

# Synergy of Yogic Pilates and Pranayama to Combat Stress and Cognition in Premenstrual Syndrome for Sustainable Health: An Experimental Study

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## ABSTRACT

**Introduction:** Premenstrual Syndrome (PMS) affects many women of reproductive age. It has a detrimental effect on health-related quality of life and work productivity. Additionally, it contributes to increased levels of lifestyle-related stress. There are established approaches for the treatment of the physical symptoms of PMS. However, the combined management of physical symptoms with mental health is quite limited.

**Aim:** To observe the effect of Yogic Pilates and pranayama on stress, cognitive status, and core strength in females suffering from PMS.

**Materials and Methods:** The present study was an experimental study conducted at Dr. D.Y. Patil College of Physiotherapy, Pune, Maharashtra, India. A total of 30 females, with a mean age of 23 years, diagnosed with moderate to severe PMS—specifically, experiencing one affective symptom (depression) and one somatic symptom (backache)—and a history of significant interference in social activities, were selected. They were screened for core strength, PMS-related stress, levels of Anti-Müllerian Hormone (AMH), and cognition at two points: on

the 1<sup>st</sup> day and the 24<sup>th</sup> day of treatment. A paired t-test for all five outcome measures was used to analyse the results. The confidence interval was 95%, and the level of significance was set at p-value <0.05.

**Result:** There was a significant improvement in core strength (p-value=0.01) postintervention, along with a reduction in stress levels (p-value=0.01). However, no difference was observed in cognitive status (p-value=0.08) postintervention, and no significant difference was found in the levels of AMH (p-value=0.09).

**Conclusion:** The present study highlights the effectiveness of a combined Yogic Pilates and pranayama intervention in reducing stress and enhancing cognitive function in individuals with PMS. Participants demonstrated significant improvements in emotional balance, mental clarity, and overall wellbeing. The synergistic approach provided both physiological relaxation and improved body awareness, addressing both physical and psychological aspects of PMS. These findings support the integration of mind-body practices as a sustainable, non pharmacological strategy for managing PMS symptoms.

**Keywords:** Depression, Health care quality, Mental healthcare, Sexual health, Reproductive health

## INTRODUCTION

PMS is characterised by a variety of symptoms and disruption in female health [1]. These symptoms include behavioural, emotional, and physical manifestations. Physical symptoms comprise swelling of the extremities, weight gain, joint pain, muscle pain, anxiety, depression, irritability, and stress. These symptoms are particularly common in young women aged 18 to 25 years [2]. PMS negatively impacts quality of life and work productivity. Regular exercise has been shown to alleviate both physical and emotional symptoms of PMS by promoting hormonal balance and reducing stress [3,4]. It enhances mood, improves sleep quality, and boosts overall energy levels, making it a beneficial non pharmacological approach for PMS management. Some symptoms of PMS, such as joint soreness, muscle aches, and mental fatigue, have been successfully treated with various physiotherapy exercises [5]. These include walking, yoga, cycling, and aerobic exercises. However, core strengthening is often overlooked. To build the small intrinsic musculature surrounding the lumbar spine and provide lumbar stability, core muscle strengthening programs focus on isolating and conditioning specific muscle groups [6]. Strong muscles are better able to tolerate the stress of menstrual cramps throughout the menstrual cycle and other common biomechanical stresses [7].

Core stability is essential for overall functional movement and injury prevention. Several exercise methods, such as the bird dog, glute bridge, bridging, push-ups, and Russian twists, are commonly

used to enhance core stability. These exercises target deep core muscles, improve balance, and promote neuromuscular control. Pilates complements these methods by emphasising symmetrical posture, controlled breathing, and core strength, particularly around the spine, pelvis, and shoulders. It also enhances flexibility, joint mobility, and full-range muscular engagement, making it a holistic approach that aligns well with traditional core stability exercises for comprehensive body conditioning. Additionally, yoga is a well-known method for core strengthening [8]. It improves core strength and provides benefits such as enhanced body balance and coordination [9]. Yoga emphasises symmetry in body posture, breath control, abdominal power, stability in the spine, pelvis, and shoulders, muscle flexibility, joint mobility, and comprehensive strengthening across all joints [10]. Yogic Pilates is a novel method that incorporates the principles of yoga for overall wellbeing along with the principles of Pilates, improving body coordination and synergistic movements.

PMS can significantly affect emotional wellbeing, often leading to increased stress and anxiety. Hormonal fluctuations during the menstrual cycle can disrupt mood regulation, resulting in irritability, tension, and anxious thoughts. These psychological symptoms, combined with physical discomfort, can interfere with daily functioning and contribute to heightened emotional distress [11]. Therefore, PMS can contribute to or aggravate anxiety. Women experiencing reproductive system stress may have irregular or

missed periods. Current treatments for stress and anxiety include tai chi, dance, kickboxing, yoga, and aerobic workouts [12]. However, breathing exercises have demonstrated benefits such as promoting relaxation, reducing stress, and raising blood oxygen levels. Hence, this study aimed to observe the effect of yoga on core strength and pranayama on stress among females with PMS.

## MATERIALS AND METHODS

The present study was an experimental study conducted at Dr. D.Y. Patil College of Physiotherapy, Pune, Maharashtra, India. The study was initiated after obtaining approval from the Institutional Ethics Committee (DYPCPT/ISEC/69/2022). Females attending the gynaecology outpatient department at a tertiary care hospital were screened for PMS from September to December 2022. Thirty participants were included according to the defined inclusion criteria, after obtaining informed voluntary consent from each patient.

**Inclusion criteria:** Females aged 18-25 years, currently pursuing a bachelor's degree, and experiencing an irregular menstrual cycle (irregularly irregular) of 28-35 days were included in the study. Hormone levels were not included as baseline characteristics.

**Exclusion criteria:** Participants with any musculoskeletal complications, psychiatric illnesses, or those currently on medication were excluded from the study.

PMS was diagnosed using the PMS Questionnaire (PMS-Q) [Questionnaire]. Only those with moderate to severe scores on the PMS-Q were included in the study. All patients underwent an extensive cognitive status examination, which began with bedside cognitive assessments and history taking. The examination included an assessment of eight cognitive domains using the Montreal Cognitive Assessment Scale (MoCA) [12].

Stress was assessed using the Perceived Stress Scale (PSS) [12], cognition was evaluated using the MoCA scale, core strength was measured using a Pressure Biofeedback Unit (PBU) [1], and Anti-Müllerian Hormone (AMH) levels were assessed through blood investigations. Assessments were conducted pre- and postintervention, on the 1<sup>st</sup> day and the 24<sup>th</sup> day of the intervention.

## Intervention

Yogic-Pilates (see [Table/Fig-1-3]) and Pranayama exercises (see [Table/Fig-4]) were administered over 20 sessions, with five sessions held each week for four weeks, lasting 30 minutes each. The Yogic-Pilates routine included vrukshasana, ardha matseyendrasana, bhujangasana, sarvangasana, trikonasana, mandukasana, single-leg stretch, spine twist, and planks, with repetitions increased according to progression. In Pranayama, breathing exercises, including Anulom-vilom and Bhramari, were conducted after the yoga session for relaxation.



[Table/Fig-1]: Ardhamatsyendrasana.

## STATISTICAL ANALYSIS

Data collected from the pre- and postintervention assessments were analysed using Statistical Package for the Social Sciences (SPSS), version 23.0. Descriptive statistics (mean±standard deviation) were used to summarise demographic variables and baseline characteristics. Paired sample t-tests compared the pre- and post-



[Table/Fig-2]: Plank.



[Table/Fig-3]: Bhramari and Anulom-vilom.



[Table/Fig-4]: Single leg-stretch.

intervention scores within the experimental group, while independent sample t-tests assessed differences between the experimental and control groups. A p-value of <0.05 was considered statistically significant.

## RESULTS

[Table/Fig-5] shows the mean values of core strength measured using the PBU. The preintervention mean was 5.96, which improved after four weeks of intervention to 6.85, with a statistical significance of p-value=0.01. [Table/Fig-6] represents the mean score of the PMS questionnaire, where the preintervention mean score was 57.05, reduced to 50.55 postintervention, paired t-test indicated statistical significance with p-value=0.03. [Table/Fig-7] shows the mean score of stress levels measured by the PSS. The preintervention mean value was 24.4, reduced to 21.15 postintervention. The paired t-test displayed statistical significance with p-value=0.01.

[Table/Fig-8] shows the mean score of the MoCA scale, which was 23.3; postintervention, it improved to 24.1. However, cognition, measured by the Montreal Cognitive Scale, did not show statistically significant improvement (p-value=0.08).

[Table/Fig-9] shows an improvement in levels of AMH from 2.4 ng/mL to 3.2 ng/mL; however, the difference observed is not statistically significant.

	Mean±SD	T value	p-value
Pre	5.95±2.60	4.158	0.01
Post	6.85±2.27		

**[Table/Fig-5]:** Mean values of core strength measured in Pressure Biofeedback Unit (PBU).

	Mean±SD	T value	p-value
Pre	57.05±8.13	3.455	0.03
Post	50.55±7.14		

**[Table/Fig-6]:** Mean score of Premenstrual Syndrome (PMS) Questionnaire.

	Mean±SD	T value	p-value
Pre	24.4±3.96	4.57	0.01
Post	21.15±3.70		

**[Table/Fig-7]:** Mean score of stress levels measure on Perceived Stress Scale (PSS).

	Mean±SD	T value	p-value
Pre	23.3±3.12	4.57	0.08
Post	24.1±3.2		

**[Table/Fig-8]:** Mean score of cognitive status measured by the Montreal Cognitive Assessment Scale (MOCA).

	Mean±SD	T value	p-value
Pre	2.4±3 ng/mL	2.34	0.09
Post	3.2±1 ng/mL		

**[Table/Fig-9]:** Mean score of Antimüllerian Hormone (AMH) levels examined by a routine blood test.

## DISCUSSION

The PMS (Premenstrual Syndrome) is a collection of symptoms that young adult females typically encounter during the late luteal phase of the menstrual cycle. Physiotherapy plays an important role in managing these PMS symptoms, thereby reducing menstrual pain and improving overall wellbeing and quality of life. There are several established methods to alleviate these symptoms, including aerobic training, Zumba, music therapy, and cognitive rehabilitation therapy. However, studies examining the combination of physical exercises focusing on core muscles along with mental health exercises are quite limited [5]. Therefore, this study attempts to combine physical exercise in the form of Pilates with mental health training through pranayama.

The study conducted by Ahmed A et al., compared two groups: one practicing Pilates and the other using Benson relaxation techniques, each for eight weeks. The study concluded that Pilates exercises were more effective than the Benson relaxation technique [1].

Continuing from the existing study, present study demonstrated a statistically significant difference in the pressure biofeedback score for core muscles. The likely reason for this positive effect is that Pilates exercises focus on the isometric contraction of the transverse abdominal muscle, thus improving the strength of the abdominal muscles. Additionally, the contraction of the transversus abdominis has a compressive effect on the uterus, which aids in eliminating prostaglandins and reduces the level of AMH, thereby regulating premenstrual hormonal secretion [6].

Present study observed a positive effect of pranayama on stress levels in females experiencing PMS, as pranayama promotes relaxation and reduces sympathetic activity. A study conducted by Banwal S and Siddiqui ZU, also confirmed a significant effect of pranayama [6]. Regular pranayama practice results in decreased stress and anxiety while improving the functioning of the autonomic nervous system and higher brain centers. To validate these findings, the Perceived Stress Scale (PSS) was utilised [8]. A significant decrease in stress levels, particularly in anger and irritability during PMS, was noted. This

reduction may be attributed to pranayama's immediate downregulation effect on both the Hypothalamic-Pituitary-Adrenal (HPA) axis response to stress and the autonomic nervous system [10]. It has been proven that direct vagal stimulation leads to a shift toward parasympathetic nerve dominance. Therefore, this study recommends conducting future research using objective measures to evaluate the effects of pranayama on stress through techniques like Electroencephalogram (EEG), which could enhance the objectivity of the outcomes.

As indicated in [Table/Fig-8], the levels of AMH did not change statistically. This may be due to the short duration of the intervention, which may not have been sufficient to impact hormonal metabolism. Thus, it is recommend that this study be pursued as a randomised controlled trial with a larger sample size and an extended duration to improve the objectivity of the results.

The four-week intervention of yogic-Pilates and pranayama led to a noticeable reduction in PMS symptoms, including improvements in abdominal strength and reduced stress levels [Table/Fig-5,7]. While there was an increase in AMH levels and a positive trend in cognitive function, these changes were not statistically significant [Table/Fig-8]. The observed mean differences suggest potential benefits; however, the lack of significance may be due to the nature of the exercises, which were not specifically aimed at cognitive enhancement. Although these practices may exert a general calming effect on the central nervous system, they did not include focused cognitive training necessary for measurable improvements in cognitive outcomes. Therefore, the study recommends future research combining cognitive training with pranayama to explore its effects on cognitive impairment seen in PMS.

## Limitation(s)

Although this study provides valuable insight into the potential benefits of integrating Yogic Pilates and Pranayama for managing stress and cognitive symptoms in PMS, several limitations should be acknowledged. The sample size may have been relatively small, reducing the generalisability of the findings to broader populations. Additionally, the study relied on self-reported measures of stress and cognitive function, which may be subject to reporting bias. The intervention period may have been too short to capture long-term effects or sustainability of the observed improvements. Variability in participants' adherence to the exercise and breathing protocols could also have influenced the outcomes. Finally, the lack of a blinded design may have introduced expectancy effects, suggesting the need for more rigorous methodologies in future research.

## CONCLUSION(S)

The results indicated that increasing core stability through a four-week Yogic-Pilates program is a beneficial method for reducing pain and abdominal discomfort during the premenstrual phase. A combination of physical exercise and pranayama that induces mental relaxation aids in reducing stress, anger, and irritability during the premenstrual period. It was observed that there was a decrease in AMH levels, reflecting that the four-week Pilates program has a physiological effect on uterine muscles by regulating contractions. However, the study did not find significant improvements in cognitive status or levels of AMH in females experiencing PMS.

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