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Review Article

Effectiveness of physiotherapy techniques for treating diastasis abdominis: A narrative systematic review

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ABSTRACT

Introduction: The body undergoes anatomical and physiological changes during pregnancy to support fetal development. One significant musculoskeletal change is abdominal diastasis (AD), which involves the separation of the rectus abdominis muscles, causing lumbopelvic stability issues. A proper evaluation and classification of AD are essential for its treatment. Some of the issues are instability, potentially leading to abdominal hernias, lower back pain, poor posture, deficiencies in the pelvic area, and loss of strength. The surgical reconstruction of the *linea alba* is the prevailing standard of medical treatment for AD, however, alternative therapeutic interventions, including various forms of physiotherapy, have been shown to be efficacious in the management of associated symptoms. **Objectives:** The objective of this study is to identify and assess the effectiveness of physiotherapy techniques for the treatment of AD in postpartum women, with a particular focus on determining which treatment approach results in the most effective reduction of the inter-recti distance. **Materials and methods:** A narrative systematic review was conducted. A comprehensive search was conducted in various databases, including PEDro, PubMed, ELSEVIER, and EBSCO, yielding a total of 62 articles. After the removal of duplicates, 33 articles were selected for further analysis, with publications spanning from 2017 to 2024, and written in both Spanish and English languages. The final selection comprised studies that met the predetermined inclusion criteria, encompassing the utilization of exercises and/or deep core stability, muscle strengthening, deep core stability, kinesiotape, neuromuscular electrical stimulation, and hypopressive techniques. **Results:** The results of the study indicated that the most efficacious treatments for AD are abdominal exercises, muscle strengthening, and deep core stability. **Conclusions:** The most effective physiotherapy treatment for AD is exercise and/or core stability, which may serve as an effective adjunct treatment to conventional care.

Key words: techniques; treatment; abdominal diastasis; non-surgical treatment; physiotherapy.

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RESUMEN

Introducción: Durante el embarazo, el cuerpo experimenta cambios anatómicos y fisiológicos significativos, entre ellos la diástasis abdominal (AD), que implica la separación de los músculos rectos del abdomen. Este cambio puede causar inestabilidad lumbopélvica, dolor lumbar, mala postura, deficiencias pélvicas y pérdida de fuerza, además de aumentar el riesgo de hernias abdominales. La reconstrucción quirúrgica de la línea alba es el tratamiento estándar para la AD, pero las intervenciones de fisioterapia podrían ser una alternativa efectiva para controlar los síntomas y mejorar los resultados. **Objetivo:** Evaluar la efectividad de técnicas fisioterapéuticas para tratar la AD en mujeres posparto y determinar qué tratamiento reduce mejor la distancia entre los rectos abdominales. **Material y métodos:** Se realizó una revisión narrativa sistemática de 33 artículos seleccionados tras buscar en bases como PEDro, PubMed y ELSEVIER. Los estudios analizados incluían técnicas como ejercicios abdominales, fortalecimiento muscular, estabilidad profunda del core, kinesiotape, estimulación eléctrica neuromuscular y técnicas hipopresivas. **Resultados:** Los ejercicios abdominales, el fortalecimiento muscular y la estabilidad del core fueron las intervenciones más efectivas para tratar la AD. **Conclusión**: El ejercicio y la estabilidad del core son tratamientos fisioterapéuticos eficaces para la AD y pueden complementar los cuidados médicos habituales, mejorando los resultados y la calidad de vida de las mujeres en el posparto.

Palabras clave: técnicas; tratamiento; diástasis abdominal; fisioterapia; diastasis postparto; tratamiento no quirúrgico.

INTRODUCTION

During pregnancy, the mother's body undergoes changes in terms of anatomy, biomechanics and physiology. A significant proportion of these alterations commence shortly after fertilization and persist throughout the entire duration of pregnancy, with the maternal body returning to its pre-pregnancy state following the postpartum and location period, as defined by the World Health Organization (WHO) and characterized by a duration ranging from six months to two years.[1,2] Diastasis abdominis (AD) is one of the more common postpartum conditions. AD is defined as the separation of the rectus abdominis muscles along the *linea alba.*[3] Approximately 30% to 70% of women experience AD during pregnancy, and 60% of them continue to have AD for the rest of their lives.[4] During the third trimester of pregnancy, the incidence of AD exceeds 60%, while in the immediate postpartum period the incidence is about 53% and in the late postpartum period the incidence declines to 36%.[5] The prevalence of AD is 33% at 21 weeks of gestation, increasing to 60% at 6 weeks postpartum and decreasing to 45% to 32% between 6 and 12 months postpartum, respectively.[6]

The primary consequences of AD are reduced mobility and limited physical exertion, resulting from the laxity of the abdominal wall muscles.[7,8] An understanding of the anatomy of the abdominal wall muscles is fundamental to the comprehension of AD. These muscles play a crucial role in maintaining pelvic and lumbar stability, which can be compromised in individuals affected by AD. The *linea alba* represents the fusion of the aponeurosis of the transversus abdominis, the external oblique, the internal oblique and the rectus abdominis muscles.[9]

The internal and external oblique muscles contribute to trunk support and rotation. When there is AD coordinated contraction of these muscles become less effective, impacting the stability and biomechanics of the pelvis and abdomen.[9] The transversus abdominis, the deepest layer, works as a natural corset helping the core stability. AD interferes with this muscle's ability to maintain tension along the *linea alba* and control intra-abdominal pressure, leading to an increased lumbar curvature.[9] The rectus abdominis muscle separation weakens the *linea alba*, impacting on the postural balance and trunk functionality.[9]

POSTPARTUM DIASTASIS ABDOMINIS

One of the more common pathologies in the postpartum period is diastasis abdominis (AD), this refers to the separation of the rectus abdominis muscles, in which these are separated along the *linea alba.*[10] To achieve good lumbopelvic stability it is essential to have proper functioning of the articular, fascial, muscular and nervous components of the abdomen.[10] An alteration in any of these structures can compromise stability, potentially leading to abdominal hernias, lower back pain, poor posture, deficiencies in the pelvic area, loss of strength.[8] In some cases, it may cause more complicated issues such as respiratory defects, limited trunk movements, primarily rotation, bending and

flexion, support of the abdominal viscera, aesthetic defects and persistent lumbopelvic pain.[11] Some risk factors include maternal age, multiparity, previous cesarean sections, obesity, multiple pregnancies, ethnicity and fetal macrosomia.[12]

DIASTASIS ABDOMINIS EXPLORATION FOR DIAGNOSIS

In the physical examination for diagnosing AD, an abdominal bulge is usually observed, which worsens with the contraction of the rectus abdominis muscles or a Valsalva maneuver.[13] The diagnosis should be confirmed through imaging studies such as ultrasound, computed tomography or magnetic resonance imaging of the rectus abdominis, measuring the separation between the muscles in three segments; at the level of the xiphoid process, 3 cm above the umbilicus, and 2 cm below the umbilicus.[14]

DIASTASIS ABDOMINIS CLASSIFICATION

The anatomy and classification of AD are fundamental aspects for the comprehension of the abdominal wall conditions, that is why different ways of classification of AD are described in this review.[15] Nahabedian establishes that anatomical structures include the *linea alba*, rectus abdominis, internal and external obliques and their fascias.[15] The *linea alba* is composed of organized collagen fibers and has a distance of 11 to 21 mm between the xiphoid process and the umbilicus, a distance of 2 to 11 mm between the umbilicus and the pubic symphysis.[15]

The German Hernia Society and the International Endohernia Society propose that the rectus abdominis muscles have a separation of no more than 1 to 2 cm and a separation greater than 2 cm is considered AD.[16] The European Hernia Society classifies diastasis recti based on three criteria: type, distance between the rectus abdominis muscles, and the presence of a concomitant umbilical and/or epigastric hernia.[17] The classification has four grades: I, II, III and IV; each grade is subdivided depending on whether the woman is postpartum or has adiposity and whether a hernia is present.[17] The distance is divided into three categories: D1 >2-3 cm, D2 >3-5 cm and D3 >5 cm.[17]

According to Keramidas *et al.* in 2022, AD can be classified into four types: type A, with a separation of 2-3 cm, indicating mild AD; Type B, with a separation of 3-5 cm, indicating a moderate AD; Type C, with a separation of 5-7 cm, indicating severe AD and Type D, with a separation of 7-9 cm, indicating very severe AD. They say diastasis must be measured subxiphoid, epigastric, umbilical, infraumbilical and suprapubic.[18] Beer *et al.* mention that abdominal diastasis is considered based on the following distances: 15 mm at the level of the xiphoid process, 22 at the supraumbilical level, and 16 mm at the infraumbilical level.[14] This study aims to evaluate physiotherapy treatment options for AD, providing a comprehensive perspective that can guide evidence-based clinical practice and future research. With the main objective to identify and assess the effectiveness of physiotherapy techniques for treating AD in postpartum women, determining which treatment best reduces the inter-recti distance.

MATERIALS AND METHODS

Study design

This study is a narrative systematic review conducted following the PRISMA methodology. This review aims to synthesize the available evidence of the most effective physiotherapy techniques for treating abdominal diastasis in postpartum AD.

Search strategy

A comprehensive search of articles published between 2017 and October 2024 was conducted in the databases PEDro, PubMed, ELSEVIER, and EBSCO. The search included studies written in both English and Spanish, using terms such as “techniques”, “treatment”, “abdominal diastasis”, “non-surgical treatment”, and “physiotherapy”, with their respective translations.

Methodological quality and risk of bias

The measurement of the risk of bias and the quality of bias of the articles included was evaluated independently by two evaluators; through the risk of bias assessment tool PEDro scale. This was used to analyze the methodological quality of all the selected articles, given that its use is recommended for the analysis of evidence in clinical trials.

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Eligibility criteria

The selection of studies was based on the PICO criteria **(Table 1).** The evaluated indicators included the reduction of the inter recti distance measured at three different points: subxiphoid, umbilical and infraumbilical; increased strength of the abdominal muscles, improvement in deep core stability and reduction in lumbopelvic pain. These outcomes were analyzed to assess the effectiveness of physiotherapy techniques in treating AD in postpartum women.

Table 1: Description of the PICO acronym and MeSH (Medical Subject Headings) terms for the search of studies

Acronym	Definition	Term
P	Participants/articles	Postpartum women with diagnosis of diastasis abdominis.
I	Intervention	Physiotherapy techniques and treatments.
C	Comparison	Different techniques and treatments used or no intervention.
O	Results	Effects of used techniques.

Inclusion criteria included: studies with variables determined before and after the intervention; participants treated solely through physiotherapy interventions; articles in English and Spanish; publications from 2017 to October 2024, any other sources published before 2017 or written in a language besides English or Spanish were excluded. Exclusion criteria include studies that involve the administration of medications for pain or inflammation; studies where the treatment is surgical; and theses. The articles included experimental studies, observational studies and original and review research. A total of 62 scientific articles were evaluated, matching our search criteria. Initially selected through a review of their titles and abstracts. Subsequently, a full-text review was performed to make the final selection of studies based on the established inclusion and exclusion criteria **(Figure 1).**

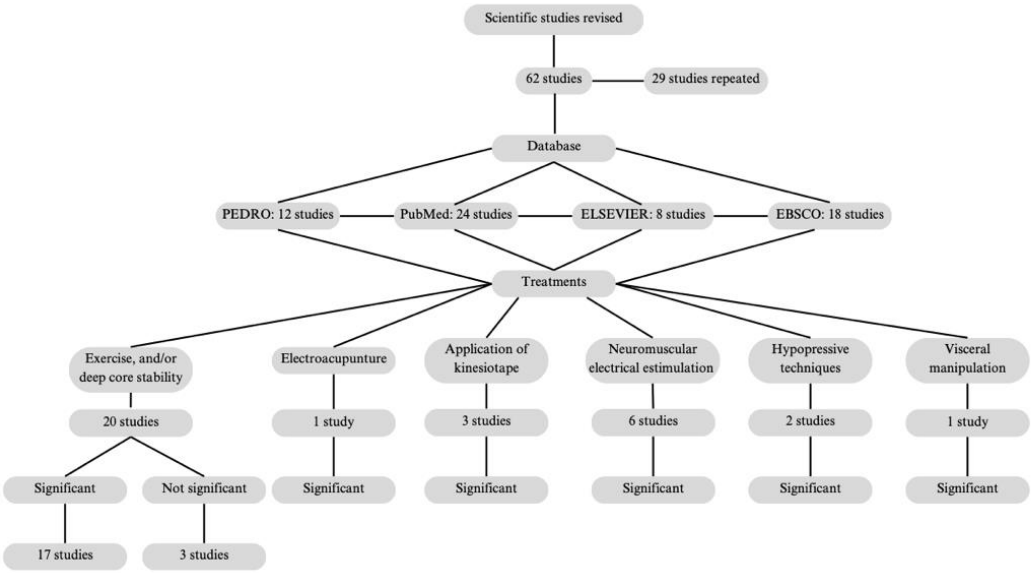

Figure 1: PRISMA flow chart for analyzing results.

Data extraction and management

Data were collected through a review of the full texts and evaluated. Additionally, the PEDro scale was used to assess the methodological quality and risk of bias of the selected studies.

Data analysis

The results of the selected studies were synthesized, and the effectiveness of different physiotherapy techniques in reducing abdominal diastasis in postpartum women was evaluated. The results were summarized in a flowchart using the PRISMA methodology **(See Figure 1).**

RESULTS

Study selection

A thorough review of 62 scientific articles, obtained from bases such as PEDro, wich contributed with 7 studies, PubMed 18 studies, ELSEVIER contributed with 8 studies and EBSCO with 18 studies. Among the final 33 studies, there were 23 experimental studies, 8 observational studies and 2 original and review research studies. Sample sizes varied significantly: 8 studies involved over 90 participants, 3 included 50-89 participants, 19 reported 10-49 participants and 3 had fewer than 10 participants, 3 of the reviewed studies did not disclose participant numbers. The studies primarily focused on interventions such as exercise and deep core stability (20 studies), neuromuscular electrical stimulation (6 studies), kinesiotape (3 studies), hypopressive techniques (2 studies), visceral manipulation (1 study) and electroacupunture (1 study). Of these, 90.0% demonstrated significant reductions in AD severity, employing longer and more frequent sessions of treatment. These protocols used treatment sessions that were 2 to 5 times per week and between 30 to 50 minutes per session. This variation in session duration and frequency highlights the different approaches used, which could influence the congruity of results among different intervention types **(Table 2).**

Table 2. Details of the included studies

Study	Participants	Intervention	Duration	Frequency	Outcomes	Authors
Experimental Study	198 participants	Neuro-Muscular Electrical Stimulation (NMES)	12 weeks	3 times a week x 30 minutes	Significant results	35
Experimental Study	40 participants	Neuro-Muscular Electrical Stimulation (NMES)	4 weeks	3 times a week x 30 minutes	Significant results	36
Experimental Study	175 participants	Exercises and/or deep core stability	16 weeks	1 time a week x 45 minutes	Not significant results	19
Experimental Study	35 participants	Exercises and/or deep core stability	4 weeks	5 times per week x 50 minutes	Significant results	20
Experimental Study	98 participants	Hypopressive techniques	1 session	Once	Significant results	42
Observational Study	30 participants	Exercises and/or deep core stability	Immediate	Once	Significant results	21
Experimental Study	42 participants	Neuro-Muscular Electrical Stimulation (NMES)	8 weeks	3 times a week x 30 minutes	Significant results	37
Observational Study	93 participants	Exercises and/or deep core stability	6 weeks.	Six 20-minute sessions	Significant results	22

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Original and Review	8 participants	Exercises and/or deep core stability	12 weeks	3 times a week	Significant results	23
Experimental Study	8 participants	Exercises and/or deep core stability	12 weeks	3 times a week	Significant results	23
Experimental Study	175 participants	Exercises and/or deep core stability	16 weeks	1 time a week x 45 minutes	Not significant results	24
Observational Study	504 participants	Exercises and/or deep core stability	3 to 12 months post-partum	>2 x week 2-5 x week <5 x week 1-2 x week	Significant results	25
Observational Study	38 participants	Exercises and/or deep core stability	Immediate	Once	Significant results	26
Experimental Study	60 participants	Neuro-Muscular Electrical Stimulation (NMES)	8 weeks	3 times a week x 30 minutes	Significant results	12
Experimental Study	66 participants	Neuro-Muscular Electrical Stimulation (NMES)	6 weeks	3 times a week x 20 minutes	Significant results	38
Experimental Study	24 participants	Kinesiotape	6 weeks	3 times a week x 30-45 minutes	Significant results	39
Experimental Study	37 participants	Exercises and/or deep core stability	6 weeks	2 times a week x 40 minutes	Significant results	4
Observational Study	3 participants	Visceral manipulation (VM)	18 to 36 weeks	Every 3 to 4 weeks	Significant results	45
Experimental Study	110 participants	Electro-acupuncture	2 weeks	5 times a week x 30 minutes	Significant results	44
Experimental Study	24 participants	Kinesiotape	48 hours	Once	Significant results	40
Experimental Study	35 participants	Exercises and/or deep core stability	4 weeks	5 times a week x 50 minutes	Significant results	20
Experimental Study	32 participants	Neuro-Muscular Electrical Stimulation (NMES)	6 weeks	7 times a week x 20 minutes	Significant results	44
Observational Study	46 participants	Hypopressive techniques	8 weeks	2 times a week x 45 minutes	Significant results	43
Experimental Study	41 participants	Exercises and/or deep core stability	8 weeks postpartum.	3 times a week x 10 minutes	Significant results	27
Original and Review	24 participants	Kinesiotape	Not specified	Not specified	Significant results	41
Experimental Study	38 participants	Exercises and/or deep core stability	Not specified	Not specified	Significant results	28
Observational Study	38 participants	Exercises and/or deep core stability	Not specified	Not specified	Significant results	31
Observational Study	19 participants	Exercises and/or deep core stability	Not specified	2 times a week	Significant results	30
Experimental Study	96 participants	Exercises and/or deep core stability	Not specified	2 times a week x 30 minutes	Non significant results	29

Experimental Study	40 participants	Exercises and/or deep core stability	8 weeks	3 times a week x 30 min	Significant results	11
Experimental Study	45 participants	Exercises and/or deep core stability	8 weeks	3 times a week	Significant results	32
Experimental Study	32 participants	Exercises and/or deep core stability	12 weeks	Weekly sessions	Significant results	33
Experimental Study	70 participants	Exercises and/or deep core stability	12 weeks	5 times a week x 10 minutes	Significant results	26

Exercise and/or core stability effects on AD

The effects of different exercises and core stability techniques on AD were evaluated. Specific types of exercises included isometric contractions, Pilates, and deep abdominal muscle strengthening. Muscular endurance was defined as the ability to sustain contractions over a specific period or test. For core stability-based techniques, improvements in reducing the inter recti distance were specifically assessed trough ultrasound imaging, along with their impact on lumbopelvic stability. Protocols ranged from 4 to 16 weeks, including supervised and self-guided exercises, performed 2 to 5 times per week for 30 to 50 minutes each session. Significant improvements were showed in 90.0% of the protocols noted in endurance, inter-recti distance, and functionality. However, a few studies showed no significant differences when comparing intervention groups to control groups.[4,11,19-34]

The effect of neuromuscular electrical stimulation

Neuromuscular electrical stimulation was used as a technique across several studies. Protocols combined NMES with exercise and/or core stabilization. Protocols were applied from 2 to 5 weeks, with a frequency of 2 to 5 times a week in sessions of 20-30 minutes.

Results showed significant improvements in abdominal wall muscle strength, inter-recti distance, and waist-hip ratio. A greater effectiveness was observed when NMES were combined with exercise.[12, 35-38]

Kinesiotape use for treating AD

Kinesiotape was used as a complementary therapy for AD. Studies evaluated both immediate and short-term effects, using applications averaging 48 hours. The results in these studies showed improvements in lumbopelvic stability and inter-recti distance, especially when combined with exercise.[39-41]

Hypopressive techniques

Hypopressive techniques were used as an alternate core strengthening protocol, reducing AD. These were implemented in structured, short-duration sessions. Results indicated that hypopressives might enhance the tensile response of the *linea alba*, having a direct impact on AD.[42,43]

Electroacupuncture

Electroacupuncture combined with physical exercises, was evaluated as an intervention for postpartum women with AD. The protocol was applied 5 days a week, for 2 weeks and 30 minutes per session. Significant reductions were found between the inter-recti distance, the lack of advanced and more extensive research could be beneficial for the use of electroacupuncture as treatment of AD.[44]

Visceral manipulation

Visceral manipulation was used as a therapeutic approach focusing on the mobility of abdominal structures, targeting the jejunoileal area in women with AD. This intervention involved sessions spaced from 18 to 36 weeks with treatment every 4 weeks. Results showed decreased pain levels, improved functional activity and a better bowel function as well as enhanced bladder function.[45]

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Adverse events

Adverse events were not reported in any of the included studies.

DISCUSSION

The findings of this study corroborate previous research on the effectiveness of physiotherapy techniques for treating diastasis recti (DR). Recent studies have highlighted that deep core strengthening exercises, such as hypopressives and isometric exercises, are effective in reducing inter-recti distance and improving lumbopelvic stability[5,34] (See Table 2).

Additionally, literature indicates that combining techniques like kinesiotape application and specific exercises can significantly enhance abdominal strength and alleviate DR-associated pain.[11,40]

Despite the observed benefits, some studies have reported variability in outcomes depending on the postpartum timing of the interventions. For instance, Gluppe *et al*. found that interventions initiated within the first 6 weeks postpartum achieve greater reductions in inter-recti distance compared to those started later.[24] These findings underscore the importance of timing in treatment initiation and the need to personalize interventions based on individual patient characteristics.[9]

However, one challenge identified in this review is the lack of consistency in evaluation methods, as seen in studies using varied techniques to measure functionality and inter-recti distance.[15,18] Therefore, it is recommended to standardize methodologies to facilitate result comparison and improve the quality of available evidence.

AD is one of the most common conditions after postpartum and some women live with this condition all their lives. However, one of the limitations found was the lack of scientific articles and studies in literature, making it extremely difficult to find the most effective treatment for this condition.

AD is relevant because 30-70% of women have it after giving birth, and 60% of them continue to have AD in their postpartum period. This affects their everyday activities and prevents them from having a good quality of life. This condition may cause abdominal hernias, lumbopelvic pain, bad posture, pelvic deficiencies, and decreased strength. However, different physiotherapy treatments are used to treat AD, helping patients to have a fully functional abdominal wall without having to get a surgical repair of their *linea alba*.

The results of this study suggest that exercise and/or core stability have a significant impact on the reduction of AD. Previous investigations stand out because of the effectiveness of the strengthening of the abdominal wall muscles. Additional data shows that neuromuscular electrical stimulation (NMES) can also be effective, according to the studies found that were all significant.

In comparison with other techniques like the use of Kinesio tape and hypopressive techniques, the results were all significant but showed less effectiveness due to the limited number of studies. The articles on visceral manipulation and electroacupuncture present both interventions as notable but lack further evidence to confirm their effectiveness, primarily due to insufficient high-quality research on these approaches.

Some studies had well-designed methods, while others had flaws, like a small number of participants, very few sessions, or short clinical trial periods. The strengths of this review are that the studies included were from multiple countries and four different databases which provided a global perspective. However, a weakness is that only studies written in English and Spanish were included, which might limit the findings. The diversity of treatment approaches provides a broad and updated vision of the different physiotherapy options for the treatment of AD.

CONCLUSION

In conclusion, following a comprehensive analysis of the various techniques employed in the treatment of AD, it was determined that abdominal exercises, muscle strengthening, and deep core stability represent the most efficacious techniques for the comprehensive treatment of AD in postpartum women. These techniques may serve as an effective adjunct treatment in conjunction with standard care.

CONFLICT OF INTEREST

The authors declared that they had no conflicts of interest.

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