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Effect of Different Plank Positions on Enhancing Abdominal Strength and Stability in Women Undergoing Lower-Segment Cesarean Section

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ABSTRACT

Aims The abdominal muscles are significantly stretched during pregnancy, leading to an increase in inter-recti distance. Several physiological changes greatly impact women's musculoskeletal systems. The abrupt drop in muscle strength caused by activity is known as fatigability. This study aimed to investigate the role of different plank positions in enhancing abdominal strength and stability for women recovering from lower-segment cesarean section.
Materials & Methods This experimental study was conducted on postpartum women based on specific inclusion and exclusion criteria, utilizing the odd-even method and a convenient sampling technique. A total of 30 subjects were allocated into two groups, including the abdominal draw-in maneuver and different plank positions (n=15 per group). The functional evaluation of abdominal muscles in both groups was performed using a pressure biofeedback unit, and the strength of the abdominal muscles was measured with the single leg lift abdominal strength test weekly for six months.
Findings Statistical analysis of the post-test values indicated the strength and functional activity of the abdominal muscles in postnatal women who underwent lower-segment cesarean section. The results showed that the different plank positions group demonstrated greater improvement than the abdominal draw-in maneuver group.
Conclusion Incorporating varied plank exercises effectively restores core stability and supports a quicker return to daily activities.

Keywords Abdominal Muscles; Cesarean Section; Postpartum; Resistance Training; Exercises

CITATION LINKS

[1] Effect of core stability training on postpartum ... [2] Impaired trunk flexor strength, fatigability, and steadiness ... [3] Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomised ... [4] Psychosocial sequelae of cesarean delivery: Review and analysis of their ... [5] Effects of cesarean section and vaginal delivery on abdominal ... [6] Force steadiness as a predictor of time to complete a pegboard test of dexterity in ... [7] Effect of core stability exercises on postpartum lumbopelvic pain: A randomized ... [8] Comparison of three different surface plank exercises on core ... [9] Recovery of physical activity after cesarean delivery and its ... [10] Performance fatigability: Mechanisms and ... [11] Pressure biofeedback: A useful tool in the quantification of abdominal ... [12] Physical activity and exercise during pregnancy and the ... [13] Safety of core muscle training immediately after abdominal surgery ... [14] Risk of chronic low back pain among parturients who undergo cesarean delivery with neuraxial anaesthesia: A nationwide population-based ... [15] Guidelines for postoperative care in cesarean delivery: Enhanced Recovery After Surgery (ERAS) Society ... [16] The effect of pelvic floor muscle training on pelvic floor function and ... [17] Effect of the abdominal draw-in manoeuvre in combination with ankle dorsiflexion in strengthening the transverse abdominal muscle in healthy young adults: A preliminary, randomised ... [18] Maximizing Recovery in the Postpartum Period: A Timeline for Rehabilitation from Pregnancy throug ... [19] A review of public health guidelines for postpartum physical activity and sedentary behavior from ... [20] Associations between physical activity and postpartum ... [21] Mobile health (m-health) technological support for women during pregnancy or the first six weeks ... [22] Physical activity beliefs, barriers, and enablers among postpartum ... [23] Postpartum Depression and Maternal Care: Exploring the Complex Effects on Mothers ... [24] Awareness about the Role of Physical Therapy in Post-Partum Females among ...

Introduction

Lower-segment cesarean section (LSCS) is a common surgical intervention for childbirth, often necessary when a vaginal delivery is not feasible or safe. While LSCS ensures a safe delivery in such circumstances, it introduces specific challenges in postpartum recovery, particularly regarding core strength [1] and stability. Women recovering from LSCS often experience a delayed return to normal function due to the disruption of abdominal muscles, which are essential for posture, movement, and daily activities. Research highlights that trunk flexor strength [2], fatigability, and overall stability are notably impaired in postpartum women, especially those recovering from LSCS. These factors make postpartum rehabilitation a crucial aspect of maternal health management. Core stability [3] plays a fundamental role in postpartum recovery. The abdominal muscles and fasciae, which are stretched and often damaged during pregnancy and delivery—particularly through LSCS [4]—are critical for maintaining trunk stability and supporting functional movements. Fan *et al.* noted that cesarean delivery [5] can disrupt the structural integrity of these muscles, leading to longer recovery times and a greater risk of chronic pain. In contrast, women who deliver vaginally typically recover faster in terms of muscle function, as the abdominal wall remains intact. The psychosocial impact of LSCS also cannot be overlooked, as the delayed recovery and increased physical discomfort may exacerbate mental health issues such as anxiety and depression during the postpartum period.

To aid in the recovery of core strength after LSCS, structured and targeted physical rehabilitation is essential [6]. Core exercises, particularly those focusing on stabilizing the trunk, have been shown to promote quicker and more effective recovery [7]. Plank exercises [8], in particular, are a cornerstone of postpartum rehabilitation, as they engage multiple muscle groups, including the transverse abdominis, rectus abdominis, and pelvic floor muscles. Smith & Chen emphasize that exercises [9] such as planks, performed in various positions, provide comprehensive engagement of the core muscles, improving stability and function. Fatigability [10], defined as the rapid onset of muscle weakness due to physical activity, is a critical concern for postpartum women, as it affects both their ability to perform daily activities and their recovery process. Evaluations of fatigability and strength in postpartum women are relatively scarce; however, it is essential to understand the limitations that may hinder effective recovery.

The study by Deering *et al.* [2] highlights the importance of addressing trunk flexor strength and fatigability, as these factors are closely linked to a woman's ability to perform functional movements, including lifting, bending, and carrying.

Technological advancements have also contributed to improved assessments and rehabilitation strategies. The pressure biofeedback unit (PBU) [11], for instance, has become a valuable tool for quantifying abdominal muscular dysfunction. It provides real-time feedback, allowing physiotherapists and patients to monitor muscle engagement and stability during exercises like the plank. This tool is particularly useful for women recovering from LSCS, as it helps track their progress and ensures that exercises are performed correctly and safely, minimizing the risk of injury or overexertion.

In light of the increasing number of cesarean deliveries worldwide, with rates as high as 18.6% across 150 countries, it is imperative to explore safe and effective rehabilitation methods. Core strength is particularly crucial for new mothers [12], as it aids in stabilizing the body, supporting proper posture, and reducing back pain, which is a common issue reported by postpartum women. Strengthening the core [13] through progressive, targeted exercises is essential for long-term physical health and recovery after LSCS.

By examining various plank variations and their effects on the core muscles, this paper provides practical recommendations for postpartum rehabilitation. Unlike mothers who have had vaginal deliveries, women recovering from LSCS experience greater impairments in strength, fatigability, and stability. As such, tailored exercise programs, including plank variations, are necessary to support effective recovery and promote long-term physical well-being. This study aimed to investigate the role of different plank positions in enhancing abdominal strength and stability for women recovering from LSCS.

Materials and Methods

This experimental study was conducted at Saveetha College of Physiotherapy on postpartum women selected based on specific inclusion and exclusion criteria, utilizing the odd-even method and convenience sampling over six months in 2022. The study included women who had undergone LSCS, were between 20 and 35 years of age, and were eight to ten weeks into the postnatal period. Women with severe postpartum comorbidities or complications were excluded from the study. Informed consent was obtained from the participants, and the details of the study were fully explained to them.

A thorough explanation of the PBU and the single leg lift abdominal strength test (SAS) was provided, as these were the outcome measures, both of which are reliable and valid. Using the confidence interval method, 30 subjects were divided into two groups, including the control group (abdominal draw-in maneuver (ADM)) and the experimental group (different plank positions (DPP)). Each group

consisted of 15 subjects. Functional evaluation of the abdominal muscles was performed using the PBU, and abdominal muscle strength was assessed using the SAS test weekly over the six months.

ADM Group

Subjects in the ADM group were instructed to lie down on a yoga mat in a hook-lying position and to pull their navel deeply toward the lumbar region. They were instructed to repeat this exercise ten times, for at least five days per week, and to continue for six months.

DPP Group

Subjects in the experimental DPP group were instructed to lie down on a yoga mat in a hook-lying position and to pull their navel deeply toward the lumbar region. They were instructed to repeat this exercise ten times, for at least five days per week. Additionally, all postnatal women in this group were asked to perform 30 seconds of a straight plank, 30 seconds of an elbow plank, 30 seconds of a side plank on the right side, and 30 seconds of a side plank on the left side, for at least five days per week for two months. After completing the two-month duration, they were instructed to perform all the planks for 1 minute each—60 seconds of the straight plank, 60 seconds of the elbow plank, sixty seconds of the side plank on the right side, and 60 seconds of the side plank on the left side—for an additional four months, after which their outcomes were measured.

Statistical analysis

SPSS version 21 was applied for data analysis using an independent samples t-test to compare the sample means between two independent groups, and a paired samples t-test to compare the means within the same groups, with a significance level of 0.05.

Findings

A total of 30 subjects participated in this study. The average age of the subjects in the ADM group was 24.03±2.04 years, while in the DPP group, it was 24.14±1.91 years. There was no significant difference between the mean ages of the subjects in both groups.

There was a significant change in the PBU measurements before and after the intervention in the ADM group. The mean PBU score before the intervention was 20.33±2.09, indicating the average initial level of abdominal muscle function across participants ($p<0.0001$). After the intervention, the mean PBU score increased significantly to 45.93±2.09, showing a notable improvement in abdominal muscle performance following the exercises. The positive covariance of +3.62 between the pre-test and post-test values suggests that participants who had higher initial scores in the pre-test tended to have higher post-test scores as well, implying a consistent relationship between their baseline and improved performances. Accordingly, the intervention, ADM, led to considerable improvements in abdominal muscle function.

In addition, there was a significant change in the PBU measurements before and after the intervention in the DPP group. The mean PBU score before the intervention was 19.80±1.37, indicating the average initial level of abdominal muscle function across participants ($p<0.0001$). After the intervention, the mean PBU score increased significantly to 67.20±15.90, showing a notable improvement in abdominal muscle performance following the exercises. The positive covariance of +4.74 between the pre-test and post-test values suggests that participants who had higher initial scores in the pre-test tended to have higher post-test scores, implying a consistent relationship between their baseline and improved performances. Accordingly, the DPP intervention led to considerable improvements in abdominal muscle function.

Following the intervention, changes in abdominal strength were observed in the ADM group based on the SAS scores. The mean score for the SAS in the pre-test phase was 72.10±16.23 ($p<0.0001$). This reflects the average baseline abdominal strength of the participants before undergoing the intervention. After the intervention, the mean score decreased to 42.33±16.02, indicating a reduction in the angle of the legs measured by the SAS test. The covariance between pre-test and post-test scores is reported as 243.21. This positive covariance suggests that participants with higher pre-test scores also tended to have higher post-test scores. In other words, there was a direct relationship between performance before and after the intervention. The magnitude of this covariance indicates a strong relationship between the pre-test and post-test results, meaning that participants' performance trends remained consistent between the two test points. Accordingly, the intervention had a meaningful impact on abdominal strength, as measured by the SAS test.

Moreover, following the intervention, there were changes in the deviation score of the angle of the legs in the DPP group, where a reduction in the angle represents an increase in abdominal strength following the intervention.

The mean score for the SAS test in the pre-test phase was 72.10±16.28 ($p<0.0001$). This reflects the average baseline abdominal strength of the participants before undergoing the intervention. After the intervention, the mean score decreased to 24.00±15.83, indicating a reduction in the angle of the legs measured by the SAS test. The covariance between pre-test and post-test scores was reported as 137.8. This positive covariance suggests that participants with higher pre-test scores also tended to have higher post-test scores. In other words, there was a direct relationship between performance before and after the intervention. The magnitude of this covariance indicates a strong relationship between the pre-test and post-test results, meaning that participants' performance trends remained consistent between the two test points. Accordingly,

the intervention had a meaningful impact on abdominal strength, as measured by the SAS test.

Discussion

This study investigated the role of different plank positions in enhancing abdominal strength and stability for women recovering from LSCS. The postpartum recovery period, especially following an LSCS, presents unique challenges [14] in terms of regaining core strength and functional stability. LSCS is associated with greater disruption of the abdominal muscles, particularly the rectus abdominis and the transverse abdominis, which are vital for posture and movement.

The use of plank exercises as a rehabilitation tool has been emphasized in various studies due to their effectiveness in engaging multiple core muscles [7, 14], including the pelvic floor [15] and lower back muscles. This study compared two rehabilitation methods: the ADM and DPP. The goal was to determine which approach was more effective at improving core strength and functionality in postpartum women who underwent LSCS. The results showed a significant improvement in the DPP group compared to the ADM group, suggesting that planking in varied positions can enhance abdominal muscle strength more effectively than traditional abdominal draw-in exercises

Research indicates that impaired trunk flexor strength and fatigability are common postpartum issues that hinder recovery, particularly in women recovering from LSCS. Deering *et al.* [2] noted that the strength and stability of the core muscles are significantly compromised in postpartum women, which affects their ability to perform functional movements, such as bending, lifting, and carrying. This impairment highlights the importance of targeted core-strengthening exercises to facilitate postpartum recovery. Core stability exercises [7], especially those that involve progressive resistance, such as planks, have been shown to improve functional recovery by enhancing abdominal muscle engagement.

The findings of this study suggested that performing DPP offers more significant improvements in core strength than the ADM. As noted by Lee *et al.* [8], plank exercises are highly effective at engaging multiple muscle groups, including the transverse abdominis, rectus abdominis, and pelvic floor muscles, which s confirmed in another study [16]. The dynamic nature of planks requires continuous core engagement, providing a more comprehensive workout compared to isolated exercises like the ADM [17], which primarily target a specific group of muscles. This comprehensive muscle engagement likely contributed to the superior outcomes observed in the DPP group.

Furthermore, the use of plank variations adds an element of progression and adaptability, allowing women to gradually increase the intensity of their exercises as their strength improves. Plank exercises performed on different surfaces or in various positions enhance muscle activity by challenging balance and stability, promoting greater muscle activation and endurance. This aligns with the findings of Cairns *et al.* [11], and other researchers who emphasized the importance of exercises [18, 19] that engage the core dynamically to restore muscle function.

Another critical aspect of postpartum recovery is addressing the psychosocial impact of childbirth, particularly following LSCS. Delayed physical recovery can contribute to mental health challenges, including postpartum depression and anxiety. As noted by Lobel & DeLuca [4], the psychosocial sequelae of cesarean delivery can exacerbate these mental health issues, particularly when women feel physically weakened or unable to perform daily activities [20]. The incorporation of structured [21, 22] physical rehabilitation, such as plank exercises, not only aids in physical recovery but also positively impacts mental health by promoting a sense of control and well-being [23]. Regular exercise [24] is known to release endorphins, which help reduce stress and improve mood, contributing to a healthier postpartum period.

In this study, the use of the PBU provided valuable feedback on muscle engagement during the rehabilitation exercises. The PBU is an effective tool for quantifying abdominal muscle function and ensuring proper technique, which is critical in preventing injury or strain during the recovery process. The combination of PBU feedback and progressively challenging exercises, such as those involving DPP, offers a practical and safe approach to postpartum rehabilitation, particularly for women recovering from LSCS.

Given the increasing global rates of cesarean deliveries, which now account for up to 18.6% of births across 150 countries [5], effective rehabilitation strategies are essential for supporting the long-term health and well-being of new mothers. Strengthening the core muscles not only helps restore functional stability but also reduces the likelihood of chronic pain and physical limitations later in life.

The postpartum period, particularly following an LSCS, is marked by several significant physiological and musculoskeletal changes. These changes often include a weakening of the abdominal muscles, which play a critical role in providing core stability and supporting functional movements such as posture, balance, and mobility. Women recovering from LSCS may experience delayed muscle recovery due to the trauma and stretching caused by the procedure, which can affect their quality of life. The abdominal muscles, especially the rectus abdominis and transverse abdominis, become highly vulnerable, requiring focused rehabilitation efforts to regain strength and function.

The improvement in the DPP group can be attributed to the dynamic nature of planking exercises. Planks require constant engagement of the core muscles to maintain balance and posture, thus providing a more comprehensive workout for the abdominal muscles. In contrast, the ADM focuses primarily on isolated muscle engagement [8], which may be less effective for overall core stability. Studies such as those by Lee *et al.* [8] also highlight the importance of exercise posture and surface variations in maximizing muscle activity during plank exercises. This evidence further supports the study's findings that DPP can stimulate deeper core engagement and lead to better functional recovery post-LSCS.

In addition to physical benefits, engaging in structured rehabilitation routines, such as those involving plank exercises, can have positive effects on mental health. Postpartum women often face increased risks of anxiety and depression, especially when their physical recovery is delayed. Exercise has been proven to release endorphins, reduce stress, and improve mood, which can play a crucial role in mitigating postpartum depression. The routine established through structured exercises like planks can provide a sense of control and empowerment, which may aid in mental recovery during this transition period.

Despite the promising findings, this study had some limitations. The small sample size (30 participants) reduces the generalizability of the results. A larger sample size would provide more robust data and enhance the external validity of the findings. Additionally, the study duration of six months may not have been long enough to capture the full extent of long-term recovery in abdominal strength and function, especially for women who may have experienced more complex or delayed recoveries.

Future studies should consider expanding the sample size and possibly including women from different demographic backgrounds to provide a more comprehensive analysis of postpartum recovery methods. Additionally, incorporating more advanced tools for measuring muscle recovery and real-time muscle activity could provide more precise data on the effectiveness of plank exercises. Postpartum rehabilitation programs should also be tailored based on individual recovery progress and comfort levels, ensuring that exercises are both safe and effective.

By addressing these limitations and enhancing study methodologies, future research can provide even more accurate insights into postpartum rehabilitation and help guide physical therapy practices for women recovering from LSCS.

Conclusion

Incorporating varied plank exercises effectively restores core stability and supports a quicker return to daily activities.

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References

1- Maleki M, Bahadoran P, Shekarchizadeh P. Effect of core stability training on postpartum mother's sexual desire. Iran J Nurs Midwifery Res. 2023;28(1):105-109.

2- Deering RE, Cruz M, Senefeld JW, Pashibin T, Eickmeyer S, Hunter SK. Impaired trunk flexor strength, fatigability, and steadiness in postpartum women. Med Sci Sports Exerc. 2018;50(8):1558-69.

3- Thabet AA, Alshehri MA. Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomised controlled trial. J Musculoskelet Neuronal Interact. 2019;19(1):62-68.

4- Lobel M, DeLuca RS. Psychosocial sequelae of cesarean delivery: Review and analysis of their causes and implications. Soc Sci Med. 2007;64(11):2272-84.

5- Fan C, Guidolin D, Ragazzo S, Fede C, Pirri C, Gaudreault N, et al. Effects of cesarean section and vaginal delivery on abdominal muscles and fasciae. Medicina. 2020;56(6):260.

6- Almuklass AM, Price RC, Gould JR, Enoka RM. Force steadiness as a predictor of time to complete a pegboard test of dexterity in young men and women. J Appl Physiol. 2016;120(12):1410-7.

7- Saleh MSM, Botla AMM, Elbehary NAM. Effect of core stability exercises on postpartum lumbopelvic pain: A randomized controlled trial. J Back Musculoskelet Rehabil. 2019;32(2):205-213.

8- Lee J, Jeong KH, Lee H, Shin JY, Choi JL, Kang SB, et al. Comparison of three different surface plank exercises on core muscle activity. Phys Ther Rehabil Sci. 2016;5(1):29-33.

9- Sharpe EE, Booth JL, Houle TT, Pan PH, Harris LC, Aschenbrenner CA, Eisenach JC. Recovery of physical activity after cesarean delivery and its relationship with

pain. Pain. 2019;160(10):2350-2357.
10- Hunter SK. Performance fatigability: Mechanisms and task specificity. Cold Spring Harb Perspect Med. 2018;8(7):a029728.
11- Cairns MC, Harrison K, Wright C. Pressure biofeedback: A useful tool in the quantification of abdominal muscular dysfunction?. Physiotherapy. 2000;86(3):127-38.
12- ACOG. Physical activity and exercise during pregnancy and the postpartum period. ACOG Committee Opinion Number 804. Obstet Gynecol. 2020;135(4):e178-88.
13- Perrodin SF, Salm L, Beldi G. Safety of core muscle training immediately after abdominal surgery: systematic review. BJS Open. 2023;7(6):zrad142.
14- Chia YY, Lo Y, Chen YB, Liu CP, Huang WC, Wen CH. Risk of chronic low back pain among parturients who undergo cesarean delivery with neuraxial anaesthesia: A nationwide population-based retrospective cohort study. Medicine. 2016;95(16):e3468.
15- Macones GA, Caughey AB, Wood SL, Wrench IJ, Huang J, Norman M, Pettersson K, Fawcett WJ, Shalabi MM, Metcalfe A, Gramlich L, Nelson G, Wilson RD. Guidelines for postoperative care in cesarean delivery: Enhanced Recovery After Surgery (ERAS) Society recommendations (part 3). Am J Obstet Gynecol. 2019;221(3):247.e1-247.e9.
16- Schütze S, Heinloth M, Uhde M, Schütze J, Hüner B, Janni W, Deniz M. The effect of pelvic floor muscle training on pelvic floor function and sexuality postpartum. A randomized study including 300 primiparous. Arch Gynecol Obstet. 2022;306(3):785-793.
17- Chon SC, Chang KY, You JS. Effect of the abdominal draw-in manoeuvre in combination with ankle dorsiflexion in strengthening the transverse abdominal muscle in healthy young adults: A preliminary, randomised, controlled study. Physiotherapy. 2010;96(2):130-6.
18- Selman R, Early K, Battles B, Seidenburg M, Wendel E, Westerlund S. Maximizing Recovery in the Postpartum Period: A Timeline for Rehabilitation from Pregnancy through Return to Sport. Int J Sports Phys Ther. 2022;17(6):1170-1183.
19- Evenson KR, Brown WJ, Brinson AK, Budzynski-Seymour E, Hayman M. A review of public health guidelines for postpartum physical activity and sedentary behavior from around the world. J Sport Health Sci. 2024;13(4):472-483.
20- Demissie Z, Siega-Riz AM, Evenson KR, Herring AH, Dole N, Gaynes BN. Associations between physical activity and postpartum depressive symptoms. J Womens Health (Larchmt). 2011;20(7):1025-34.
21- Lavender T, Smyth RMD, Chimwaza AF, Mills TA, Dwan K. Mobile health (m-health) technological support for women during pregnancy or the first six weeks postpartum, or both. Cochrane Database Syst Rev. 2023;2023(3):CD015191.
22- Evenson KR, Aytur SA, Borodulin K. Physical activity beliefs, barriers, and enablers among postpartum women. J Womens Health (Larchmt). 2009;18(12):1925-34.
23- Saharoy R, Potdukhe A, Wanjari M, Taksande AB. Postpartum Depression and Maternal Care: Exploring the Complex Effects on Mothers and Infants. Cureus. 2023;15(7):e41381.
24- Nazar, Ghania. (2021). Awareness about the Role of Physical Therapy in Post-Partum Females among Gynecologists. Healer J Physiother Rehabil Sci. 2021;1(1):21-6.