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Research Article

Therapy for Diastasis Recti Abdominis

Deep Core Stability Exercise Along with Kinesio Taping Therapy Techniques for Diastasis Recti Abdominis

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Abstract: Diastasis recti abdominis (DRA) has been defined as an impairment characterized by the split of the rectus abdominis muscle along with the linea Alba. Diastasis Rectus Abdominis Muscle is familiar during pregnancy and later pregnancy and has been connected to lumbopelvic stability and pelvic floor weakness. The study aims to find the effect of deep core stability exercise and kinesio-taping therapy techniques in diastasis recti. This is an experimental design with pre and post-comparative study. The study setting is at the Faculty of Physiotherapy ACS Medical College and Hospital 30 samples were selected, and intervention was carried out for about 4 weeks. If diastasis recti abdominis was present at 8 weeks postpartum, either vaginal delivery or cesarean section were options. Less than 8 weeks after giving birth, the following ailments were excluded: respiratory illnesses, sensory defects, neurological disorders, hypertension, diabetes mellitus, heart conditions, abdominal surgeries, vaginal hemorrhage, skin conditions, pregnancy, obesity, and neoplastic diseases. In Group-A, 15 subjects received deep core stability exercises and Kinesio taping, while Group-B, 15 received Traditional abdominal exercises. The outcome tools were the digital nylon caliper and finger breath. On comparing the Pretest and Posttest within Group A & Group B on Digital Nylon Caliper (Above Umbilicus and below Umbilicus) score & finger Breadths (Above Umbilicus and below Umbilicus) score shows a significant difference in the mean values at $P \leq 0.05$. This study concluded that deep core stability exercise and kinesio taping therapy techniques effectively reduce diastasis recti in postpartum women; they help restore postpartum abdominal efficiency. These exercises could be effective in narrowing the inter-recti distance. The result shows that deep core stability exercise and kinesio taping therapy techniques significantly reduce diastasis recti.

Keywords: Diastasis recti abdominis, Deep core stability exercise, Kinesio taping therapy, Digital nylon caliper, Finger breaths Palpation.

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1. INTRODUCTION

A natural strength issue affecting pregnant and postpartum women is diastasis rectus abdominis (DRA), a midline inter recti separation[1]. After childbirth, women face physiological and structural alterations in their appearance and shape that may require repair to restore their physical and psychological well-being. One of these alterations is the increase in abdominal girth during pregnancy that causes stretching and thinning of the midline abdominal fascia; thus aggravating preexisting diastasis of the rectus muscle that can result in herniation or protrusion of abdominal contents [2] of a pathological diastasis of the rectus abdominis muscle (DRAM) is 2.7cm at the level of the umbilicus[3]. Multi parity, obesity, polyhydramnios, fetal macrosomia, and weak abdominal muscles are the main risk factors.[4] The displacement of the abdominal organs causes elastic changes in the connective tissue, which lead to DRA, estrogen, relaxin, progesterone hormones, and mechanical forces put on the abdominal wall by the growing fetus. Mechanical stressors Causes of DRA[5]The abdominal wall plays a crucial role in respiration, posture, trunk movement, pelvic instability, and the support of the abdominal viscera.[6] various estimates of the prevalence of DRA during the third trimester of pregnancy have been published; ranging from 66% to 100%[7,8] This causes the integrity, mechanical control, and functional strength of the abdominal wall to reduce as a result of the abdominal separation or diastasis recti [9]. It can cause changes in posture, altered trunk mechanics, reduced pelvic stability, and increased risk of damage to the lumbar spine and pelvis, exacerbating lower back pain and pelvic instability[10]. Additionally, it may fail in pelvic floor functions, abdominal viscera support, trunk rotation, trunk side bending, respiration, evacuation, and parturition [11]. DRA and pelvic floor muscle weakness are connected [12]. Research proved the existence of a relationship between DRA and fecal incontinence, pelvic organ prolapses, stress urinary incontinence, and the incidence of diastasis recti abdominis in the urogynecological patient population was of 66% of all patients with DRA[13]. Most prevalence studies are based on palpation[14] or caliper[15.] Based on the number of finger widths, the findings were categorized into:

Normal (<2)
Mild DRA (2-3)
Moderate DRA (3-4)
Severe (>4) [16]
DRA is divided into four groups based on the measurement of the gap between the rectus abdominis muscle's two bellies with a digital nylon caliper; however, If the gap is less than 2.5cm at or below the level of the umbilicus, the patient is considered to be normal.

Mild <3.5cm
Moderate<5cm
Severe>5.0cm[17]

The most widely used procedures for treating rectus distance RD are laparoscopy and open abdominoplasty, but the surgical treatment of RD still needs to be determined. Many complications are associated with those procedures, including hematoma, seroma formation, wound infection, necrosis of the skin flaps, and hypertrophic carring[18.] Physiotherapy is the only available treatment that has the potential to give relief from symptoms related to RD without complications[19.] Deep core stability-strengthening program[20] profusely affects the metabolic demand of producing a given muscle force, increasing muscular endurance and power [21.] Abdominal exercises are also often suggested to postnatal women with DRA, and aerobic exercises are other examples of non-surgical interventions used regularly for women with DRA[2.2.] Kinesiotaping (KT) is a relatively new form of elastic therapeutic tape that has become increasingly common over the last decade. Physiotherapists today view it as a technique for supporting, rehabbing, and modifying some physiological systems. [23]. KT has five different applications for correction, including the following: Mechanical, fascial, spatial, ligament/tendon, and functional corrections, which offer a variety of potential KT relocation effects, subluxated joints, delivering sensory stimulation, aligning fascial tissues, and varying tape stretching techniques reducing swelling, edema, and discomfort in the joints, as well as supporting or impairing muscle function[24]. This can be explained by the pulling force of the stretch applied by the tape on the skin that creates more space by lifting the fascia and soft tissue, which improves communication with mechanoreceptors and increases the number of motor units recruited, which can facilitate muscle contraction, and ultimately improve muscle strength[25]. The study aims to find the effect of deep core stability exercise and kinesio-taping therapy techniques in diastasis recti. This is an experimental design with pre and post-comparative study. The study found the effect of deep core stability exercise and kinesio-taping therapy techniques in postpartum women with diastasis recti.

2. MATERIALS AND METHODS

The study was a quasi-experimental design with pre and post-tests. The study was conducted in the physiotherapy outpatient department of ACS Medical College and Hospital for 4 weeks. The study included 30 subjects. The age range of 23 to 40, If diastasis recti abdominis was present at 8 weeks postpartum, either vaginal delivery or cesarean section were options. Less than 8 weeks after giving birth, the following ailments were excluded: respiratory illnesses, sensory defects, neurological disorders, hypertension, diabetes mellitus, heart conditions, abdominal surgeries, vaginal hemorrhage, skin conditions, pregnancy, obesity, and neoplastic diseases after the selection processes. The study subjects were given a written consent form and a detailed explanation of the procedure and the purpose of the study to all the participants. 30 subjects of two group: Group A 15 Females and Group B 15. Subject A receives Diaphragmatic breathing, Pelvic floor contraction, and Plank exercise 20 repetitions for each exercise, holding a contraction for 5 secs, followed by 10 seconds of relaxation 3 times a week along with kinesiology taping IX techniques and Subject B receives static Abdominal contraction, Posterior pelvic tilt, Reverse sit-up exercise, Trunk twist exercise, 20 repetitions for each exercise, holding a contraction for 5 sec followed by 10 sec of relaxation for 3 times a week. Later, all the standard outcome measures were measured after the study

duration as per-test and post-test values of above and below umbilical level using a digital nylon caliper and finger breath palpation.

2.1. Ethics statement

The study received approval from the ACS Medical College and Hospital's department for conducting and publishing the study. Additionally, all participants have provided written informed consent for their involvement in the study and the subsequent publication.

2.2. Inclusion criteria

The 30 individuals aged 23 to 40 had either a vaginal delivery or a cesarean section and had diastasis recti abdominis at 8 weeks postpartum.

2.3. Exclusion criteria

Patients with less than 8 weeks postpartum, Respiratory conditions, Sensorydefects, Neurological defects, Hypertension, Diabetes mellitus, Heart conditions, Pelvic surgery, Abdominal surgery, Vaginal bleeding, Skin disease, Pregnancy, Obesity, and Neoplastic were excluded.

3. MEASURING TOOLS

Table 1: Measuring Tools

Variables	Tools
1. Inter rectic distance	Digital nylon caliper
2. Recti distance RD	Finger breadths

4. INTERVENTION PROTOCOL

4.1. Deep Core Stability Exercise[26]

4.2. Diaphragmatic breathing

Sit or lie in a comfortable place. Place one hand on the chest and one hand on the abdomen. Inhale through the nose for about 4 seconds, feeling the abdomen expand. Hold your breath for 2 seconds. Exhale very slowly and steadily through the mouth for about 6 seconds[27].

4.3. Pelvic floor contraction

Patient are made to lie with knees slightly apart and adviced to squeeze and lift pelvic floor muscles as hard as possible and try to hold up for 10 seconds[28].

4.4. Plank exercise

Patient lays on the floor with elbows under shoulders, hands flat, and core engaged. Keeping the forearm and knees on the floor, slowly rise upwards until the body is in a straight line from the knees to the head. Hold the position for as long as can[29].

4.5. IX-kinesiology taping techniques

I-Strips will be applied over recti abdominis bellies as the base will be affixed to the origin of 2 recti at symphysis pubis in resting with very light to light tension (15-25% of available tension) over the right and left rectus abdominis bellies up to the insertion at the xiphoid process. X-strips will be applied to the lower border of the thoracic cage downwards and laterally towards the other side in an across manner above and below the umbilicus, towards the symphysis pubis with light to moderate tension (25-50%) of available tension[30]. (Figure 1).

Fig 1: Kinesio tape for core support and pain relief.

5. TRADITIONAL ABDOMINAL EXERCISE[31]

5.1. Static Abdominal Exercise

The instructions are: Lie on the back. Bend knees to a comfortable position. Lock fingers behind the head. Curl head, shoulder, upper and lower back off the floor and angle left elbow toward right knee. Breathe out as lift. Hold this position for 5 seconds. Slowly return to the starting position[32].

5.2. Posterior Pelvic Tilt

The instructions are: Lie on the floor on stomach and stretch arms in front of you. Lift the chest off the floor and try to hold that position for 10 to 30 seconds[33].

5.3. Reverse Sit-up exercise

The instructions are : Lie on the back of a mat with knees bent and feet flat on the floor. Cross arms in front of the chest. Crunch abdomen muscles to lift the shoulder off the mat. Hold for a second, then slowly return to the starting position[34].

5.4. Trunk Twists Exercise

The instructions are: Sit with legs crossed. Reached left hand towards the left foot and placed a right hand at the side for support. Slowly twist the torso to the right. Switch hands and twist to left[35].

6. DATA ANALYSIS

The collected data were tabulated and analyzed using both descriptive and inferential statistics. All the parameters were assessed using the statistical package for Social Science (SPSS) version 24, with a significance level of p-value less than 0.05 and a 95% confidence interval set for all analyses. The Shapiro-Wilk test was used to determine the normality of the data. The Sharpio Wilk test showed that the data was normally distributed on the dependent values at P>0.05 in this study. Hence, a parametric test was adopted. A paired t-test was adopted to find the statistical difference within the groups & and an Independent t-test (Student t-test) was adopted to find the statistical difference between the groups.

Table-1 Comparison of Digital Nylon Caliper (Above Umbilicus) 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	2.46	.255	2.54	.266	-.839	28	.409*
POST-TEST	1.45	.203	2.33	.252	-10.51	28	.000**

(*- 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 the pretest and post-test. This table shows no significant difference in pretest values between Group A & Group B at P > 0.05. The above table shows a statistically significant difference in post-test values between Group A & Group B at P ≤ 0.05.

Table- 2Comparison of Digital Nylon Caliper (Below Umbilicus) 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	3.04	.247	2.94	.264	.999	28	.326*
POST-TEST	1.90	.345	2.36	.299	-3.84	28	.001**

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

Table – 3 Comparison Of Fingerbreadths (Above Umbilicus) 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	2.56	.284	2.72	.234	-1.68	28	.104*
POST-TEST	1.45	.258	2.49	.240	-11.40	28	.000**

(*- 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 the pretest and post-test.This table shows no significant difference in pretest values between Group A & Group B at P > 0.05. The above table shows a statistically significant difference in post-test values between Group A & Group B at P ≤ 0.05.

Table – 4 Comparison of Fingerbreadths (Below Umbilicus) 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	3.06	.266	3.04	.284	-.265	28	.793*
POST-TEST	1.96	.396	2.45	.282	-3.92	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 the pretest and post-test. This table shows no significant difference in pretest values between Group A & Group B at P > 0.05The above table shows a statistically significant difference in posttest values between Group A & Group B at P ≤ 0.05.

Table- 5 Comparison Of Digital Nylon Caliper (Above Umbilicus) Score Within Group – A And Group - B Between Pre Test and Test

GROUPS	PRE-TEST		POST-TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	2.46	.255	1.45	.203	15.50	.000**
GROUP- B	2.54	.266	2.33	.252	23.48	.000**

(**- P ≤ 0.05 – Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value, and p-value between the pre-test and post-test within Group – A & Group – B . A statistically significant difference exists between the pretest and posttest values within Group A and Group B at P ≤ 0.05.

Table – 6Comparison of Digital Nylon Caliper (Below Umbilicus) Score Within Group – A and Group - B Between Pre-Test and Post-Test

GROUPS	PRE-TEST		POST-TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	3.04	.247	1.90	.345	23.38	.000**
GROUP- B	2.94	.264	2.36	.299	6.76	.000**

(**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value, and p-value between the pre-test and post-test within Group – A & Group – B. A statistically significant difference exists between the pretest and posttest values within Group A and Group Bat P ≤ 0.05.

Table – 7 Comparison ofFingerbreadths (Above Umbilicus) Score Within Group – A and Group - B Between Pre-Test and Post-Test

GROUPS	PRE-TEST		POST-TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	2.56	.284	1.45	.258	15.84	.000**
GROUP- B	2.72	.234	2.49	.240	7.32	.000**

(**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value, and p-value between the pre-test and post-test within Group – A & Group – B. A statistically significant difference exists between the pretest and posttest values within Group A and Group B at P ≤ 0.05.

Table – 8 Comparison of Fingerbreadths (Below Umbilicus) Score Within Group – A and Group - B Between Pre-Test and Post-Test

GROUPS	PRE-TEST		POST-TEST		t - TEST	SIGNIFICANCE
	MEAN	S.D	MEAN	S.D		
GROUP- A	3.06	.266	1.96	3.96	16.81	.000**
GROUP- B	3.04	.284	2.45	.282	6.23	.000**

(**- P ≤ 0.05 - Significant).

The above table reveals the Mean, Standard Deviation (S.D), t-value, and p-value between the pre-test and post-test within Group – A & Group – B. A statistically significant difference exists between the pretest and posttest values within Group A and Group B at P ≤ 0.05.

7. RESULTS

On comparing the Mean Values of Group A & Group B on Digital Nylon Calliper (Above Umbilicus & Below Umbilicus) score, it shows a significant decrease in the post-test mean values in both groups, but (Group A - Deep Core Stability Exercise along with Kinesiotaping Therapy) shows 1.45 ± 0.203 & 1.90 ± .345 which has the lower mean value is more effective than (Group B - Traditional Abdominal Exercises) 2.33 ± .252 & 2.36 ± .299 at P ≤ 0.05. Hence, the null hypothesis is rejected. On comparing the Mean Values of Group A & Group B on Finger Breadths (Above Umbilicus and below Umbilicus) score, it shows a significant decrease in the post-test mean values in both groups, but (Group A - Deep Core Stability Exercise along with Kinesiotaping Therapy) shows 1.45 ± .258 & 1.96 ± .396 which has the lower mean value is more effective than (Group B - Traditional Abdominal Exercises) 2.49 ± .240 & 2.45 ± .282 at P ≤ 0.05. Hence, the null hypothesis is rejected. On comparing the Pretest and Posttest within Group A & Group B on Digital Nylon Caliper (Above Umbilicus and below Umbilicus) score and finger Breadths (Above Umbilicus and below Umbilicus) score shows a significant difference in the mean values at P ≤ 0.05.

8. DISCUSSION

The results of this study testified that KT is an effective method in reducing abdominal circumferences in postpartum women with or without DRAM[37]. Our study shows that kinesio taping with exercise shows a greater effect on diastasis recti than only exercises in post-partum women[38] The study revealed a significant improvement in the inter recti distance above, below, and at the umbilicus in both the groups as well as a significant change in muscle strength and low back pain was found in both groups. However, applying NMES and core stabilization exercises was more effective on all the outcome measures. Still, it can be concluded that both techniques can be combined [39]. The deep core stability exercise program effectively treats diastasis recti and improves postpartum women's quality of life[40]. The traditional and experimental groups showed a significant reduction in DRA measurement from pre- to post-test, with the traditional program exhibiting a slightly greater decline from pre- to post-DRA measurement than the experimental group. These findings suggest that a traditional or experimental strengthening program could reduce DRA measurement in postpartum women. However, this study was limited by a small sample size and would benefit from future research focused on specific exercise prescription progression[41]. The results of the present study indicated the effect of both the Kegel exercise program and core stability on reducing DRAM. It seems that the use of these two exercise programs in this community can lead to desirable results and shows the importance of using them in the postpartum period.[42]. Isometric-isotonic exercises of core stability can improve lumbopelvic control by reducing the width of Linea Alba and thus reduce lumbopelvic pain and disability in people with diastasis recti. According to the results, the exercises presented in this study can be used to treat diastasis recti[43]. Kinesio Taping (KT), when combined with abdominal strengthening exercises, boosted the recovery of Recti diastasis and improved back function in postnatal females. This study shows that abdominal exercises effectively reduce diastasis recti in early postpartum women and inter recti distance and support the prescription of an abdominal exercise programme for postnatal women and useful in reducing complications of it[45]. Based on the available evidence and quality of this evidence, after the exercise regimen and bracing, the Diastasis recti muscle separation by finger palpation was found to be reduced. Hence, it can be interpreted that non-surgical interventions (Physical Therapy) can prevent or reduce DRAM in the postpartum[46]. There is an effect of plank exercise on changes in the distance of the DRA below the umbilicus, and there is a relationship between plank exercise and a reduction in the width of the DRA below the umbilicus in postpartum women[47]. Core stability exercise affects reducing diastasis recti abdominis in mothers after normal delivery[48]. The study concluded that structured abdominal exercises with an abdominal corset are more effective in reducing diastasis recti in postpartum women[49]. Abdominal KT in the form of IX-technique is the most effective technique in reducing abdominal circumferences and treating postpartum rectus diastasis[50]. Kinesio Taping (KT) helps recover abdominal muscle after cesarean delivery[51]. Applying KT tapes using the corrective technique can reduce RAD in women up to 12 months after delivery[52].

9. LIMITATION

The results of the current study indicate that the Deep core stability exercise and kinesio taping therapy technique group showed a greater difference than the Traditional abdominal exercise group, and there was no adverse effect. The current study may have some limitations. Because there are not enough patients and no control group in this study. The current study did not involve a long-term follow-up. Due to time constraints, only a 4-week program was given.

10. FUTURE RECOMMENDATIONS

A future study must be conducted with long-term follow-up and a large sample size. Future research on diastasis recti can include various alternative workout regimens, and their efficacy can be evaluated.

11. CONCLUSION

This study concluded that deep core stability exercise and kinesio taping therapy techniques effectively reduce diastasis recti in postpartum women. It helps to increase abdominal muscle strength and restore postpartum abdominal efficiency. These exercises could be effective in narrowing the inter-recti distance. The result shows that deep core stability exercise and kinesio taping therapy techniques significantly reduce diastasis recti.

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13. AUTHORS CONTRIBUTION STATEMENT

K. Muthu Lakshmi & P.Sowmiya. Conceptualized, designed, and gathered data. G.Thirulogachandar & V. Saravanan analyzed these data. Inputs were given P. Priyadharshini & K. Saraswathi, and M. Sivasakthi discussed the methodology and results and contributed to the final manuscript.

14. CONFLICTS OF INTEREST

Conflict of Interest declared none.

15. REFERENCES

1. Chiarello CM, Falzone LA, McCaslin KE, Patel MN, Ulery KR. The effects of an exercise program on diastasis recti abdominis in pregnant women. J Womens Health Phys Ther. 2005;29(1):11-6. doi: 10.1097/01274882-200529010-00003.
2. Artal R, O'Toole M, White S. Guidelines of the American College of Obstetricians and Gynecologists for exercise during pregnancy and postpartum. Br J Sports Med. 2003;37(1):6-12; discussion 12. doi: 10.1136/bjsm.37.1.6, PMID 12547738.
3. Hsia M, Jones S. Natural resolution of rectus abdominis diastasis. Twosingle case studies. Aust J

Physiother. 2000;46(4):301-7. doi: 10.1016/s0004-9514(14)60291-9, PMID 11676815.
4. Mesquita LA, Machado AV, Andrade AV. Fisioterapia para redução da diástase dos músculos retos abdominais no pós-parto. Rev Bras Ginecol Obstet. 1999;21(5):267-72. doi: 10.1590/S0100-72031999000500004.
5. Whiteford B, Polden M. Seu Corpo antes e depois do parto. Exercícios pós- natais: um programa de seis meses para boa forma da mãe e do bebê. São Paulo. Maltese-NORMA. 1992.
6. Bursch SG. Interrater reliability of diastasis recti abdominis measurement. Phys Ther. 1987;67(7):1077-9. doi: 10.1093/ptj/67.7.1077, PMID 2955430.
7. Hanneford R, Tozer J. An investigation of the incidence, degree andpossible predisposing factors of the rectus diastasis in the immediate postpartum period. J Nat obstet Gynaecol special group. Aust Physiother assoc. 1985;4:29-32.
8. Candido G, Lo T, Janssen P. Risk factorsfor diastasis of therecti abdominis. J Assoc Chart Physiother Womens Health. 2005;97:49-54.
9. Benjamin DR, van de Water AT, Peiris CL. Effects of exercise on diastasis of the rectus abdominis muscle in the antenatal and postnatal periods: a systematic review. Physiotherapy. 2014;100(1):1-8. doi: 10.1016/j.physio.2013.08.005, PMID 24268942.
10. Lee DG, Lee LJ, McLaughlin L. Stability, continence and breathing: the role of fascia following pregnancy and delivery. J Bodyw Mov Ther. 2008;12(4):333-48. doi: 10.1016/j.jbmt.2008.05.003, PMID 19083692.
11. Spitznagle TM, Leong FC, Van Dillen LR. Prevalence of diastasis recti abdominis in a urogynecological patient population. Int Urogynecol J Pelvic Floor Dysfunct. 2007;18(3):321-8. doi: 10.1007/s00192-006-0143-5, PMID 16868659.
12. Chiarello CM, Falzone LA, McCaslin KE, Patel MN, Ulery KR. The effects of an exercise program on diastasis recti abdominis in pregnant women. J Womens Health Phys Ther. 2005;29(1):11-6. doi: 10.1097/01274882-200529010-00003.
13. Spitznagle TM, Leong FC, Van Dillen LR. Prevalence of diastasis recti abdominis in a urogynecological patient population. Int Urogynecol J Pelvic Floor Dysfunct. 2007;18(3):321-8. doi: 10.1007/s00192-006-0143-5, PMID 16868659.
14. Mantle J, Haslam J, Barton S, Cardozo L. Physiotherapy in obstetrics and gynaecology.2004.
15. Boxer S, Jones S. Intra-rater reliability of rectus abdominis diastasis measurement using dial calipers. Aust J Physiother. 1997;43(2):109-14. doi: 10.1016/s0004-9514(14)60405-0, PMID 11676678.
16. Candido G, Lo T, Janssen PA. Risk factors for diastasis of the recti abdominis. J Assoc Chart Physiother Womens Health. 2005;54:97-49.
17. Khandale S, Hande D. Effects of abdominal exercises on reduction of diastasis recti in postnatal women. IJHSR. 2016;6:182-91.
18. Huang GJ, Bajaj AK, Gupta S, Petersen F, Miles DAG. Increased intraabdominal pressure in abdominoplasty: delineation of risk factors. Plast Reconstr Surg. 2007;119(4):1319-25. doi: 10.1097/01.prs.0000254529.51696.43, PMID 17496607.
19. Boissonnault JS, Blaschak MJ. Incidence of diastasis. recti abdominis during the childbearing year. Phys Ther. 1988;68(7):1082-6. doi: 10.1093/ptj/68.7.1082, PMID 2968609.
20. Thabet AA, Alshehri MA. 1Department of physical therapy for gynaecology and obstetrics. Giza, Egypt: Faculty of Physical Therapy, Cairo University; 2Physiotherapy Department. Mecca, Saudi Arabia: Faculty of Applied Medical Sciences, Umm Al Qura University. Brisbane: School of Health and Rehabilitation Sciences, University of Queensland, Australia J Musculoskelet Neuronal Interact; 2019; 19(1):62-68. p. 3Department of Physiotherapy.
21. Kisner C, Colby L. Therapeutic exercise foundations and techniques. 5th ed. Philadelphia: F A Davis; 2007.
22. Opala-Berdzik A, Dąbrowski S. Physiotherapy in diastasis of the rectus muscles of abdomen in women during pregnancy and postpartum. Fizjoterapia. 2009;17(4):67-70. doi: 10.2478/v10109-010-0039-2.
23. Mostafavifar M, Wertz J, Borchers J. A systematic review of the effectiveness of kinesio taping for musculoskeletal injury. Phys Sportsmed. 2012;40(4):33-40. doi: 10.3810/psm.2012.11.1986, PMID 23306413.
24. Pyšný L, Pyšná J, Petrů D. Kinesio taping use in prevention of sports injuries during teaching of physical education and sport. Procedia Soc Behav Sci. 2015;186:618-23. doi: 10.1016/j.sbspro.2015.04.039.
25. Added MA, Costa LO, Fukuda TY, de Freitas DG, Salomão EC, Monteiro RL. et al. Efficacy of adding the Kinesio Taping method to guideline-endorsed conventional physiotherapy in patients with chronic nonspecific low back pain: a randomised controlled trial. BMC Musculoskelet Disord. 2013;14:301. doi: 10.1186/1471-2474-14-301, PMID 24156687.
26. Thabet AA, Alshehri MA. Effects of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomised controlled trial. J Musculoskelet Neuronal Interact. 2019;19(1):62-8. PMID 30839304.
27. Diaphragmatic Breathing for GI Patients | Michigan Medicine [Internet]. www.uofmhealth.org. Available from: https://www.uofmhealth.org/conditions-treatments/digestive-and-liver-health/diaphragmatic-breathing-gi-patientsAvailable from: https://www.nhsinform.scot/ready-steady-baby/pregnancy/looking-after-yourself-and-your-baby/how-to-look-after-your-pelvic-floor.
28. How to Plank - Planks for Beginners - Plank Benefits [Internet]. purefitness.com. [cited 2023 Nov 4]. Available from: https://purefitness.com/exercise-guides/abs/planks/
29. Mady MM. Kinesiotaping therapy Techniquesfor treating postpartum rectus diastases: A comparative Study; 2018.
30. Thabet AA, Alshehri MA. Effects of deep core stability exercise program in postpartum women with diastasis recti abdominis: a randomised controlled trial. J Musculoskelet Neuronal Interact. 2019;19(1):62-8. PMID 30839304.
31. 3 Exercises to Keep Your Abs Strong [Internet]. Verywell Health. Available from: https://www.verywellhealth.com/abdominal-exercises-2696610
32. Posterior Pelvic Tilt: 5 Exercises to Correct It [Internet]. Healthline. 2017. Available from: https://www.healthline.com/health/posterior-pelvic-tilt
33. How to Do Crunches: Proper Exercise Form &

Variations [Internet]. wikiHow. [cited 2023 Nov 4]. Available from: https://www.wikihow.com/Do-Crunches#aiinfo
34. Trunk twist (pregnancy) | Cigna [Internet]. www.cigna.com. [cited 2023 Nov 4]. Available from: https://www.cigna.com/knowledge-center/hw/trunk-twist-zm6024.
35. Beer GM, Schuster A, Seifert B, et al. The normal width of the linea alba innulliparouswomen. Clin Anat. 2009;22:706-11.
36. Mady MM. Effect of Kinesio taping therapy on waist circumferences in postpartum women. J Med Sci Res. 2018;1(1). doi: 10.4103/JMISR.JMISR_12_18.
37. Pawar PA Et al. Effect of Kinesiotaping on diastasis recti in post-partum women; 2020.
38. Situt G, Kanase S. Effectiveness of NMES and taping on diastasis recti in postnatal women. JEOH. 2020;21(3). doi: 10.18311/jeoh/2021/28267.
39. 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):62-8. PMID 30839304.
40. Walton LM et al. The effects of a 6 week dynamic core stability plank exercise program compared to a traditional supine core stability strengthening program on diastasis recti abdominis closure, pain, Oswestry disability index (ODI) and pelvic floor disability index scores (PFDI); 2016.
41. safaee M, Barati AH, Naderifar H. Comparison of the effect of eight weeks of core stability training and Kegel on diastasis rectus abdominis in multiparous women. Iran Rehabil J. 2022;20(4):509-16. doi: 10.32598/irj.20.4.1185.4.
42. Yalfani A, Bigdeli N, Gandomi F. The effect of isometric-isotonic exercises of core stability in women with postpartum diastasis recti and its secondary disorders (randomized controlled clinical trial). JHC. 2020;22(2):123-37. doi: 10.52547/jhc.22.2.123.
43. Sara Magdy, Ahmed et al. 2023. Investigating Kinesiotaping effect on postnatal rectus abdominis diastasis recovery and back function: A randomized clinical trial.
44. Khandale SR et al. Effects of abdominal exercises on reduction of diastasis recti in postnatal women; 2016.
45. Acharry N et al. 2015 abdominal exercise withbracing,atherapeutic efficacy in reducing diastasis-recti among postpartal females.
46. lisnaini 2022 effect of plank exercise on diastasis recti abdominis below umbilicus in postpartum women.
47. Oktaviyani F, Pamungkasari EP, Murti B. Effect of core stability exercise in preventing diastasis recti abdominis among normal birth delivery of postpartum mothers: meta-analysis. INDONES J MED. 2022;7(2):188-99. doi: 10.26911/theijmed.2022.07.02.07.
48. Dave H. Effect of structured abdominal exercise programme on diastasis of rectus abdominis muscle in postpartum women- an experimental Study; 2019.
49. Mady MM. Kinesio taping Therapy Techniques for Treating postpartum rectus Diastases: A Comparative Study; 2018.
50. Mohamed HK et al. Kinesio Taping (KT) helps in recovery of abdominal muscle after cesarean delivery; 2020.
51. Ptaszkowska L, Gorecka J, Paprocka-Borowicz M, Walewicz K, Jarzab S, Majewska-Pulsakowska M, Gorka-Dynysiewicz J, Jenczura A, Ptaszkowski K. Immediate effects of kinesio taping on rectus abdominis diastasis in postpartum women—preliminary report. Journal of Clinical Medicine. 2021 Oct 28;10(21):5043.