

**Effect of Yoga on Clinical, Biochemical and Doppler Parameters in Infertile Women with Polycystic Ovarian Syndrome**Kumari Jyoti<sup>1</sup>, Bindu Bajaj<sup>2</sup>, Sheeba Marwah<sup>3</sup><sup>1</sup>MBBS, MD, Department of Obstetrics & Gynecology, Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India<sup>2</sup>MD, Professor & Head of Department, Department of Obstetrics & Gynecology, Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India<sup>3</sup>DNB Associate Professor, Department of Obstetrics & Gynecology, Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India

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Conflict of interest: Nil

**Abstract:**

**Background:** Polycystic Ovarian syndrome (PCOS) is one of the common endocrine disorders in women with a prevalence range of 2.2% to 26% in India. It is thought to have a complex etiology involving gonadotrophic dysregulation, genetic predisposition and environmental variables. These women can present with varying symptoms such as infertility, menstrual irregularities, hirsutism, acne, polycystic appearing ovaries, and insulin resistance. When it comes to infertility with PCOS, Lifestyle intervention is the first line treatment. There is role of Yoga on the various parameters in infertile women with PCOS.

**Objectives:** To determine the effect of Yoga on clinical, biochemical and Doppler parameters in infertile women with polycystic ovarian syndrome

**Study Design:** A Randomized Comparative study was conducted over a period of 3 months in infertility clinic at Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India, where in first consecutive 50 infertile women fulfilling the Rotterdam Criteria of PCOS were enrolled after taking ethical permission and written informed consent of each participant. They (along with their partners) were evaluated, subjected to baseline investigations and further managed as per routine standard hospital protocol. The study participants were then divided into two groups-Group A undergoing lifestyle modification with dietary changes and exercises, whereas Group B had the same, with additional well-structured Yoga sessions of 45 minutes, thrice a week including Asanas (yoga poses), Pranayama (proper breathing), Shavasana, and Meditation. After 3 months reevaluation was done by repeating biochemical investigations, hormonal levels and Doppler parameters by transvaginal ultrasound. Data of two groups that was not normally distributed was compared using non-Parametric tests (Wilcoxon-Mann-Whitney Test) at each of the time points. Normally distributed data was contrasted with "independent sample t-test" or "One-Way ANOVA". The groups were compared with Chi-squared test in case of categorical information. Pearson's Correlation was conducted to explore linear correlation between two variables (in case of normal distribution of data) and Spearman's correlation was performed (when data is not normally distributed).

**Results:** Significant improvement in glucose tolerance was observed in Group B, even though no change in body weight was noted. Although decrease in testosterone levels ( $p = 0.821$ ) and DHEAS levels ( $p = 0.434$ ) were witnessed, these were not statistically significant. Also, significant differences in Uterine artery Pulsatility index ( $p < 0.001$ ) and Resistance index ( $p = 0.004$ ) were detected in Group B, even though the mean Uterine Artery PSV remained unchanged over time ( $p = 0.262$ )

**Conclusion:** The effect of Yoga on infertile woman with PCOS alters the biochemical and hormonal profile favourably, besides improving blood flow in uterine artery of such women.

**Keywords** Infertility, Polycystic Ovarian Syndrome, Effects of Yoga, Biochemical Hormonal and Doppler Parameters.

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**Introduction**

Polycystic ovary syndrome (PCOS), or Stein Levinthal Syndrome, is one of the most widespread heterogeneous endocrine disorders, with a prevalence of around 19% of women in their

reproductive age across the world [1-6] Some of the common signs of PCOS are non-ovulatory symptoms like infertility, amenorrhea, etc. and elevated androgen level with signs like alopecia,

acne, etc. [2] Hyperandrogenism and hyperinsulinemia are two very important contributors in the pathogenesis of PCOS. To diagnose PCOS in adult women, 2 out of 3 Rotterdam criteria must be fulfilled i.e laboratory/clinical hyperandrogenism, amenorrhea or oligomenorrhoea and polycystic ovaries observed on ultrasound [5-7]. Over the period of time, PCOS has been increasing in Indian women rapidly. If left untreated, it may become a cause for heart disease, diabetes, hypertension, infertility and even cancer. Whole gamut of medical treatments is available to treat PCOS, but most of them lack Food and Drug Administration (FDA) approval for the same. [5-8]

The International Evidence-Based Guideline for the Assessment and Management of PCOS emphasizes lifestyle intervention as the foremost initial management strategy. [9-11] in this fast-paced modern world, since the surfacing of the biopsychosocial model of healthcare, health disciplines have witnessed a plodding shift towards holistic care. [12] Subsequently, when almost everyone is suffering from some kind of psychological morbidities, including anxiety and stress, lifestyle modification including exercise, meditation and Yoga is rapidly being reconnoitred to acquire relief.

The same is being explored for PCOS management too, where it entails physical and breathing exercises that improve emotional and physical health. [6-9] Respiratory and physical yoga poses can improve muscular health and flexibility, while improving oxygen and blood circulation in the body towards all reproductive tissues and cells. [7-9,12-14] Soothing thoughts and relaxation techniques in yoga improve nervous system and reduce triglyceride levels, blood pressure, and control emotions and breathing problems. Yoga regulates endocrine levels, improves reproductive function, and manages neurological hormones and stress. It also elevates excretion of cortisol levels to reduce serum cortisol to improve PCOS symptoms. [3,5,7-9]

However, due to application of yoga exercises in PCOS being novel strategy, and with lack of comprehensive consensus on beneficial impact of Yoga on PCOS, these interventions have not been recommended in the existing guidelines. Keeping

this in mind, along-with paucity of Indian literature regarding the upshots of yoga on clinical, biochemical and Doppler parameters in infertile women, the present study was conceived to investigate the influence of yoga on PCOS symptoms, in order to optimize management of infertile patients.

### Materials and methods

A Randomized Comparative study was conducted over a period of 3 months in infertility clinic at Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India, where in first consecutive 50 infertile women fulfilling the Rotterdam Criteria of PCOS were enrolled after taking ethical permission and written informed consent of each participant. They (along with their partners) were evaluated, subjected to baseline investigations and further managed as per routine standard hospital protocol.

The study participants were then divided randomly into two groups using computer generated sequence of random numbers-Group A undergoing lifestyle modification with dietary changes and exercises, whereas Group B had the same, with additional well-structured Yoga sessions of 45 minutes, thrice a week including Asanas (yoga poses), Pranayama (proper breathing), Shavasana, and Meditation. After 3 months reevaluation was done by repeating biochemical investigations, hormonal levels and Doppler parameters by transvaginal ultrasound. Data of two groups that was not normally distributed was compared using non-Parametric tests (Wilcoxon-Mann-Whitney Test) at each of the time points.

Normally distributed data was contrasted with "independent sample t-test" or "One-Way ANOVA". The groups were compared with Chi-squared test in case of categorical information. Pearson's Correlation was conducted to explore linear correlation between two variables (in case of normal distribution of data) and Spearman's correlation was performed (when data is not normally distributed)

### Results

**Table 1: Comparative summary of Changes in Clinical, biochemical and Doppler parameters in both groups after intervention**

Parameters	Pre Intervention			Post Intervention		
	Group A	Group B	P value	Group A	Group B	P value
BMI (Kg/m <sup>2</sup> )	24.42	23.84	0.294	25.14	24.27	0.662
FBS (mg/dl)	90.94	93.87	0.102	86.52	95.04	<0.001
OGTT (mg/dl)	113.91	114.92	0.461	107.44	118.16	0.001
S.TSH (IU/ml)	1.89	1.82	0.64	1.71	2.52	0.002
S. Testosterone (ng/dl)	81.89	81.52	0.969	68.04	69.80	0.634
S. DHEAS (ug/dl)	145.26	135.44	0.346	140.79	137.84	1.000
S. Insulin (mIU/ml)	52.03	46.96	0.560	54.84	50.50	0.541
D2 FSH (mIU/ml)	4.86	5.16	0.503	4.21	5.36	0.001

D2 LH (Miu/ml)	5.88	7.02	0.854	4.79	7.81	0.004
D2 Estrogen (ng/ml)	58.76	53.36	0.193	52.77	56.47	0.294
D2 Prolactin (ng/ml)	9.15	9.08	0.628	10.13	10.31	0.801
Ovarian artery RI	0.94	0.92	0.816	0.81	0.94	0.268
Ovarian artery PI	1.87	1.20	0.043	1.68	1.20	0.088
Ovarian artery PSV (cm/sec)	22.42	14.80	0.003	24.61	14.76	0.089
Uterine artery RI	0.91	0.91	0.858	0.84	0.99	0.008
Uterine artery PI	3.49	3.28	0.677	2.70	3.53	0.007
Uterine artery PSV (cm/sec)	28.49	26.88	0.322	31.29	26.88	0.107

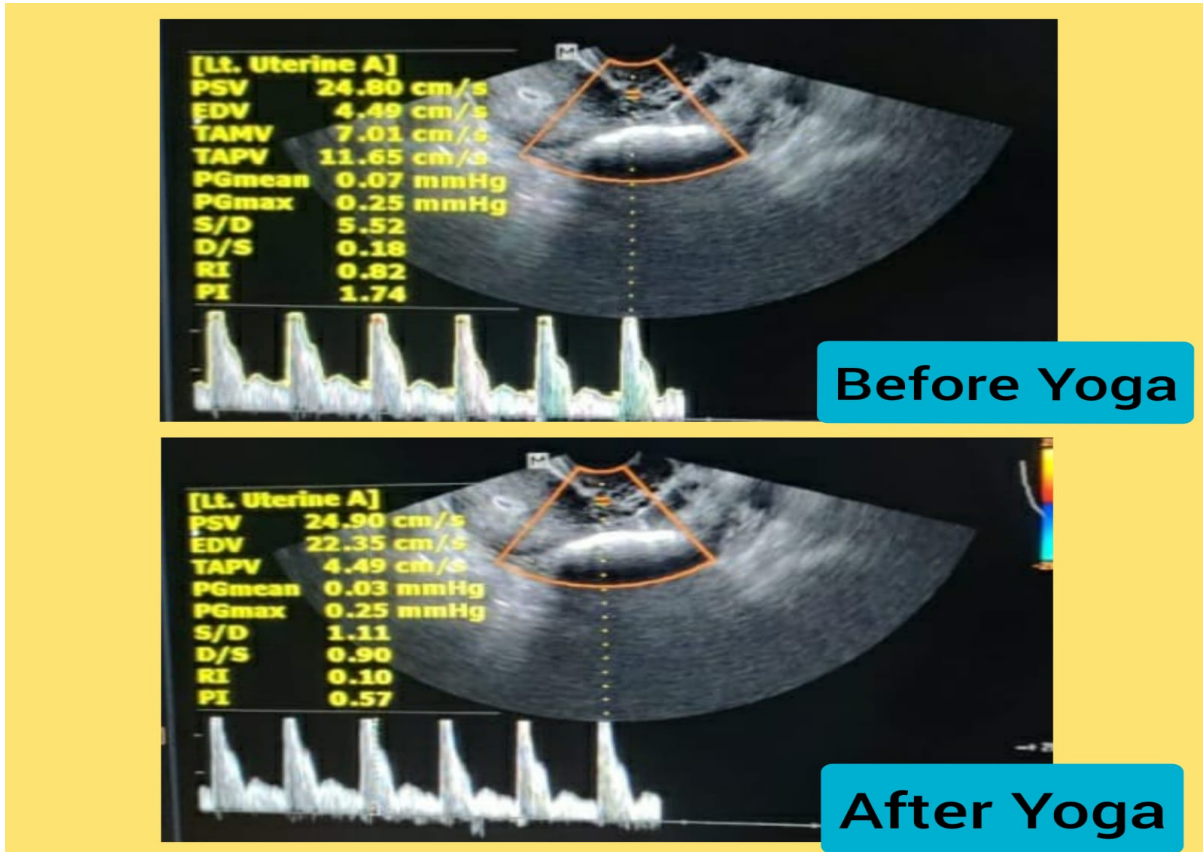


Figure 1: Change in uterine A Doppler parameters (pre and post intervention) in one Yoga Group

**Comment:**

**a. Principal Findings –**

**BMI of women in Yoga and Non-Yoga PCOS group**

The mean BMI of Group B (Kg/m<sup>2</sup>) decreased significantly to a minimum of 24.42 at the post-Intervention time point.

However, the overall difference in BMI (Kg/m<sup>2</sup>) when compared in the two groups using the Generalized Estimating Equations method was insignificant (p = 0.848).

**Hormonal profile of women in Yoga and Non-Yoga group PCOS group**

Although decrease in testosterone levels (post intervention values of 69.80 ng/dl in Group A and 68.04 ng/dl in Group B) and DHEAS levels (post intervention values of 137.84ng/dl in Group A and

140.79 ng/dl in Group B) were witnessed in both groups, the overall change was not statistically significant (p = 0.821 in s testosterone and p = 0.434in s DHEAS respectively.) There was a significant difference in the trend of D2-FSH (p = 0.010), D 2 LH (p = <0.001) and D 2 Estrogen (p = <0.001) over time between the two groups, whereas no significant difference in D2 prolactin amongst the two groups was observed (p = 0.834).

**Insulin resistance**

No significant difference in the trend of S. Insulin over time between the two groups was noticed (p = 0.835).

**Uterine and Ovarian stromal artery blood flow in PCOS women**

Significant differences in Uterine artery Pulsatility index (p = <0.001) and Resistance index (p = 0.004) were detected in Group B, even though the mean

Uterine Artery PSV remained unchanged over time ( $p = 0.262$ ) There was no significant difference in the trend of Ovarian Artery: RI ( $p = 0.115$ ), PI ( $p = 0.374$ ) or PSV over time between the two groups ( $p = 0.263$ ).

### **b. Results in the Context of What is Known**

No change in BMI in both groups was similar to work done by Gupta et al, even though they had a larger sample size of 223 cases and 216 controls. [15] However, these were different from the conclusions of a recent RCT ( $n=67$  women with PCOS) which suggested that 90 minutes of yoga per day for six weeks can significantly reduce waist and hip circumference. [9] The different findings can be attributed to the variable duration and type of yoga exercises. Also, it points out that along with BMI, measuring waist circumference is more important, as it being more symbolic of the total body fat and the amount of metabolically active visceral fat, would be a more accurate measure of the metabolic risk associated in PCOS women.

Hyperandrogenism has been reported to be major underlying biochemical disturbance in PCOS. Higher serum concentration of Testosterone has been reported in approximately 40-50% of women with PCOS. [1-5] In the largest meta-analysis available till date of nine trials (263 participants), pooled analyses of change from baseline or post-intervention values, exercise showed no advantageous results on any of the androgenic/hormonal and inflammatory biomarkers/variables, which was similar in the present study. [8]

It has been hypothesized that Yoga regulates the endocrine gland of the body, and also the metabolic functions, which might help in curing PCOS and infertility. Akin to this, the present study also revealed improved profile of D 2 FSH, LH and s.estrone in infertile following the structured program. But this was different from most of the previous researchers. [5,7,8,9,14] However, inconsistency in reporting fertility-related effects, small sample size and/or intervention duration can be plodded as the reasons for difference in results. Adipose tissue dysfunction, such as hypertrophic adipocytes and impairments in lipolysis and insulin action, underscores the metabolic derangements associated with PCOS. [1-3,5,12] Though no effect of exercise on fasting blood glucose (FBG) change or absolute post-intervention values (when compared with controls) was revealed, the Meta-analysis divulged a positive influence of exercise on the change of FI values from baseline (MD - 2.44  $\mu$ IU/ mL, 95% CI - 4.24 to - 0.64), but with substantial heterogeneity. [9] Scanty perifollicular vascularity is accountable for low oxygen tension in follicle, leading to hypoxic ovum. Even if such hypoxic ovum will fertilize, that would be result in

either pregnancy with chromosomal anomalies or recurrent abortion. Thus, it becomes imperative to break this vicious cycle by instituting a structures exercise program.

Regular sessions of Yoga and Pranayam can aid in conceiving even without drugs, by facilitating the perifollicular flow of blood and hence increased nutrient and oxygen provision to the reproductive organs. In congruence with past pollsters, the uterine blood flow was improved in the Yoga group. [5,6,9] Also, investigation of C. Battaglia et al. showed no significant difference in stromal vascularization were observed between obese and lean women, which remain unexplored in the present study due to time constraints. [16]

Increased LH levels in PCO might be responsible for the increased vascularization of ovarian stroma via its effect on catecholaminergic stimulation, neoangiogenesis, or by the release of prostaglandins. All therapies targeted to improve LH levels would assist in improving fertility outcomes through the aforesaid mechanism. [5,6,8,9] Slight fall in mean PI and RI of ovarian arteries in the Yoga Group B also boost hopes in such women, even though it wasn't statistically significant. Longer duration of study or large intervention period would augment these findings even further, and hence are recommended.

### **c. Clinical Implications**

As it's a proven fact that Lifestyle changes and high intensity exercises succor women in PCOS, correct and consistent incorporation of Yoga (an easy to perform set of breathing exercises), in daily schedule would be instrumental in improving reproductive outcomes in infertile women with PCOS.

### **d. Research Implications**

Currently, there is limited data on clinical symptoms, endocrine and metabolic features in women belonging to different phenotypes of PCOS, besides significant racial and ethnic variations in the presentation of PCOS. In the present study, maximum A and D phenotypes of PCOS women were observed. So, the effect of Yoga should be observed after PCOS phenotyping to see if the effect is the same for each phenotype.

### **e. Strengths and Limitations**

The extant study was conducted during the covid pandemic, and hence the study population and duration was limited. Moreover, the semi-supervised nature of the study allowed few participants to undertake all sessions supervised, whereas most of the others chose to exercise at home due to lockdown restrictions. Though this motivated the participants by giving them more flexibility based on individual time preferences, yet their adherence could have been compromised, leaving

scope for even more favorable results in the Yoga group.

### Conclusion

Infertile women with PCOS performing yoga for 45 minutes a day, three times a week, for a period of three months, exhibited significant improvement in their glucose tolerance, even though no change in body weight was observed. Although decrease in testosterone levels and DHEAS levels were witnessed, these were not statistically significant.

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