Effect of Functional Exercises on Pain and Quality of Life in Females with Primary Dysmenorrhea

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ABSTRACT

Background: Primary dysmenorrhea (PD) is the most prevalent pelvic pain, which adversely impacts the quality of life (QoL) of females at a prevalence of 16% and 91%. **Purpose:** To explore the effect of functional exercises on pain and QoL in females with PD. **Subjects:** Fifty-eight female participants diagnosed with PD were recruited from HAVEN Cleopatra Hospital, 6th of October City. Participants were randomly assigned to one of two groups. Group A (Control Group, n=29) underwent lifestyle modification advice for eight weeks. Group B (Study Group, n=29) underwent a program of 45-minute functional exercises (2 stretching exercises, a yoga pose, 2 core-strengthening exercises, 2 pelvic area exercises, and Kegel exercises) along with the same lifestyle change advice as Group A, three times a week for eight weeks. **Methods:** Pain level, menstrual symptoms, and QoL were measured prior to and after treatment by the Visual Analogue Scale (VAS), Menstruation Symptoms and Distress Questionnaire (MDQ), and Quality of Life Enjoyment and Satisfaction Questionnaire (Q-LES-Q-SF), respectively. **Results:** A comparison of post-treatment scores revealed significant improvements in pain level, menstrual symptoms and distress, and QoL for both groups, with the study group (Group B) demonstrating more pronounced benefits compared to the control group (Group A), as evidenced by statistically significant changes ($p = 0.001$) in all measured variables. **Conclusion:** The combined functional exercises had a significant, positive effect on pain and QoL in females with PD.

Keywords: Functional Exercises; Quality of Life; Primary Dysmenorrhea

INTRODUCTION

The incidence of unpleasant cramps during menstruation that originate in the uterus is the hallmark of dysmenorrhea. It is among the most frequent reasons for pelvic pain [1]. It is the most prevalent in young adults and adolescents, affecting 45% to 95% of reproductive-aged women [2].

Regarding the clinical presentation of primary dysmenorrhea (PD), pain generally is an essential stressful factor in many girls' lives [3]. The pain can be throbbing, dull, nauseating, or shooting pain. It may precede menstruation by several days [4]. Physical symptoms and emotional changes that occur with PD include headache, backache, breast swelling and tenderness, cramping, digestive manifestations, salt and water retention, depression, moodiness, sadness, anxiety, and agitation [5].

PD has profound social, physical, and financial issues. It affects 50% to 91% of young women and manifests in a wide range of physical and emotional ways [6].

Due to physical and social functionality, generalized health issues, and pain, women with PD report a much lower quality of life [7]. It represents the most frequent gynecological problems and is the leading cause of missing work and school. It lowers their daily activities, QoL, and financial status because of reduced working hours [8].

The first line of management for PD is NSAIDs; however, these medications may cause unwanted side effects involving headaches, sleepiness, and dyspepsia [9].

Due to the adverse effects of medical treatment, alternative treatment approaches that are safe and easy to use to alleviate PD symptoms, such as conservative and non-pharmacological therapy, must be given priority [10].

However, a study looked at the impact of functional activities on the level of pain related to PD, including yoga poses, pelvic exercises, core-strengthening exercises, stretching exercises, and Kegel exercises [11]. Their impact on the females' QoL was not yet examined. Therefore, the study aimed to look into how functional exercises affect the quality of life and pain levels of women who have PD.

MATERIALS AND METHODS

Study Design

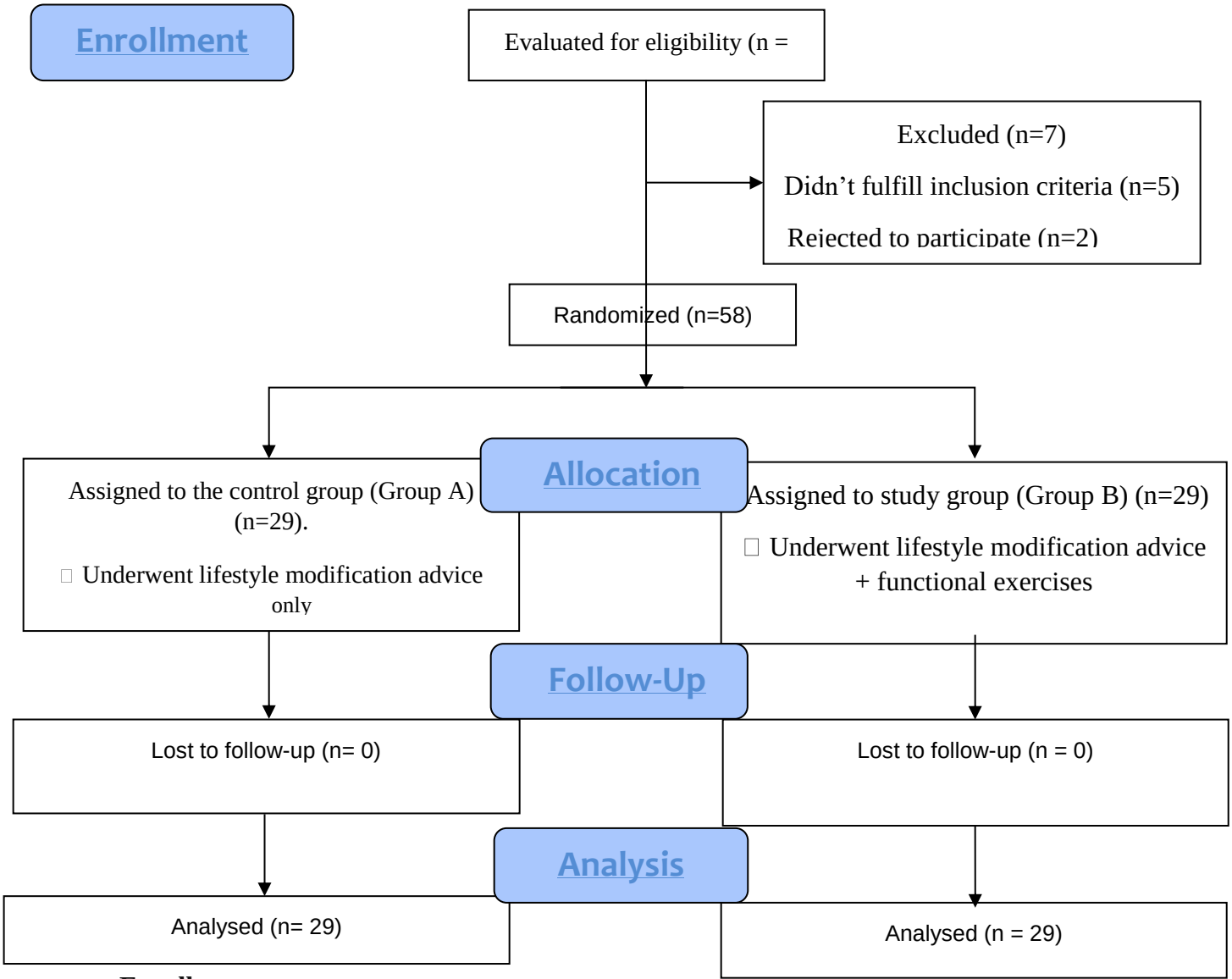
It was a randomized controlled trial study.

Sample Size Calculation:

Using pain, as described in [11], the sample size was calculated with 80% power at the $\alpha = 0.05$ level, 2 measurements for two groups, and the effect size = 0.4 utilizing F-test MANOVA within and between interaction effects to prevent type II error. The minimum appropriate sample size was 52 subjects, with six subjects (10% as dropouts); the overall sample size was 58, with 29 participants in every group. Using G*Power software (version 3.0.10), the sample size was determined.

Participants:

Fifty-two subjects fulfill the eligibility criteria were included in the study: They were referred by a gynecologist, were between the ages of 18 and 25, diagnosed with PD depending on the Menstrual Distress questionnaire, had a BMI between 20 and 24.9 kg/m², had regular menstrual cycles (28-34 days), were sedentary virgin females, did not smoke, had not participated in an exercise regimen for the past three months, and had been told not to use any analgesics for two successive menstrual cycles. If women had secondary dysmenorrhea, used a contraceptive pill or regular medication, had neuromuscular, metabolic, or cardiac problems, or had a previous illness that precluded them from participating in an exercise program, they were excluded.



Enrollment

A total of 65 individuals were recruited to participate in the research. Seven of them weren't included as they didn't fulfill the eligibility criteria: two women declined to sign the consent form and declined to take part in the study for private reasons. So, fifty-eight were included. An independent researcher used a computer-based randomization procedure to divide them into two equal groups (control and study). The research group was given functional exercises plus lifestyle advice, while the control group was given lifestyle advice only. Following randomization, there were no participants dropping out. Every participant was made aware of the goals and advantages of the study, their ability to decline or discontinue participation at any moment, and the privacy of any data collected. Each participant signed a consent form at the beginning of the trial, and they were fully informed about the assessment and treatment methods.

Outcome measures

Pain Assessment: The VAS was utilized to measure the pain level in both groups (A and B) before and after the treatment. To indicate how much pain she was experiencing, each woman was asked to indicate a point between the extremes. Typically, the VAS is displayed as a 10 cm horizontal line with a point representing the participant's level of pain located between "no pain at all" and "worst pain imaginable" **[12].**

Menstrual distress questionnaire (MDQ): It comprises menstruation-related symptoms. It has 47 items. It has a 5-point scale that ranges from 0 to 4. There are five possible answers for each item: no, mild, moderate, severe, and very severe. There are four possible scores: four for "very severe," three for "severe," two for "moderate," one for "mild," and zero for "no." Pain, water retention, autonomic reactions, negative impacts, decreased attention, mood and behavioral alterations, and arousal control are its seven subscales. The following was the interpretation of the total score: less than 50 is mild, 50 to 70 is moderate, and >70 is severe **[13] .**

Quality of life enjoyment and satisfaction questionnaire (Q-LES-QSF): It comprises physical wellness, mood, working, household and leisure activities, family and social relations, daily functions, economic status, living or housing situations, physical mobility, capability to work or engage in hobbies, and general well-being. Answers were graded on a five-point scale, with greater scores denoting better life satisfaction and enjoyment (from "very poor" to "very good"). A percentage of the overall maximum score was displayed when the scores were added together. A score of greater than 70 indicates a normal quality of life **[14].**

Interventions

Lifestyle intervention advice

A) **Lifestyle modification advice**

All participants were advised to avoid exposure to tobacco smoke in the environment, eliminate smoking and drinking alcohol, reduce consumption of sweets, caffeine, cold beverages, and foods high in salt, dress in loose-fitting cotton clothing, and get enough good sleep—at least 6 to 8 hours—to rest **[15].**

Intervention exercises program

The program comprised a warm-up phase. All participants in group (B) performed walking on the treadmill for 5 minutes at an intensity of 40 % of maximum heart rate (HRMax).

1- **Piriformis stretching**: The female was told to lie in a supine position, with knee bending and stretched extremities on the opposite side of the laterally rotated hip. The piriformis muscle was then stretched by pulling the corresponding limb towards the trunk with the arms (5 repetitions × 20 seconds).

2- **Adductor stretching**: The female was asked to a sitting position; the soles of her feet were facing each other, her elbow was flexed 90 degrees, and both hands were on her ankles pressed to the floor, supported by her forearm and elbow (5 repetitions × 30 seconds) **[11].**

3- **Cobra Pose:** The female was instructed to lie in the prone position while maintaining flexion and opening her arms shoulder-width apart. Arms were then used to support the lower back extension. This position stretched the trunk flexors (5 repetitions × 20 seconds) **[11].**

4- **Sit up:** The female was told to assume a crook lying position. Then, she was directed to thrust forward her trunk to stretch the body. (10 repetitions × 3 sets), and this exercise aimed to strengthen the rectus abdominis is higher during sit-ups **[16].**

5- **Bridge exercise:** The female was told to assume a crook lying position and thrust up her body. This exercise aimed to strengthen the core area (10 repetitions × 3 sets). **[11].**

6- **Kegel exercise:** The pelvic muscles were frequently tightened and relaxed while the female was made to lie in a crook-lying position. A series of moderate contraction motions and one quick contraction movement made up one repetition. This exercise was designed to strengthen the pelvic floor muscles (PFMs) (10 repetitions × 3 sets) **[11].**

7- **Pelvic elevator:** The female was asked to flex her elbow 90 degrees with both hands on the ilium crest, then elevate the pelvis in the standing position. One repetition comprises a series of pelvic-raising motions that alternately elevate the pelvis on both sides. This exercise activates the pelvic region (10 repetitions × 3 sets) **[11].**

8- **Pelvic rotation:** The female was asked to perform pelvic rotation while standing. The position of arms: flex of elbow 90 degrees and both hands on ilium crest. One repetition was assigned to each pelvic rotation (right and left). This exercise aimed to activate the pelvic region (10 repetitions × 3 sets) **[11].**

Data analysis and statistical design

The mean ± SD was utilized to express the data. The unpaired t-test was employed to compare participants' characteristics across the two groups. The normality of the data distribution was examined via the Shapiro-Wilk test. Mixed design MANOVA was employed to compare within and between groups' effects for all measured variables: pain intensity by VAS, menstruation symptoms and distress by MDQ, and quality of life by Q-LES-Q-SF. The statistical package for the social sciences (SPSS Inc., Chicago, Illinois, USA) version 20 for Windows was utilized to analyze the data. Significant results were defined as $P < 0.05$.

RESULTS

Results:

Demographic data of subjects:

As shown in Table 1, no significant change was detected in the mean values of age, weight, height, and BMI among both groups (p=0.128, 0.377, 0.200, and 0.352), respectively.

Table (1): Participant's demographic data of both groups

Demographic data	Group A	Group B	t-value	p-value
Age (years)	21.1±2.63	22.1±2.47	-1.54	0.128
Weight (kg)	60.17±6.34	62.54±7.52	-0.89	0.377
Height (cm)	162.9±6.04	164.28±5.74	-1.29	0.200
BMI (kg/m^2)	22.6±1.9	23.1±2.13	-0.93	0.352

Data was expressed as mean ± standard deviation, p- value: significance

Normality test:

The data normality, homogeneity of variance, and the existence of extreme scores were examined. According to the Shapiro-Wilk test for normality, all assessed variables had a normal distribution (p>0.05).

Results of repeated measures MANOVA revealed that effects were found for groups, P P= 0.001; also statistically significant multivariate effects were found for time, p = 0.001, and for the interaction between groups and time, p = 0.001.

Pain:

Within-group comparison indicated a statistically significant pain decrease in groups A and B by 7% and 33.5% post-

treatment, respectively (p = 0.001). Between-group comparison indicated a statistically significant pain reduction after treatment in group B compared to group A (p = 0.001). (Table 2).

Menstruation symptoms and distress:

Within-group comparison indicated no statistically significant change in MDQ after treatment in group A (p = 0.593); it was decreased by 0.8%, while there was a statistically significant decrease of MDQ by 28% after treatment (p = 0.001). Between-group comparison indicated a statistically significant reduction in MDQ post-treatment in group B compared to group A (p = 0.001). (Table 2).

Quality of life:

Within-group comparison indicated no statistically significant change in Q-LES-Q-SF post-treatment (p = 0.845); it was increased by 0.7%, while there was a statistically significant increase in Q-LES-Q-SF by 45.5% post-treatment. Between-group comparison indicated a statistically significant increase in Q-LES-Q-SF post-treatment in group B than in group A (p = 0.001). (p = 0.001) (Table 2).

Table (2): Mean ±SD of pain intensity, MDQ and Q- LES-Q-SF before and after treatment of both groups.

Measured variables	Group A Mean ±SD	Group B Mean ±SD	MD (95% CI)	P-value[1]
Pain level (cm)				
Pre-treatment	7 ± 1.5	6.9 ± 1.84	0.1 (-0.78, 0.99)	0.816
Post-treatment	6.52 ± 1.5	4.59 ± 1.52	1.93 (1.1, 2.7)	0.001*
MD (95% CI)	0.48 (0.2, 0.8)	2.31 (2, 2.6)		
P-value[2]	0.001*	0.001*		
MDQ				
Pre-treatment	50.38 ± 14.28	49.14 ± 14.09	1.24 (-5, 9.9)	0.507
Post-treatment	49.97 ± 14.35	35.14 ± 12.96	14.83 (7.6, 22)	0.001*
MD (95% CI)	0.41 (-1.1, 1.9)	14 (13.2, 14.3)		
P-value[2]	0.593	0.001*		
Q- LES-Q-SF Pre-treatment	37.62 ± 10.65	37.59 ± 10.33	0.03 (-5.4, 5.6)	0.990
Post-treatment	37.87 ± 10.66	54.69 ± 12	-16.82 (-22.8, -10.9)	0.001*

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MD (95% CI)	-0.25 (-2.7, 2.2)	-17.1 (-19.6, -14.6)		
P-value[2]	0.845	0.001*		

SD: standard deviation, MD: mean difference, CI: confidence interval, P-value[1]: significance between groups, P-value[2]: significance within group, *: significant

DISCUSSION

This study aimed to find out how functional exercises affected the quality of life (QoL) and pain levels of females with PD. Fifty-eight females took part in the current study. They were aged between 18 and 25, and BMIs ranged from 20 to 24.9 kg/m². They were distributed into two equal groups; Group (A) (Control group), which comprised 29 women who were asked to follow lifestyle modification advice throughout the study, and Group (B) (Experimental group), which comprised 29 women who underwent the same lifestyle modification advice as group A. In addition, they were required to perform various functional exercises for 45 minutes each session, 3 times a week, for 8 weeks. These functional exercises enhance pelvic region mobility [11].

Our study found there was a significant effect on primary dysmenorrhea by combined exercise therapy in one program. The 45-minute exercise program comprised two stretches, one yoga pose, two core-strengthening exercises, two pelvic exercises, and Kegel exercises. Five minutes before the combined exercises, warm-up exercises were completed. For eight weeks, this program was followed by the study group three times a week.

Our findings align with Kirmizigil and Demiralp [11], who demonstrated the efficacy of functional exercises, including yoga, core strengthening, stretching, pelvic and Kegel exercises, in relieving pain ($p < 0.05$) and enhancing QoL ($p < 0.05$) in women aged between 18 and 35 with PD. They related these results to enhancing pelvic mobility, resulting in increased pelvic blood flow and subsequently lowered prostaglandin levels.

These findings are also corroborated by Saleh et al. [17], who reported a significant reduction in pain degree and duration in exercise groups in comparison to the control group ($P < 0.001$). This study sought to explore the impact of two specific exercise modalities, stretching and core strengthening, in managing PD, comparing their impact on pain intensity and duration, with pain level measured via the VAS and pain duration quantified in hours. This improvement may be attributed to enhanced uterine circulation and metabolism through exercise, potentially mitigating dysmenorrhea symptoms. Exercise may also reduce the sympathetic nervous system activity and relieve stress via the endorphins released from the brain and raise the pain threshold, thus decreasing symptoms. Therapeutic exercise can stimulate endorphin secretion, increasing the body's pain threshold [18].

Additionally, Daley [19] proposed that contracted ligamentous bands in the abdominal area contribute to nerve pathway compression and irritation, suggesting the efficacy of stretching exercises. Furthermore, it was suggested that improved core stability may also ameliorate dysmenorrhea symptoms.

Moreover, Goda et al. [20] explored the effectiveness of stretching exercises on PD among secondary female students in Assiut City. The participants' average age was 16.31 ± 0.9 years. The study found that stretching exercises effectively reduced both psychological and physical symptoms of PD, including anxiety, breast pain, and concentration issues. These exercises also improved abdominal tone, relaxed uterine muscles, and increased flexibility.

Supporting our findings, Shahrjerdi et al. [21] studied the effects of core exercises on PD. Their study demonstrated significant reductions in pain severity (P = 0.008), pain duration (P = 0.021), and analgesic consumption (P = 0.018) in the experimental group in comparison to the control group. The findings indicate that core stability exercises may serve as an efficient treatment to alleviate menstrual pain symptoms, potentially by enhancing the strength and coordination of the lumbosacral muscles and improving blood circulation to pelvic structures.

Additionally, Gamit et al. [22] found that stretching exercises significantly reduced pain and alleviated the severity of dysmenorrhea in young females, as determined by the VAS and the Verbal Multidimensional Scoring System (VMS). The analysis of between-group comparisons indicated statistically significant differences in pain reduction, with results showing U = 31.0 ($p < 0.01$) for the VAS and U = 12.0 ($p < 0.01$) for the VMS. These findings underscore the benefits of stretching exercises in managing dysmenorrhea-related pain.

Three of the included papers employ yoga, a modality that is becoming more popular, to lessen menstrual discomfort [23]; [24]; [25]. According to Yonglitthipagon et al. [25], yoga is an effective intervention technique because it stimulates the brain's pain modulatory system, which projects to the spinal cord, and encourages the body's natural painkiller, beta-endorphin, to be secreted. The "relaxation response" in the neuroendocrine and parasympathetic nervous systems is triggered by linking breathing and body movement, which simultaneously improves the quality of life in different aspects. This procedure improves metabolism, heart rate, blood pressure, and breathing and provides proper muscle tension.

In a study by Yang and Kim [24], the experimental group revealed a considerable drop in monthly pain intensity and menstrual distress ratings when compared to the control group. They mentioned yoga techniques trigger a relaxation response, which lowers oxygen consumption and sympathetic nervous system activity, reduces oxidative stress, and increases pain alleviation, in addition to promotion of endocrine balance and pain relief [24].

Gopal et al. [26] examined the use of relaxation techniques and core stability exercises for PD in an unmarried female. For five weeks, four sessions per week, participants with PD received 20-30 minute sessions of relaxation and core stability

exercises. The results indicated that the PD patients' pain outcomes, as measured by the VAS and WaLIDD scores, significantly improved after doing core stability and relaxation exercises. The advantages of the core stability exercise and Mitchell's relaxation method were to lessen endometrial tension and ultimately relax the uterine muscles responsible for this change. Core stability exercises provide the desired strength in the uterine muscles.

Saikia et al. [27] found a significant decrease in PD symptoms across adolescent participants after practicing pelvic rocking exercises. Pelvic rocking exercises proved to be the best method for alleviating dysmenorrhea in young females. These exercises help reduce menstrual pain by improving blood flow and releasing natural pain-relieving substances. They also aid in easing abdominal muscle tension and stimulating circulation, making them a beneficial and drug-free treatment option. Additionally, pelvic rocking is easy to perform, requires no special instruction, and can help manage stress.

Deodato et al. [28] examined the effectiveness of manual therapy and PFM exercises, including Kegel exercises, on pain and clinical outcomes in women with PD. Their study found that the combination of these therapies yielded the most significant benefits when administered with a comparable total treatment volume. Using a portable algometer, the researchers measured pressure pain thresholds (PPT) in various lumbar and pelvic regions. Results indicated significant improvements in overall pain levels (with a Numeric Rating Scale (NRS) of $p < 0.001$ and a partial eta-squared ($p\eta^2$) of 0.511) and in several domains of the SF-36 health questionnaire, even though there was no statistically significant change in the general health category ($p = 0.613$; $p\eta^2 = 0.010$).

While Kegel exercises alone did not significantly enhance outcomes in the quadratus lumborum compared to manual therapy and the combined program ($p = 0.039$), there was an overall improvement in PPT across all assessed areas. These findings highlight the effectiveness of Kegel exercises as part of a comprehensive physiotherapy strategy for alleviating symptoms in women with PD, particularly when combined with manual therapy.

Moreover, our findings align with previous studies that demonstrated the usefulness of stretching, pelvic rocking, and Kegel exercises in treating PD. However, according to Goda et al. [20] and Hassan et al. [29], Kegel exercises are considered superior to pelvic rocking and stretching exercises in alleviating the degree of PD.

The findings of Mohamed and Hafez [30] , who explored the effects of pelvic rocking movements on PD in adolescents, also support our results. Their findings indicated that pelvic rocking exercises effectively reduce pain intensity and duration, shorten menstrual flow, and decrease the number of analgesics taken among teenage girls with moderate to severe PD in the first two menstrual cycles following the intervention. Exercise influences hormone secretion, reduces the release of prostaglandins, limits endometrial proliferation, diverts blood flow from the uterus, and enhances the endorphins release, the natural painkillers [31].

Hassan et al. [29] examined the impacts of pelvic rocking and Kegel exercises on PD severity in adolescent girls. They reported that these exercises are innovative, simple, cost-effective, and non-pharmacological interventions that can meaningfully reduce the severity of dysmenorrhea. However, Kegel exercises significantly reduced the intensity of dysmenorrhea and showed a more pronounced impact on related physical and emotional symptoms than pelvic rocking exercises. Kegel exercises alleviated symptoms such as nausea, headaches, dizziness, and mood swings. These findings highlight the effectiveness of Kegel exercises as a non-pharmacological strategy for managing PD in adolescents, supporting their broader implementation in clinical practice.

Limitations:

This study would be limited by pain tolerance that differs from one female to another, the emotional and psychological state of the participants, the degree of cooperation of females, the regulation of the sessions, and the daily efforts; all may impact the study's results.

Conclusion:

From a statistical perspective, it could be concluded that combined functional exercises had a significant effect on pain and QoL in females with PD.

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