DOI: https://doi.org/10.53350/pjmhs2023176346

ORIGINAL ARTICLE

Prevalence of Diastasis Recti Abdominis in a Gynecological Population: A Cross-Sectional Study

ASMA AMEER[1], HUMA WAQAR[2], SHANZA AYUB[3], AQSA ILYAS[4], BILAL UMAR[5]. SARA KHAN[6]
[1,2,3,4]DPT, Government College University Faisalabad
[5]Senior Lecturer, Riphah International University Faisalabad Campus
[6]Lecturer Physical Therapist, Institute:University of Lahore
Corresponding author: Asma Ameer, Email: Drasmaameer@gmail.com, Cell: +92 323 7627151

ABSTRACT

Background: Diastasis recti is the divarication of rectus abdominal muscles due to the splitting of the mid-line collagen structure called the linea alba. It results in poor body biomechanics and alteration in the center of gravity of the body. It occurs mostly in multiparous females and in those who have poorly toned abdominal musculature. Physical activity and maternal care are significant to resolve this condition.

Objective: The purpose of the study is to substantiate the prevalence of diastasis recti in a sample of immediate post-partum females attended by the Allied Hospital of Faisalabad. The aim is to create awareness of DRAM in clinical settings and the general population.

Study design: This is a cross-sectional study that included 90 samples of females in the immediate postpartum period.

Methodology: Specific assessment was done by finger-width method manually and confirmed the presence of DRAM. The umbilical region was the set point from which measurements were taken.

Results and Conclusions: The separation was present and mostly affected the multiparous females. The study showed 63.3% prevalence and normal rectus abdominis is 36.7%. It also verified that 42.2% of females suffered from DRAM above the navel out of 63.3% and the rest are below the umbilicus. DRAM was prevalent to be in the majority of post-partum females. It was more present in the supra-umbilical region.

Keywords: Pregnancy, rectus abdominis, multiparous, primiparous, physiotherapy.

INTRODUCTION

The human body may surprise you in many aspects and for a female being pregnant is one of them. Female bodies are made to bear children and are also resilient in getting back to their prior position. Excessive gain in weight, billowing breasts, changes in skin color, poor body biomechanics, and changes in normal levels of hormones are all part of the nine-month course. The musculoskeletal changes are weight gain, laxity of ligaments and muscles, soft tissue edema in the lower limbs, hyperlordosis, and changes in abdominal muscle elasticity. [1] [2] As the pregnancy progresses, the abdominal muscles become distended and more laxity occurs. These changes result in the separation of the abdominal muscles and divarication. These biomechanical and hormonal changes make abs separate along the linea alba and create a gap. This causes a bulge to appear at the center of the umbilicus. This is known as diastasis recti abdominis. A normal gap is 1-2 finger widths. If this gap is over 2.7 cm finger widths, it is considered diastasis recti. [3] The appearance of the umbilicus is changed. [4] Also, during pregnancy, the postural changes influence the postural biomechanics of the mother. [5] The rectus abdominis is an important postural muscle that assists during childbirth. It is a superficial abdominal muscle that may be palpated easily during pregnancy. To locate the position, the medial edges of the right and left rectus abdominis muscles were palpated, with the subject positioned supine to facilitate muscle palpation. [6] Diastasis recti is very common among pregnant females, unmarried females if they have higher BMIs, and multiparous females if they are close to aging. [7] It can cause pelvic floor muscle weakness and urinary incontinence. [8] Diastasis of rectus abdominis is also associated with low back pain as it also weakens the muscles around the trunk so it may put extra pressure on the lower back causing backache. Due to distorted posture and pelvic instability, the posterior glute muscles overwork, contributing to sciatica. [9] [10] Diastasis recti abdominis is divided into types based on the location of the umbilical region. It may be present above the umbilicus, below the umbilicus, around the umbilicus, and no diastasis recti as in some primiparous females. This condition can be grouped into 3 types depending on the severity. [11]

- Mild 2-3 finger widths
- Moderate 3-4 finger widths
- Severe 4+ finger widths

Treatment methods include surgical intervention and conservative management. Surgical repair is beneficial as there are fewer chances of recurrence of diastasis recti. But other risk factors like infections, scar formation, and changes in the skin surface must be considered. [13] Conservative management includes exercises and postural training. Physical therapists specializing in obstetrics and gynecology are now developing an interest to gain knowledge about the occurrence, prevention, and treatment of the diastasis recti abdominis. A great deal of encouragement is needed to stimulate the females to keep exercising. [14] Walking is ideal, physiotherapists recommend exercising at least three days a week but avoid exercise during the Puerperium if there is heavy bleeding, pain, infection, or abscess. [8] There are different methods to assess the diastasis recti of abdominal muscles. The most simple and easy method is finger width measurements. If the separation is 2cm or less it is considered normal but if it exceeds 2cm widths then diastasis recti abdominis is confirmed. If the diastasis is greater than 15mm then it is sub dislocation and it is associated with pain, swelling, and deformity. [15] The other method is the use of dial calipers. Some tests including the curl-up test and leg lift test are also performed for manual assessment. Ultra-sonographic measurements are also available. Ultrasound Imaging is a gold standard method to measure the IRD above the umbilicus and at the level of the umbilicus. [16] [6] In Pakistan, there is very little research done on this topic. A physical therapist that is certified in women's health is best suited to assess the degree of abdominal separation and pelvic floor damage. To check the prevalence of diastasis recti among females with normal vaginal delivery, there is a need to further research to see how much this condition is present in females. Our research is also in this regard. We will be able to know that in a given population what percentage of females is affected by diastasis recti and what percentage is intact.

MATERIALS AND METHODS

Procedure: This Cross-sectional study was conducted by manual palpation methods on each patient included in the study. A simple random sample was collected for studies of prevalence. A Convenient sampling technique is used for collecting data. It is a type of simple random sampling. The study was approved by the review board of the institute. 90 females aged 18-45 were taken in the immediate post-partum period with normal vaginal delivery

from Fatima and Amna ward of the Gynae department of Allied Hospital Faisalabad. The inclusion criteria were the Immediate Postpartum females, Females with age equal to or greater than 18 years up to menopausal age, and females who underwent normal vaginal delivery. And the Exclusion criteria were females with previous miscarriage history, females who underwent lower C-sections or any other abdominal surgery in the previous six months, and females who are not willing to participate. The variables that were considered the most during data collection were age, parity (the number of times a female is being pregnant), occupation (as it is directly related to the physical health of the females), obesity, awareness of the masses, and the environment from where the data were collected. During research pilot study is conducted on a small scale to evaluate the feasibility, cost, time, and adverse effects of the given study. We have done our pilot study on 30 individuals and checked the validity and reliability of our project. The questionnaire is having good internal reliability. The descriptive data obtained were statistically analyzed by frequency distribution and percentages were calculated. The software that assisted during interpretation were Statistical software (SPSS-23), Microsoft Excel, and Word. Analysis was based on calculating the prevalence of the condition. Inclusion and exclusion criteria were already decided and hence analyzed accordingly.

Ethical considerations: All the ethical and moral values were considered for the hospital and the participants. For this purpose, consent was taken from the subjects and they were assured that the data will be used only for research.

Tools for measurements: Measurements were taken by the manual finger width method. Before the measurements, a questionnaire is filled out by the subject. It includes demographics, general health of the females, low back pain assessment, pelvic floor assessment, facial expression scale, and diastasis recti assessment. For manual assessment, two methods are used. One is the curl-up test and the other is the leg lift test. During the curl-up test, ask the subject to lie on their back. Knees are bending and feet are flat on the floor. Ask the subject to lift the upper body from the plinth and take measurements according to the severity or depth of fingers in the muscles, diastasis recti are graded on the evaluation form or questionnaire. During the leg lift test, the subject is lying on the back. Both knees are straight. Ask the subject to raise both legs one by one, check the ranges first, and then the abdominal separation by palpation methods. The depth of the fingers indicates the severity of the diastasis recti.

RESULTS

The mean age of the subjects included in the research was calculated as 28.47 (±5.573). The mean weight calculated was 54.32 (±25.389). (Table 1) Diastasis recti was more prevalent in the above naval region in 38 multiparous females which is 42.2 %. On the other hand, in primiparous females out of 11, only 3 females have diastasis recti which was very mild and mostly measured as normal. The other 8 females have normal rectus abdominis muscles. 12.2% of females were primiparous and 87.8% were multiparous. Females were categorized into four groups according to the types of diastasis recti. 36.7% of females have normal rectus abdominis muscle, 20% have below and around naval diastasis recti, 42.2% have above naval diastasis recti and 1.1% of females have open diastasis recti which means severe abdominal muscles separation. (Table 2) When the association of diastasis recti was studied according to related risk factors, age was found to be significant (χ^2 =17.265, p value=0.008) weight has p value=0.01, χ^2=11.411 (significant), pelvic floor muscle weakness has χ^2=90.810, p value=0.000 (significant). Two factors including low back pain and urinary incontinence were found to be non-significant (p value>.05).

Table 1: Mean and Standard Deviation of Variables

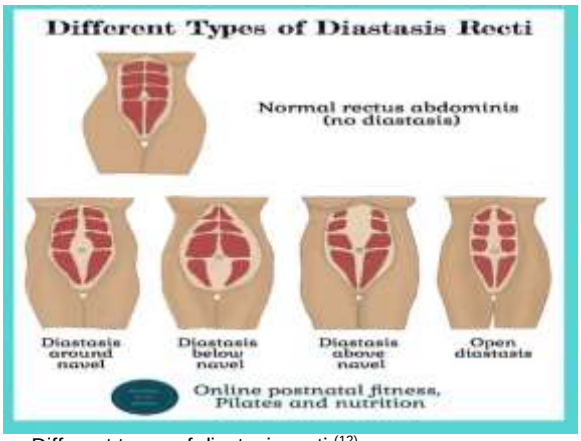
Variables	Mean	Standard Deviation (±S. D)
Age	28.47	5.573
Weight	54.32	25.389
No. of births	1.88	0.329
General health of females	2.09	0.323
Activity status of females	2.59	0.616
Awareness of Diastasis Recti	1.06	0.230
Facial Pain Scale- (During DRA assessment)	1.77	0.520
Type of Diastasis Recti	2.08	0.914

Table 2: Frequency distribution of subjects according to different variables

Variables	Frequency	n (%)
Age (years)	18-28 29-38 39-48	55 (61.1) 30 (33.3) 05 (5.6)
Weight in kgs	50-70 71-90	74 (82.2) 16 (17.8)
No. of births	Primiparous Multiparous	11 (12.2) 79 (87.8)
General health of females	Very Good Fair Poor	01 80 09
Activity status of females	Very Active Less Active Sedentary lifestyle	06 (6.7) 25 (27.8) 59 (65.6)
Awareness of Diastasis Recti	Yes No	05 (5.6) 85 (94.4)
Facial Pain Scale (during DRA assessment)	No Hurt Little bit Hurt Hurt worst	25 (27.8) 61 (67.8) 04 (4.4)
Type of Diastasis Recti	Open diastasis recti Above naval diastasis recti Below and around diastasis recti Normal rectus abdominis	01 (1.1) 38 (42.2) 18 (20.0) 33 (36.7)
Total		90 (100%)

Table 3: Association of diastasis recti with additional risks

Variables		Type of diastasis recti				Chi-square	P value
		open	Above naval	Below/ around naval	Normal rectus abdominis		
Age	18-28	0	15	13	27	17.265	.008
	29-38	1	19	5	5		
	39-48	0	4	0	1		
Weight	50-70	0	27	17	30	11.411	.010
	71-90	1	11	1	3		
No. of Births	Primiparous	0	0	3	8	10.206	.017
	Multiparous	1	38	15	25		
Low Back Pain	Mild	0	4	1	2	2.857	.827
	Moderate	1	17	11	19		
	Severe	0	17	6	12		
Urinary Incontinence	Mild	0	10	3	10	6.156	.406
	Moderate	0	13	7	16		
	Severe	1	15	8	7		
Pelvic floor muscles weakness	Mild	0	0	0	33	90.810	.000
	Moderate	0	13	6	0		
	Severe	1	25	12	0		
Total		90					



(a) Different types of diastasis recti [12]

DISCUSSIONS

Diastasis recti was found to be prevalent in multiparous females, primiparous females were least affected by this condition. The prospective cohort study was carried out on 300 pregnant females. Data were collected by electronic questionnaire and clinical examinations by two physiotherapists and it was concluded that the prevalence of mild diastasis recti abdominis was higher before and after childbirth. [17] Beer et al. conducted a study on 150 nulliparous females to determine the width of linea Alba. The ultrasound machine took three measurements at three positions, so diastasis recti was classified. [16] A cross-sectional study was carried out and diastasis was calculated by the number of finger breadths between medial ends. The incidence of diastasis in the supra umbilical area was the same in primiparous and multiparous females but in the infra umbilical area, it was more evident in multiparity. [15] Demartini et al. conducted a descriptive study of transversal type on 88 women in the instant Puerperium. The result of this study was 61.36%. Diastasis recti abdominis was more prevalent in multiparous and its frequency was higher at the umbilicus than at the supra and infra umbilical region. [18] Sperstad et al. carried out a prospective cohort study and classified the females into four classes: a) No diastasis b) Mild diastasis c) Moderate diastasis d) Severe diastasis. It was concluded that the prevalence of mild diastasis recti abdominis was higher. [17] Between January to May 2011, 95 patients were examined by Turan et al. aged range from 19 to 24 to study the diastasis recti abdominis. It was 2% in primiparous and 59% in multiparous females. It was concluded that in multiparous females with frequent abdominal surgery the threat of diastasis recti abdominis increases. [19] Gitta et al. conducted a case study on a nulliparous woman that gave birth to a child by cesarean section. She feels lower back pain and weakness of abdominal muscles and received physical therapy treatment for three months to build up the transverse abdominal muscles. Due to the isometric contraction of transverse abdominal muscles the inter rectus space returns to its normal form. [14] A survey-based prevalence study was carried out by Adkitte et al. on 100 women in rural and urban areas from which 50 were urban and 50 were from rural areas. The incidence of diastasis in immediate post-partum females was 68%. Urban women have a greater percentage of diastasis due to inactive lifestyles and decreased physical activity. [20] Spitznagle et al. performed a retrospective study in urogynecological patients to study the prevalence of diastasis recti abdominis. It was seen that the prevalence of diastasis was more in those patients that are Asians, older, multiparous, weak pelvic floor muscles, at the menopausal stage, using hormone replacement therapy, and having surgery in the abdomen. It was also noted that the incidence of diastasis recti abdominis increases with the increasing percentage of support-related pelvic floor weaknesses. [21] A systematic review was conducted to determine if the exercise effect abdominal muscles to minimize the diastasis recti of the abdominal muscles. The results showed that exercise helps to preserve the strength, tone, and control of the muscles of the abdomen decreasing the stress on the band of linea Alba. [2] D. Lee et al. conducted a cross-sectional observational study to check the response of linea alba during the curl-ups in patients having divarication of the rectus abdominis muscle and its comparison with patients without diastasis recti. The result of the study shows that linea alba widen in those patients who had divarication of the rectus abdominis muscle. Automatic abdominal curl-ups helped in decreasing the separation gap. [22] A randomized study was performed by Emanuelsson et al. on 64 patients with abdominal pain due to abdominal rectus muscle diastasis with a width greater than 3cm to check the problem, pain, and quality of life after the reconstructive surgery for abdominal rectus muscle diastasis. This technique was considered reliable for abdominal rectus diastasis. [23] Mota et al. conducted a case study of 31 years old pregnant woman who took part in the study. It was seen that the inter recti distance increases as compared to the thickness of linea Alba. [24] Yaseen et al. conducted a cross-sectional study to check the prevalence of diastasis recti. It was more prevalent to be during pregnancy and above the naval region. [25] Kamel and Yousif, 2017 conducted a randomized study and found that neuromuscular electrical stimulation with abdominal exercise minimizes the diastasis recti abdominis muscle after childbirth. [26] Surgical repair is cosmetically beneficial. As females are very conscious about their figure, they prefer to do abdominoplasty. Also, there are fewer chances of recurrence of diastasis recti. [13] Women with diastasis recti abdominis can use non-surgical intervention regularly that includes posture and back care, external support (tub grip), and aerobic exercise. [17] As age increases several changes occur in the female body. Diastasis rectus of abdominal muscles is one of them. Our purpose of research is to check the incidence and prevalence of diastasis recti.

CONCLUSION

A small sample size was taken to execute this study. It was performed in a small tertiary care hospital in Faisalabad. The results showed that more population was affected by diastasis recti. Primiparous females have a very low incidence, indicating parity is significant in this study. Associated risk factors include obesity, low back pain, urinary incontinence, and pelvic floor muscle weakness. If we consider the type of diastasis, open diastasis was the least incident. More above umbilicus DRA cases were reported.

Conflict of Interest: Not declared.

Funds for study: Not funded by any external sources.

Acknowledgments: The work presented in this manuscript was accomplished under the enlightened supervision of Dr. Rafia Imtiaz, we are grateful for her ever-inspiring guidance.

REFERENCES

1. Adkitte, Roshan, Khyati Bhatt, Ujwal Yeole, Pravin Gawali, and Gaurai Gharote. “PREVALENCE OF DIASTASIS OF RECTUS ABDOMINIS MUSCLE IN IMMEDIATE POST-PARTUM WOMEN OF URBAN AND RURAL AREAS.” EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH 3 (May 1, 2016): 460–62.
2. Axer, Hubertus, Diedrich Graf v. Keyserlingk, and Andreas Prescher. “Collagen Fibers in Linea Alba and Rectus Sheaths: I. General Scheme and Morphological Aspects.” Journal of Surgical Research 96, no. 1 (March 1, 2001): 127–34. https://doi.org/10.1006/jsre.2000.6070.
3. Barbosa, S., R. A. Moreira de Sá, and L. G. Coca Velarde. “Diastasis of Rectus Abdominis in the Immediate Puerperium: Correlation between Imaging Diagnosis and Clinical Examination.” Archives of Gynecology and Obstetrics 288, no. 2 (August 1, 2013): 299–303. https://doi.org/10.1007/s00404-013-2725-z.
4. Beer, Gertrude M., Antonius Schuster, Burkhardt Seifert, Mirjana Manestar, Daniela Mihic-Probst, and Sina A. Weber. “The Normal

Width of the Linea Alba in Nulliparous Women." Clinical Anatomy 22, no. 6 (2009): 706–11. https://doi.org/10.1002/ca.20836.
5. Benjamin, D.R., A.T.M. Van De Water, and C.L. Peiris. "Effects of Exercise on Diastasis of the Rectus Abdominis Muscle in the Antenatal and Postnatal Periods: A Systematic Review." Physiotherapy 100, no. 1 (March 2014): 1–8. https://doi.org/10.1016/j.physio.2013.08.005.
6. Cavalli, M., A. Aiolfi, P. G. Bruni, L. Manfredini, F. Lombardo, M. T. Bonfanti, D. Bona, and G. Campanelli. "Prevalence and Risk Factors for Diastasis Recti Abdominis: A Review and Proposal of a New Anatomical Variation." Hernia 25, no. 4 (August 1, 2021): 883–90. https://doi.org/10.1007/s10029-021-02468-8.
7. Demartini, Elaine, Keila Cristiane Deon, Eliane Gonçalves de Jesus Fonseca, and Bruno Sérgio Portela. "Diastasis of the Rectus Abdominis Muscle Prevalence in Postpartum." Fisioterapia Em Movimento 29 (June 2016): 279–86. https://doi.org/10.1590/0103-5150.029.002.AO06.
8. Doubkova, Lucie, Ross Andel, Ingrid Palascakova-Springrova, Pavel Kolar, Jiri Kriz, and Alena Kobesova. "Diastasis of Rectus Abdominis Muscles in Low Back Pain Patients." Journal of Back and Musculoskeletal Rehabilitation 31, no. 1 (February 6, 2018): 107–12. https://doi.org/10.3233/BMR-169687.
9. Emanuelsson, P., U. Gunnarsson, K. Strigård, and B. Stark. "Early Complications, Pain, and Quality of Life after Reconstructive Surgery for Abdominal Rectus Muscle Diastasis: A 3-Month Follow-Up." Journal of Plastic, Reconstructive & Aesthetic Surgery 67, no. 8 (August 1, 2014): 1082–88. https://doi.org/10.1016/j.bjps.2014.04.015.
10. Fuentes Aparicio, Laura, Montserrat Rejano-Campo, Gráinne Marie Donnelly, and Victoria Vicente-Campos. "Self-Reported Symptoms in Women with Diastasis Rectus Abdominis: A Systematic Review." Journal of Gynecology Obstetrics and Human Reproduction 50, no. 7 (September 1, 2021): 101995. https://doi.org/10.1016/j.jogoh.2020.101995.
11. Gitta, S., Z. Magyar, P. Tardi, I. Füge, M. Járomi, P. Ács, J. Garai, J. Bódis, and M. Hock. "How to Treat Diastasis Recti Abdominis with Physical Therapy: A Case Report." Journal of Diseases 3, no. 2 (Subtitle 2016): 16–20. https://ideas.repec.org//a/pkp/joudis/v3y2016i2p16-20id2438.html.
12. Gunnarsson, Ulf, Birgit Stark, Ursula Dahlstrand, and Karin Strigård. "Correlation between Abdominal Rectus Diastasis Width and Abdominal Muscle Strength." Digestive Surgery 32, no. 2 (2015): 112–16. https://doi.org/10.1159/000371859.
13. "Correlation between Abdominal Rectus Diastasis Width and Abdominal Muscle Strength." Digestive Surgery 32, no. 2 (March 5, 2015): 112–16. https://doi.org/10.1159/000371859.
14. Kamel, Dalia M., and Amel M. Yousif. "Neuromuscular Electrical Stimulation and Strength Recovery of Postnatal Diastasis Recti Abdominis Muscles." Annals of Rehabilitation Medicine 41, no. 3 (June 29, 2017): 465–74. https://doi.org/10.5535/arm.2017.41.3.465.
15. Kaufmann, R. L., C. S. Reiner, U. A. Dietz, P. A. Clavien, R. Vonlanthen, and S. A. Käser. "Normal Width of the Linea Alba, Prevalence, and Risk Factors for Diastasis Recti Abdominis in Adults, a Cross-Sectional Study." Hernia 26, no. 2 (April 1, 2022): 609–18. https://doi.org/10.1007/s10029-021-02493-7.
16. Keshwani, Nadia, Sunita Mathur, and Linda McLean. "Relationship Between Interrectus Distance and Symptom Severity in Women With Diastasis Recti Abdominis in the Early Postpartum Period." Physical Therapy 98, no. 3 (March 1, 2018): 182–90. https://doi.org/10.1093/ptj/pzx117.
17. "The Impact of Exercise Therapy and Abdominal Binding in the Management of Diastasis Recti Abdominis in the Early Post-Partum Period: A Pilot Randomized Controlled Trial." Physiotherapy Theory and Practice 37, no. 9 (September 2, 2021): 1018–33. https://doi.org/10.1080/09593985.2019.1675207.
18. Khorashadi, Leila, Jonelle M. Petscavage, and Michael L. Richardson. "Postpartum Symphysis Pubis Diastasis." Radiology Case Reports 6, no. 3 (January 1, 2011): 542. https://doi.org/10.2484/rcr.v6i3.542.
19. Lee, Diane, and Paul W. Hodges. "Behavior of the Linea Alba During a Curl-up Task in Diastasis Rectus Abdominis: An Observational Study." Journal of Orthopaedic & Sports Physical Therapy 46, no. 7 (July 2016): 580–89. https://doi.org/10.2519/jospt.2016.6536.
20. Liaw, Lih-Jiun, Miao-Ju Hsu, Chien-Fen Liao, Mei-Fang Liu, and Ar-Tyan Hsu. "The Relationships Between Inter-Recti Distance Measured by Ultrasound Imaging and Abdominal Muscle Function in Postpartum Women: A 6-Month Follow-up Study." Journal of Orthopaedic & Sports Physical Therapy 41, no. 6 (June 2011): 435–43. https://doi.org/10.2519/jospt.2011.3507.
21. Mommers, Elwin H. H., Jeroen E. H. Ponten, Aminah K. Al Omar, Tammo S. de Vries Reilingh, Nicole D. Bouvy, and Simon W. Nienhuijs. "The General Surgeon's Perspective of Rectus Diastasis. A Systematic Review of Treatment Options." Surgical Endoscopy 31, no. 12 (December 1, 2017): 4934–49. https://doi.org/10.1007/s00464-017-5607-9.
22. Mota, Patrícia, Augusto Gil Pascoal, Fátima Sancho, Ana Isabel Carita, and Kari Bø. "Reliability of the Inter-Rectus Distance Measured by Palpation. Comparison of Palpation and Ultrasound Measurements." Manual Therapy 18, no. 4 (August 1, 2013): 294–98. https://doi.org/10.1016/j.math.2012.10.013.
23. Nahas, Fabio Xerfan, Lydia Masako Ferreira, and José de Arimatéia Mendes. "An Efficient Way to Correct Recurrent Rectus Diastasis." Aesthetic Plastic Surgery 28, no. 4 (August 1, 2004): 189–96. https://doi.org/10.1007/s00266-003-0097-7.
24. Palanivelu, C., M. Rangarajan, P. A. Jategaonkar, V. Amar, K. S. Gokul, and B. Srikanth. "Laparoscopic Repair of Diastasis Recti Using the 'Venetian Blinds' Technique of Plication with Prosthetic Reinforcement: A Retrospective Study." Hernia 13, no. 3 (June 1, 2009): 287–92. https://doi.org/10.1007/s10029-008-0464-z.
25. Reinpold, Wolfgang, Ferdinand Köckerling, Reinhard Bittner, Joachim Conze, René Fortelny, Andreas Koch, Jan Kukleta, Andreas Kuthe, Ralph Lorenz, and Bernd Stechemesser. "Classification of Rectus Diastasis—A Proposal by the German Hernia Society (DHG) and the International Endohernia Society (IEHS)." Frontiers in Surgery 6 (2019). https://www.frontiersin.org/articles/10.3389/fsurg.2019.00001.
26. Rett, M. T., M. D. Braga, N. O. Bernardes, and S. C. Andrade. "Prevalence of Diastasis of the Rectus Abdominis Muscles Immediately Postpartum: Comparison between Primiparae and Multiparae." Brazilian Journal of Physical Therapy 13 (August 2009): 275–80. https://doi.org/10.1590/S1413-35552009005000037.
27. Sokunbi, Gbolabo, Gaston Camino-Willhuber, Philip K. Paschal, Oluseun Olufade, Farah S. Hussain, Jennifer Shue, Celeste Abjornson, et al. "Is Diastasis Recti Abdominis Associated With Low Back Pain? A Systematic Review." World Neurosurgery 174 (June 1, 2023): 119–25. https://doi.org/10.1016/j.wneu.2023.03.014.
28. Turan, Volkan, Cagdas Colluoglu, Esengul Turkuilmaz, and Umit Korucuoglu. "Prevalence of Diastasis Recti Abdominis in the Population of Young Multiparous Adults in Turkey." Ginekologia Polska 82, no. 11 (2011). https://journals.viamedica.pl/ginekologia_polska/article/view/46265.
29. Yaseen, Kaiynat, Naveed Anwar, Sana Ayesha, Sana Tauqeer, Kehkshan Khalid, and Farah Shaheen. "Prevalence of Diastasis Recti among Pregnant Women: A Cross-Sectional Study." Pakistan Journal of Medical Research 61, no. 1 (May 12, 2022): 40–42. https://www.pjmr.org.pk/index.php/pjmr/article/view/221.
30. Figure a [Internet]. Available from: https://endurancepilates.wordpress.com/2017/08/28/prenatal-and-postnatal-pilates-qa-with-instructor-danielle/