycystic ovarian syndrome is a common heterogenous endocrinological disorder that occurs in 5-10% of women in reproductive age group. Because of the heterogenicity of PCOS, ultrasound alone cannot be used for diagnosis. It should therefore be examined to what extent assessment of ovarian changes by sonography may contribute to diagnosis of PCOS based on endocrine and clinical observation. The objective is to correlate clinical features with endocrinological parameters in ultrasound diagnosed polycystic ovaries. **Materials and Methods:** This cross-sectional analytical study was carried out among women with polycystic ovaries on ultrasonographic examination reporting to the Gynaecology Outpatient Department at ESIC MC PGIMS Rajajinagar Bangalore between November 2015 to April. **Result:** The maximum number of cases (74%) in the present study were found in the age group of 20-30 years. The most common symptom was oligomenorrhea(64%). Serum level of testosterone was raised in 84% of cases of which it correlated with high BMI values(p value-0.02) and menstrual symptoms like amenorrhea (p value -0.01) and menorrhagia (p value -0.04). Serum LH was abnormal in 46% of cases. p value of Serum LH in patients with high WHR was 0.05 which was statistically significant. The LH/FSH ratio was found to be increased in patients presenting with polymenorrhea, mean value being 14.1. p value <0.001, which was statistically significant. Mean value of Serum TSH was raised in patients presenting with menorrhagia (6.4 mIU/ml) p value 0.003, which was statistically significant. FG score was high in 22% cases. **Conclusion:** High BMI was found in 78% of cases and found to have good correlation with raised serum testosterone levels, p value being 0.02, which is statistically significant. Total testosterone was elevated in 84% of cases and proved to be the best hormonal marker of PCOS.

INTRODUCTION

Polycystic ovary syndrome (PCOS) is the most common endocrinopathies affecting women of reproductive age.^[1] It affects approximately 5 % to 10% of women in reproductive age group.^[2] However the prevalence rate as high as 26% has been reported.^[3] It is a disorder that affects the reproductive, endocrine and metabolic systems.^[4] PCOS is characterized by chronic anovulation and hyperandrogenism.⁵ It is a heterogenous endocrine and metabolic disorder, associated with menstrual disorders, infertility, obesity, hirsutism and insulin resistance. The disorder varies from mild presentation to severe disturbances of endocrine, metabolic and reproductive functions.

Several criteria have been proposed to define PCOS. Among which Rotterdam Criteria (2003),^[6] has been widely used to define PCOS, hence has been included in this study. It includes any two of the following three parameters to define PCOS.

- Oligo or anovulation
- Clinical and/or biochemical signs of hyperandrogenism.
- Polycystic ovaries as identified by ultrasonography (12 or more follicles measuring 2- 9mm in diameter, or increased ovarian volume >10mm³ in each ovary), with exclusion of other etiology of hyperandrogenism (e.g. congenital adrenal hyperplasia, androgen secreting tumors, Cushing's syndrome).

In 2006, Androgen Excess Society (AES) laid more emphasis on hyperandrogenism and defined PCOS

as a hyperandrogenic disorder (clinical and /or biochemical) with either ovulatory dysfunction or polycystic ovarian morphology.^[4]

In 2009, According to the AE-PCOS Society Task Force, PCOS should be defined by the presence of hyperandrogenism (clinical and/or biochemical), ovarian dysfunction (oligo-anovulation and/or polycystic ovaries), and the exclusion of related disorders.^[7]

However, the syndrome cannot be explained easily by a single unifying hypothesis, and appears to be a complex interplay of genetic, epigenetic and environmental factors. Newer developments in molecular biology and bio informatics should lead to better understanding of this complexity.

Many normal, healthy women in the general community will have the classical ultrasound appearance of polycystic ovaries but no relevant symptoms. A distinction needs to be made between those women with polycystic ovaries and no symptoms and those with symptoms and signs sufficient to warrant the diagnosis of PCOS.

Hence the present study to correlate clinical features with endocrinological parameters in ultrasound diagnosed polycystic ovaries.

MATERIALS AND METHODS

This cross-sectional analytical study was carried out among women with polycystic ovaries on ultrasonographic examination reporting to the Gynaecology Outpatient Department at ESIC MC PGIMSR RAJAJINAGAR BANGALORE between November 2015 to April.

Sample Size: Patients with confirmed polycystic ovaries on ultrasonography (minimum of 50 cases). Hospital incidence is 80-100 cases per year.

Method of Collecting Data: Women with polycystic ovaries fitting into inclusion criteria are recruited into this study after obtaining written informed consent.

Inclusion Criteria

- Age between 18-35 years.
- History of infertility/menstrual disturbance/hirsutism.
- Patients with polycystic ovaries on ultrasound.

Exclusion Criteria

- Patients with PCOS on treatment
- Pregnant women

Methodology

Patients presenting with history of menstrual disturbance, infertility, or hirsutism to outpatient department of gynaecology at ESIC MC PGI MSR are subjected to pelvic ultrasonography. The patients with polycystic ovaries on ultrasonography fitting into the inclusion criteria are recruited into this study.

These patients are evaluated on outpatient basis after obtaining detailed menstrual, obstetric and medical history. Menstrual pattern was characterized as regular (cycles recurring every 21–35 days),

oligomenorrhea (cycle length over 35 days and under six months), polymenorrhea (cycles occurring more frequently than every 21 days), menorrhagia (heavy menstruation requiring intervention) and amenorrhoea (absence of menstruation for six months or longer). Fertility status was classified as fertile (had a previous pregnancy with no subsequent infertility), infertile (primary or secondary infertility of at least 1 year duration) and unproven (pregnancy not attempted). The clinical examination, apart from general examination, focused on the assessment of androgen status (hirsutism, temporal recession of hair, acne) and evidence of acanthosis nigricans.

Anthropometric measurements like height in centimeters, weight in kg, BMI>25 is taken as significant. Waist circumference, Waist hip ratio>0.88 is taken as significant. Ferriman and Gallwey scoring system is used to assess hirsutism and a score of 7 or more is taken as significant.

Ultrasonography is done by trained radiologist using Philips HD6 ultrasound machine with a probe of 2-5MHz. Presence of 12 or more follicles in each ovary measuring 2–9 mm in diameter, and/or increased ovarian volume (>10 mL) is taken as significant.

Ovarian volume is calculated by measuring diameters in three dimensions using the formula: Ovarian volume = 0.5 x length x width x thickness.

Laboratory evaluation includes baseline investigations like complete blood count, liver and renal function tests, random blood sugars, oral glucose tolerance test and lipid profile.

Specific investigations like serum LH, FSH and serum total testosterone is assessed by standard techniques in laboratory (Done in Beckman coulter by chemiluminescence immuno assay).

Blood sample for serum LH, FSH and serum total testosterone is taken in fasting state in early follicular phase (day 3 to day 5).

After correlating clinical features with endocrinological parameters patients are managed accordingly.

Statistical Analysis

Descriptive analysis of variable data are expressed as mean and standard deviation (SD). Inferential analysis is done by using Pearson correlation coefficient (r) and student t test. P value of 0.05 is taken as significant. Mean values of endocrinological parameters are compared with clinical features using student t test.

RESULTS

74% of cases in the present study were found in the age group of 20-30 years. 16% were < 20 years and 10% were > 30 years. The youngest was 18 years and oldest was 33 years.

The patients presented with various clinical symptoms like Menstrual irregularities (Amenorrhea, Oligomenorrhea, Polymenorrhea,

Menorrhagia), Infertility, Acne and Hirsutism. The most common symptom was oligomenorrhea (64%). In the present study, among the menstrual irregularities, 64% had oligomenorrhea, 14% had amenorrhea, 6% had menorrhagia, 2% had

polymenorrhea. The menstrual cycles were found to be normal in 14% of cases.

In the present study, high waist-to-hip ratio (>0.88) was found in 28% of cases, High BMI (>25) was found in 78% of cases and high FG score (>7) in 22% of cases.

Table 1: Hormonal profile of 50 PCO patients

	Normal		Increased	
	Number of cases	Percentage	Number of cases	Percentage
LH	27	54%	23	46%
FSH	29	58%	21	42%
LH/FSH	28	56%	22	44%
Testosterone	8	16%	42	84%
TSH	45	90%	5	10%

Table 2: Comparison of hormone values with amenorrhoea

Sl. No.	Hormone	Amenorrhoea		p value#
		NoMean (SD)	YesMean (SD)	
1	LH (mIU/ml)	11.2 (5.3)	10.5 (5.8)	0.74
2	FSH (mIU/ml)	4.7 (2.3)	5.0 (1.8)	0.75
3	LH/FSH	3.7 (2.9)	2.6 (2.9)	0.42
4	Testosterone(ng/ml)	1.4 (0.5)	2.0 (0.3)	0.01*
5	TSH(mIU/ml)	3.1 (1.9)	3.6 (2.1)	0.62

Note: # p value based on independent sample t test, SD-standard deviation, * statistically significant (p<0.05)

In the present study, serum levels of LH,FSH,LH/FSH ratio,Testosterone,TSH were measured in patients with and without amenorrhea. Mean value of Serum testosterone was raised (2.0ng/ml) in patients presenting with amenorrhea. P-value being 0.01, hence statistically significant.

Table 3: Comparison of hormone values with oligomenorrhoea

Sl. No.	Hormone	Oligomenorrhoea		p value#
		NoMean (SD)	YesMean (SD)	
1	LH(mIU/ml)	11.3 (5.2)	10.9 (5.5)	0.80
2	FSH(mIU/ml)	4.9 (2.5)	4.6 (2.1)	0.66
3	LH/FSH	3.8 (3.7)	3.3 (2.4)	0.54
4	Testosterone(ng/ml)	1.6 (0.4)	1.4 (0.6)	0.18
5	TSH(mIU/ml)	3.7 (2.3)	2.9 (1.6)	0.17

Note: # p value based on independent sample t test, SD-standard deviation

In the present study, comparison of serum levels of LH, FSH, LH/FSH ratio, testosterone and TSH in patients presenting with oligomenorrhoea is not statistically significant.

Table 4: Comparison of hormone values with polymenorrhoea

Sl. No.	Hormone	Polymenorrhoea		p value#
		NoMean (SD)	YesMean (SD)	
1	LH(mIU/ml)	10.9 (5.3)	18 (5.3)	0.19
2	FSH(mIU/ml)	4.8 (2.2)	1.2 (2.2)	0.12
3	LH/FSH	3.3 (2.5)	14.1 (2.9)	<0.001*
4	Testosterone (ng/ml)	1.5 (0.5)	0.9 (0.5)	0.30
5	TSH(mIU/ml)	3.2 (1.9)	2.9 (1.9)	0.87

Note: # p value based on independent sample t test, SD-standard deviation, * statistically significant (p<0.05)

Serum levels of LH, FSH, LH/FSH ratio, Testosterone, TSH were measured in patients with and without polymenorrhoea. The LH/FSH ratio was found to be increased in patients presenting with polymenorrhoea. p value <0.001, hence statistically significant.

Table 5: Comparison of hormone values with menorrhagia

Sl. No.	Hormone	Menorrhagia		p value#
		NoMean (SD)	YesMean (SD)	
1	LH(mIU/ml)	10.9 (5.4)	13.1 (3)	0.51
2	FSH(mIU/ml)	4.7 (2.2)	5.6 (3.6)	0.52
3	LH/FSH	3.4 (2.9)	4.6 (3.6)	0.50
4	Testosterone(ng/ml)	1.4 (0.5)	2.1 (0.4)	0.04*
5	TSH(mIU/ml)	3.1 (1.6)	6.4 (3.9)	0.003*

Note: # p value based on independent sample t test, SD-standard deviation, * statistically significant (p<0.05) In the present study, serum levels of LH, FSH, LH/FSH ratio, Testosterone, TSH were measured in patients with

and without menorrhagia. Mean value of Serum testosterone was raised in patients presenting with menorrhagia (2.1 ng/ml).p value 0.04,hence statistically significant.

Table 6: Comparison of hormone values with FG score

Sl. No.	Hormone	FG score		p value#
		NormalMean (SD)	HighMean (SD)	
1	LH(mIU/ml)	10.4 (4.3)	13.2 (7.8)	0.12
2	FSH(mIU/ml)	4.7 (2.2)	4.7 (2.5)	0.99
3	LH/FSH	3.3 (2.5)	4.2 (4)	0.37
4	Testosterone (ng/ml)	1.4 (0.5)	1.6 (0.6)	0.35
5	TSH(mIU/ml)	3 (1.8)	3.7 (2.4)	0.31

Note: # p value based on independent sample t test, SD-standard deviation

In the present study, serum levels of LH,FSH,LH/FSH ratio, Testosterone, TSH were compared with FG score of patients. FG score was high in 22% cases.The mean hormonal values in patients with high BMI were as follows, LH-13.2, FSH-4.7,LH/FSH ratio 4.2.Testosterone-1.6 and TSH-3.7.However,p values were not significant.

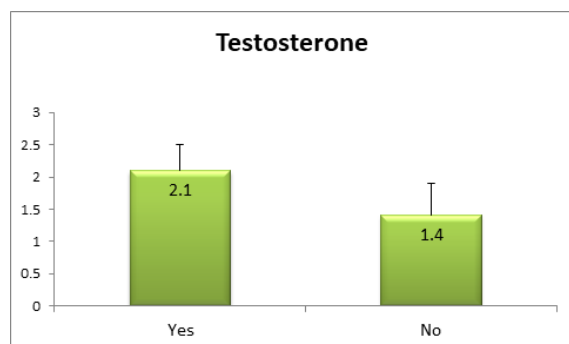


Figure 1: Comparison of serum testosterone in patients with and without menorrhagia

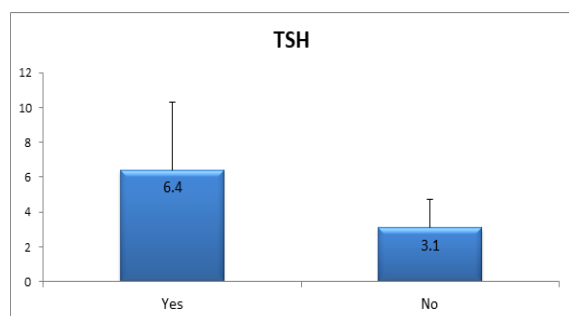


Figure 2: Comparison of serum TSH in patients with and without menorrhagia

Mean value of Serum TSH was raised in patients presenting with menorrhagia (6.4 mIU/ml).p value 0.003, hence statistically significant.

In the present study, serum levels of LH,FSH,LH/FSH ratio, Testosterone, TSH were measured in patients with and without infertility.The mean hormonal values in patients with infertility were as follows, LH-9.8, FSH-4.8,LH/FSH ratio 2.9.Testosterone-1.5 and TSH-2.9.However,p values were not significant.

In the present study, serum levels of LH,FSH,LH/FSH ratio, Testosterone, TSHwere measured in patients with and without acne.The mean hormonal values in patients with acne were as follows, LH-13, FSH-5.3,LH/FSH ratio 2.6.Testosterone-1.5 and TSH-3.1.However,p values were not significant.

In the present study, serum levels of LH,FSH,LH/FSH ratio, Testosterone, TSH were measured in patients with and without hirsutism. The mean hormonal values in patients with hirsutism were as follows, LH-13.1, FSH-4.6,LH/FSH ratio 4.1.Testosterone-1.7 and TSH-3.7.However,p values were not significant.

In the present study, serum levels of LH, FSH, LH/FSH ratio, Testosterone, TSH were compared with BMI of patients. Mean value of serum testosterone with high BMI is 1.5. p value being 0.02 which is statistically significant.

Serum levels of LH,FSH,LH/FSH ratio, Testosterone, TSHwere compared with waist to hip ratio(WHR) of patients. The mean hormonal values in patients with high WHR were as follows, LH-13.4, FSH-5.1,LH/FSH ratio 3.5.Testosterone-1.6 and TSH-3.1.p value ofSerum LH in patients with high WHR was 0.05,hence statistically significant.

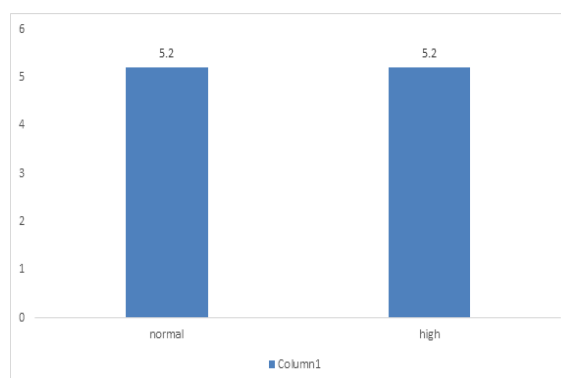


Figure 3: Comparison of LH in patients with normal and high WHR

DISCUSSION

In the present study maximum number of cases(74%) were within age group of 20-30 years with mean age of 23.8 years. Similarly, Turhan NO et al,^[8] noted 24.8 ±0.3 years as the mean age in his study. 27±5 years was the mean age group with Spandana et al.^[9]

The patients presented with various clinical features like Menstrual irregularities (Amenorrhea, Oligomenorrhea, Polymenorrhea, Menorrhagia), Infertility, Acne and Hirsutism.

Oligomenorrhoea (64%) was the most common menstrual symptom in our study, which is also the common symptom observed in other studies. Spandana et al found oligomenorrhea in 59% of cases, 46.4% with Turhan NO et al.^[8]

In our study, 14% of cases had amenorrhoea, 6% menorrhagia, 2% polymenorrhoea and 14% of cases did not have any menstrual symptoms despite being diagnosed as PCO on sonography.

In the present study 24% had hirsutism comparable to the study by Kavitha Mandrelle et al (28.3%).^[10] Hirsutism was seen in 44.2% of cases in the study by Bhattacharya dipankar et al,^[11] Acne was seen in 18% cases in our study which is comparable to Najem et al (12%). Kavithamandrelle et al,^[10] reported 9.2% cases of acne.

In the present study 32% cases had infertility. Turhan NO et al,^[8] found infertility in 50.4% cases. Franks et al,^[12] found infertility in 42% cases.

In our study 78% of cases had BMI > 25 kg/m² comparable with Fouzia Nazir et al (86.5%).^[13] Fauzia Haq et al,^[14] found 68.5% of cases with high BMI.

The mean BMI of our study was 28.9 kg/m² which is comparable to Fouzia Nazir et al,^[13] (27.7±5kg/m²) Bhattacharya dipankar et al,^[11] (28.98 kg/m²) and Kavitha Mandrelle et al (28.19 kg/m²).^[10]

In the present study, increased waist to hip ratio (>0.88) was seen in 28% of cases and in the study by Kavitha Mandrelle et al,^[10] raised waist to hip ratio was seen in 45% of cases.

Increased waist hip ratio was correlating with increased LH, with p value (0.05) being statistically significant. Increased BMI correlated with raised serum testosterone levels p value (0.02) being statistically significant, indicating that obesity being associated with raised testosterone and LH.

In the present study 44% cases had elevated LH/FSH ratio which is comparable to J. Holte et al 15 (41%). Robinson et al found LH / FSH ratio raised in 41-44% of cases. The results are similar to the results derived from our study. Spandana et al⁹ found 35% of cases with elevated LH / FSH ratio.

The LH/FSH ratio was found to be increased in patients presenting with polymenorrhea, mean value being 14.1. p value <0.001, which was statistically significant.

In the present study elevated serum testosterone levels were found in 84% of cases which is comparable to Robinson et al (70%).^[16] Michelmores et al found 60% of cases with elevated testosterone levels.^[3]

Raised Serum testosterone correlated with menstrual symptoms like amenorrhea, menorrhagia and high BMI values.

Robinson et al (1992) and Rahilayousouf et al concluded total testosterone as best hormonal marker for the condition and was the single most

diagnostic test.^[16,17] Total testosterone was the best hormonal marker in our study as well.

In the present study 10% patients had hypothyroidism. Mean value of Serum TSH was raised in patients presenting with menorrhagia (6.4 mIU/ml) p value 0.003, which was statistically significant. Spandana et al found that 22% patients had hypothyroidism. Najem FI9 et al found hypothyroidism in 3% cases.^[18]

CONCLUSION

In the present study, most common presenting symptom was menstrual irregularity, commonest being oligomenorrhea (64%). High BMI was found in 78% of cases and found to have good correlation with raised serum testosterone levels, p value being 0.02, which is statistically significant. Total testosterone was elevated in 84% of cases and proved to be the best hormonal marker of PCOS. However, a larger study is required to exactly find the correlation of different clinical and endocrinological parameters, in ultrasound diagnosed polycystic ovaries.

REFERENCES

1. Kawadzki JK, Dunaif A. Diagnostic criteria for polycystic ovary syndrome: A rational approach. *Polycystic Ovary Syndrome*, Cambridge, Blackwell Scientific MA 1992; 377-84.
2. Jansen E, Laven JS, Dommerholt HB, Polman J, van Rijt C, van den Hurk C, et al. Abnormal gene expression profiles in human ovaries from polycystic ovary syndrome patients. *MolEndocrinol* 2004; 18(12): 3050-63.
3. Michelmores KF, Balen AH, Dunger DB, Vessey MP. Polycystic ovaries and associated clinical and biochemical features in young women. *ClinEndocrinol (Oxf)* 1999; 51: 779-86.
4. Livadas S, Diamanti-Kandarakis E. Polycystic ovary syndrome: definitions, phenotypes and diagnostic approach. *Front Horm Res* 2013; 40: 1-21.
5. Dunaif A. Insulin resistance and the polycystic ovary syndrome, mechanisms and implication for pathogenesis. *Endocr Rev* 1997; 18: 774-800.
6. The Rotterdam ESHRE/ASRM-Sponsored PCOS Consensus Workshop Group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. *FertilSteril* 2004; 81: 19-25.
7. Azziz R, Carmina E, Dewailly D, et al. The androgen Excess and Polycystic Ovary Syndrome Society criteria for the polycystic ovary syndrome: the complete task force report. *FertilSteril* 2009; 91:456-488
8. Turhan NO, Senoz S, Gulekli B, Ozaksit G, Oral H, Gokmen O. Clinical and endocrine features of ultrasound diagnosed polycystic ovary patients: the correlation between ovarian volume and androgen activity. *JPMA. The Journal of the Pakistan Medical Association*. 1993 Jan;43(1):4-6.
9. Spandana JC, Shetty PKK. A study on the clinical, biochemical and hormonal profile of polycystic ovary syndrome patients attending tertiary care hospital. *Int J ReprodContraceptObstetGynecol* 2017;6:1986-92.
10. Mandrelle K, Kamath MS, Bondu DJ, Chandy A, Aleyamma T, George K. Prevalence of metabolic syndrome in women with polycystic ovary syndrome attending an infertility clinic in a tertiary care hospital in south India. *Journal of Human Reproductive Sciences*. 2012;5(1):26-31.
11. B. Dipankar, M. S. Kumar, M. Satinath and P. Mamata, "Clinical Correlation with Biochemical Status in Polycystic

- Ovary Syndrome,” *Journal of Obstetrics & Gynecology of India*, Vol. 55, No. 1, 2005, pp. 67-71
12. Franks S. Polycystic ovary syndrome: a changing perspective. *Clinical Endocrinology (Oxford)* 1989;3 1:87-120
 13. Nazir F, Tasleem H, Tasleem S, Sher Z, Waheed K. Polycystic ovaries in adolescent girls from Rawalpindi [Internet]. [cited 2017 Nov 30]. Available from: http://www.jpma.org.pk/full_article_text.php?article_id=3010
 14. Nawaz FH, Khalid R, Naru T, Rizvi J. Does continuous use of metformin throughout pregnancy improve pregnancy outcomes in women with polycystic ovarian syndrome? *J Obstet Gynaecol Res.* 2008 Oct 1;832-7.
 15. Holte J, Bergh T, Gennarelli G, Wide L. The independent effects of polycystic ovary syndrome and obesity on serum concentrations of gonadotrophins and sex steroids in premenopausal women. *Clin Endocrinol (Oxf)*. 1994 Oct;41(4):473-81.
 16. Robinson S, Rodin DA, Deacon A, Wheeler MJ, Clayton RN. Which hormone tests for the diagnosis of polycystic ovary syndrome? *Br J Obstet Gynaecol.* 1992 Mar;99(3):232-8.
 17. Yousouf R, Khan M, Kounsar Z, Ahangar S, Lone WA. Polycystic Ovarian Syndrome: Clinical Correlation with Biochemical Status. *Surg Sci.* 2012;03(05):245-8.
 18. Zargar AH, Gupta VK, Wani AI, Masoodi SR, Bashir MI, Laway BA, et al. Prevalence of Ultrasonically Proved Polycystic Ovaries in North Indian Women with Type 2 Diabetes Mellitus. *Reproductive Biology & Endocrinology.* 2005;3(25): doi:10.1186/1477-7827-3-35.