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The effect of standard treatment modalities on clinical and ovarian parameters in polycystic ovarian syndrome

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Abstract
Background: Polycystic Ovarian Syndrome is one of the most common endocrinopathy affecting women of reproductive age group worldwide. The aim of the present study was to find out the effects of standard treatment modalities on Clinical and Ovarian Parameters of PCOS patients attending the Gynaecology OPD of a tertiary care hospital in eastern India.
Material and Method: A total of 162 patients were recruited during January 2017 to October 2018 to assess the effects of standard treatment modalities on Clinical and Ovarian Parameters in PCOS patients. The selected patients were divided in two groups A and B based on the clinician's assessment with respect to the patient profile. Group A received lifestyle intervention plus metformin and Group B received lifestyle intervention plus Oral Contraceptive Pill. 24 patients were loss to follow up.
Result: In our study, Group A showed significant reduction in weight and BMI and also improvement in the menstrual symptoms. Group B also showed improvement in the menstrual symptoms but there was a significant increment in the weight and BMI.
Conclusion: In the study Group A was found to be more effective in reducing the body weight and BMI while Group B was more effective in reducing the prevalence of USG features suggestive of PCOS. Both the treatment modalities improved the menstrual symptoms and LH: FSH.

Keywords: PCOS, metformin, oral contraceptive pill

1. Introduction
One of the most common endocrine disorder affecting women in reproductive period worldwide, is Polycystic Ovarian Syndrome (PCOS) [1]. The prevalence of PCOS in India is 3.7% - 22.5% [2, 3]. The etiology of PCOS is still uncertain and is considered as a heterogenous disorder that results in excess production of androgens and insulin resistance [1]. Anovulation, Hyperandrogenism and Insulin resistance are the characteristic features of PCOS. Anovulation leads to irregular menstruation, amenorrhea, ovulation-related infertility and polycystic ovaries whereas hyperandrogenism is the cause of acne and hirsutism. Because of insulin resistance there is obesity, Type 2 diabetes, and high serum cholesterol in PCOS patients [4].
As the pathophysiology of PCOS is still not very clear, standard guidelines regarding management is deficient. The management options vary as per age and presenting complaints of the patient. Maintenance of contraception with improvement of other phenotypic features of PCOS or, induction of fertility with control of the other phenotypic symptoms is done, as desired by the patient. The commonly used drugs in PCOS are insulin sensitizers, oral contraceptives and anti- androgens [5]. Conventional treatment modalities are lifestyle modification in combination with metformin or lifestyle modification in combination with an oral contraceptive pill (OCP). There are a limited number of studies in our country regarding the outcome of different drugs used in treatment of PCOS [6, 7].
The aim of the present study was to find out the effects of standard treatment modalities on the clinical and ovarian parameters of PCOS patients attending the Gynaecology OPD of a tertiary care hospital in eastern India.

2 Materials and Methods
2.1 Study population
This institutional based Observational Study was performed in the Department of Obstetrics and Gynaecology at Medical College, Kolkata from January 2017 to October 2018. Prior ethical

Clearance was obtained from the institutional ethics committee of Medical College, Kolkata. 162 women with PCOS were recruited. PCOS patients were diagnosed using the Rotterdam criteria 2003.The following formula was used to calculate the sample size:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

n = Sample Size, Z= statistic level of confidence, P= Prevalence, d= Precision For the level of confidence of 95%, which is conventional, Z value is 1.96. Prevalence = 12 %, Precision = 5% 24 patients were loss to follow up.

The Inclusion Criteria were patient aged 15-35 years who were not pregnant at the time of inclusion or anytime during the study period, patients who were not on any medications which can alter glucose levels and sex hormone levels (Eg: Oral contraceptives, Metformin etc).The Exclusion Criteria included women who were suffering from any other pre-existing or Co-existing gynaecological diseases, patients with pre-existing diabetes, hypertension, Dyslipidemia or any other medical conditions. Patient selected were divided into two groups based on the clinician's assessment with respect to the patient's profile: 71 patients were allotted in Group A and 91 patients were allotted in Group B. The patients were counselled about healthy lifestyle and dietary advice was given for weight reduction. Group A received Lifestyle intervention and Oral Metformin 500 mg at the initiation of the study and according to patient's response and clinical judgement the dosage of Oral Metformin was titrated further to a maximum of 2000 mg per day. While Group B received Lifestyle intervention and OCP (50 micrograms ethinyl estradiol plus 2 milligrams cyproterone acetate). Each patient recruited in the study was followed up with all the relevant clinical and laboratory parameters for a period of six months. During the follow up period they were evaluated at 2 months and 6 months from the date of recruitment/initiation of specific treatment. None of the patient developed serious adverse reaction to the given medication.

2.3 Study measures

After the written informed consent was taken, clinical data were collected from the participants which included Age, Weight, presenting complaints (Hirsutism, Menstrual history, and symptoms of androgen excess), and drug history. Weight was recorded on a digital weighing scale and body mass index (BMI) was calculated as weight in kilograms divided height in meters squared. A detailed general examination was conducted for the identification of acne, Hirsutism (scored by the Ferriman and Gallwey system), acanthosis Nigricans, and skin tags. And for the ovarian parameters, LH, FSH, LH: FSH and the USG change were obtained. Laboratory tests and ultrasonography were done at Medical College, Kolkata.

2.4 Study definitions

Polycystic ovary syndrome was diagnosed using Rotterdam Criteria (2003). A patient has PCOS if any two out of the following criteria are met [8]

1. Oligoovulation and / or anovulation
2. Excess androgen activity
3. Polycystic ovaries on ultrasound examination.

Polycystic ovaries on ultrasound were defined as presence of 12 or more follicles in each ovary, measuring 2 – 9 mm in diameter, and / or increased ovarian volume > 10 ml [9]. Improvement in USG was considered present in the study if the number of follicles decreased to less than 12 in number and or the ovarian volume reduced to less than 10 cc during the two scheduled follow up. Oligomenorrhea was defined as infrequent menses, occurring at intervals > 35 days while secondary amenorrhea was defined as no menses for an interval of time equivalent to a total of at least three previous cycles or 6 months [10]. A thickened, pigmented, velvety, skin lesion in the vulva, axilla, over the nape of the neck, below the breast, and on the inner thigh was considered as the presence of Acanthosis Nigricans in our study[11]. Hirsutism was graded by Modified Ferriman Gallwey scoring system. A score of 8 or more was taken as presence of Hirsutism and a score of less than 8 as absence of Hirsutism [12]. Presence of Comedones in face, chest or back was considered as Acne Vulgaris [13].

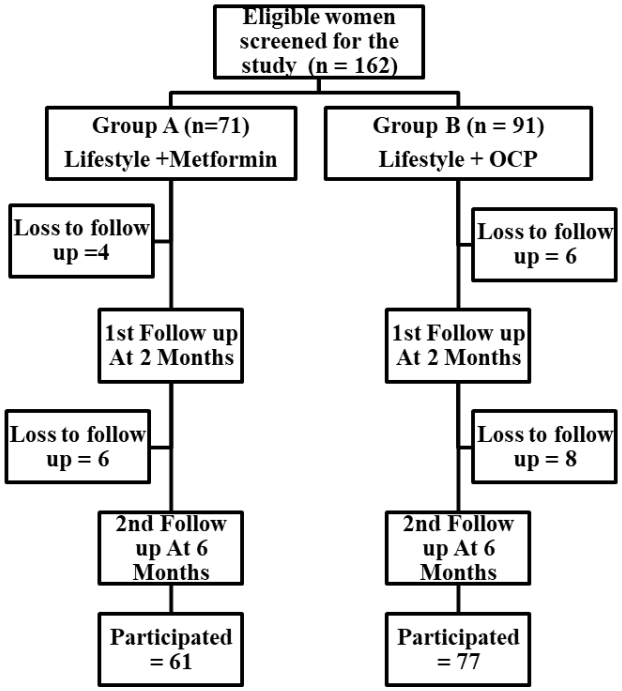

Fig 1: Flow diagram to depict consort statement of the study

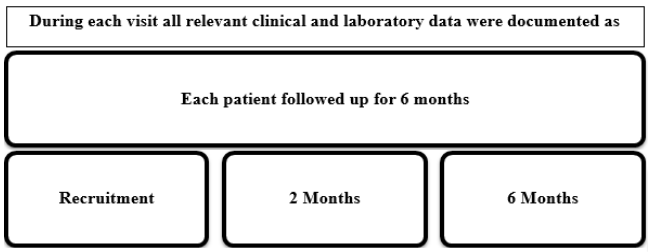

Fig 2: Follow up protocol

2.5 Statistical analysis

Statistical analysis was performed with SPSS software (version 24). Data were presented as mean ± standard deviation and percentages (numbers). The student t test, ANOVA and Chi-square test were used to compare the data. A *p* value of < 0.05 was considered to be statistically significant.

3. Results

A total of 162 patients were recruited for the present study of which 24 were loss to follow up. Group A received (n=61) received lifestyle intervention plus metformin and Group B

received (n=77) lifestyle intervention plus OCP. A flow chart of the study is depicted in Figure 1.

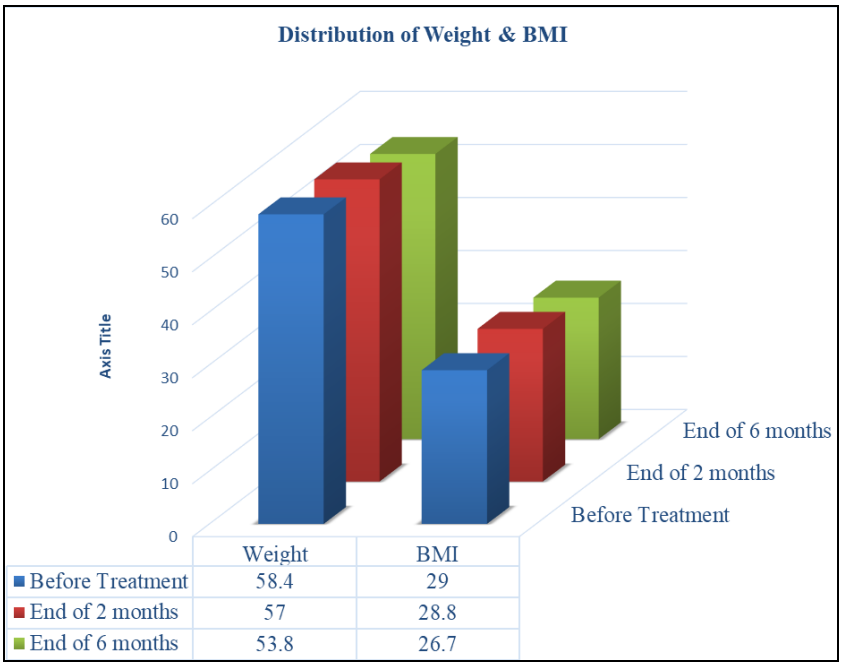

Fig 3: Showing the distribution of Mean body weight and BMI among the study population in Group A during the study period.

The mean body weight of the study population in Group A before treatment was 58.40±2.63 kg, at 2 months after treatment was 57.04±2.97 Kg and at 6 months after treatment was 53.84±1.77 kg respectively and the distribution of the data was found to be highly statistically significant (p=0.0001).

Similarly, the BMI of the study population at the beginning of the study period was 29.05+2.73 kg/m [2], at two months after treatment was 28.87±2.80 kg/m [2] and at 6 months after treatment was 26.77±2.25 kg/m^2 respectively. The distribution of the data was found to be highly statistically significant (p=0.0001).

The prevalence of oligomenorrhea and amenorrhea in Group A before initiation of treatment was 67.2%, 2 months after treatment was reduced to 50.8% and 6 months after treatment was further reduced to 34.4%. The distribution of the data was found to be highly statistically significant (p=0.001417).

However, the prevalence of Acanthosis Nigricans before initiation of treatment was 29.5% which got reduced to 27.8% at the end of 2 months after treatment. At the end of 6 months it remained 27.8%. The distribution was not statistically significant (p=0.973493).

Similarly, the prevalence of Acne at the beginning of the study period was 57.4%, it got reduced to 54.1% and 52.4% at the end of 2 months and 6 months respectively. However, the distribution of the data was not statistically significant (p= 0.856983).

The prevalence of Hirsutism was 44.3% before initiation of treatment. It got reduced to 41% and 39.3% at the end of 2 months and 6 months of treatment respectively. However, the distribution of the data was not statistically significant (p= 0.854255).

Table 1: Showing the clinical parameters of study population in Group A before and after treatment (n=61)

Clinical Parameters	Before Treatment Number (%)	At 2 Months Number (%)	At 6 Months Number (%)	p value
Oligomenorrhea/Amenorrhea	41(67.2%)	31(50.8%)	21(34.4%)	0.001417
Acanthosis Nigricans	18(29.5%)	17(27.8%)	17(27.8%)	0.973493
Hirsutism	27(44.3%)	25(41%)	24(39.3%)	0.854255
Acne	35(57.4%)	33(54.1%)	32(52.4%)	0.856983

Regarding the ovarian parameters the LH: FSH ratio was found to be 2.73±0.19 before initiation of treatment which decreased to 2.43±0.26 and 1.90±0.19 at the end of 2 months and 6 months of treatment respectively in Group A. The distribution of the data was found to be highly significant (p=0.0001).

However, about 40.1% of the study population had USG changes suggestive to PCOS before initiation of the treatment, which got reduced to 37.7% and 36.1% at the end of 2 months and 6 months of treatment respectively. The rate of improvement of the USG changes of PCOS among the study population in Group A was found to be not statistically significant (p=0.850486).

Table 2: Showing the distribution of Ovarian Parameters among the study population in Group A (n =61) before and after the treatment.

Ovarian Parameters	Before Treatment Mean (SD)	At 2 Months Mean (SD)	At 6 Months Mean (SD)	p value
LH:FSH	2.73(0.19)	2.43(0.26)	1.90 (0.19)	0.0001
	Number (%)	Number (%)	Number (%)	
USG	25 (40.1%)	23 (37.7%)	22(36.1%)	0.850486

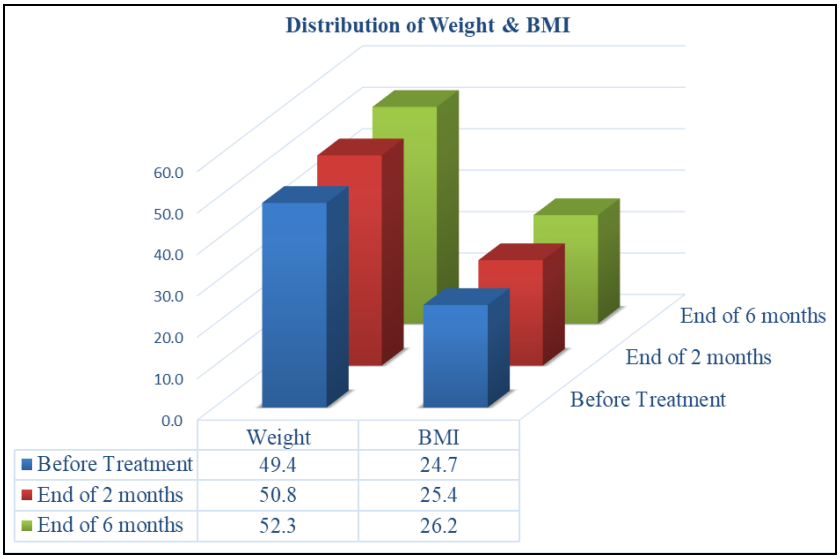

Fig 4: Showing the distribution of mean Weight and Body Mass Index of the study population in Group B (n=77)

The mean body weight of the study population in Group B before treatment was 49.39±2.21 kg, at 2 months after treatment it got increased to 50.75±2.28 Kg and at 6 months after treatment was 52.34±2.06 Kg respectively and the distribution of the data was found to be highly statistically significant (p=0.0001). Similarly, the BMI of the study population at the beginning of the study period was 24.74+2.22 kg/m^2, at two months after treatment was 25.44±2.51 kg/m^2 and at 6 months after treatment was 26.21±2.25 kg/m [2] respectively. The rate of increase in mean BMI was found to be highly statistically significant (p=0.0001).

Table 3: Showing the clinical parameters of study population in Group B before and after treatment (n=77)

Clinical parameters	Before treatment number (%)	At 2 months number (%)	At 6 months number (%)	p value
Oligomenorrhea/Amenorrhea	53(68.8%)	42(54.5%)	27(35.1%)	0.00014
Acanthosis nigricans	19(24.7%)	19(24.7%)	18(23.4%)	0.976704
Hirsutism	41(53.2%)	41(53.2%)	40(51.9%)	0.982779
Acne	44(57.1%)	40(51.9%)	36(46.7%)	0.43499

The prevalence of oligomenorrhea and amenorrhea before initiation of treatment was 68.8%, 2 months after treatment was reduced to 54.5% and 6 months after treatment was further reduced to 35.1% in Group B. The distribution of the data was found to be highly statistically significant (p=0.00014).

However, the prevalence of Acanthosis Nigricans before initiation of treatment and at the end of 2 months was 24.7%. At the end of 6 months it got decrease to 23.4%. The distribution was not statistically significant (p=0.976704).

Similarly, the prevalence of Acne at the beginning of the study period was 57.1%, it got reduced to 51.9% and 46.7% at the end of 2 months and 6 months respectively. However, the distribution of the data was not significant (p=0.43499).

The prevalence of Hirsutism before initiation of treatment and at the end of 2 months remained at 53.2%. It marginally got reduced to 51.9% at the end of 6 months of treatment. However, the distribution of the data was not statistically significant (p= 0.982779).

Table 4: Showing the distribution of Ovarian Parameters among the study population in Group B (n =77) before and after the treatment.

Ovarian Parameters	Before Treatment Mean (SD)	At 2 Months Mean(SD)	At 6 Months Mean(SD)	p value
LH: Fsh	2.93 (0.33)	2.18 (0.23)	1.88(0.28)	0.0001
	Number (%)	Number (%)	Number (%)	
USG	47 (61%)	35 (45.4%)	29(37.7%)	0.012648

The LH: FSH ratio was found to be 2.93±0.33 before initiation of treatment which decreased to 2.18±0.23and 1.88±0.28 at the end of 2 months and 6 months of treatment respectively among the study population in Group B. The distribution of the data was found to be highly significant (p=0.0001) Similarly, about 61% of the study population had USG changes suggestive to PCOS before initiation of the treatment, which got reduced to 45.4% and 37.7% at the end of 2 months and 6 months of treatment respectively. The rate of improvement of the USG changes of PCOS among the study population was found to be highly significant (p=0.012648). Regarding the clinical parameters among the two groups at the beginning of the study the mean weight among the study subjects in Group A were 58.40±2.63 Kg as compared to 49.39±2.21 Kg among Group B of the study population (p=0.0001).

The mean BMI among the study subjects in Group A were 29.05±2.73 Kg/m^2 as compared to 24.74±2.22 Kg/m^2 among Group B (p=0.0001).

The mean Waist Hip Ratio among the study subjects in Group A were 0.91± 0.03 as compared to 0.79± 0.03 among Group B (p=0.0001).

Table 5: Showing the comparative analysis of Clinical parameters between Group A (n=61) and Group B (n=77) at the beginning of the study.

Clinical Parameters	Group A (n = 61) Mean (SD)	Group B (n= 77) Mean (SD)	p value
Body weight (kg)	58.40(2.63)	49.39(2.21)	0.0001
BMI (kg/m$^{2)}$	29.05(2.73)	24.74(2.22)	0.0001
Waist-hip ratio	0.91(0.03)	0.79(0.03)	0.0001

The percentage of patients having Oligomenorrhea or amenorrhea among Group A study population was 67.21% as compared to 68.83% among Group B of the study population (p=0.9851).
The percentage of patients having Acanthosis Nigricans among Group A study was 29.51% as compared to24.67%among Group B (p=0.6578).
The percentage of patients having Acne among Group A study population was 57.38% as compared to57.14%among Group B study population (p=0.9780).
The percentage of patients having Hirsutism among Group A study population was 44.26% as compared to 53.24% among Group B study population (p=0.3805).

Table 6: Showing the comparative analysis of Clinical parameters between Group A (n=61) and Group B (n=77) at the beginning of the study.

Clinical Parameters	Group A (n=61) Number (%)	Group B (n= 77) Number (%)	p value
Oligomenorrhea/amenorrhea	41 (67.21%)	53 (68.83%)	0.9851
Acanthosis nigricans	18 (29.51%)	19 (24.67%)	0.6578
Hirsuitism	27 (44.26%)	41 (53.24%)	0.3805
Acne	35 (57.38%)	44 (57.14%)	0.9780

Regarding the clinical parameters at the end of the study, the mean weight among the study subjects in Group A were 53.84±1.77 Kg as compared to 52.34±2.06 Kg among Group B study population (p=0.0001).
The mean BMI among the study subjects in Group A at the end of the study were 26.93±2.29 Kg/m $^{[2]}$ as compared to 26.13±2.23Kg/m^2 among Group B (p=0.0405).
The mean Waist Hip Ratio among the study subjects in Group A were 0.88±0.06 as compared to 0.85±0.03among Group B study population (p=0.0002).

Table 7: Showing the comparative analysis of Clinical parameters between Group A and Group B at the end of the study.

Clinical Parameters	Group A (n = 61) Mean (SD)	Group B (n= 77) Mean (SD)	p value
Body weight (kg)	53.84(1.77)	52.34(2.06)	0.0001
BMI (kg/m$^{2)}$	26.93(2.29)	26.13(2.23)	0.0405
Waist-hip ratio	0.88(0.06)	0.85(0.03)	0.0002

The percentage of patients having oligomenorrhoea or amenorrhea among Group A study population was 34.4% as compared to 35.06% among Group B study population (p=0.9376).
The percentage of patients having Acanthosis Nigricans among Group A study population at the end of the study was 27.87% as compared to 23.38% among Group B study population (p=0.6852).
The percentage of patients having Acne among Group A study population was 52.46% as compared to 46.75% among Group B study population (p=0.6210).
The percentage of patients having Hirsutism among Group A study population at the end of the study was 39.34% as compared to 51.95% among Group B study population (p=0.1927).

Table 8: Showing the comparative analysis of Clinical parameters between Group A and Group B at the end of the study.

Clinical Parameters	Group A (n=61) Number (%)	Group B (n= 77) Number (%)	p value
Oligomenorrhea/Amenorrhea	21(34.4%)	27(35.06%)	0.9376
Acanthosis nigricans	17(27.87%)	18(23.38%)	0.6852
Hirsutism	24(39.34%)	40(51.95%)	0.1927
Acne	32(52.46%)	36(46.75%)	0.6210

Regarding the ovarian parameters at the beginning of the study, the mean LH:FSH ratio levels among the study subjects in Group A were 2.73±0.19 mmol/L as compared to 2.93±0.33 mmol/L among Group B study population (p=0.0001).
The percentage of patients with USG changes suggestive of PCOS in Group A was 40.98% as compared to 61.03% in Group B (p=0.0300).

Table 9: Showing the comparative analysis of ovarian parameters between Group A and Group B at the beginning of the study.

Ovarian Parameters	Group A (n=61) Mean (SD)	Group B (n=77) Mean (SD)	p value
LH:FSH	2.73(0.19)	2.93(0.33)	0.0001
	Number (%)	Number (%)	
USG	25 (40.98%)	47 (61.03%)	0.0300

Regarding the ovarian parameters at the end of the study, the mean LH: FSH ratio levels among the study subjects in Group A were 1.90 mmol/L as compared to 1.88±0.28 mmol/L among Group B study population (p=0.6338).
The percentage of patients with USG changes suggestive of PCOS in Group A was 36.06% as compared to 37.67%in Group

B (p=0.9877).

Table 10: Showing the comparative analysis of ovarian parameters between Group A and Group B at the end of the study.

Ovarian Parameters	Group A (n=61) Mean (SD)	Group B (n=77) Mean (SD)	p value
LH:FSH	1.90 (0.19)	1.88(0.28)	0.6338
	Number (%)	Number (%)	
USG	22 (36.06%)	29 (37.67%)	0.9877

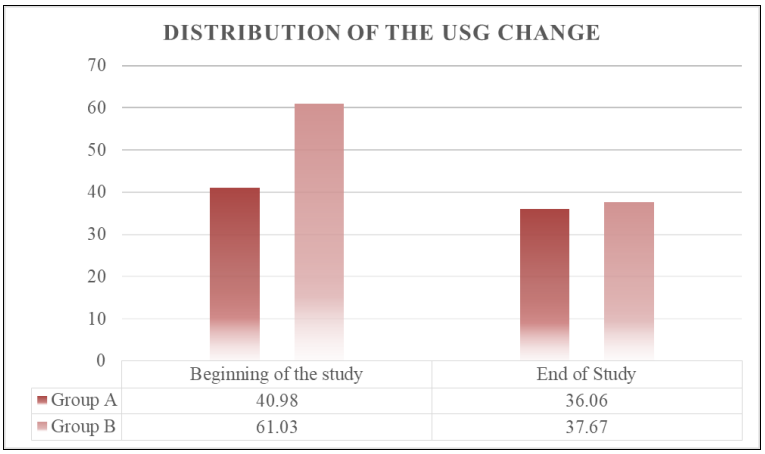

Fig 5: Showing the distribution of USG change in GROUP A (n= 61) and GROUP B (n=77) at the beginning of the study and at the end of the study

6. Discussion

Polycystic ovarian syndrome is a multisystem disorder resulting in infertility and metabolic syndrome. The etiopathogenesis of PCOS still remains to be unearthed fully. It is now accepted that it is multifactorial and partly genetic. Insulin resistance has been noted consistently among many women with PCOS, especially in those with hyperandrogenism, but it is not included in any of the diagnostic criteria. Now there is strong evidence that cardiovascular disease risk factors and disturbances in carbohydrate metabolism are all increased in patients with PCOS compared with the healthy population. The other very important point that has been made is that the basis of treatment is the modification of lifestyle [14].

In a study conducted by Hugar AL [15] regarding the prevalence and clinical manifestations of PCOS, the authors observed that between 5-10% women of reproductive age suffer from PCOS and most common symptoms of PCOS are obesity, acne, amenorrhea, irregular menstrual cycles, Hirsutism, insulin resistance and high cholesterol. Our study also showed that 67.21% and 68.83% of study population in study groups A & B were having irregular menstrual cycles at the beginning of the study period. The present study has also shown that a considerable proportion of study population had Hirsutism and Acne in both the study groups. However, only 29.51% of study population had Acanthosis Nigricans in Group A as compared to 24.67% in Group B at the beginning of the study.

The present showed that after the treatment with Oral Metformin in combination with lifestyle modification resulted in significant reduction in mean weight, BMI and waist hip ratio as well as reduce the prevalence of Oligomenorrhea and amenorrhoea among the study population at the end of 6 months of follow up period. In a meta-analysis conducted by Dashti S*et al* [16], the authors concluded that Metformin improved insulin sensitivity but its effect on weight reduction is not well documented. Thiazolidinediones was also found to have similar effects as Metformin. But the authors also concluded that the beneficial effects of Thiazolidendiones in PCOS needs further substantiation from further studies. The authors also found that the effect of Lifestyle modification alone in PCOS patients was minimal and there was high dropout rate.

The current study also documented significant improvement in the LH: FSH Ratio among the study population who received lifestyle modification with oral metformin. However, this modality of treatment did not improve the prevalence of USG features indicative of PCOS and other clinical manifestations like Acanthosis Nigricans, Acne Vulgaris and Hirsutism among the study population at the end of 6 months of follow up.

In our study Oral Contraceptive pills along with lifestyle modifications showed significant improvement in menstrual symptoms at the end of 6 months of follow up. However, there has been significant increment in mean weight and mean BMI among the study subjects at the end of study period. The mean LH: FSH Ratio also showed significant improvement at the end of 6 months of follow up with this treatment modality. The prevalence of USG features suggestive of PCOS also reduced significantly among the study subjects at the end of the study period. However, other clinical features of PCOS like Acanthosis Nigricans, Acne Vulgaris and Hirsutism showed no significant improvement among the study subjects at the end of 6 months of follow up with this treatment modality. A scientific document published by PCOS society of India intended to provide a consensus regarding the use of OCPs among PCOS patient in India [17]. The authors recommended that for PCOS patients who do not desire pregnancy OCPs are the first line of treatment to manage the menstrual and androgenic symptoms. It was also observed from meta-analysis of past relevant scientific literature that with OCP menstrual symptoms improve immediately as compared to androgenic symptoms which requires approximately 6 months to resolve. The authors recommended that combined OCP with low dose neutral or anti-androgenic OCPs may be the drug of choice in treating PCOS patients in India. However, the authors concluded that though the use of OCP outweighs the risks with the benefits involved, still the use of OCPs should be individualized after proper risk stratification. The present study also echoes the enormous risk-benefit ratio of using OCP as a treatment modality for PCOS. However, the present study also recommends individual case to case basis risk stratification for PCOS patient and strongly

suggests discontinuing OCP or shifting to other treatment modalities if contraindications for OCP use emerge.

In a scientific review by Saleem F *et al* [18] on the effect of different therapeutic approaches on Metabolic syndrome and obesity associated with PCOS, the authors have detailed the therapeutic effects of Inositols, Statins, anti-obesity drugs and have even highlighted the effects of non-conventional non-therapeutic treatment modalities like acupuncture. However, the authors did not conclude or recommend the routine use of non-conventional therapies either as solo or as adjunct to conventional ones. The present study has shown that Metformin therapy is more beneficial in controlling metabolic syndrome and OCP resulted in significant reduction in the prevalence of USG features suggestive of PCOS.

In a single-centre, double-blind, randomized placebo-controlled trial conducted for 7 years by Trummer C *et al* [19] in central Europe, the effect of Vitamin D supplementation was documented among PCOS patients. 123 PCOS patients with serum Vitamin D of less than 75 nmol/L were included in the study. The study subjects were randomly distributed in a ratio of 2:1 into two study groups. One received vitamin D supplementation and the other received placebo. Vitamin D supplementation lead to a significant increase in 25(OH)D [mean treatment effect 33.4 nmol/L; 95% confidence interval (CI) 24.5 to 42.2; $p < 0.001$] but had no significant effect on AUC glucose (mean treatment effect − 9.19; 95% CI − 21.40 to 3.02; $p = 0.139$). The authors concluded that Vitamin D supplementation had no significant effect on metabolic and endocrine parameters in PCOS with the exception of reduced plasma glucose during OGTT. However, the present study did not co-relate vitamin D levels among the study population with the standard modalities of treatment. The present author felt that the non-conventional therapies in PCOS cannot ameliorate the clinical paradigms faced by the patients. The therapeutic effect of lifestyle modification combined either with OCP or oral metformin still remains the main stay of PCOS management.

The present study shows that standard modalities like Metformin and OCP can ameliorate PCOS symptoms but the treatment regimen and duration needs to be individualized in accordance to patient's expectations and risk-benefit stratification.

7. Conclusion

Our study suggests that oral metformin plus lifestyle modification and OCP plus lifestyle modification improves the LH: FSH Ratio and the menstrual symptoms of PCOS. However, oral Metformin with lifestyle modifications has significant improvement on the BMI at the end of 6 months of follow up while Oral Contraceptive pills along with lifestyle modification resulted in significant reduction in the prevalence of USG features suggestive of PCOS among the study subjects at the end of study period. However, this treatment modality has also caused significant deterioration in mean BMI among the study population at the end of 6 months of follow up.

8. Conflict of Interest: None

9. References

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