



Effect of pilates on regulating menstrual cycle in females with polycystic ovarian syndrome

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ABSTRACT

Background: Polycystic Ovarian Syndrome (PCOS) is the most common genetic disorder of the endocrine gland among females during the age of reproduction with an estimated prevalence ranging from 2.2 % to 26 %. It is a typical reason for ovulatory infertility, menstrual dysfunction, and hirsutism. It is a condition in which ovarian cysts develop with a diameter of between two and nine millimeters on one or each ovaries and therefore there is an increase in the volume of one is larger than ten millimeters.

Objective: To analyze the effect of pilates on pain and regulation of the menstrual cycle in females with PCOS.

Research methodology: A single centered, quasi-experimental study, performed in Lovely Professional University, India on a total of 26 participants suffering from PCOS, based on inclusion and exclusion criteria. After a detailed assessment, the Pilates exercise protocol was given for 3 months i.e. 3 times per week. The readings for pain and regulation were taken at baseline, at the end of 1st, 2nd and 3rd month using visual analog scale (VAS) and verbal multidimensional score system (VMSS).

Results: The result findings indicates suggested that there is significant change in the pain (Wilk's Lambda = .117, $F(3,23) = 58.109$, $P < 0.05$), variable during the menstruation in PCOS over the time of three months. The menstrual cycles were regularised and the cycle was shifted towards the normal parameters. The VMSS also shows changes that signify that Pilates is effective in PCOS complications.

Conclusion: This study concluded that Pilates is effective in reducing the pain in PCOS cases which improves the working ability of the females and also regulates the menstrual cycles which were irregular at the beginning of the treatment.

Introduction

Polycystic ovarian syndrome (PCOS) is also known as Stein- Leventhal Syndrome or hyperandrogenic anovulation [1]. It is the highly prevalent genetic endocrine disorder of females of unknown etiology. The estimated prevalence of PCOS is considered to be ranging from 2.2 per cent to 26 per cent. It is the main cause of ovulatory infertility, menstruation dysfunction, and hirsutism [2,3]. This is a disorder in which small cysts with a width of between 2 and 9 mm grow on one or both ovaries with an ovarian volume of 10 mm in at least one ovary [1,4, 5].

PCOS was earlier diagnosed by applying the recommendation from National Institute of Health/ NICH and Human Development but in the year 2004 PCOS consensus workshop formulated Rotterdam criteria, according to which PCOS is diagnosed if at least two of three features are present, 1) amenorrhea, 2) biochemical hyperandrogenism, 3) PCOS

detection in ultrasonography [2,3]. As the inclusion criteria of Rotterdam criteria were broader than NIH, it was preferred in finding the prevalence of PCOS [6]. However, recently in 2006, Androgen Excess Society (AES) has created a consensus declaration that describes PCOS as a hyper androgen condition and stresses the existence of certain clinical and/or biochemical symptoms of hyperandrogenism along with certain aspects of PCOS for diagnosis (Fig. 1) [1,7].

The symptomatic presence of PCOS differs with age, young females often complain of fertility and psychiatric issues, while older women complain of metabolic problems (Fig. 2) [8]. Detailed clinical evaluation, family records, gynecological records, and scientific studies need to be carried out in order to make the correct diagnosis [9].

There are evidence that women with PCOs have multiple long term health risks such as type 2 diabetes, cardiovascular disease dyslipidemia, abnormal vascular function, coronary heart diseases, etc. Women with PCOs are also thought to be it the increased risk of endometrial cancer

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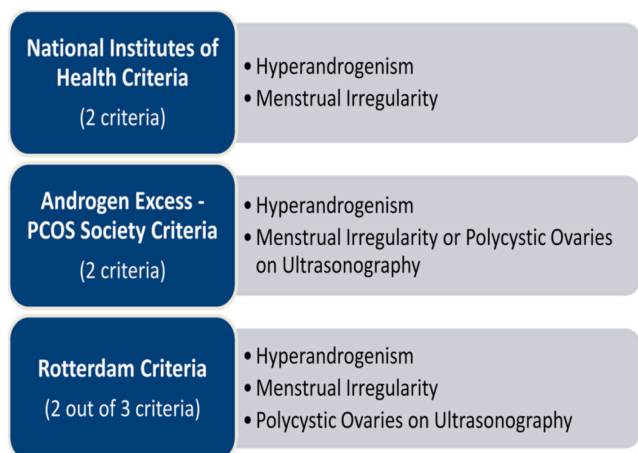


Fig. 1. Guidelines for the diagnosis of PCOS.

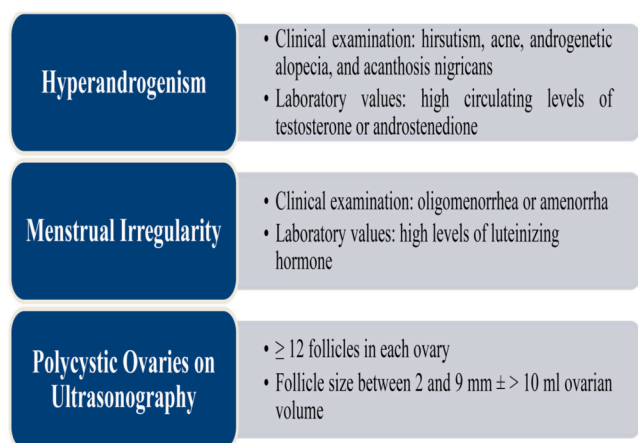


Fig. 2. Symptomatic presentation of PCOS.

due to the unexposed estrogen exposure of the endometrial [5].

Pilates fitness program has been found to be helpful to the physical and psychological well-being of young people in terms of anthropometric appearance, mental health, exhaustion, and certain aspects of quality of life [10]. Pilates was founded in 1920 by Joseph Pilates, who concentrated on regulating the posture and orientation of the body. The original term proposed for Pilates was "Contrology." The Pilates is based on eight traditional principles which include centering, control, flow, concentration, precision, breathing, isolation, and routine. The exercises used in this are floor-based or it involves the specialized types of equipment [11]. Pilates is open to all regardless of age or physical ability. These exercises don't involve any kind of impact, if carried out properly they involve no stress, strain, or pain.

The polycystic ovarian syndrome is of increasing distress among females around the world with a varying range of its prevalence [12]. It also increases the rate of absentees in students and working females and also leads to wide consumption of medicines like antispasmodics and hormonal therapy. These medications have proven to have side effects like weight gain, hirsutism, Diabetes Miletus, infertility, polyps in the uterus, etc. The studies conducted in patients with polycystic ovarian syndrome concluded that exercise training can augment the benefits of ovulation changes by improving metabolic parameters [13] and regulating the androgen secretion [14]. Researches also suggest that various treatment options have proved to be effective in relieving the symptoms of PCOS but to date, no study has been done to prove the effectiveness of Pilates in PCOS cases. Therefore, in this study, we tried to regulate the

menstrual cycle and decrease the pain during the cycle by using Pilates as a method of treatment.

Material and method

Design

A quasi experimental design was applied, Prior to participation, all subjects was informed orally and in written about the study protocol and only those participants who gave the signed consent were included in the study. The study was approved by the institutional ethic committee of Lovely Professional University under the IEC number(LPU/IEC/2019/03/11) and procedure following with the Helsinki Declaration.

Participants

Female participants from the reproductive age group diagnosed as having polycystic ovarian syndrome by ultrasonography. The study population was females who were diagnosed as having polycystic ovarian syndrome by ultrasonography. The participants included were having menstrual cycle >30 days with pain and abdominal cramps due to menstruation. The participants having systemic disease, primary dysmenorrhoeal, pregnancy, under any medication for PCOS, athlete females were excluded from the study. At the level of 0.05 % significance level and power of 0.80 sample of 26 females was calculated by G* Power.

Study settings

The study was conducted in controlled settings of Lovely Professional University physiotherapy OPD, Phagwara, Punjab-144411. After the study obtained ethical clearance from the Institutional Ethical Committee and patient recruitment started immediately after that. The patients were invited using University Management System (UMS) and flyers. The flyers were posted on the notice board of different departments and hostels of the university.

Procedure

After the ethical approval and flyer distribution, 36 respondents voluntarily approached the researchers but only 30 were appropriate as per the inclusion and exclusion criteria. In these 26 participants having the recent USG reports were selected and written consent was taken. An assessment was taken with a focus on menstrual regularity, gynecological history, medications, along with family history. The pre-treatment readings were recorded by using the USG [4,15,16] to detect the PCOS, VAS [17–19] for pain and VMSS for the assessment of dysmenorrhoea.

Tests procedures

Visual analog scale for pain assessment (VAS)

VAS is a 10 cm long line which determines the degree of pain with 0 on the left side and 10 on the right side. The left extremity of the line represents 'no discomfort at all', while the right extremity represents 'unbearable discomfort'. Participants were required to measure the degree of pain by labeling the rows. Level ratings were graded as mild dysmenorrhoea if they were below 1–3 points, moderate below 4–7 points, and extreme between 8–10 points [17–19]. .

VMSS (verbal multidimensional scoring system) assessment

VMSS is to assess dysmenorrhoea for the female. This assessment system has four grades from grade 0 to Grade 3. This assessment scale indicates the working ability, symptoms, and the use of analgesics. Grade 3 is considered as having the most symptoms and working ability inhibited and grade 0 is having none symptoms without any working

Table 1
Pilates exercise progression.

Phase	Exercise	Repetitions	Progression
Phase 1	Roll up/down	15–20 Repetitions	Week 1–4
	Hundred	10–15 Repetitions	Week 1–4
	Single leg circle	5 in each direction	Week 1–4
	Rolling like a ball	6 Repetitions	Week 1–4
	Single leg stretch	5–10 Repetitions	Week 1–4
	Double leg stretch	5–10 Repetitions	Week 1–4
	Spine stretch forward	5 Repetitions	Week 1–4
Phase 2	Single straight leg	10 Repetitions	Week 2–4
	Double straight leg	10 Repetitions	Week 2–4
	Saw	4 Repetitions	Week 2–4
	Neckroll	3 in each direction	Week 2–4
	Single leg kicks	5 in each direction	Week 2–4
	Sidekick series	1 series	Week 2–4
	Crisscross	10 Repetitions	Week 2–4
Phase 3	Open leg rocker	6 Repetitions	Week 3–4
	Teaser 1	3–5 Repetitions	Week 3–4
	Seal	6 Repetitions	Week 3–4
	Plank	3 Repetitions	Week 3–4
	Side plank	3 with each arm	Week 3–4

ability affected..

Exercise protocol

The Pilates exercise protocol was started for them i.e. 4 weeks / 3 times per week. After 4 weeks of the protocol the females were assessed again to check the pain intensity and menstrual regulation and the reading will be recorded. After the second phase of the recording, the protocol was continued further for 4 weeks and by the end of these 4 weeks, the same assessment will be taken with the same outcome measures which were used initially.

Results

Normality testing

The data was analyzed with the IBM SPSS version 22 to calculate the normality of data. The normality of the data was checked by the help of descriptive analysis as well as the Z score of skewness and kurtosis (Between -1.96 and $+1.96$). The normality was also analyzed by the Shapiro- Wilk test of normality ($p > 0.05$). Through several methods, it was found that the data was normally distributed.

Descriptive analysis

In the demographic data, the age (in years), height (in cms), weight (in kg), and BMI have the Mean value and Standard deviation of 22.81 ± 3.51 , 162.73 ± 5.6 , 67.46 ± 10.22 , 25.63 ± 4.85 .

The dependent variables used in this study are Pain, menstrual history, and VMSS score and the independent variable is time. The readings were taken at different intervals of time. A one way repeated measured analysis of variance (ANOVA) was performed to test the significance of the treatment. The pain was analyzed at the four different intervals i.e. the first reading was taken at the 0 months which means the pre-treatment reading and rest all the other readings were post-treatment readings which were taken after one month, second month and the

Table 2
Descriptive statistics of Pain at 0, 1, 2, 3 months after the treatment.

S.NO	VARIABLE	MEAN \pm SD
1	Pain assessment at 0 month	7.6923 \pm 1.51708
2	Pain assessment at 1 month	7.2308 \pm 1.33589
3	Pain assessment at 2 month	6.4615 \pm 6.4615
4	Pain assessment at 3 month	6.0385 \pm 1.21592

third month after the treatment and the mean and standard deviation of pain at different intervals were as 7.6923 ± 1.51708 , 7.2308 ± 1.33589 , 6.4615 ± 6.4615 , 6.0385 ± 1.21592 (Table 3). The mean of the pain itself indicates that there is a reduction in the mean values taken at the beginning of the treatment and the reading taken at the end of the treatment. The finding of this study indicates the significant time effect, after the treatment by the Pilates for consecutive for three months for PCOS condition.

One more objective of this study was to analyze the effect of Pilates on the menstrual cycle regulation. The females was divided into three groups according to their menstrual cycle i.e. females having menstrual cycle within 30th - 40th day, females having menstrual cycle between 40th–50th day, and the females having menstrual cycle between 50 and 60th day. At the baseline readings, it was found out that 9 females were in group 30–40, 10 females in 40–50, and 6 females in 50–60. As the treatment started it was found that the females were having regularities in their menstruation and the cycle day was shifted towards the normal range. The treatment was continued for three months and it was found out that their number of females increased in the first group 30–40 which indicates that there was regularity in the menstrual cycle and the day of menstruation was shifted to normal (Fig. 3). After the individual analysis of 26 female participants, there is a significant improvement in the cycle regulation of every female subject included in the study (Fig. 4). Thus we can conclude here that Pilates has been proven to be effective in regulating the menstruation cycles of the female subjects in PCOS. In Fig. 5, VMSS assessment of dysmenorrhea indicates that before the treatment started none of the females was having grade 0 and maximum females were in grade 2 and grade 3 but after the treatment, the female subject was having a reduction in the pain status and even the graph clearly defines that there was a reduction in the symptoms of pain and females reached maximum to grade 1 and grade 0.

Inferential analysis- statistical tests

The multivariate tests were used to determine the effect of Pilates on the pain variable over the time of three months particularly the most common test used is Wilk's Lambda = .117, $F[3,23] = 58.109$, $P < 0.05$, which suggested that there is significant change in the pain variable during the menstruation in PCOS. The ANOVA result indicates that there is a significant difference in the pain variable over a different time duration. That implies that the patients included in the study were having a reduction in the pain intensity presented before the treatment protocol and there was also a reduction in the pain intensity over the different time duration (T0, T1, T2, T3). So the overall result indicates that Pilates proves to improve the pain status and menstrual regularities in female subjects. So it improves the working ability of the females as compared to the beginning of the study.

Discussion

The result of this study demonstrated that the females with PCOS who received Pilates treatment as an intervention showed a decrease in pain and regulation of the menstrual cycle. The results of this study are persistent with those of the previous studies which demonstrated the efficacy of exercises in regulating the menstrual cycle and causing ovulatory changes in females diagnosed with PCOS [13,20].

Menstrual irregularity is considered to be one of the most common gynecological presentations in females with PCOS. In 85–90 % of females with Oligomenorrhea and 30–40 % with amenorrhea have also shown a sign of PCOS [5,21]. The incidence of infertility, primarily attributed to anovulation in PCOS patients, ranges between 35 % and 94 % [14,16]. For the regulation of the menstrual cycle, a decrease in Body Mass Index(BMI) has shown a positive effect. It has been seen that obesity may render the underlying hormonal abnormalities worse (eg; elevated androgen level) and can be a risk factor for cardiovascular disorders and diabetes [13,20,22,23]. During exercise, a series of

Table 3
Multivariate Test to check the significance of pain within the subjects.

Tests	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power
Pillai's Trace	.883	58.109	3.000	23.000	.000	.883	174.326	1.000
Wilks' Lambda	.117	58.109	3.000	23.000	.000	.883	174.326	1.000
Hotelling's Trace	7.579	58.109	3.000	23.000	.000	.883	174.326	1.000
Roy's Largest Root	7.579	58.109	3.000	23.000	.000	.883	174.326	1.000

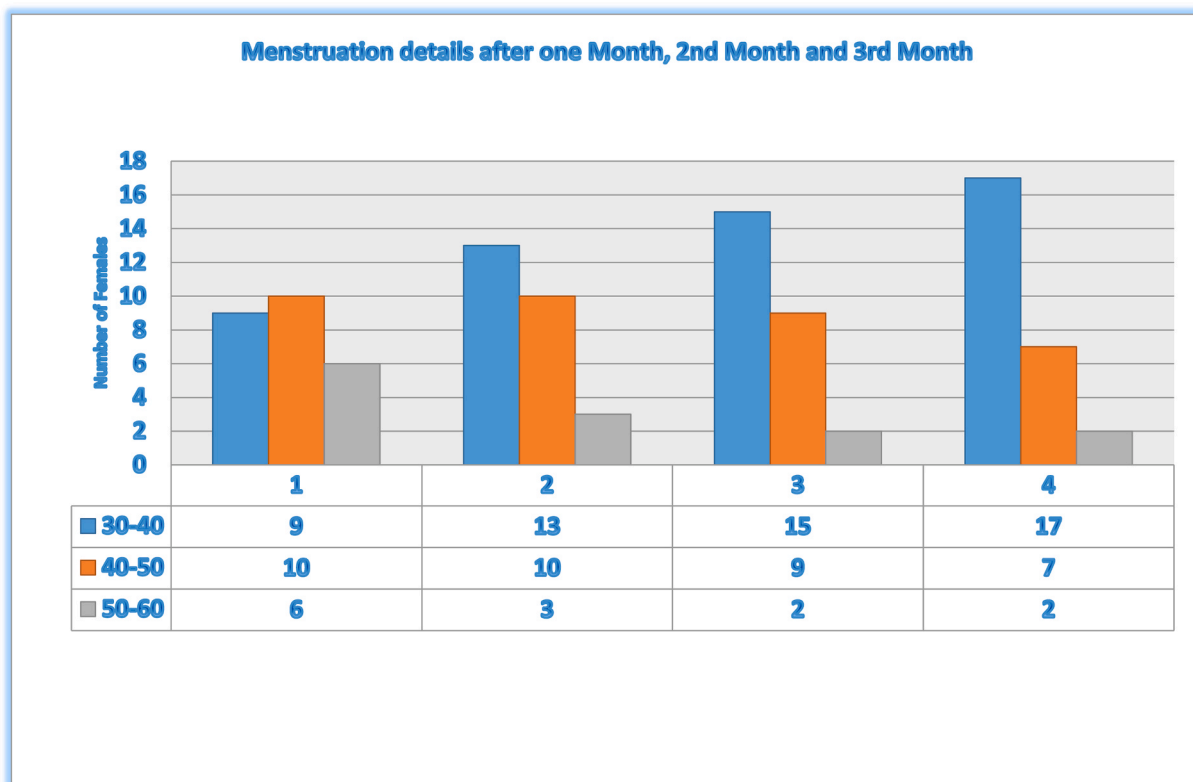


Fig. 3. Menstruation details after one Month, 2nd Month and 3rd Month (Post-treatment reading).

biochemical adaptations are triggered which causes a physiological stimulus to occur which in turn increase oxygen consumption; oxidation of free fatty acids and circulation of glucose as a source of energy [22, 24] and increase the aerobic metabolism, which helps in supplying the energy obligatory for muscle contraction, decreasing weight, reducing obesity and enhancing cardiorespiratory fitness [22,25,26]. Furthermore, a reduction in weight of as little as 5 % from original body weight can restore regular menses and enhance ovulation-inducing reaction and fertility medications [14,27,28].

One randomised control trial suggested that 3 months of structured and supervised exercises help in reducing insulin resistance and body mass index compared with females randomized to no exercise group [14,29]. It has also been suggested that fat mass reduction occurs more in the exercise group than in the dietary group [14,30]. Exercises have been seen to improve insulin resistance and reduce anovulatory infertility [14,31] in females with PCOS.

Dysmenorrhea is common in teenage girls and has been recorded as the prevalent cause of school and workplace absences for teenagers and young adults [32,33]. Studies have recorded a school absenteeism incidence of 14-52 % among adolescents with dysmenorrhea [32,34]. Pilates has shown a positive effect in decreasing the pain during menstruation and are consistent with our result as seen in table 4.2 and graph 4.2.

Pilates has been proven statistically significant in decreasing the pain in 4-15 weeks [35]. In one of the high quality, RCT, it was suggested that

a 24 week Pilates exercise program and education are effective in reducing pain than education only [35,36]. Though Pilates can decrease the pain, it will, in turn, decrease the prevalence of absentees of students and working females from collages and workplaces respectively. Plus, it doesn't have any side effects compared to analgesics and steroids taken by the PCOS females and will, in turn, increase their quality of life. Economically also Pilates is beneficial, as it only requires proper instruction from the physiotherapist on the first meeting and can be then performed at home as it doesn't require any special equipment compared to the pharmacological intervention which is to be taken lifelong. Though this research gives an evidence-based intervention for the treatment of PCOS there were some limitations. Firstly, the sample size of the study can be considered as one of the limitations but as it was calculated using a statistical method so it can't be of genuine concern so we can take it as a future scope to try this protocol in the larger sample. Secondly, due to the COVID- 19, we weren't able to do an ultrasound at the end of the 3rd month to check the volume of ovaries, although there was a regulation in the menstruation cycle.

Clinical implication

This study supports the usage of physical activity to regulates the menstrual cycles and reduce cramps. Pilates will be best alternative for all the females who take or do not want to take the medication, pilates do not need any expensive or special equipment for doing in the clinical

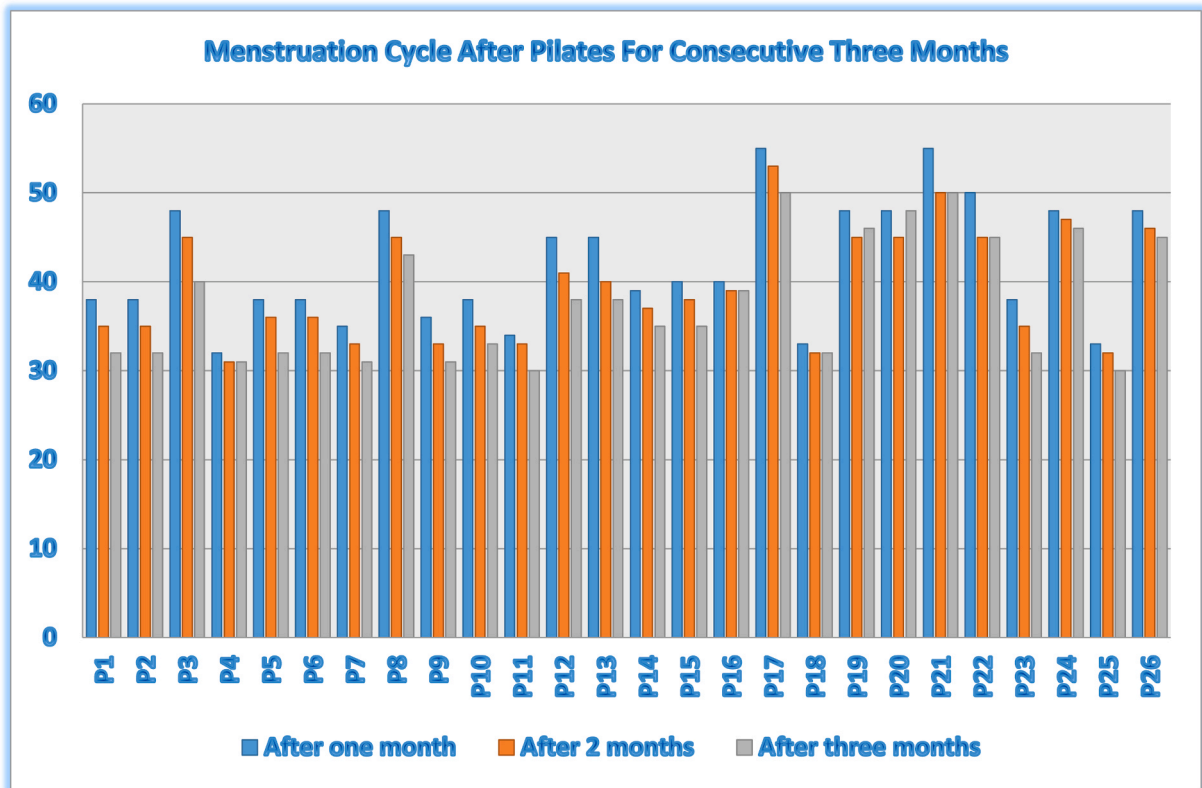


Fig. 4. Menstruation Cycle after Pilates for Consecutive Three Months.

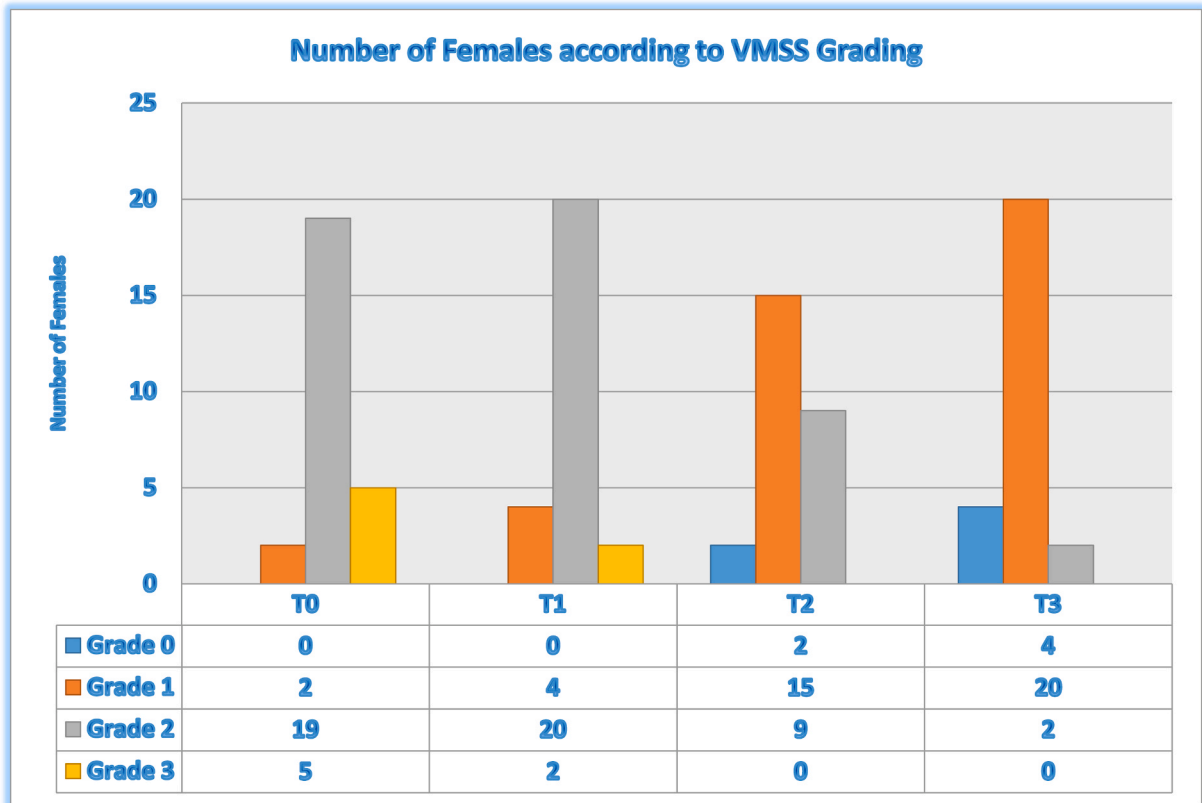


Fig. 5. VMSS Assessment of dysmenorrhoea.

Table 4

Pairwise comparison to check the significance of pain between the different time durations (0, 1, 2, 3, months).

Pairwise Comparisons					
Time		Mean Difference	Std. Error	Sig.	95 % CID
					Lower Bound Upper Bound
T0	2	.462*	.114	.003	.135 .788
	3	1.231*	.101	.000	.942 1.520
	4	1.654*	.146	.000	1.235 2.073
T1	1	-.462*	.114	.003	-.788 -.135
	3	.769*	.101	.000	.480 1.058
	4	1.192*	.136	.000	.802 1.582
T2	1	-1.231*	.101	.000	-1.520 -.942
	2	-.769*	.101	.000	-1.058 -.480
	4	.423*	.113	.006	.098 .748
T3	1	-1.654*	.146	.000	-2.073 -1.235
	2	-1.192*	.136	.000	-1.582 -.802
	3	-.423*	.113	.006	-.748 -.098

practice and can be replicated anywhere be it clinic or home. If tailored properly, it can be even given to pregnant females during their first trimester to strengthen their core muscles, which will help in normal delivery.

Limitations/recommendations

There is paucity in literature for the regulation of menstrual cycles, therefore, more studies can be done to check the effect of various interventions on the cycle regulation and the physiological effects produced in the body. Though we weren't able to do the ultrasound at the end of treatment, therefore a study can be done in which ultrasound will be done at the end of the treatment season to check the physiological effect of exercise on the ovarian volume. In our study we continued the exercise follow-up for 3 months only, so studies should be done in which long term follow-ups can be taken to check the long term effect and to also know the adherence and compliance of females towards exercises. Further studies can be done to check the effect of physiotherapy versus pharmacological interventions. Plus with the advancement in physiotherapy intervention, studies can be done in which we can check the effect of different exercises.

Conclusion

PCOS is a quintessence with a life long span that requires control rather than cure. This study demonstrates that females with PCOS when treated with Pilates, had shown a positive effect on dysmenorrhoea and regulation of the menstrual cycle. This study provides clinicians with insight into the role of Pilates in treating the symptoms of PCOS. Pilates has also helped in decreasing the BMI which has proven helpful in the regulation of the menstrual cycle.

Therefore we can conclude with the sentence that Pilates training should be part of routine medical management to increase the benefits of ovulation, reduce pain, regulation of cycle, and improve the quality of life of PCOS women.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence

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