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Effectiveness of Pilates on Diastasis Recti and Core Stability in Primiparous Women

Gowrishankari S[1], Dr. Soundharya M[2], Dr. Bright Alwin Victor P[3], Dr. Dharshini K[4], Dr. P. Nithya[5]

[1]BPT, [2]Assistant Professor, [3]Principal, [4]Clinical Instructor, [5]Assistant Professor

Revathi Institute of Physiotherapy and Research, Avinashi, Tirupur, India.
(Affiliated to the Tamil Nadu Dr. M.G.R Medical University, Chennai)

Corresponding Author: Dr. P. Bright Alwin Victor, MPT, PhD
Email: alwin0729@gmail.com

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Abstract:

Background: Diastasis recti abdominis is the separation of the rectus abdominis muscle along the linea Alba. This study aimed to evaluate the effectiveness of mat–based Pilates on diastasis recti and core stability in primiparous women.

Methodology: A quasi–experimental study was conducted among 30 primiparous women at Ponni Hospital, Trichy Road, Palladam, Tirupur. The experimental group performed Pilates exercises, while the control group received conventional exercise. Diastasis recti was measured using a manual caliper, and core stability was measured using the plank test. Both groups underwent training 3 times per week for 4 weeks.

Result: Significant difference were found in manual caliper ($t = -2.63$, $p < 0.001$) and plank test ($t = 3.74$, $p<0.001$), indicating reduced diastasis recti and improved core stability.

Conclusion: Pilates exercise effectively reduced diastasis recti and enhanced core stability in primiparous women.

Keywords: Core stability, Diastasis recti, Manual caliper, Pilates exercise, Plank test, Primiparous women.

Introduction:

Diastasis recti abdominis is defined as the separation of the left and right rectus abdominis muscles along the linea alba and is commonly observed during pregnancy and the early postpartum period[1]. Diastasis recti may occur above, below, or at the level of the umbilicus [2]. During pregnancy, progressive enlargement of the uterus increases mechanical stress on the abdominal muscles and connective tissues, thereby contributing to the development of diastasis recti abdominis[3].

The prevalence of diastasis recti ranges from approximately 30 - 70 % among women, and an increased inter – recti distance persists in nearly 35 - 60 % of women during the early postpartum period. Diastasis recti is also reported in about 39 % of older multiparous women undergoing abdominal hysterectomy and in approximately 52 % of menopausal women attending urogynecological clinics[4].

Pilates Exercise:

Pilates is a form of body – mind exercise that emphasizes controlled movement, postural alignment, breathing, and core activation. The Pilates method was developed by Joseph H. Pilates, who initially

designed it as a physical conditioning program during the First World War and later refined it into a structured exercise system[5].

Mat–based Pilates is performed on a mat using body weight and gravity as resistance. It activates the deep abdominal muscles, particularly the transversus abdominis, which enhance core support[6].

The primary objectives of mat–based Pilates are to enhance core muscle strength and functional performance while reducing pain and disability associated with conditions such as chronic low back pain[7]. In postpartum women, mat–based Pilates has been shown to improve abdominal muscle structure and function, reduce waist circumference, increase abdominal muscle endurance, decrease inter–recti distance, and enhance quality of life. It may also assist in weight and body composition management, improve psychological well-being, increase self – confidence, enhance sleep quality, reduce maternal fatigue, and decrease the incidence of urinary incontinence and pelvic organ prolapse[8].

Conventional Exercise

Conventional exercise programs are non – invasive, cost effective, and suitable for both rehabilitation and home – based practice. These exercises help to approximate the separated rectus muscles, reduce the inter–recti distance, and restore the integrity of the abdominal wall. Conventional exercise also strengthens the core muscles, particularly the transversus abdominis and rectus abdominis, improves muscle activation and tension across the linea Alba, and enhances core strength and stability.

It enhances trunk support and functional stability, which may contribute to reducing diastasis recti. Regular exercise may reduce the risk of low back pain, improve musculoskeletal balance, and enhance the overall quality of life in postpartum women[9].

Methodology:

The study was approved by the Institutional Ethics Committee (IEC-RIPT/DT/21/4513). This study was conducted at Ponni Hospital, Tirupur, India. A total of 30 postpartum women aged 25 – 35 years were recruited. Participants with diastasis recti at supra-umbilical level, an inter – recti distance of 2 to 4cm, a BMI $\leq$ 29 kg/m^2, six weeks postpartum and a history of normal vaginal delivery were included. Women with diastasis recti at or below the umbilical level, urinary incontinence, abdominal hernia, pervious abdominal surgery, musculoskeletal deformities, neurological conditions, cardiovascular disorders, or psychological disorders were excluded. Participants were divided into two groups: Group A received Pilates exercise, while Group B received conventional exercise. Both groups underwent intervention three times per week for four weeks. Core stability was assessed before and after four weeks of intervention using the plank test, and diastasis recti was measured before and after the intervention using a manual caliper.

Measurement procedure:

1. Plank test

The body is supported on the forearms and toes, with elbows positioned under the shoulders. The trunk, hips, and legs are kept in a straight line while maintaining a neutral spine. As soon as the participant is in the correct position, the stopwatch is started. The test is terminated when the participant is unable to maintain a straight back.

2. Manual caliper

Diastasis recti was measured using a manual caliper with the participant in a crook–lying position. The participant was asked to perform a gentle head and shoulder lift to activate the abdominal muscles. The inter – recti distance was measured in the supra – umbilical region by placing the caliper across the medial borders of the rectus abdominis muscles. The measurement was recorded in centimeters. The same procedure was repeated before and after the intervention period to assess changes in diastasis recti.

Pilates exercise procedure group A

The exercise protocol incorporated five Pilates exercises performed with core engagement. In the Supine leg circle, lift one leg towards the ceiling and move it slowly in a circular motion in both clockwise and anti – clockwise directions. In the single-leg stretch, bring one knee toward the chest while extending the opposite leg forward. In the Double-leg stretch, extend both arms overhead and both legs forward to an angle of 45^0, then return to starting position with control. In the Quadruped superman, adopt a quadruped position extend the opposite arm and leg simultaneously, hold for few seconds and repeat on

the other side. In the Mermaid exercise, sit in a side – sitting position raise one arm overhead and bend sideways towards the supporting arm, hold and return to the starting position. Perform all movements with controlled breathing.



Fig1: Supine leg Cricle



Fig 2: Single leg Stretch



Fig 3: Double leg stretch



Fig 4: Quadruped superman



Fig 5: Mermaid

Conventional exercise procedure group B

The exercise protocol incorporated five conventional exercises. In the Static abdomen exercise, gently draw the abdomen inward towards the spine without holding the breath. In Bridging exercise, lift the hips from crook - lying to form a straight line from the shoulder to the knees, maintain the position and lower the hips slowly. In Abdominal curl – ups, lift the head, neck, shoulders, and upper back from the mat by contracting abdominal muscles. In Diagonal curl – ups, same as abdominal curl – ups but rotate the trunk so that one shoulder move towards the opposite side knee. In Head raise with pelvic tilt, lower the back against the mat by tilting the pelvis posteriorly, lift the head and shoulders slightly and then slowly return to starting position. Perform all movements with controlled breathing.



Fig 6 : Static Abdomen



Fig 7 : Pelvic Bridging



Fig 8: Abdominal curl-up



Fig 9 : Diagonal curl-up



Fig 10: Head raise with pelvic tilt

Data analysis and results

Table 1: Comparison of manual caliper test score between group A and group B in pre and post test

TEST	GROUP - A		GROUP - B		t - TEST	df	Significance
	MEAN	S.D	MEAN	S.D			
Pre Test	3.98	.612	3.95	.339	.184	28	.855*
Post Test - 1	3.32	.559	3.49	.619	-.773	28	.446**
Post Test - 2	2.41	.755	3.16	.794	-2.63	28	.001**

(*- P > 0.05 - Not Significant) & (**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-test, degree of freedom (df) and p-value between Group A & Group B in pre test and post tests.

This table shows that there is no significant difference in pre test & post test-1 value between Group A & Group B at P > 0.05.

The above table shows that statistically significant difference in post test - 2 values between Group A & Group B at P ≤ 0.05.

Table 2: Comparison of plank test score between group A and group B in pre and post tests

TEST	GROUP - A		GROUP - B		t - TEST	df	Significance
	MEAN	S.D	MEAN	S.D			
Pre Test	16.45	2.47	16.47	2.26	-.023	28	.982*
Post-test - 1	25.44	6.37	19.29	4.32	3.09	28	.004**
Post Test - 2	34.90	11.30	22.25	6.56	3.74	28	.001**

(*- P > 0.05 - Not Significant) & (**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-test, degree of freedom (df) and p-value between Group A & Group B in pre test and post tests.

This table shows that there is no significant difference in pre-test values between Group A & Group B at $P > 0.05$

The above table shows that statistically difference in Post test – 1 & Post test - 2 values between Group A & Group B at $P \leq 0.05$.

Table 3: Comparison of manual caliper test score within group A and group B between pre and post test.

TEST	GROUP - A		GROUP – B	
	MEAN	S.D	MEAN	S.D
Pre Test	3.98	.612	3.95	.339
Post Test - 1	3.32	.559	3.49	.619
Post Test - 2	2.41	.755	3.16	.794
F VALUE	412.52		124.68	
P VALUE	.001**		.001**	

(**- $P \leq 0.05$ - Significant.

The above table reveals the Mean, Standard Deviation (S.D), F value, and p-value between pre-test and post-tests within Group – A & Group – B. There is a statistically significant difference between the pre-test and post-test values within Group A and Group B at $P \leq 0.05$.

Table 4: Comparison of plank test scores within group A and group B between pre-test and post-test.

TEST	GROUP - A		GROUP - B	
	MEAN	S.D	MEAN	S.D
Pre Test	16.45	2.47	16.47	2.26
Post Test - 1	25.44	6.37	19.29	4.32
Post Test - 2	34.90	11.30	22.25	6.56
F Value	536.45		331.48	
P Value	.001**		.001**	

(**- $P \leq 0.05$ - Significant).

The above table reveals the Mean, Standard Deviation (S.D), f value and p value between pre-test and post-test within Group A & Group – B. There is a statistically significant difference between the pre test and post-test values within Group A and Group B at $P \leq 0.05$.

Results

The value of standard deviation for group A and group B are 0.755 and 0.794 (manual caliper), and 11.30 and 6.56 (plank test). The 't' value for independent 't' test calculated between the group is 412.52 (manual caliper) and 536.45 (plank test) in which the level of significant is $p \leq 0.05$. The result showed that the Pilates and conventional exercises was effective; however, Pilates was more effective than conventional exercises.

Discussion

The purpose of this study is to find out the effectiveness of Pilates on diastasis recti and core stability in primiparous women. The total duration of the study was 4 months which include selection of participants, training, data collection and data analysis. Thirty (30) primiparous women were selected for the study and were randomly assigned to two groups according to the selection criteria. The treatment duration was 4 weeks for each group. Inter-recti distance was measured using a manual caliper, and core stability was measured using the plank test. Data were analyzed and the results were interpreted using paired and unpaired 't' test.

In this study, after 4 weeks of training the statistical analysis was performed between group A and group B which shows the post-test values of plank test 34.90 and 22.25 seconds manual caliper with mean of 2.41 and 3.16.

The present study showed that Pilates exercises were more effective than conventional exercises in reducing inter – recti distance and improving core stability in primiparous women. This is consistent with

the study by Vaishnavi Ravikantiwar *et al.* (2021), which reported a reduction in diastasis recti following a structured Pilates exercise program in postpartum women. Similarly, Mrunal Kulkarni *et al.* (2020) found the Pilates exercises improved core muscle strength and endurance among postpartum women. These findings support the effectiveness of Pilates in enhancing abdominal muscle function and reducing inter – recti separation in postpartum women.

Lee *et al.* (2023), investigated the effects of Pilates on inter–recti distance in primiparous women. This study reported a significant reduction in inter–recti distance following a 4-week Pilates intervention. Hence, this study supports the present study's findings that Pilates is effective in reducing diastasis recti. Silva *et al*. (2024), reported that a 12 week mat Pilates program produced a significant decrease in diastasis recti among climacteric women. Improvements was observed at supraumbilical, umbilical, and infraumbilical levels. These findings are in consistent with the present study, supporting the use of Pilates as an exercise – based intervention for reducing abdominal muscle separation.

The beneficial effects of Pilates may be attributed to its emphasis on controlled movements, breathing and progressive activation of the core musculature. Improved abdominal muscle control and endurance contribute to better abdominal wall support and a reduction in inter-recti distance and improving core stability in primiparous women.

Conclusion

This study employed a quasi – experimental pre-test and post-test design to evaluate the effectiveness of Pilates on diastasis recti and core stability in primiparous women. Thirty participants were divided into 2 groups and trained for 4 weeks, with outcomes assessed using the plank test and manual caliper. Pilates was more effective than conventional exercise because its controlled, targeted movements, enhance deep abdominal muscle activation and improve trunk control. This can promote better approximation of the rectus abdominis muscle, thereby narrowing the inter-recti distance while enhancing overall core stability.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this study.

Author Contributions

Gowrishankari S: Conceptualization, methodology, participant recruitment, data collection, intervention administration, data analysis, interpretation of results, manuscript drafting, and manuscript revision.

Soundharya M & Dr. P. Nithya: Supervision, methodology, critical review of the manuscript, interpretation of results, and final approval of the manuscript.

P. Bright Alwin Victor: Study supervision, methodology, validation, critical review of the manuscript, and final approval of the version to be published.

Dharshini K: Data collection, investigation, literature review, assistance with data analysis, manuscript review, and final approval of the manuscript.

Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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