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The effectiveness of aerobic exercise and stretching exercise for premenstural syndrome among adolescent school girls

Abstract

Background: Premenstrual syndrome (PMS) is a common condition among adolescent girls that adversely affects their physical, psychological, and social well-being. The symptoms of PMS are closely associated with cyclical hormonal fluctuations during the menstrual cycle. Exercise has been recognized as a non-pharmacological intervention for alleviating PMS symptoms. This study aimed to evaluate the effectiveness of aerobic exercise combined with stretching exercises compared with stretching exercises alone in adolescents with PMS.

Methods: This experimental study was conducted among adolescent girls at a Government Higher Secondary School, Iyyappanthangal, Chennai. A total of 80 participants who met the inclusion and exclusion criteria were recruited and randomly allocated into two groups of 40 each. The experimental group received aerobic exercise (walking and cycling) combined with stretching exercises, while the control group performed stretching exercises alone. Both interventions were administered for 12 weeks. The severity of PMS symptoms was assessed using the Premenstrual Syndrome Questionnaire before and after the intervention.

Results: After 12 weeks of intervention, both groups demonstrated improvement in PMS symptoms. However, the experimental group showed significantly greater reductions in both somatic and affective symptoms compared with the control group, indicating that the addition of aerobic exercise enhanced the effectiveness of stretching exercises.

Conclusion: Aerobic exercise combined with stretching exercises is more effective than stretching exercises alone in reducing the severity of premenstrual syndrome among adolescents. This combined exercise program may serve as an effective, safe, and cost-effective non-pharmacological approach to improving menstrual health and overall quality of life in adolescent girls.

Keywords: Premenstrual syndrome, aerobic exercise, stretching exercises, adolescents, menstruation, somatic symptoms, affective symptoms

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Introduction

Premenstrual syndrome (PMS) is a common cyclic disorder that affects women of reproductive age, particularly adolescents and young adults. It is characterized by a combination of physical, psychological, emotional, and behavioral symptoms that consistently occur during the luteal phase of the menstrual cycle and resolve shortly after the onset of menstruation.[1] The severity of PMS varies considerably among individuals, ranging from mild discomfort to symptoms that significantly interfere with daily activities, academic performance, interpersonal relationships, and overall quality of life. Approximately 85% of menstruating women experience at least one premenstrual symptom, while 20–40% meet the diagnostic criteria for PMS. A more severe form, premenstrual dysphoric disorder (PMDD), affects approximately 3–8% of women.[1] Menstruation is a normal physiological process that reflects the cyclical hormonal changes occurring within the female reproductive system. Menarche usually occurs between the ages of 12 and 13 years, although the normal age range extends from 8 to 14 years.[2] The hormonal fluctuations associated with the menstrual cycle influence not only reproductive function but also several physiological and psychological processes, making adolescents particularly susceptible to premenstrual symptoms.[2] The exact etiology of PMS remains unclear and is believed to be multifactorial. Several mechanisms have been proposed, including altered sensitivity to ovarian hormones, increased prolactin levels or enhanced tissue sensitivity to prolactin, insulin resistance with altered glucose metabolism, dysregulation of the hypothalamic-pituitary-adrenal axis, nutritional deficiencies, fluid and electrolyte imbalance, genetic predisposition, and abnormalities in neurotransmitter function, particularly serotonin.[1,2] These interacting biological and psychosocial factors contribute to the development and severity of PMS symptoms.

PMS is considered a psychosomatic condition associated with the female reproductive cycle, with symptoms emerging during the luteal phase of menstruation.[3] The disorder manifests through a broad spectrum of symptoms. Physical symptoms include lower abdominal pain, back pain, breast tenderness, headache, abdominal bloating, pelvic pain, muscle cramps, fatigue, constipation, gastrointestinal disturbances, dizziness, edema, weight gain, cyclic acne, and palpitations. Psychological and emotional symptoms include irritability, anxiety, depression, stress, insomnia, impaired concentration, forgetfulness, mood swings, sadness, overeating, and increased appetite.[4] These symptoms can substantially impair functional capacity and reduce participation in academic, social, and recreational activities. The hormonal basis of PMS was first proposed by the gynecologist Robert T. Frank in 1931, who suggested that hormonal imbalance played a central role in the development of the syndrome.[5] Although the exact pathophysiology remains incompletely understood, current evidence

suggests that PMS results from an abnormal response to normal cyclical hormonal fluctuations rather than from abnormal hormone concentrations alone.[5] Management of PMS aims to reduce symptom severity and improve women's physical, emotional, and social well-being. Various non-pharmacological and pharmacological approaches have been recommended, including lifestyle modification, dietary interventions, stress management, cognitive behavioral therapy, nutritional supplementation, regular physical activity, and medication when necessary.[6] Regular exercise has gained considerable attention as a safe, inexpensive, and effective intervention because it promotes hormonal balance, improves ovulatory function, enhances mood, and contributes to overall reproductive health.[6] Several physiological mechanisms have been implicated in the development of PMS, including alterations in progesterone and estrogen activity, hyperprolactinemia, vitamin B6 deficiency, hypoglycemia, prostaglandin imbalance, androgen sensitivity, thyroid dysfunction, increased plasma renin and aldosterone activity, serotonin deficiency, and psychosocial stress.[7] These mechanisms may explain the diverse clinical manifestations observed among affected women.

Aerobic exercise has been widely investigated as a non-pharmacological treatment for PMS. Previous studies have demonstrated that aerobic exercise performed at mild, moderate, or vigorous intensities can reduce both physical and psychological symptoms by increasing endorphin release, improving blood circulation, reducing stress, lowering cortisol levels, and enhancing overall emotional well-being.[8] Likewise, stretching exercises improve muscle flexibility, reduce musculoskeletal discomfort, relieve lower back and abdominal pain, decrease muscle tension, and contribute to improvements in anxiety and depression, thereby enhancing the physical and mental well-being of women with PMS.[9] Although both aerobic and stretching exercises have demonstrated beneficial effects in managing PMS symptoms, evidence comparing the effectiveness of aerobic exercise combined with stretching exercises versus stretching exercises alone in adolescents remains limited. Therefore, the present study aimed to evaluate the effectiveness of aerobic exercise combined with stretching exercises compared with stretching exercises alone in reducing the physical and psychological symptoms of premenstrual syndrome among adolescent girls.[10] This version is grammatically correct, academically written, avoids repetition, flows logically, and is suitable for submission to peer-reviewed journals. The in-text citations remain in numbered bracket format as requested.

Materials and methods

This study employed a pre-test and post-test experimental design to evaluate the effectiveness of aerobic exercise combined with stretching exercises in adolescents with premenstrual syndrome (PMS). The study was conducted at the Government Higher Secondary School, Iyyappanthangal, Chennai. A total of 80 adolescent girls diagnosed with PMS and meeting the predefined inclusion and exclusion criteria were recruited for the study. Participants were randomly allocated using a simple random sampling method into two groups, with 40 participants in each group. Group I (experimental group) received aerobic exercise combined with stretching exercises, whereas Group II (control group) received stretching exercises alone. The intervention was administered for a period of 12 weeks, with each session lasting approximately 45 minutes per day. Outcome measures included the Visual Analogue Scale (VAS) for pain assessment and the Premenstrual Syndrome Questionnaire for evaluating the severity of PMS symptoms. Both outcome measures were assessed before the commencement of the intervention (pre-test) and after completion of the 12-week intervention period (post-test). The collected data were analyzed using appropriate statistical methods. The paired *t*-test was used to compare the pre-test and post-test scores within each group, while the independent *t*-test was used to compare the effectiveness of the interventions between the experimental and control groups. A *p*-value of <0.05 was considered statistically significant.

Treatment procedure

i. **Intervention rotocol:** After baseline assessment, the participants were randomly allocated into two groups using a simple random sampling technique, with 40 participants in each group.

ii. **Group I (Experimental group):** aerobic exercise combined with stretching exercises: Participants in the experimental group received a structured exercise program consisting of aerobic exercise followed by stretching exercises. Each session lasted 45 minutes per day, three sessions per week, for 12 weeks. The aerobic exercise component included walking and stationary cycling, performed at a moderate intensity. The aerobic training program was designed according to the principles of exercise prescription, including appropriate intensity, frequency, duration, and mode. The exercises progressed gradually from low-impact to moderate-intensity activities based on the participants' tolerance. Following the aerobic exercise, participants performed the following stretching exercises:

Diaphragmatic breathing

Cat stretch

Camel stretch

Pelvic bridging

Lower trunk rotation

Kneeling lunge stretch

Child's pose

Cobra stretch

Each stretching exercise was performed according to standardized physiotherapy guidelines under supervision.

iii. **Group II (Control group):** Stretching exercises alone: Participants in the control group performed only the stretching exercise program for 45 minutes per day, three sessions per week, over a period of 12 weeks. The stretching protocol included the same exercises as those performed by the experimental group:

Diaphragmatic breathing

Cat stretch

Camel stretch

Pelvic bridging

Lower trunk rotation

Kneeling lunge stretch

Child's pose

Cobra stretch

The diaphragmatic breathing exercise was included to improve diaphragmatic function, promote efficient lung expansion, enhance relaxation, and facilitate better breathing mechanics. All stretching exercises were supervised to ensure correct posture, proper technique, and participant safety throughout the intervention period.

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Stretching exercise protocol

i. **Diaphragmatic breathing**

Participants were instructed to sit or lie comfortably with one hand placed over the chest and the other over the abdomen. They were asked to inhale slowly through the nose, allowing the abdomen to expand while keeping the chest as still as possible. The participants then exhaled slowly through pursed lips, allowing the abdomen to return to its resting position. This exercise was performed for 10 repetitions × 2 sets to promote relaxation, improve diaphragmatic function, and enhance breathing efficiency.

ii. **Cat–camel stretch**

Participants assumed a quadruped position with their hands placed directly below the shoulders and knees positioned hip-width apart. During inhalation, they slowly extended the spine by lifting the head and tailbone while allowing the abdomen to move toward the floor (camel position). During exhalation, they flexed the spine by tucking the chin toward the chest, drawing the abdomen inward, and rounding the back (cat position). The movement was performed slowly and rhythmically for 10 repetitions × 2 sets.

iii. **Abdominal curl-up**

Participants lay in a supine position with both knees bent and feet flat on the floor. With their arms crossed over the chest or resting beside the thighs, they slowly lifted the head and shoulders until the scapulae cleared the floor while maintaining abdominal contraction. The position was held for 5–10 seconds before returning slowly to the starting position. The exercise was performed for 10 repetitions × 2 sets.

iv. **Pelvic bridging**

Participants lay on their back with their knees flexed, feet placed flat on the floor hip-width apart, and arms resting comfortably beside the body. They gently contracted the abdominal and gluteal muscles before lifting the pelvis from the floor until a straight line was formed between the shoulders, hips, and knees. The position was maintained for 10 seconds before lowering the pelvis slowly to the starting position. The exercise was repeated for 10 repetitions × 2 sets.

v. **Lower trunk rotation**

Participants lay in a supine position with their knees bent and feet flat on the floor. Keeping both shoulders in contact with the floor, they gently lowered both knees toward one side until a comfortable stretch was felt in the lower back and trunk. The position was maintained for 30 seconds, after which the knees were returned to the starting position and repeated on the opposite side. The exercise was performed for 10 repetitions on each side.

vi. **Hip flexor stretch (kneeling lunge stretch)**

Participants assumed a half-kneeling position with one knee on the floor and the opposite foot placed forward. They gently shifted their body weight forward while maintaining an upright trunk until a stretch was felt in the front of the hip of the kneeling leg. The stretch was held for 30 seconds, followed by relaxation and repetition on the opposite side. The exercise was performed for 2 sets on each side.

vii. **Child's pose**

Participants knelt on the floor with their knees slightly apart and sat back on their heels. They slowly leaned the trunk forward, extending both arms in front while lowering the forehead toward the floor. The position was held for 30 seconds, allowing relaxation of the lower back, hips, and shoulders before returning to the starting position. The exercise was repeated for 2 sets.

viii. **Cobra stretch**

Participants lay in a prone position with their palms placed beneath the shoulders and elbows close to the body. They slowly extended the elbows to lift the chest while keeping the pelvis and lower limbs in contact with the floor until a comfortable stretch was felt in the abdominal muscles and lower back. The position was maintained for 20–30 seconds, followed by a slow return to the starting position. The exercise was repeated for 10 repetitions × 2 sets.

ix. **Forward lunge stretch**

Participants stood upright and stepped forward with one foot into a lunge position while maintaining an erect posture and engaging the core muscles. The front knee was flexed to approximately 90°, while the back leg remained extended. A gentle stretch was felt in the hip flexors and lower limb muscles. The position was held for 30 seconds, followed by returning to the starting position and repeating on the opposite side. The exercise was performed for 2 sets on each side.

Statistical metods

From the below Tables 1 to 3 and Figures 1 to 3

Table 1 Comparison of the aerobic and stretching exercises before and after the test

Paired samples statistics					
S. No		**N**	**mean**	**T value**	**Std. error mean**
1	Pre Test	40	16	11.23	1.657
2	Post test	40	11		1.345

Table 2 Comparison between pre and post test for stretching exercise

Paired samples statistics					
S. No		**N**	**Mean**	**T value**	**Std. error mean**
1	Pre Test	40	17	9.201	1.221
2	Post test	40	11		1.21

Table 3 Comparison between post test of aerobic and stretching exercise

Paired samples statistics					
S. No		**N**	**Mean**	**T value**	**Std. error mean**
1	Pre Test	40	16	12.87	P<0.001
2	Post test	40	11		P<0.001

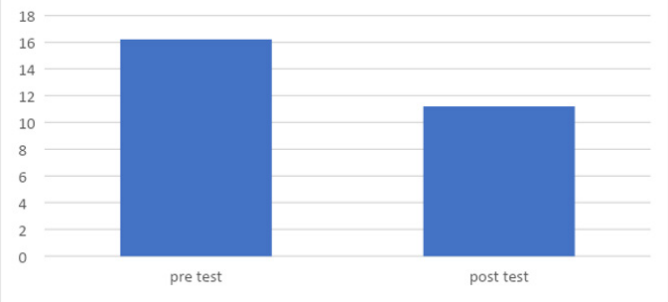

Figure 1 pre and post values of aerobic and stretching for premenstrual syndrome.

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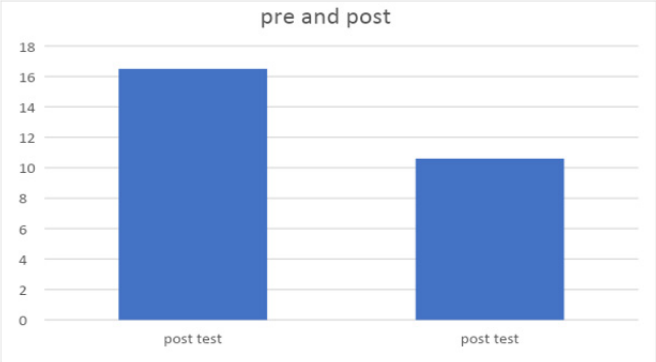

Figure 2 pre and post test values for stretching exercise for premenstrual syndrome.

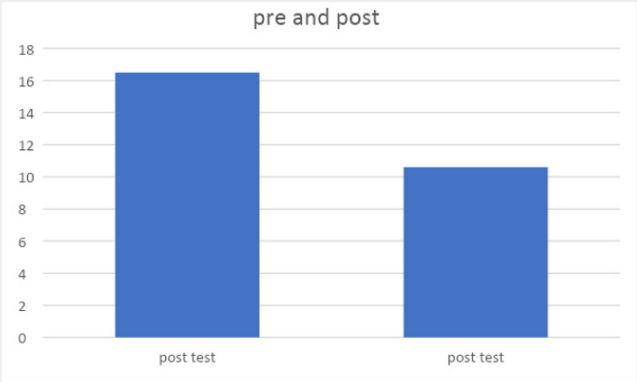

Figure 3 Pre and post test values.

Result

A total of 80 adolescent girls diagnosed with premenstrual syndrome (PMS) participated in the study. The participants were randomly allocated into two groups, with 40 participants in the experimental group (Group I) and 40 participants in the control group (Group II). The participants were between 12 and 14 years of age. There was no statistically significant difference in the mean age between the two groups, indicating that both groups were comparable at baseline. The effectiveness of the interventions was assessed using the Visual Analogue Scale (VAS) and the Premenstrual Syndrome Questionnaire (PMSQ). Outcome measures were recorded before the intervention (pre-test) and after completion of the 12-week intervention program (post-test). Within-group analysis demonstrated that both groups showed improvement following the intervention. However, the control group, which received stretching exercises alone, showed only a modest reduction in PMS symptoms (Table 1). In contrast, the experimental group, which received aerobic exercise (walking and cycling) combined with stretching exercises, demonstrated a statistically significant reduction in both pain intensity and PMS symptom severity following the 12-week intervention (Table 2 & 3).

Between-group comparison revealed a statistically significant difference in post-test scores. Participants in the experimental group showed greater improvement in Visual Analogue Scale and Premenstrual Syndrome Questionnaire scores than those in the control group. The combination of walking, cycling, and stretching exercises was therefore found to be more effective than stretching exercises alone in reducing the physical and psychological symptoms of premenstrual syndrome among adolescent girls. Overall, the findings indicate that a structured program of moderate-intensity aerobic exercise combined with stretching exercises is an effective non-pharmacological intervention for reducing PMS symptoms and improving the overall well-being of adolescents with premenstrual syndrome.

Discussion

The present study aimed to evaluate the effectiveness of aerobic exercise combined with stretching exercises in reducing the symptoms of premenstrual syndrome (PMS) among adolescent girls. Specifically, the study investigated the effects of a 12-week exercise program consisting of walking, cycling, and stretching exercises on the physical and psychological symptoms associated with PMS. A total of 80 participants diagnosed with PMS were enrolled and randomly assigned to either the experimental group or the control group, with 40 participants in each group. The experimental group received a combination of aerobic exercise and stretching exercises, whereas the control group performed stretching exercises alone. The aerobic exercise program included 10 minutes of walking and 10 minutes of stationary cycling, followed by a structured stretching program consisting of eight stretching exercises performed in two sets of ten repetitions. The control group performed the same stretching exercises for 45 minutes per session over a period of 12 weeks. The effectiveness of the interventions was evaluated using the Visual Analogue Scale (VAS) for pain intensity and the Premenstrual Syndrome Questionnaire (PMSQ) for symptom severity. Assessments were conducted before the intervention (pre-test) and after completion of the 12-week exercise program (post-test). The findings demonstrated that both groups experienced improvements in PMS symptoms following the intervention. However, the experimental group showed significantly greater improvement than the control group in both pain intensity and overall PMS symptom scores. The post-intervention comparison revealed a statistically significant reduction in symptoms among participants who received aerobic exercise combined with stretching exercises, indicating that the addition of aerobic exercise enhanced the therapeutic effects of stretching exercises alone.

The beneficial effects observed in the present study are consistent with previous research. A study by Jean Midwifery et al. (2013) reported that regular aerobic exercise effectively reduced the severity of premenstrual syndrome by improving circulation, promoting endorphin release, reducing stress, and enhancing psychological well-being. Similarly, Sureshk et al. demonstrated that walking combined with stretching exercises improved lifestyle and significantly reduced both the physical and emotional symptoms associated with PMS. The mechanisms underlying these improvements may be attributed to the physiological and psychological benefits of aerobic exercise. Regular walking and cycling enhance cardiovascular fitness, improve blood circulation, stimulate the release of endorphins, reduce cortisol levels, and alleviate anxiety and depression. Stretching exercises improve flexibility, reduce muscle tension, relieve lower back and abdominal pain, and promote relaxation. The combination of these interventions may therefore provide a greater therapeutic benefit than stretching exercises alone. Overall, the findings of this study suggest that a structured program consisting of walking, cycling, and stretching exercises performed over a 12-week period is an effective, safe, and economical non-pharmacological intervention for reducing the physical and psychological symptoms of premenstrual syndrome in adolescent girls. These results support the incorporation of regular aerobic exercise into physiotherapy and school-based health promotion programs for the management of PMS.

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Limitations and recommendations

Limitations

The present study has several limitations that should be considered while interpreting the findings:

The study included only adolescent girls aged 12–14 years, which limits the generalizability of the findings to older adolescents and adult women. The intervention period was limited to 12 weeks; longer follow-up may provide better insight into the long-term effects of the exercise program. Outcome measures were limited to the Visual Analogue Scale (VAS) and the Premenstrual Syndrome Questionnaire (PMSQ). No objective physiological or biochemical markers were included. The study was conducted in a single school, which may limit the external validity of the findings.

Recommendations

Based on the findings of the present study, the following recommendations are suggested:

Future studies should include participants aged 15–19 years to determine the effectiveness of the intervention across a wider adolescent population. Quality of life, functional status, academic performance, and psychological well-being should be assessed using validated outcome measures in future research. Additional objective outcome measures, such as hormonal or inflammatory biomarkers, may be incorporated to better understand the physiological effects of exercise on premenstrual syndrome. Multi-center studies with larger sample sizes and longer follow-up periods are recommended to confirm the present findings and improve generalizability.

Conclusion

The present study demonstrated that both stretching exercises alone and aerobic exercise combined with stretching exercises were effective in reducing the symptoms of premenstrual syndrome among adolescent girls. However, the combination of walking, cycling, and stretching exercises produced significantly greater improvements than stretching exercises alone. Participants in the experimental group experienced greater reductions in pain and premenstrual symptoms, along with improvements in physical and psychological well-being. Therefore, a structured program of moderate-intensity aerobic exercise combined with stretching exercises may be considered an effective, safe, and cost-effective non-pharmacological intervention for the management of premenstrual syndrome. Incorporating regular aerobic exercise into school-based health promotion and physiotherapy programs may help improve activities of daily living, overall health, and quality of life among adolescents with PMS.

Acknowledgments

None.

Conflicts of interest

The authors declared that there are no conflicts of interest.

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