

## Effect of Kinesio Taping on Diastasis Recti and Body Image Concerns among Postpartum Women

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### Abstract

**Background:** Diastasis of the rectus abdominis (DRA) has many long-term consequences for women's health. It is described as a large gap between the rectus abdominis muscles which usually appears early in the last trimester of pregnancy. Kinesio taping is a well-known non-pharmacological technique that is increasingly utilized successfully in sports, neuromuscular rehabilitation, and the management of musculoskeletal problems. **Aim:** determine the effect of Kinesio taping on diastasis recti and body image concerns among postpartum women. **Design:** a quasi-experimental research design was followed in this study. **Setting:** The study was conducted at the obstetric and gynecologic outpatient clinic at Damanhour National Medical Institute. **Subjects:** A purposive sample of 80 postpartum women was selected. **Tools:** Two tools were used for data collection. **The first tool** Socio-demographic structured interview schedule. **The second tool** is the body image concerns inventory scale. It was originally developed by Littleton et al. (2005) for measuring body dysmorphic appearance concerns among postpartum women. **Results:** According to the current study's findings, there was a highly statistically significant decrease in the inter-rectus distance after the intervention at the three levels of inter-rectus separation ( $p < 0.001$ ). Regarding the effect of KT on body image concerns, the study findings revealed that 45% and 37.5% of the study group had either moderate or high dysmorphic concern regarding body image respectively, before the intervention. This percentage decreased to only 27.5% & 7.5% among the study group respectively after the application of KT with highly statistically significant improvement in body image. **Conclusion:** the study concluded that postpartum women for whom Kinesio taping was applied had less degree of diastasis recti and lowered body image concerns than those who did not. **Recommendations:** the study recommended Kinesio taping as a safe, available, painless, cost-effective, easy-to-use, and effective, non-pharmacological method for managing diastasis recti.

**Keywords:** Kinesio taping, Diastasis recti, Body image concerns, postpartum women.

### Introduction

In most pregnant women, the inter-recti distance (IRD) increases due to stretching and thinning of the linea alba. This is a normal process that occurs to some extent in most pregnancies. However, in some circumstances, the alterations to the abdominal muscles may become severe and continue beyond delivery. Diastasis of the rectus abdominis (DRA) is characterized as a large gap between the rectus abdominis muscles' bellies. DRA is measured by the inter-recti distance and can occur anywhere along the linea alba, from the xiphoid process to the pubic bone (Eriksson Crommert et al., 2020).

The linea alba, which connects the two muscular bellies of the rectus abdominis muscle, lengthens and curves round during pregnancy as the abdominal wall grows to

accommodate the developing fetus. The abdominal wall is mechanically stressed by the growing fetus, hormonal changes that cause elastic alterations in the connective tissue, and displacement of the abdominal organs all contribute to DRA (Cavalli et al., 2021).

IRD starts to rise about the fourteenth week of pregnancy and keeps rising till birth. Clinically severe DRA usually appears early in the last trimester of pregnancy, and its highest incidence is immediately after and in the first few weeks after childbirth. A reported prevalence of up to 100% during the last trimester of pregnancy, 60% at sixth weeks postpartum, and 32% at 12 months postpartum (Da Mota et al., 2015 & Sperstad et al., 2016).

After labor, the alterations in the abdominal musculature, particularly in the linea alba and

rectus abdominis sheath, typically revert to normal and have no substantial effects on health. If no interventions are made, IRD may stay raised for the rest of one's life. Recovery is most pronounced between one day and eight weeks after birth, followed by a plateau phase (Gluppe et al., 2022).

In addition to supporting the abdominal viscera, the abdominal wall also contributes significantly to trunk and pelvic stability, breathing, trunk movement, and postural control. Numerous symptoms and dysfunctions may develop as a result of persistent DRA. These can lead to altered trunk mechanics, compromised pelvic stability, and changed posture, all of which increase the risk of injury to the lumbar spine and pelvis. DRA is also related to low back pain, probably as a result of deteriorated trunk muscle strength, lumbopelvic instability, and pelvic floor weakness (Benjamin et al., 2019).

There has been evidence that many factors, such as multiparity, maternal age, body mass index before conception and six months after delivery, weight gain during pregnancy, baby weight at birth, abdominal circumference at gestational week 35, and type of delivery, all increase the risk of DRA (Kaufmann et al., 2022).

Accordingly, due to the physical changes that take place after giving birth, women frequently come to the realization that they may be much further away from the "perfect body" than they were before. The woman's body does not change dramatically right away, and the signs and impression of pregnancy are still discernible and this gives a sensation of dissatisfaction. An experience and appraisal of the physical self-make perceived body image. The emphasis on body image in today's society is on weight and shape, both of which are particularly important for women (Antonie & Vintila, 2022).

During puerperium, body image is one of the most important concerns for women. Women work hard to maintain a lovely pre-pregnancy body image and shape. It has been discovered that body image has a significant role in determining one's sense of efficacy, self-worth, and quality of life, particularly among women of reproductive age. Higher

levels of self-esteem are associated with greater levels of creativity, success, health, self-confidence, assertiveness, and the ability to articulate one's thoughts clearly. It is also associated with greater perceived social compatibility (Kaur & Sagar, 2018).

Postpartum women might feel surprised & ashamed when they cannot return to their pre-pregnancy shape and weight. It has been found that 63% of women reported "much concern" about returning to a "normal" figure in just two weeks after giving birth and 75% of women were concerned with their ability to return to a normal figure at six months postpartum. When a mother feels negative about her body, this can lead to feelings of depression and even to the development of eating disorders, which can in turn lead to eating pathology in her child (Kapa et al., 2022).

Kinesio taping is a relatively new technique used in rehabilitation programs, though it has been used in orthopedic and sports settings. It is increasingly being used as an adjunct treatment option for other musculoskeletal impairments, correcting muscle function by strengthening weakened muscles, improving circulation of blood and lymph by eliminating tissue fluid or bleeding beneath the skin by moving the muscle, decreasing pain through neurological suppression, and regaining range of motion (Alqahtani & Parveen, 2023).

The direction in which Kinesio taping affects how well the muscle contracts. The main idea behind using tape to weaken muscles for therapeutic purposes is to start at the muscle's origin, go along the muscle, and end at the muscle's insertion. This causes a concentric pull on the fascia during muscular contraction, facilitating or strengthening the contraction (Dolphin et al., 2021). Taping offers instant sensory feedback on functional capacities. Postpartum women frequently describe symptom reduction and increased comfort after the Kinesio tape has been applied. Kinesio tape's elasticity fits the body and permits mobility (Tabatabaee et al., 2019).

Kinesio tape extends soft tissue manipulation to maximize the advantages of manual therapy performed in a physical therapy clinic. Increased fluid flow through a

damaged location, improved control over muscular contractions, decreased pain, and eventually faster healing. The nervous system selectively stimulates the sensory-motor system to modify and coordinate this effect (Hadadi et al., 2020).

The basic idea that the body has built-in healing processes is also the foundation of the Kinesio taping technique. Through the stimulation of the circulatory and nervous systems, Kinesio taping demonstrates its effectiveness. The circulation of lymph and venous flows is also controlled by muscles, in addition to being responsible for bodily movement. As a result, the significance of muscle function received so much attention that the concept of treating the muscles in order to trigger the body's natural healing process was developed (Jaroń et al., 2021).

### **Significance of the study**

Generally speaking, diastasis recti has many long-term consequences for women's health. It may change posture as it causes an increase in abdominal circumferences and gives more back strain due to reduced strength and function. Consequently, leading to low back pain together with dissatisfaction about body shape, altered self-esteem, and disadvantages in interpersonal relationships (Sperstad et al, 2016).

As diastasis recti is often not considered a pathological entity. Non-pharmacological therapy is the most appropriate treatment that has the potential to give relief from symptoms related to RAD without complications. Kinesio taping is a well-known technique that is increasingly utilized successfully in sports, neuromuscular rehabilitation, and the management of musculoskeletal problems. It is effective in enhancing blood circulation and lymphatic drainage as well as joint stability and mobility by using the right taping techniques. Kinesio tape can be beneficial for the proprioceptive, motor, and sensory systems (Slomka,2018& Jaroń et al., 2021) .

Accordingly, this study was designed to determine the effect of Kinesio taping on diastasis recti and body image concerns among postpartum women.

### **Aims of the study**

#### **The aim of the study is to:**

Determine the effect of Kinesio taping on diastasis recti and body image concerns among postpartum women

#### **Research hypothesis:**

**H0:** Postpartum women for whom Kinesio taping was applied exhibit the same degree of diastasis recti and body image concerns as those who do not.

**H1:** Postpartum women for whom Kinesio taping was applied exhibit less degree of diastasis recti than those who do not.

**H2:** Postpartum women for whom Kinesio taping was applied exhibit a lower level of body image concerns than those who do not

#### **Operational Definition:**

**Diastasis recti:** refers to a condition characterized by abnormally thinning and separation of the rectus abdominis muscle and usually associated with laxity of the abdominal muscles.

**Body Image Concerns:** refers to preoccupation and dissatisfaction with one's body appearance including weight, shape, and other characteristics.

### **Materials and Method**

#### **Materials:**

#### **Research design:**

A quasi-experimental research design was utilized for this study.

#### **Settings:**

This study was conducted at the obstetric and gynecologic outpatient clinic at Damanhour Medical National Institute. This clinic includes a waiting area in which the researchers interviewed each woman to collect the needed data. And a room for examination and application of the Kinesio taping in total privacy. This setting was particularly chosen as it is a major hospital that serves Damanhour city and surrounding areas. Also, the turnover of women is satisfactory.

**Subjects:**

A purposive sample of 80 postpartum women were selected from the previously mentioned setting. Utilizing Epi info 7 statistical programs based on the following parameters: population size = 115 (per last 3 month), minimal sample size = 78, final sample size = 80 for a potential normal response, predicted frequency = 50%, tolerable error = 5%, confidence coefficient = 95%. The study subjects were selected according to the following **inclusion criteria**:

- Age ranged from 18 to 35 years
- Postpartum period 4-6 weeks.
- Rectus abdominis diastasis (RAD) > 2 cm
- Free from any skin diseases
- Free from any medical diseases such as diabetes and hypertension.

The chosen participants were equally assigned to the study group (40) or the control group (40).

**Tools: two tools were used:**

**Tool one: socio-demographic and reproductive history structured interview schedule:** It was developed by the researchers to collect the necessary data from women. It included four main parts

**Part I:** socio-demographic characteristics: such as age, level of education, occupation, current residence, and family type

**Part II: reproductive history:** such as gravidity, parity, number of abortions, type of delivery, and history of last pregnancy.

**Part III: Anthropometric measurements** such as weight, and height to calculate body mass index (BMI).

**Part IV: Measurement of inter-rectus distance:** diastasis recti was graded by the number of fingerbreadths between the medial edges of the bellies of the rectus abdominis muscle where each finger breadth represented 1.5 cm. The RD was considered present and relevant if the separation was greater than 2 finger width between the medial edges of rectus abdominis muscles.

The degree of RD based on the width was classified by **Reinbold et al., 2019** as follows:

- A separation of <3 cm between the rectus muscles represent mild diastasis
- A separation of 3–5 cm represents moderate diastasis
- A separation of >5 cm represents severe diastasis

**Tool II: Body image concerns inventory scale:**

It was originally developed by **Littleton et al. (2005)** for measuring body dysmorphic appearance concerns among postpartum women. This tool was adopted & translated into the Arabic language by the researchers. Body dysmorphic appearance concern includes a lot of deep concern and preoccupation with the perceived defaults in appearance. It consists of 19 items, for every item, postpartum women were asked to rate how often they had the described feeling or performed the described behavior on a Likert scale, with 1= never, 2= rarely, 3= sometimes, 4= often, and 5 = always. Summing the scores of all items generates a dysmorphic appearance concern score, with higher scores indicating greater dysmorphic concern. The total score ranged between (19-95). The total score of body image concerns inventory scale was categorized as follows:

- 19 - < 45 low dysmorphic concern.
- 45- < 70 moderate dysmorphic concern
- 70- 95 high dysmorphic concern

**Fieldwork:****First phase (Preparatory phase):**

- An ethical approval from the Research Ethics Committee, of Damanhour University, Faculty of Nursing was obtained 19 January 2023 before conducting the study.
- After outlining the purpose of the study, the Faculty of Nursing Damanhour University delivered an official letter to the relevant authorities in the study settings requesting their consent to collect data.
- Tool I was developed by the researchers, while tool II was adopted.
- The tools' validity was evaluated by a panel of three expert professors in the field of

Obstetric & Gynecologic Nursing and some modifications were made accordingly.

- Tool II reliability was assessed using Cronbach's alpha test and both were found to be reliable. The result was (0.84).
- A pilot study was conducted on 8 (10%) women to review the tools' clarity and applicability.
- Data was collected from the beginning of March 2023 until the end of July 2023.

### Second phase (Implementation phase):

- Each postnatal woman who had the inclusion criteria was randomly assigned to either a study or control group. The researchers were started by the control group to avoid contamination of the study.
- **The control group:** included 40 postpartum women who were given routine postnatal care. Each postpartum woman was interviewed for about 30 minutes at the waiting area of the obstetric and gynecologic outpatient clinic and the researchers used tool one to collect baseline data. Then the researchers examined the woman's abdomen to determine the degree of inter-rectus distance at the obstetric and gynecologic outpatient clinic using finger breadth or a caliber as a pre-test. After that, the researchers measured body dysmorphic appearance concerns among postpartum women using tool two as a pre-test.
- **The study group:** comprised 40 postpartum women for whom Kinesio taping was applied. To collect baseline data using tool one, the researchers interviewed each woman in the study group personally for about 30 minutes.
- Before providing intervention, a pre-test was administered, and the mothers were informed about the study's nature and objectives.
- Data from tool one was collected individually from postpartum women in the waiting area through an interview schedule before intervention.
- After that the researchers start to assess the degree of inter rectus distance at the obstetric and gynecologic outpatient clinic using finger breadth or a caliber to determine the degree

of rectus abdominis separation as a pre-test for both groups.

- The level of body image concerns was assessed using tool II as a pre-test for both groups.
- The Kinesio taping technique was conducted according to the following steps:
  - Take the woman individually and allow her to lie on the examination bed pull the paravan and close the door & window to ensure privacy.
  - Manual assessment for the inter rectus distance between 2 Recti was done by asking every woman to rest in a crook lying position, feet supported and arms extended over the body and asked to perform a forward trunk flexion until the inferior angle of the scapula is off the bed.
  - Then, the researchers placed fingers perpendicularly between the medial edges of the rectus abdominis muscles and then turned the fingers clock wisely.
  - The RD was considered present and relevant if the separation was greater than 2 finger widths between the medial edges of the rectus abdominis muscles
  - The researchers also used a caliber to determine the degree of rectus abdominis separation in addition to finger breadth measurement as illustrated in Figure (1).



**Figure (1):** assessment of the degree of inter-rectus distance using finger breadth & a caliber to determine the degree of rectus abdominis separation.

- Before starting the application of Kinesio taping, clean the abdominal with cotton and alcohol to clean the skin and remove any discharges before applying the Kinesio taping to ensure proper taping stick.

- Kinesio taping used in this study was latex-free, not allergic, breathable, and water permeable with a 5 cm diameter, designed to the same thickness and elasticity of the epidermis of the skin.
- Each woman was instructed to lie in a relaxed supine position on the examination bed with a small pillow under her neck, back, and knees to accommodate her body curves.

**Then Kinesio taping was applied according to the following steps:**

- Step one: Tape was applied using an I band with about two fingerbreadths horizontally above the symphysis pubis.
- Step two: Tape was applied on the rectus abdominal. The band was started on symphysis pubis with no tension, then the woman was asked to stretch the abdominal region by deep abdominal respiration, and the band ended on the xiphoid process. The technique was applied first on the left side and then on the right side rectus abdominal muscle.
- Step three: Finally, KT was performed on the external oblique muscles. The procedure started with no tension from the bottom end of the 6–12th ribs, then the hip was placed in flexion and rotation to the opposite direction, and the band was performed on the pubic bone. This was applied first on the left side then on the right side external oblique muscle (figure 2).
- The woman rested for ten minutes after the tape application to allow the tape to gain full adhesive strength.



**Figure (2):** application of Kinesio taping on abdominal muscles **Mohamed et al (2020).**

**Third phase (Evaluation phase):**

- The control group was started and completed before the study group to avoid sample contamination.
- Kinesio taping was applied for a week and then removed for one day and reapplied for an additional 3 weeks and removed for one day following every week.
- To remove the tape from the woman's abdomen, they were instructed that it is easier to remove the tape when they had bathed or the tape was moist. It had been best to remove it from up to down. This would be within the direction of the hair, ease its removal, and limit the sense of discomfort.
- The next day of tape removal each woman was instructed to come to the obstetric and gynecologic outpatient clinic for reapplying of a new taping and this was repeated three consecutive times.
- Measurement of inter-rectus distance and the level of body dysmorphic appearance concerns among postpartum women were assessed before the intervention and after one month for both groups at the examination room of the obstetric and gynecologic outpatient clinic.
- After data collection, the necessary statistical analysis was performed
- The effect of implementing Kinesio taping was determined by comparing the degree of diastasis recti and the body image concerns between the two groups

**Ethical considerations:**

Each woman provided informed written consent after an explanation of the study's purpose. The confidentiality of the gathered data, the subjects' freedom to withdraw at any moment, and their anonymity and privacy all were maintained.

**Statistical analysis:**

Data were fed to the computer and analyzed using IBM SPSS software package version 23.0. Comparisons between groups for categorical variables were assessed using Chi-square test (Monte Carlo). Student t-test was

used to compare the two groups for normally distributed quantitative variables. Marginal Homogeneity Test Used to analyze the significance for ordinal data between before and after, while paired t test was used to analyze the significance between before and after in each group for normally distributed quantitative variables. Significance of the obtained results was judged at the 5 level.

### Results:

**Table (1)** shows that around one quarter (25% & 27.5%) of the control and the study groups age ranged from  $\geq 30$  years. Furthermore, 10% of the control group had a university degree compared to 5% of the study group. 82.5% and 70.0% of the control and study groups respectively were housewives. Moreover, both the study and the control group 55.0% and 70.0% were rural residents, respectively. No statistically significant difference was found in relation to socio-demographic data among the study and control groups

**Table (II)** presents the number and percent distribution of the study participants according to their reproductive history. It was observed that one-fifth (20%) of the control group were primigravida and primipara compared to (10%) of the study group. While the majority ( 92.5% & 90%) of the control and study groups had no history of abortion. Around two-fifths (40% & 37.5%) of the control and study groups had polyhydramnios and abdominal over-stretching. While 72.5% and 57.5% of the control and study groups delivered cesarean section. More than half (52.5%) of the control group had less than 2 years of inter-conceptual space compared to three-fifths (60%) of the study group. The majority of the control and study groups (80% & 85%) had increased pregnancy weight gain by more than 12 kg. There were no statistically significant differences in relation to the reproductive history between the study and control groups.

**Table (3)** demonstrates the distribution of the study and control groups according to their anthropometric measurements. It was found that the mean weight was  $73.90 \pm 9.63$  among the control group compared to  $75.55 \pm 9.03$  among the study group. Regarding the study subjects height it was found that the mean height was  $164.0 \pm 6.58$  among the control group compared to  $165.0 \pm 5.46$  among the study group. Regarding BMI it was

observed that 65% & 70% of the control and the study groups were overweight, respectively. While the mean BMI was  $27.71 \pm 2.20$  among the control group compared to  $28.03 \pm 2.12$  among the study group. No statistically significant difference between the control and study groups concerning their anthropometric measurements ( $p=0.507$ )

**Table (4)** displays a comparison between the two studied groups according to the measurement of inter-rectus distance. It was found that before intervention more than one-half (55%) of the control group had an inter-rectus distance of 3–5 cm which means moderate diastasis this percent decreased to 50% after intervention among the same group without any statistically significant difference ( $p=0.883$ ). On the other hand among the study group, it was found that before intervention three-fifths (60%) had inter-rectus distance of 3–5 cm which means moderate diastasis this percentage decreased to only 25% after intervention among the same group, with a highly statistically significant improvement ( $p<0.001$ ).

In addition, the study findings revealed that there were significant improvements among the study group after intervention at the three levels of inter-rectus separation including above the umbilicus, at the umbilical level, and below the umbilical level ( $p<0.001$ ) such improvement was absent among the control group after the intervention. There were statistically significant variations among the control and the study groups ( $p=0.015$ ) in favor of the study group.

**Table (5):** demonstrates a comparison between the study and the control groups according to body image concerns inventory scale. It showed that before intervention 60% and 27.5% of the subjects in the control group had either moderate or high dysmorphic concern regarding body image respectively, compared to only 45% and 37.5% of the subjects in the study group on the same scale. Whereas, after the intervention, this percentage decreased to 57.5% & 22.5% among the control group compared to only 27.5% & 7.5% among the study group respectively. There were highly statistically significant differences between the studied groups ( $p<0.001$ ), favoring the study group.

**Table (1): Distribution of the control and study groups according to their socio-demographic characteristics:**

Part I: Socio-demographic characteristics	Control group (n=40)		Study group (n=40)		$\chi^2$	P
	No.	%	No.	%		
<b>Age (years)</b>					0.491	0.782
18 - <25	16	40.0%	13	32.5%		
25 - <30	14	35.0%	16	40.0%		
30-35	10	25.0%	11	27.5%		
<b>Occupation before retirement</b>					1.726	0.189
Housewife	33	82.5%	28	70.0%		
Worker	7	17.5%	12	30.0%		
<b>Level of education</b>					4.239	MC $p = 0.236$
Illiterate	16	40.0%	9	22.5%		
Read & Write	15	37.5%	22	55.0%		
Secondary	5	12.5%	7	17.5%		
University education/ more	4	10.0%	2	5.0%		
<b>Residence</b>					1.920	0.166
Rural	22	55.0%	28	70.0%		
Urban	18	45.0%	12	30.0%		
<b>Type of family</b>					0.238	0.626
Nuclear	29	72.5%	27	67.5%		
Extended	11	27.5%	13	32.5%		

$\chi^2$ : Chi square test MC: Monte Carlo

**Table (2): Distribution of the control and study groups according to their reproductive history:**

Part II: Reproductive history	Control group (n=40)		Study group (n=40)		$\chi^2$	P
	No.	%	No.	%		
<b>Gravidity</b>					2.569	0.277
One	8	20.0%	4	10.0%		
Two	19	47.5%	17	42.5%		
more than two	13	32.5%	19	47.5%		
<b>Parity</b>					1.949	0.377
One	8	20.0%	4	10.0%		
Two	21	52.5%	21	52.5%		
more than two	11	27.5%	15	37.5%		
<b>Abortion</b>					0.157	1.000
No	37	92.5%	36	90.0%		
Yes	3	7.5%	4	10.0%		
<b>Pregnancy problems</b>					2.911	MC $p = 0.742$
None	15	37.5%	13	32.5%		
Multiple pregnancies	2	5.0%	5	12.5%		
Polyhydramnios	16	40%	15	37.5%		
Gestational age >37 weeks	3	7.5%	5	12.5%		
Macrosomic baby	4	10.0%	2	5.0%		
<b>Delivery type</b>					1.978	0.160
Normal	11	27.5%	17	42.5%		
Cesarean	29	72.5%	23	57.5%		
<b>inter-conceptual space</b>					0.457	0.499
<2years	21	52.5%	24	60.0%		
>2years	19	47.5%	16	40.0%		
<b>Pregnancy weight gain</b>					0.346	0.556
10-12 kg	8	20.0%	6	15.0%		
More than 12 kg	32	80.0%	34	85.0%		

$\chi^2$ : Chi square test MC: Monte Carlo



Table (3): Distribution of the control and study groups according to anthropometric measurements

Part III: Anthropometric measurements	Control group (n=40)		Study group (n=40)		Test of sig.	P
Weight	73.90±9.63		75.55±9.03		t = 0.791	0.432
Height	164.0±6.58		165.0±5.46		t = 0.740	0.462
Body mass index	No.	%	No.	%	0.228	0.892
Normal	7	17.5%	6	15.0%		
Overweight	26	65.0%	28	70.0%		
Obese	7	17.5%	6	15.0%		
Mean ± SD	27.71±2.20		28.03±2.12		t = 0.667	0.507

$\chi^2$ : Chi-square test MC: Monte Carlo t: Student t-test

Table (4): Comparison of the control and study groups according to measurement of inter-rectus distance

Part IV: Measurement of inter-rectus distance	Control group (n=40)				Study group (n=40)				Test of sig. study vs control	
	Before Kinesio taping		After Kinesio taping		Before Kinesio taping		After Kinesio taping		Before Kinesio taping	After Kinesio taping
	No.	%	No.	%	No.	%	No.	%		
Mild diastasis	15	37.5%	18	45.0%	14	35.0%	30	75.0%	$\chi^2 = 0.406$ , MC p=0.883	$\chi^2 = 7.900^*$ , p=0.015*
Moderate diastasis	22	55.0%	20	50.0%	24	60.0%	10	25.0%		
Severe diastasis	3	7.5%	2	5.0%	2	5.0%	0	0.0%		
<b>MH</b>	<b>0.157</b>				<b>&lt;0.001*</b>					
<b>Above umbilicus</b>									t = 1.255, p = 0.213	t = 11.450*, p < 0.001*
Mean ± SD	3.38±0.82		3.31±0.82		3.14±0.87		1.11±0.90			
<b>p<sub>0</sub></b>	<b>0.168</b>				<b>&lt;0.001*</b>					
<b>At umbilicus</b>									t = 1.292, p = 0.200	t = 9.050*, p < 0.001*
Mean ± SD	2.81±0.93		2.69±1.02		3.05±0.70		0.70±0.94			
<b>p<sub>0</sub></b>	<b>0.077</b>				<b>&lt;0.001*</b>					
<b>Below umbilicus</b>									t = 0.399, p = 0.691	t = 7.695*, p < 0.001*
Mean ± SD	2.86±1.01		2.71±0.62		2.95±0.95		0.90±1.02			
<b>p<sub>0</sub></b>	<b>0.096</b>				<b>&lt;0.001*</b>					

$\chi^2$ : Chi square test for comparing the two groups MC: Monte Carlo

t: Student t-test for comparing the two groups

MH: Marginal Homogeneity Test for comparing between before and after in each group

P<sub>0</sub>: p value for Paired t test for comparing between before and after in each group

\* Statistically significant p-value at  $\leq 0.05$

**Table (5): Comparison of the control and study groups according to Body image concerns inventory scale**

Tool II: Body image concerns inventory scale	Control group (n=40)				Study group (n=40)				Test of sig. study vs control	
	Before Kinesio taping		After Kinesio taping		Before Kinesio taping		After Kinesio taping		Before Kinesio taping	After Kinesio taping
	No.	%	No.	%	No.	%	No.	%		
- Low dysmorphic concern	5	12.5%	8	20.0%	7	17.5%	26	65.0%	$\chi^2= 1.806$ , $p=0.406$	$\chi^2=16.765^*$ , $p<0.001^*$
- Moderate dysmorphic concern	24	60.0%	23	57.5%	18	45.0%	11	27.5%		
- High dysmorphic concern	11	27.5%	9	22.5%	15	37.5%	3	7.5%		
<b>MH</b>	<b>0.059</b>				<b>&lt;0.001*</b>					

$\chi^2$ : Chi square test for comparing the two groups MC: Monte Carlo

t: Student t-test for comparing the two groups

MH: Marginal Homogeneity Test for comparing between before and after in each group

\* Statistically significant p-value at  $\leq 0.05$

## Discussion

Undoubtedly, abdominal muscles are very vital in stabilizing the spine. During pregnancy, hormones lead to weakness and decrease the strength of abdominal muscles and ligaments. In addition, muscle imbalance due to excessive stretching of the abdominal and back muscles brings about worsening lordosis conditions, especially in multiparous women (Cavalli et al, 2021 & Mohamed et al, 2020).

RAD can lead to abdominal discomfort and back pain during and after childbirth, seriously affecting women's quality of life. Consequently, it is essential to recognize the time of RAD and take initial measures to treat it (Pawar, et al, 2020 & Yurtutan & Sancak, 2020).

Currently, the conservative approach, such as manual therapy, electrical stimulation, therapeutic exercises, and Kinesio taping, is regarded as the most effective therapeutic approach for several musculoskeletal problems as RAD. Kinesio taping is among the most frequently employed modalities for managing RAD. Along with its impressive level of acceptance as a non-invasive treatment and does not present any risks to human health (Radhakrishnan & Ramamurthy, 2022).

Therefore, the goal of this study was to investigate how Kinesio taping improved postpartum women's rectus abdominis diastasis and lowered the level of body image concerns.

According to the current study's findings, postnatal women with diastasis recti for whom Kinesio taping was applied experienced a highly statistically significant decrease in the inter-rectus distance after the intervention at the three levels of inter-rectus separation including above the umbilicus, at the umbilical level, and below the umbilical level ( $p<0.001$ ). There were statistically significant variations among the studied subjects ( $p=0.015$ ) in favor of the study group.

This could be confirmed by the fact that KT promotes neuromuscular recovery, as applying KT directly to the skin promotes muscle activation and blood flow by expanding the interstitial space this leads to increased muscle oxygenation and anaerobic muscle function. With its adhesive and elastic properties, KT works by lifting the skin and increasing the space between the skin and the tissues. KT bandage helps in muscle function correction as it acts on weak muscles and increases their strength. Therefore, it stabilizes ligaments and reduces muscle tension, thus positively helping

to return muscle and facial function (**Hormann et al 2020 & Jaron et al 2020**).

In addition, applying Kinesio taping induced a tactile stimulation of the skin which influences the excitability of the central nervous system and correlates with motor function. Therefore, enhanced bioelectrical activity, greater recruitment of motor units, and increased muscle strength (**de Almeida Lins et al, 2013 & Slomka, et al 2018**).

Additionally, applying KT reduces intra-abdominal pressure by supporting the abdominal muscles therefore correcting rectus abdominis muscle alignment and preventing any potential further muscle separation caused by overload activities. Supporting the abdominal wall and linea alba seems to be effective in facilitating the contraction of transverse abdominis muscle and tissue regeneration (**Tuttle et al, 2018 & Zamani et al, 2023**).

The study's findings coincided with a study in Turkey by **Kulli & Alpay (2023)**. Who revealed statistically significant improvements after Kinesio taping application ( $P = .001$ ) in addition, Kinesio taping improved abdominal endurance immediately after application in women with diastasis recti abdominis. Also, concluded that Kinesio taping may be an effective tool in the therapy of women with diastasis recti abdominis. A randomized controlled trial by **Situt & Kanase (2021)** investigated the effect of neuromuscular electrical stimulation versus Kinesio tape and exercises on diastasis recti among 6-week puerperal women in India. They revealed a significant improvement at all three levels of inter-recti distance (above, below, and at umbilical level) and other parameters after the application of KT, and a significant improvement in low back pain especially was found.

Moreover, this finding corresponds with a study by **Ptaszkowska et al (2021)** who assessed the immediate effects of Kinesio taping on rectus abdominis diastasis in postpartum women. The results showed that utilizing KT in the study group resulted in a statistically significant reduction in RDA in all examined areas. The inter-group comparison revealed that the KT group's RAD was

considerably lower after the intervention. Furthermore, this decrease was more noticeable at the umbilicus level. This study found that applying KT in a corrective manner can help in the reduction of RAD in women for up to 12 months postnatal. In addition, **Rishi et al (2021)** concluded that Kinesio taping group demonstrated significant improvement in reducing Inter recti distance and pain at ( $p < 0.05$ ).

Furthermore, the findings of the present study were in line with the findings of an Egyptian study by **Mohamed et al (2020)** who investigated the effect of Kinesio taping on strength recovery of postnatal abdominal muscles after cesarean section. Who found a significant decrease in the rectus abdominal distance and a significant increase in the thickness of the rectus abdominal muscles after the application of KT ( $p < 0.0001$ ). Moreover, it aligns with a study by **Pawar et al (2020)** that investigated the effect of KT on diastasis recti among 200 postpartum mothers who applied it every 6 days for 4 weeks. Who showed that there is a significant difference between pre and post-treatment on all three inter-rectus levels.

Likewise, it is significant that another Egyptian study of **Mady (2018)** is in accordance with the current results, demonstrating the effect of KT on waist circumferences among postpartum women. The findings revealed a noteworthy decrease in waist circumference especially among women with RAD.

In contradiction with the current study findings **Depledge et al (2021)**, who conducted a study in New Zealand to investigate the effect of exercises, tub grip, and Kinesio taping in reducing rectus abdominis diastasis after 3 weeks postnatal concluded that Kinesio taping was not effective in reducing the rectus abdominis diastasis in the conditions tested. In addition, **Tuttle et al (2018)** found that there was no statistically significant difference between the Kinesio taping group and the control group in inter rectus distance change. This discrepancy between the results of both studies may be due to differences in research designs, selection criteria of subjects, sampling techniques, and research methodology.

Regarding the effect of KT on body image concerns, the findings of the present study revealed that 45% and 37.5% of the study group had either moderate or high dysmorphic concern regarding body image respectively, before the intervention. This percentage decreased to only 27.5% & 7.5% among the study group respectively after the application of KT with highly statistically significant improvement in body image ( $p < 0.001$ ), favoring the study group.

These findings can be attributed to the fact that applying taping over the abdominal muscles during the early postnatal period generates positive pressure during the proliferative, contraction, and remodeling phases of muscle and tissue repair. Thus enhancing the restructuring of collagen fibers, preventing cell misalignment, and promoting a better appearance of the abdomen. Therefore, promoting body image satisfaction and lowering concerns regarding body appearance.

A similar finding was reported by **Lopes et al (2024)** who performed a Brazilian study to evaluate the effects of taping in the post-gestational period. Who found a decrease in abdominal circumference after applying taping and the majority of the study group had a greater degree of body image satisfaction. Another study supportive study by **Gluppe et al (2022)** assessed Primiparous women's knowledge of diastasis recti abdominis, concerns about abdominal appearance, treatments, and perceived abdominal muscle strength 6–8 months postpartum. Also, it was reported that women reporting abdominal protrusion were significantly more preoccupied with the appearance of their abdomen and less satisfied with their abdominal appearance. Significantly more women with protrusion reported weaker abdominal muscles compared to women without protrusion.

Furthermore, **Keshwani et al (2021)** performed a randomized controlled trial to compare the effect of exercise therapy and abdominal binding intervention during the early postnatal period on RAD. Which concluded that a positive effect on body image was observed among the abdominal binding group after the intervention.

In addition, the findings of the present study agree with the findings of a previously mentioned study by **Mohamed et al (2020)** who concluded that KT is a more effective method that helps reinforce strength and recovery of abdominal muscle in women who had a cesarean delivery and promoting satisfaction with abdominal appearance.

### Conclusion:

The findings of the present study confirmed the acceptance of H1 and H2; while H0 was rejected, where Kinesio taping significantly decreased diastasis recti and lowered the level of body image concerns.

### Recommendations

Based on the findings of the present study, the following recommendations are suggested:

- Including Kinesio taping as one of the routine hospital care for correcting diastasis recti and enhancing abdominal muscle strength among postpartum women.
- Kinesio taping should be recommended as a safe, available, painless, cost-effective, easy-to-use, and effective, non-pharmacological method for managing diastasis recti.
- Replicate further studies with larger sample sizes, other settings, and regulations for generalization of the findings.

### References:

- Alqahtani A & Parveen S. (2023). Kinesio taping as a therapeutic tool for masticatory myofascial pain syndrome-an insight view. *International Journal of Environmental Research and Public Health*, 20(5), 3872. <https://doi.org/10.3390/ijerph20053872>.
- Antonie L & Vintila M. (2022). Postpartum body image and self-esteem. *Bulletin of the Transilvania University of Braşov. Series VII: Social Sciences. Law*, 15(64), 145-152. <https://doi.org/10.31926/but.ssl.2022.15.64.2.3>.
- Benjamin D, Frawley H, Shields N, van de Water A & Taylor N. (2019). Relationship between diastasis of the rectus abdominis muscle (DRAM) and musculoskeletal dysfunctions, pain and quality of life: a systematic review. *Physiotherapy*, 105(1), 24-34. <https://doi.org/10.1016/j.physio.2018.07.002>.

- Cavalli M, Aiolfi A, Bruni P, Manfredini L, Lombardo F, Bonfanti M, Bona D & Campanelli G. (2021). Prevalence and risk factors for diastasis recti abdominis: a review and proposal of a new anatomical variation. *Hernia*, 25(4), 883-890. <https://doi.org/10.1007/s10029-021-02468-8>.
- Da Mota, P. G. F., Pascoal, A. G. B. A., Carita, A. I. A. D., & Bø, K. (2015). Prevalence and risk factors of diastasis recti abdominis from late pregnancy to 6 months postpartum, and relationship with lumbopelvic pain. *Manual therapy*, 20(1), 200-205.
- Depledge, J., McNair, P., & Ellis, R. (2021). Exercises, Tubigrip and taping: can they reduce rectus abdominis diastasis measured three weeks post-partum?. *Musculoskeletal Science and Practice*, 53, 102381.
- De Almeida Lins, C, Neto, F, de Amorim, A, de Brito Macedo, L & Brasileiro, J. (2013). Kinesio Taping® does not alter neuromuscular performance of femoral quadriceps or lower limb function in healthy subjects: Randomized, blind, controlled, clinical trial. *Manual therapy*, 18(1), 41-45.
- Dolphin, M., Brooks, G., Calancie, B., & Rufa, A. (2021). Does the direction of kinesiology tape application influence muscle activation in asymptomatic individuals? *International Journal of Sports Physical Therapy*, 16(1), 135-144. <https://doi.org/10.26603/001c.18799>.
- Eriksson Crommert, M., Petrov Fieril, K., & Gustavsson, C. (2020). Women's experiences of living with increased inter-recti distance after childbirth: an interview study. *BMC Women's Health*, 20(1), 260. <https://doi.org/10.1186/s12905-020-01123-1>.
- Gluppe, S., Ellström Engh, M., & Bø, K. (2022). Primiparous women's knowledge of diastasis recti abdominis, concerns about abdominal appearance, treatments, and perceived abdominal muscle strength 6-8 months postpartum. A cross sectional comparison study. *BMC Womens Health*, 22(1), 428. <https://doi.org/10.1186/s12905-022-02009-0>.
- Hadadi, M., Haghighat, F., Mohammadpour, N., & Sobhani, S. (2020). Effects of kinesiotape vs soft and semirigid ankle orthoses on balance in patients with chronic ankle instability: A randomized controlled trial. *Foot & Ankle International*, 41(7), 793-802. <https://doi.org/10.1177/1071100720917181>.
- Hormann J, Vach W, Jakob M, Seghers S, Saxer F.(2020). Kinesiotaping for postoperative oedema- what is the evidence? A systematic review. *BMC Sports Sci.med.Rehabil*,12,14-15.
- Jaroń A, Jedlinski M, Grzywacz E, Mazur M, Trybek G. (2020). Kinesiology taping as an innovative measure against postoperative complications after third molar extraction - systematic review. *J.CLI.Med*.9:3390/jcm9123988.
- Jaroń, A., Preuss, O., Grzywacz, E., & Trybek, G. (2021). The impact of using kinesio tape on non-infectious complications after impacted mandibular third molar surgery. *International Journal of Environmental Research and Public Health*, 18(2), 399. <https://doi.org/10.3390/ijerph18020399>.
- Kapa, H. M., Litteral, J. L., Keim, S. A., Jackson, J. L., Schofield, K. A., & Crerand, C. E. (2022). Body image dissatisfaction, breastfeeding experiences, and self-efficacy in postpartum women with and without eating disorder symptoms. *Journal of Human Lactation*, 38(4), 633-643. <https://doi.org/10.1177/08903344221076529>.
- Kaufmann, R. L., Reiner, C. S., Dietz, U. A., Clavien, P. A., Vonlanthen, R., & Käser, S. A. (2022). Normal width of the linea alba, prevalence, and risk factors for diastasis recti abdominis in adults, a cross-sectional study. *Hernia*, 26(2), 609-618. <https://doi.org/10.1007/s10029-021-02493-7>.
- Kaur, A., & Sagar, N. (2018). Mamta. Assess the attitude of women regarding body image during pregnancy and post partum period. *International Journal of Health Sciences and Research*, 8(3), 193-198.
- Keshwani, N., Mathur, S., & McLean, L. (2021). The impact of exercise therapy and abdominal binding in the management of diastasis recti abdominis in the early postpartum period: a pilot randomized controlled trial. *Physiotherapy theory and practice*, 37(9), 1018-1033.

- Kulli, H. D., & Alpay, K. (2023). Acute Effects of Kinesio Taping on Women with Diastasis Recti Abdominis. *Age (year)*, 32, 4-6.
- Littleton, H. L., Axsom, D., & Pury, C. L. S. (2005). Development of the body image concern inventory. *Behaviour Research and Therapy*, 43(2), 229-241. <https://doi.org/10.1016/j.brat.2003.12.006>.
- Lopes, C., Pereira, P., Lopes, E., Pitanga, F., Lopes, L., Lopes, M. (2024). Evaluation of The Effects of Applying The Taping Technique in The Post-Gestational Period. *Int Clin Med Case Rep Journal*, 3(2):1-7.
- Mady, M. M. (2018). Effect of Kinesio taping therapy on waist circumferences in postpartum women. *Journal of Medicine in Scientific Research*, 1(1), 9.
- Mohamed, H., Yousef, A., Kamel, H. E., Oweda, K., & Abdelsameaa, G. (2020). Kinesio taping and strength recovery of postnatal abdominal muscles after cesarean section. *Egyptian Journal of Physical Therapy*, 4(1), 13-19.
- Pawar, P. A., Yeole, U. L., Navale, M., & Patil, K. (2020). Effect of Kinesio taping on diastasis recti in post-partum women. *Indian Journal of Public Health Research & Development*, 11(6), 692-697.
- Ptaszkowska, L., Gorecka, J., Paprocka-Borowicz, M., Walewicz, K., Jarzab, S., Majewska-Pulsakowska, M., ... & Ptaszowski, K. (2021). Immediate effects of kinesio taping on rectus abdominis diastasis in postpartum women—preliminary report. *Journal of clinical medicine*, 10(21), 5043.
- Radhakrishnan, M., & Ramamurthy, K. (2022). Efficacy and challenges in the treatment of diastasis recti abdominis—a scoping review on the current trends and future perspectives. *Diagnostics*, 12(9), 2044.
- Reinhold, W., Köckerling, F., Bittner, R., Conze, J., Fortelny, R., Koch, A., Kukleta, J., Kuthe, A., Lorenz, R., & Stechemesser, B. (2019). Classification of rectus diastasis—a proposal by the German Hernia Society (DHG) and the International Endohernia Society (IEHS). *Frontiers in Surgery*, 6, 1-6. <https://doi.org/10.3389/fsurg.2019.00001>.
- Rishi, P., Yadav, J., Anand, P., & Yadav, B. (2021). Effectiveness of kinesio taping in improving pain and inter recti distance in women with post-partum low back pain. *Indian Journal of Health Sciences and Care*, 8(spls), 47-47.
- Situt, G., & Kanase, S. (2021). Effectiveness of NMES and taping on Diastasis Recti in postnatal women. *Journal of Ecophysiology and Occupational Health*, 105-111.
- Sperstad, J. B., Tennfjord, M. K., Hilde, G., Ellström-Eng, M., & Bø, K. (2016). Diastasis recti abdominis during pregnancy and 12 months after childbirth: prevalence, risk factors and report of lumbopelvic pain. *British journal of sports medicine*, 50(17), 1092-1096.
- Slomka, B., Rongies, W., Ruszczuk, P., Sierdzinski, J., Saganowska, D., Zdunski, S., & Worwag, M. E. (2018). Short-term effect of kinesiology taping on temperature distribution at the site of application. *Research in Sports Medicine*, 26(3), 365-380.
- Tabatabaee, M., Cheraghifard, M., & Shamsoddini, A. (2019). The effects of kinesio taping of lower limbs on functional mobility, spasticity, and range of motion of children with spastic cerebral palsy. *The Egyptian Journal of Neurology, Psychiatry and Neurosurgery*, 55(1), 70. <https://doi.org/10.1186/s41983-019-0118-3>.
- Tuttle, L. J., Fasching, J., Keller, A., Patel, M., Saville, C., Schlaff, R., ... & Gombatto, S. P. (2018). Noninvasive treatment of postpartum diastasis recti abdominis: a pilot study. *The Journal of Women's & Pelvic Health Physical Therapy*, 42(2), 65-75 .
- Yurttutan M, Sancak K. (2020). The effect of kinesio taping with the web strip technique on pain, edema, and trismus after impacted mandibular third molar surgery. *Nigerian Journal of Clinical Practice.*;23(9):1260-
- Zamani, Y. S., Moradian, M., Eftekharsadat, B., Safiri, S., Mirghafourvand, M., Hasanpour, S., & Bani, S. (2023). The Effect of Kinesio Taping on abdominal muscles disorders in Postpartum: A systematic review and Meta-analysis.