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The Effect of Pilates Exercise and Spiral Taping on Premenstrual Syndrome

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ABSTRACT

Background: Premenstrual syndrome (PMS) is identified by a cyclical recurrence of severe emotional, physical, and behavioral alterations limited to the menstrual luteal phase. Although up to 75% of women in the reproductive age range experience some premenstrual changes overall, three to 10% claim that their lives have been disrupted when the symptoms are severe. Its onset is in the luteal phase of menstruation and goes away a few days later. There have been reports of a 70% to 90% prevalence of PMS throughout the reproductive phase. Affective symptoms might persist from a few days to two weeks. Typically, symptoms peak two days prior to the menstrual initiation and get worse one week beforehand. Usually, a time without symptoms precedes ovulation.

Purpose: To explore the effectiveness of Pilates exercise and spiral taping on PMS.

Methods: 60 non-parous women participated in this study; all were between 18 and 30 years. This research was conducted in the outpatient clinic of the Department of Gynecology and Obstetrics at the Isis Specialized Hospital in Luxor Governorate. The females were randomly split into two equal groups (A&B). All females were evaluated for the diagnosis of PMS through a questionnaire at the beginning of the study. After completing an initial evaluation of premenstrual tension symptoms, the participants were referred to a gynecologist for confirmation of the diagnosis (Group A: Pilates and spiral taping). For four weeks, beginning 14 days before the start of their periods and continuing until their menses ended, 30 females underwent Pilates exercises and spiral taping, three times a week. They also got medication (non-steroid anti-inflammatory medications), such as ibuprofen, which suppresses prostaglandin synthetase. Group B (Control group): 30 females received medication (non-steroid anti-inflammatory drugs) such as ibuprofen suppress.

Results: The study's result revealed a statistical significant reduction of ACTH by 36% after intervention relative to before intervention ($p = 0.001$) in study group and there is no statistical significant variation in the mean values of ACTH pre-intervention across both groups ($p= 0.077$), but there was statistical significant change after intervention ($p=0.001$) with the superiority of the study group and also there was a statistical significant reduction of cortisol level by 34% after intervention relative to before intervention ($p = 0.001$) in study group. There was no statistically significant variation in the mean values of cortisol level before intervention across both groups ($p= 0.088$), however there was a statistically significant change after intervention ($p= 0.001$), with the superiority of the study group.

Conclusion: Pilates exercise and spiral taping are a simple, safe, cost-free, and non-pharmacological method in reducing PMS symptoms in females.

KEYWORDS: Pilates exercise, PMS (premenstrual syndrome), spiral taping, menstrual pain, menstrual cycle.

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INTRODUCTION

Premenstrual syndrome (PMS) is identified by a cyclical occurrence of severe emotional, physical, and behavioral alterations related to the luteal phase of the menstrual cycle (LPMC). About 75% of reproductive-aged females exhibit some premenstrual changes overall, but three to 10% claim life disruption when symptoms are assessed for severity. (1).

After puberty, ovarian hormones impact the endometrium of women, resulting in menstruation, or periodic uterine bleeding (2). About 80% of females experience some symptoms one to two weeks before their periods (3).

PMS impacts women's financial, social, and quality of life (QoL). According to another study, between 23 and 31 percent of women in their reproductive years have PMS to a degree that interferes with their routine activities (4).

Although the precise cause of PMS is still unidentified, theories include hormone changes and persistent inflammation. Dietary

lipids may impact women's hormone and cytokine levels. It has been demonstrated that dietary fat and SFA function as pro-inflammatory agents, raising levels of C-reactive protein (CRP) (5).

A minimum of one of the first four symptoms is an indication of PMS: 1) depression; 2) anxiety or stress; 3) low back pain (LBP); 4) reduced activity; 5) appetite changes; and 6) physical manifestations (headaches, bloating, muscular soreness, and breast tenderness). Consequently, moderate to severe premenstrual symptoms have an effect on women's QoL and are a common cause of distress for them during their reproductive years (6). Numerous treatments, such as conservative therapies like medicine and thermotherapy, as well as self-treatment techniques, have been recommended to address menstrual discomfort and PMS. For instance, acupuncture, herbal medicines, and several medical therapies have all been shown to alleviate menstrual pain (7). Since PMS is a collection of over 95 emotional, psychological, and physical manifestations, taking one or two medications is rarely beneficial over the long term. However, medications are utilized for severe PMS symptoms, involving significant breast discomfort, abdominal pain, and noticeable edema. Moreover, medication treatments have been shown to have numerous concerning side effects, and the majority of females with PMS experience mild to severe symptoms (8). However, some treatments can have negative effects, like discomfort from and dread of acupuncture and tolerance to analgesics due to misuse. Therefore, simple and accessible ways to manage PMS and menstrual discomfort instead of using irritant therapies or medicine will assist in decreasing expenditures for both individuals and society (9).

Pilates is a form of training that is particularly popular with women worldwide. It enhances psychological state (higher motivation, improved mood, and body awareness), motor abilities (muscle control, stability, and coordination), and physical wellness (muscle strength, endurance, and core muscular stabilization) (10).

Additionally, Pilates strengthens muscles, corrects posture, improves torso and pelvic floor control and mobility, and builds body balance. It enhances flexibility, reduces musculoskeletal trauma, improves QoL, enhances sleep pattern and health perception in older people, enhances psychological well-being, and helps manage stress in those with hypertension (11).

Young girls who consistently participate in Pilates exercises report improvements in their lean body mass and body fat percentage. Pilates exercises also help with pain management and flexibility (12).

In modern clinical settings, tapes have been applied to the skin to treat convulsions, muscle strain, and diminished muscle strength. They also frequently reduce muscle discomfort by enhancing blood, tissue fluid, and lymph circulation (13).

Spiral taping therapy reduces pain by applying tape to the skin to improve blood circulation or contract the appropriate muscles. Depending on the body's natural healing mechanism, spiral taping is a technique that can be used in various conditions, from foot issues to headaches and everything in between (14).

It is regarded as an easy and harmless therapy with few adverse consequences that continues to work as the tape is affixed to the skin (15).

However, its primary responsibility and obligation is to prioritize the development and safety of women's health. In this regard, one of the midwives' abilities is helping women live comfortable lives by reducing their PMS symptoms (16).

Hypothesis of the study:

The Pilates exercise and spiral taping had no effect on premenstrual syndrome.

This study aimed to:

1) To explore the impact of Pilates exercise and spiral taping on PMS.

2) Compare these results to a control group that received medication and didn’t receive Pilates exercise and taping.

METHODS

Study Design

It is a prospective, randomized pre-posttest-controlled trial. It was conducted between September 2024 and January 2025.

Participants

60 non-parous women will participate in this study; all of them are between 18 and 30 years old. This research was done in the outpatient clinic of the Department of Gynecology and Obstetrics at Isis Specialized Hospital in Luxor Governorate. Their body mass index was less than 30, and 7), and their visual analogue scale (VAS) values for menstrual pain were five or greater. Females were excluded if they had endometriosis, pelvic inflammatory diseases, any pelvic pathological condition, or used oral contraceptives.

Additionally, any participant with a history of diagnosed diseases, such as liver or kidney dysfunction, genital disease, pelvic or abdominal surgery, diabetes, or spondylolisthesis was excluded.

Randomization

Using an online randomization application, all participating females were randomized to either the study group or the control group (ratio 1:1) (http://www.randomizer.org/); 32 participants in each group. To ensure allocation hiding, an investigator who was not clinically included in the study created systematically numbered index cards that included the random group allocations based on the generated random numbers. The folded index cards were put in closed envelopes that were concealed to both groups. The therapist who was administering the interventions then opened each envelope and split the participants into groups based on the index card that was chosen. The group assignments were hidden from the participants. There were no participant withdrawals following randomization (Fig. 1). Group A (study group):31 females received Pilates exercise & spiral taping three times/week for 4 weeks. Group B (Control group):31 females received medication (non-steroid anti-inflammatory drugs) such as ibuprofen suppress prostaglandin synthetase.

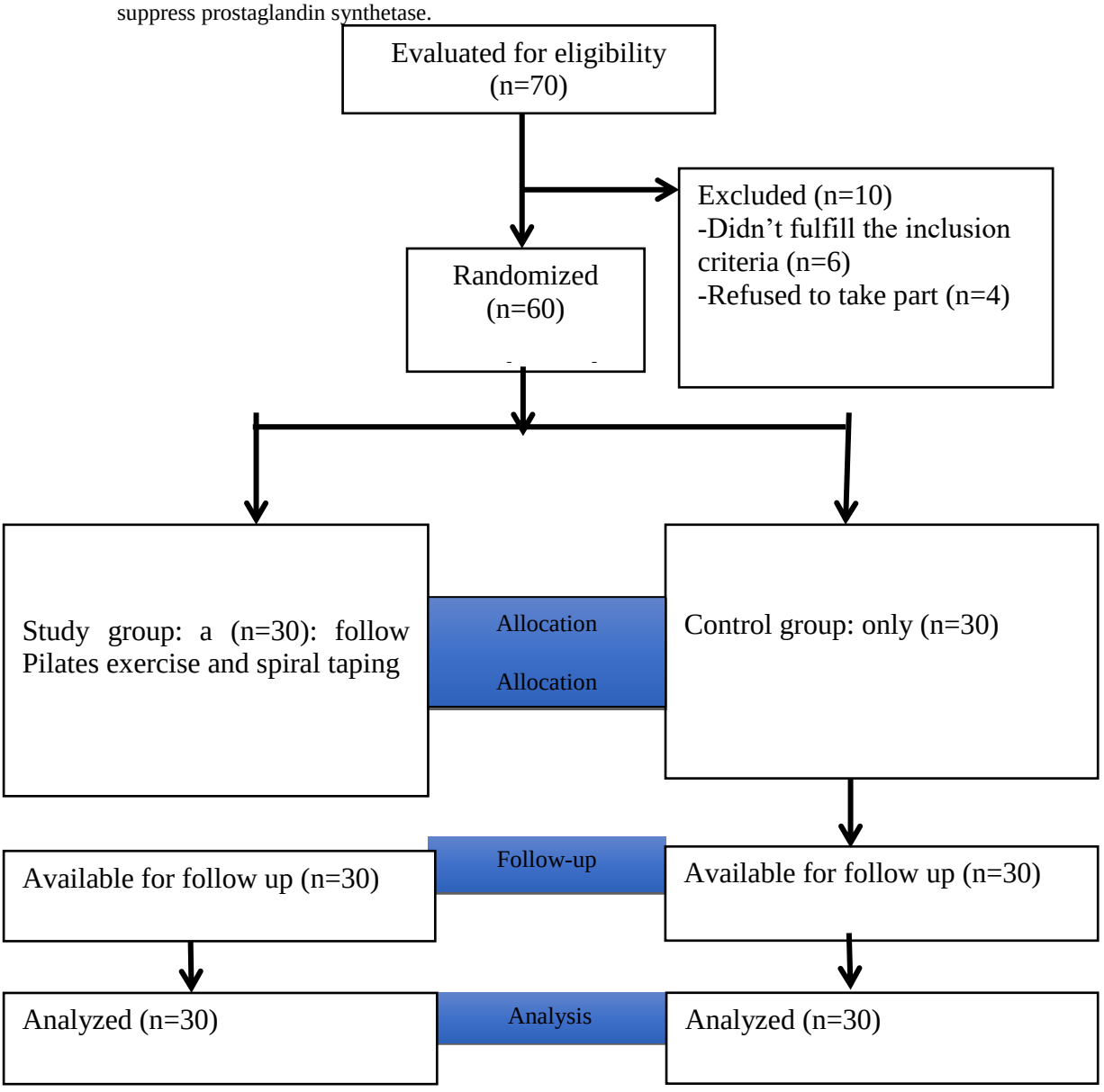

Fig. 1: The study's flow chart.

Procedures:

First, to foster collaboration and confidence throughout the therapeutic program, all participants in both groups were fully informed about the features, goals, and possible advantages of the treatment protocol before evaluation and interventional procedures began.

Each woman received a brief explanation of the treatment procedure prior to the first session, which helped her to become more cooperative and confident.

The females were randomly distributed into two equal groups (A and B).

Group A (Pilates exercise and spiral taping group):

- Thirty-one women participated in Pilates exercises, which included 5 minutes of warm-up exercises, 30 minutes of standard Pilates exercises, and 5–7 minutes of cooling down. One to three sets of eight to twelve repetitions each were used in each session, with the number of repetitions gradually increased.

• The first phase included standing, rolling down, and alternating arms as warm-up exercises for the first five minutes.

• The second phase comprised 30 minutes of fundamental Pilates exercises, such as pelvic rocking, single and double leg stretches, leg circles, spine stretching forward, and single and alternating leg lifts. Throughout each workout, breath control will be practiced. These exercises were chosen from the standard Pilates practices because they were simple to perform without the need for special equipment.

• The third phase involved cooling down for the final five to seven minutes (using sitting and lying down positions to go back to the starting state).

Phase	Exercise	Repetitions	Progression
Phase 2	Roll up/down	15–20	Week 1–4
	Hundred	10–15	Week 1–4
	Single leg circle	5 in each direction	Week 1–4
	Pelvic rocking	6	Week 1–4
	Single leg stretch	5–10	Week 1–4
	Double leg stretch	5–10	Week 1–4
	Spine stretch forward	5	Week 1–4

Mat Pilates exercise (38).

For four weeks, beginning 14 days before the menstrual initiation and lasting until their ends, the women engaged in three Pilates sessions per week, and for the spiral taping, spiral tape (Excel Spiral Tape) based on Tanaka's recommended balance taping points was used. A type: Tanaka spiral tape (Japan). Considering the numerous patterns of menstrual discomfort, spiral tape was placed to the lower abdomen, which is the primary site of pain, to assess its impact on pain reduction. The females were recorded once a week for four weeks, beginning fourteen days before the start of their periods and lasting until their ends.

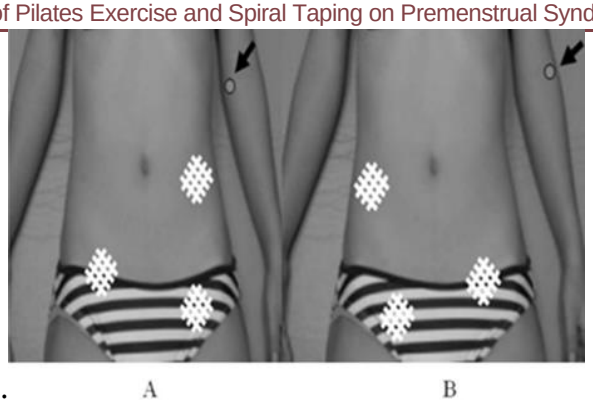

Fig 2: spiral taping (14)

Group B (CONTROL group):

31 females (Group B) had served as experimental control and received medication (non-steroid anti-inflammatory drugs), such as ibuprofen suppress prostaglandin synthetase.

Measured outcome

Cortisol level and ACTH

After being collected, blood for cortisol and ACTH will be placed in EDTA-treated tubes, put on ice right away, and then cold centrifuged to separate the plasma within a few minutes. Approximately the same number of PMs and control samples were run for each test kit, and all assays were carried out in duplicate. Blood samples were taken throughout the menstrual cycle's follicular phase (5-7 days) and luteal phase (22-26 days).

The sample size power analysis:

An a priori analysis is done to measure the required sample size via the G*POWER statistical software (G*POWER version 3.1). Utilizing data on menstrual pain from Lim et al. (17), a two-sided t-test with an α error probability of 5%, a power of 80%, and an effect size of 0.8 was carried out, providing a sample size of 26 participants in every group. The number increased to 30 subjects per group to overcome the possible dropout.

Statistical Analysis

The mean ± SD was utilized to express the data. The unpaired t-test was applied to compare participants' characteristics recognized across both groups. The normality of the data distribution was determined utilizing the Shapiro-Wilk test. ANOVA was employed to determine the effect of the measured variables (ACTH and cortisol level) both within and across groups. Data analysis was conducted utilizing the SPSS computer program (SPSS Inc., Chicago, Illinois, USA; version 20 for Windows). A P-value of 0.05 or less was regarded significant.

RESULTS

Demographic data of subjects:

As presented in Table 1, no significant change was noticed between the mean value of subjects' age, weight, height, and BMI of both groups (A & B) (p=0.799, 0.138, 0.118, and 0.156, respectively).

Table 1. Participant's characteristics of both groups

Demographic data	Study group (n=30)	Control group (n=30)	t-value	p-value
Age (years)	22.13±3.07	21.93±2.97	0.26	0.799
Weight (kg)	59.7±4.1	57.93±4.95	1.5	0.138
Height (cm)	145.3±6.45	148.9±10.74	-1.59	0.118
BMI (kg/m2)	27.1±2.43	26.2±2.42	1.44	0.156

Data was presented as mean ± SD, p- value: significance

Pain level:

As displayed in Table 2 and Figure 5, the mean value of subjects' pain levels in the study and control groups was 7.63±1.56 and 7.47±1.43 cm, respectively.

Table 2. Pain level of both groups

Pain (cm)	Study group (n=30)	Control group (n=30)	t-value	p-value
	7.63±1.56	7.47±1.43	0.43	0.668

Data was presented as mean ± SD, p- value: significance

ACTH:

Within-group comparison

Study group: The mean values ± SD of ACTH pre- and post-intervention of the study group were 72.64 ± 11.17 and 46.64 ± 17.78 pg/ml, respectively. A statistically significant decrease of ACTH by 36% was noted after intervention compared to before intervention (p = 0.001), with an MD and 95% CI of 26 (22, 29.99).

Control group: The mean values ± SD of ACTH before and after intervention of the control group were 60.01 ± 15.62 and 53.99 ± 13.57 pg/ml, respectively. A statistically significant reduction in ACTH ratio by 11% was noted after intervention compared to before intervention (p = 0.004), with MD and 95% CI of 6.02 (2.03, 10) (Table 3, Figure 6).

Between-groups comparison

There was no statistically significant variation in the mean values of ACTH pre-intervention across both groups (p=0.077), but a statistically significant variation was noticed post-intervention (p=0.001), with superiority of the study group (Table 3).

Table (3) Mean ±SD of ACTH before and after-treatment of both groups.

ACTH (pg/ml)	Study group Mean ±SD	Control group Mean ±SD	MD (95% CI)	P-value	η2
Pre-treatment	72.64 ± 11.17	60.01 ± 15.62	-7.35 (-15.5, 0.82)	0.077	0.053
Post-treatment	46.64 ± 17.78	53.99 ± 13.57	12.63 (5.61, 19.65)	0.001*	0.183
MD (95% CI)	26 (22, 29.99)	6.02 (2.03,10)			
% of change	%	10 %			
P-value	0.001*	0.004*			

SD: standard deviation, MD: mean difference, CI: Confidence interval, p-value: level of significance, *: significant, η2: partial eta squared

Cortisol level:

Within-group comparison

Study group: The mean values ± SD of cortisol level before and after intervention in the study group were 10.67 ± 2.71 and 7.07 ± 3.17 ug/ml, respectively. A statistically significant reduction in cortisol level by 34% was noted after intervention relative to pre-intervention (p = 0.001), with MD and a 95% CI of 3.6 (3.1, 4.12).

Control group: The mean values ± SD of cortisol levels before and after intervention in the control group were 11.78 ± 2.18 and 10.73 ± 1.98 ug/ml, respectively. A statistically significant increase in the cortisol level ratio of 9% was noted after intervention relative to before intervention (p = 0.001), with MD and a 95% CI of -1.05 (0.54, 1.55) (Table 4; Figure 8).

Between-groups comparison

There was no statistically significant variation in the mean values of cortisol level before intervention across both groups (p= 0.088), while a statistically significant difference was detected after intervention (p= 0.001) with the superiority of the study group (Table 4, Figure 9).

Table (4) Mean ±SD of Cortisol level before and after-treatment of both groups.

Cortisol level (ug/ml)	Study group Mean ±SD	Control group Mean ±SD	MD (95% CI)	P-value	η2
Pre-treatment	10.67 ± 2.71	11.78 ± 2.18	-1.11 (-2.37, 0.17)	0.088	0.049
Post-treatment	7.07 ± 3.17	10.73 ± 1.98	-3.66 (-5, -2.3)	0.001*	0.332
MD (95% CI)	3.6 (3.1, 4.12)	1.05 (0.54, 1.55)			
% of change	34%	9 %			
P-value	0.001*	0.001*			

SD: standard deviation, MD: mean difference, CI: Confidence interval, p-value: significance level, *: significant, η2: partial eta squared

DISCUSSION

Premenstrual Syndrome (PMS) is identified by psychological and physical manifestations that occur through the luteal phase of the menstrual cycle (LPMC), which usually go away a few days after the menstrual onset. It is a common cyclic and recurrent condition that affects women of reproductive age (18).

When specific symptoms that affect a woman's life exclusively appear during the LPMC, it is clinically classified as PMS (19).

The oral contraceptive pill (OCP) and selective serotonin reuptake inhibitors are pharmacological therapy methods that have been suggested for preventing or treating PMS symptoms. In the community, NSAIDs are very popular for treating the physical manifestations of PMS and dysmenorrhea (20).

So, the current study aimed to identify the impact of Pilates exercise and spiral taping on cortisol levels and ACTH in PMS. The result of the study indicated a statistically significant reduction of ACTH by 36% after intervention compared to before intervention ($p = 0.001$) in the study group, and there is no statistically significant change in the mean values of ACTH before intervention across both groups ($p = 0.077$), but a statistically significant variation was noted after intervention ($p = 0.001$) with the superiority of the study group. Additionally, the study group experienced a statistically significant reduction in cortisol levels by 34% following treatment relative to before intervention ($p = 0.001$).

No significant variation was observed in the mean values of cortisol levels before intervention across both groups ($p = 0.088$), however there was a significant change after intervention ($p = 0.001$), with the study group being superior.

These findings support the research of Nazir et al. (21), which demonstrated that Pilates exercises reduced physical and psychological symptoms by regulating hormonal changes throughout the luteal phase.

The results obtained are corroborated by those of Balmumcu et al. (22), who highlighted the emotional and physical advantages of Pilates as part of a comprehensive treatment, showing that a protocol integrating Pilates with a WhatsApp-based support program successfully decreased PMS severity. According to earlier research, the intervention group's decreased PMS symptoms may have been caused by better circulation, relaxed muscles, and lower cortisol levels.

These findings are in line with those of Tejmalji & Mahalakshmi (23), who showed regular exercise, such as Pilates, decreased bloating and cramping in the abdomen, which are frequently worsened by prolonged menstrual flow durations.

This study was aligned with Çitil and Kaya's (24) quasi-experimental study, which indicated that Pilates exercises were useful in alleviating symptoms of PMS.

The study's findings concur with those of Lee and Shin (25), who demonstrated that Pilates stability exercises are beneficial and aid in enhancing balance and menstrual related symptoms as measured by the MEDI-Q and ODI.

The study's findings are corroborated by those of Hyun (26), who demonstrated that Kinesio taping, and Pilates stability exercises can help female college students have less discomfort and difficulty during their periods.

The study's findings align with Roh (27), who indicated that the prostaglandin level that triggers uterine muscle hyperactivity and menstrual discomfort decreases with the Pilates intervention, resulting in a decrease in women's monthly pain and symptoms. This study demonstrated that Pilates may impact the function of the pelvis, which may lessen menstrual pain and symptoms.

These results are confirmed by Barghout et al. (28), who showed that Pilates training improved blood pressure and cortisol levels.

The benefits of Pilates exercise are agreed with those of Saglam & Orsal (29), who demonstrated that Pilates training produces a natural analgesic effect, increases endorphin levels, which contribute to the production of progesterone and estrogen, stimulates the production of endogenous anti-inflammatory materials, lowers adrenal cortisol levels, and encourages venous return via the regular muscular contraction and relaxation.

These findings support practicing Pilates as an exercise method to assist women with PMS, providing well-established benefits for their health in the aspects of motor ability, psychology, and physical health (30).

The beneficial effects of spiral taping and Pilates training are concurred with Ahmadi & Mehravar's (31) findings, which demonstrated that following eight weeks of Pilates activity, cortisol levels dropped in the Pilates group in comparison to the control group ($P<0.05$).

These results concur with those of Choi (32), who discovered that applying taping to the skin improves blood circulation as a result of the spine's vasomotor reflex. So, the blood's concentrations of substances that cause pain, such as prostaglandin and histamine, are decreased, which helps to lessen pain.

These findings are aligned with Kiseljak et al. (33), who discovered that taping may help women experience less anxiety, distress, and menstrual pain. As a result, it may be an affordable, noninvasive, simple, and acceptable treatment option for women that doesn't interfere in any way with their regular physical activity.

The study's results are corroborated by Boguszewski et al. (34), who indicated that tape reduces the demand for analgesic drugs and limits motor activity. Additionally, tape helped reduce the amount of anxiety related to menstrual pain and discomfort.

The results obtained are in line with the belief of Seo et al. (35) that one alternative medical area, tape therapy, will reduce menstrual pain in conjunction with medical therapy.

This study aligned with the results of Chaegil et al. (36), who revealed that spiral taping produced notable improvements in individuals with PMS, which is brought on by a variety of intricate circumstances. Women can utilize this technique as a coping mechanism for both PMS and menstrual pain.

Furthermore, Elbandrawy et al. (37) indicated that Tele-Pilates and Kinesio taping are both useful in reducing the behavioral, psychological, and physical symptoms of PMS.

Therefore, this study demonstrated that the integration of spiral taping and Pilates exercise had a greater impact in lowering cortisol and ACTH levels. These results demonstrate the possible benefits of spiral tape and Pilates exercise in reducing menstrual pain in PMS.

CLINICAL IMPLICATIONS

Pilates exercise and spiral taping are simple, safe, viable, cost-free, and non-pharmacological methods for reducing PMS symptoms.

CONCLUSION

Based on the aforementioned results, Pilates exercise and spiral taping could be useful adjunctive treatments for PMS.

STRENGTHS AND LIMITATIONS:

Strengths of this study include its determined sample size and randomized technique. However, the study was conducted without any patient follow-up. Therefore, more investigation is necessary to ascertain the long-term impacts of spiral taping and PILATES exercise on PMS symptoms with patient follow-up.

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AUTHOR CONTRIBUTIONS

YR-A, HM-H, HH-K and WK-M conducted research design, data gathering, statistical analysis, and interpretation of the data. Before it was published, they cooperated to write, edit, and approve the final manuscript.

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Data availability: On request, the authors are delighted to supply the raw data that confirms the findings of this work.

DECLARATIONS

Ethics approval and consent form

The study proposal was authorized by the institutional review board at the Faculty of Physical Therapy, Cairo University (No: P.T.REC/012/004255), and the Pan African Clinical Trail Registry also approved the registration of this study in accordance with WHO and ICMJE standards (PACTR202309784838404).

Conflict of Interest: No conflicts of interest.

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