Efficiency Of Abdominal Exercises and Pelvic Floor Muscle Exercises on Women with Diastasis Recti Abdominis

Dr. Vanya Seth (Pt)[1], Miss Prisha[2]
[1]*assistant Professor Department of Physiotherapy, Guru Nanak Dev University, Amritsar-143001(Punjab)*
[2]*Department Of Physiotherapy, Guru Nanak Dev University, Amritsar-143001(Punjab)*

***Abstract*— Background: The study clearly demonstrates the efficacy of abdominal exercises and pelvic floor muscles exercises in postpartum women with diastasis recti. It is a comparative approach in convention to the research.**

Objective

1. **To estimate the effect of abdominal exercises on postpartum women with diastasis recti abdominis**
2. **To estimate the effect of pelvic floor exercises on postpartum women with diastasis recti abdominis**

Research Methodology:
Study design- comparative study
Study setting- Guru Nanak Dev Hospital Amritsar

Population and Sampling
Total 42 patients are taken that are diagnosed with the diastasis recti abdominis meeting the inclusion criteria will be enrolled for the study. The purpose and procedure of the study will be explained to them and their informed consent will be taken. The subjects will be divided randomly in two Groups [A-21] and [B-21].

Results: Both groups showed significant improvement in terms of inter recti distance in patients with diastasis recti abdominis. But group A showed better result as compared to group B. In the present study, within group analysis showed reduction in inter recti distance which was statistically significant in both the groups ($p<0.01$) whereas the between group analysis revealed that Group A was highly significant ($p<0.01$) as compared to Group B.

Conclusion: Both groups statistically showed significant responses to their interventions. Abdominal exercises were found to be more effective than pelvic floor muscles exercises to reduce the inter recti distance in patients with diastasis recti abdominis in post-partum women.

I. INTRODUCTION

The four layers of the abdominal muscles extend from the ribs and breastbone to the pelvis. The acronym "Core Muscle" denotes to the major muscles of the abdomen. The internal and external oblique, transverse abdominis, and rectus muscles form the abdominal wall. Five muscle pairs with fibers arranged vertically, horizontally, and obliquely make up the lateral and anterior abdominal walls. The muscles in question have skeletal attachments to the pelvis, thoracic cage, and spinal column via the thoracolumbar fascia.[1]

In a standard clinical write-up, the anterolateral abdomen is divided into nine sections by four imaginary planes: two horizontal (transpyloric/intertubercular) and two vertical (midclavicular/midinguinal) planes that precisely represent the sites of apparent abnormalities, masses, and pain.The transpyloric plane, which crosses the stomach's pylorus at the lower border of the first lumbar vertebra, is the halfway between the umbilicus and xiphoid process. The transpyloric plane may be substituted by the subcostal plane, which crosses the upper border of the third lumbar vertebra and the costal margins. Connecting the iliac tubercles on both sides, the lower horizontal plane, also known as the intertubercular line, passes across the anterior abdomen at the level of the fifth lumbar vertebra. The interspinous plane, a second lower horizontal plane that crosses the sacral promontory and connects the anterior superior iliac spines on both sides, may also be employed.[2]

Abdominal muscles are crucial for protective reflexes like coughing, sneezing, and vomiting, aid in

ventilation when the urge to breathe increases (due to exercise or diaphragmatic exhaustion), and, depending on one's point of view, contribute to speech, one of humanity's finest or worst traits. [3]

Maintaining appropriate posture, which includes stabilizing the pelvic and lumbar spine, depends on the tonic activity of the abdominal muscles, which also supports and shields the viscera. Increased intraabdominal pressure occurs after coughing, laughing, micturition, defecation, or birthing when the diagonal and transverse fibers shorten. Additionally, the abdominal muscles are engaged in trunk bending, trunk rotation (the external oblique muscle and the contralateral internal oblique muscle), and lateral flexion (ipsilateral oblique muscles with a minor contribution from the ipsilateral rectus abdominis muscle). The diaphragm rises during exhalation as a result of the previously described muscles contracting, supporting the breathing process.[4]

A woman's "pregnancy" is regarded as the most significant stage of her life.[1]

One of the poets once said something lovely: "There are two bodies, one inside the other, during pregnancy." Two individuals have a common skin. Pregnancy is a typical physiological process that healthy women go through in their lifetime. The uterus grows five to six times in size from its pre-pregnancy dimensions of 5 by 10 cm to 25 by 36 cm. Each uterine muscle cell grows by around ten times its pre-pregnancy length by the conclusion of the pregnancy. [5]

The state of having implanted products of conception, either in the uterus or elsewhere in the body, is known as pregnancy. It results with an elective or spontaneous abortion or delivery.In order to support the developing fetus, the mother's body experiences major alterations during this time which impact every organ system. During pregnancy, the female body undergoes significant changes that affect every organ system. The physiology differs from that of a woman who is not pregnant as a result of these alterations. In addition, anomalies in the course of pregnancy may result in additional issues for the mother and the foetus. [6]

In addition to satisfying the fetus's developmental needs and enabling both mother and fetus to withstand the challenges of childbirth, pregnant women experience anatomical and physiological changes that are crucial for managing the higher metabolic demands of pregnancy. [7]

In a woman's life, the postpartum phase is characterized by significant health and psychological changes. The separation (or diastasis) of the rectus abdominis muscle is one of the most noticeable physiological changes that lasts into the postpartum phase because of the expansion of the abdominal wall that takes place during pregnancy to accommodate the growing fetus.[8]

The abnormal separation of the rectus abdominis muscles along the linea alba is known as diastasis recti abdominis (DRA), and it is a common but often underestimated ailment that can cause both functional and cosmetic issues. DRA has historically been thought to belong to a postpartum condition that mostly affects women. But recent research has shown how much of an influence it has on men, especially when combined with older age, weight gain, smoking, or inactivity.[9]

Diastasis recti abdominis (DRA) is an abnormality distinguished by the separation of the two rectus abdominis muscles along the linea alba. However, other terminology, including divarication of rectus abdominal muscles (DRAM) or rectus abdominis diastasis (RAD), are occasionally used in literature. [4]

The rectus sheath is formed by the aponeurosis of the abdominal wall muscles, M. rectus abdominis, M. obliquus externus and internus, and M. transversus abdominis (TrA), with tendon fibers connecting with the linea alba and crossing the midline. From the symphysis to the xiphoid process, the linea alba is a "tendinous raphe," according to certain descriptions. In vitro investigations of the architecture of the linea alba reveal a more complicated structure with groupings of longitudinal, transverse, and oblique collagen fibers, in contrast to other tendinous structures where the collagen fibers are arranged parallel to the tendon's line of action.It has been noted that parous women have a greater percentage of transverse collagen fibers. [10]

The recti abdominis muscle's two bellies are connected by the linea alba, which widens during pregnancy. This condition is known as pregnancy-related diastasis rectiabdominis (DRA). The expanding fetus's stretching of the surrounding abdominal muscles and connective tissue throughout the second and third trimesters of pregnancy results in this increased interrecti distance (IRD).[11]

Between 33% and 75 % of the women who have given birth suffer from rectus abdominis diastasis. Katy Bowman claims that because DRA is such a common postpartum ailment, it is generally accepted to be inevitable and linked to both considerable abdominal wall stretching and hormonal changes. Although DRA is characterized by an increase in the space between the two rectus abdominis muscle bellies, the disorder affects more than just the abdominal walls; it has serious effects on the entire body. Lumbo-pelvic discomfort, fecal and urine incontinence, lowering of the smaller pelvic organs, sexual difficulties, and peristaltic abnormalities are the most frequent dysfunctions that accompany DRA.[12]

It has been proposed that 90% of women who do not exercise during the early postpartum phase have DRA, which is linked to adverse outcomes such body dissatisfaction, pelvic girdle/low back discomfort, urine incontinence, and core function. These symptoms have a major negative influence on quality of life and last for years in the postpartum phase for many women. According to study, 60% of women have unresolved DRA that lasts throughout the early postpartum period (around six weeks), impacting quality of life long after childbirth, even though other women experience DRA healing on its own. Furthermore, six months after giving birth, up to 39% of women still have DRA.[8]

The DRAM is more prevalent in cases of obesity, fetal macrosomia, flaccid abdominal muscles, polyhydramnios in multiparous mothers, and repeated pregnancies. Women who are multiparous, have a narrow pelvis, or have had multiple deliveries are more prone to develop DRAM because of the baby's anterior placement during pregnancy. It is extremely common during pregnancy, with a 100% global prevalence at gestational week 35. It can last for up to six months when the prevalence is between 39% and 45% and for six weeks following delivery when it is between 50% and 60%. [13]

Atypical separation of the rectus muscles along their entire longitudinal range, without any fascial abnormalities, is the hallmark of diastasis recti abdominis (DRA). Increased intra-abdominal pressure causes this separation by increasing the tension applied to the linea alba and thereby widening the inter-rectus gap. Three different criteria are used to stratify the severity of this condition: Mild denotes a gap of two to three fingerbreadths; moderate denotes a gap of three to four fingerbreadths; and severe denotes a gap of more than four fingerbreadths.[14]

According to some research, pregnant women's overstretched abdominal muscles were the reason behind their noticeably weaker abdominal muscles compared to nonpregnant women during a sit-up performance test. Due to repeated and extended strain on the abdominal wall, multiparity puts a woman at risk for developing DRA, particularly if there is no recovery of abdominal tone between subsequent pregnancies. A woman is at risk if she has several pregnancies that are closely spaced out in time because the abdominal wall won't have enough time to heal between pregnancies.[15]

Anatomical structure, muscle function, and physiological alterations are just a few of the several components that make up the intricate pathogenic mechanism of DRA. According to studies, DRA may be linked to a reduction in core muscle strength, which may result in problems like low back pain. Hormonal changes during pregnancy are a significant factor from an anatomical viewpoint. The connective tissues of the abdomen wall loosen as a result of pregnancy-related hormonal changes, which promotes the development of DRA. Furthermore, mechanical considerations must not be disregarded. The rectus abdominis muscles gradually elongate and thin as a result of the constant pressure that the growing uterus exerts on the wall of the abdomen during pregnancy. In some situations, a fetus positioned anteriorly concentrates tensile pressures on the linea alba instead of permitting the abdominal wall to experience uniform stress distribution. The separation of the rectus muscles is largely caused by this localized and sustained mechanical tension. [16]

Pregnancy-related diastasis recti are caused by elevated levels of the hormone’s estrogen, progesterone, and relaxing, which weaken the linea alba and soften connective tissues.[5] Most pregnant women have an anterior pelvic tilt, either with or without lumbar hyper lordosis. These postural modifications can impact postural biomechanics by altering the insertion angle of the pelvic and abdominal muscles. The main risk factors are being obese, polyhydramnios, numerous pregnancies, flaccid abdominal muscles, multiparity, and fetal macrosomia. Pregnancy-related changes mostly impact the rectus abdominis, which starts to lengthen and stretch as a result of the developing fetus.[17]

In addition to being a cosmetic concern for many women, other hypothesized effects include pelvic floor disorders, low back, pelvic, and abdominal girdle pain, and decreased abdominal strength.[5] The abdominal wall is essential for breathing, posture, trunk and pelvic stability, and abdominal visceral support. An increase in the inter-recti distance puts these processes at risk and can compromise the function of the abdominal muscles by weakening them. Injury to the lumbar spine and pelvis can result from changes in posture, posture, and trunk mechanics. The lumbar spine and pelvis may sustain injuries as a result of altered posture, changed trunk mechanics, and diminished pelvic stability. There is a high correlation between DRA and stomach discomfort in women in the early postpartum period. [18]

The interact distance (IRD) is evaluated in order to diagnose and assess the presence of DRA. IRD is measured by ultrasound imaging, calipers, and palpation; ultrasound has the highest reliability, with intra- and inter-rater intraclass correlation values >0.9. [19]

There is currently disagreement regarding the definition and cut-off values for DRA and normal IRD values, though. For instance, some of studies used palpation to classify a mild DRA as an IRD >25 mm while in a curl-up position right after delivery, while other used ultrasonography to report normal IRD values ranging from 17 to 28 mm when measured 2 cm 6 months postpartum.[11]

When measuring IRD, the subject's place and the activity they are performing at the time of the assessment differ between study and practice. IRD can be measured intraoperatively in a supine posture or while the abdominal muscles are at rest in a supine crook-lying position.

A partial curl-up, in which the participant raises their head and shoulders off the bench until their scapula clears the surface, or hook-lying with their neck flexed, is how some studies test IRD. Certain studies do not state whether they were conducted while at rest or while performing an active abdominal engagement, such as a curl-up. [20]

DRA is defined as the linea alba's width at or above the level of the umbilicus during an incomplete sit-up being greater than a 2-finger width (1.5 cm) when measured with the palm of the hand or 2 cm when measured with a dial caliper. [21]

The thickness of subcutaneous fat can be a misleading factor for measurements that are reliant on palpation, such as callipers and tape measures. Additionally, there is a chance that a person with a thick and rounded muscular structure, abundant subcutaneous tissue, or obesity can misidentify medial portions of RA with calipers, particularly below the umbilicus. It can be clinically challenging to standardize palpation techniques (such as calipers, tape measures, and finger width), and thus calls for a standardization methodology. For instance, determining the examiner's finger width in centimetres or millimetres. According to a recent study, palpation demonstrates good intra-rater reliability and moderate inter-rater reliability, making it sufficiently reliable for use in clinical practice. [20]

Studies that looked at the features of DRA came to the conclusion that ultrasound imaging is a more precise method of assessing IRD in postpartum women, but they did not offer any particular standards for diagnosing DRA.[21]

During the third trimester, parturients frequently experience varying degrees of DRA. They may develop severe DRA over time if they receive inadequate care or no treatment at all.The abdomen not only swells and changes appearance, but it may also lead to spinal instability, which impairs quality of life and causes lower back discomfort. What's more important is that in order to alleviate their clinical symptoms, some severe individuals will ultimately require surgery. On the other hand, symptoms can be immediately alleviated and postpartum women's quality of life enhanced when DRA is promptly treated. Therefore, to increase the separation of the rectus abdominis after delivery, adequate therapy is crucial.[22]

The first course of treatment that is recommended is conservative therapy. However, women are referred to surgical intervention when conservative therapy appears to be inadequate in severe situations.[23]

Patients suffering from postpartum DRA can now be treated using a variety of techniques, including electrical stimulation therapy, abdominal binding, exercises to strengthen the pelvic floor muscles, restraint band assistance, acupuncture in traditional Chinese medicine, and surgery.[22]

Surgeons take a variety of approaches to DRA. Techniques include endoscopic, laparoscopic, open, and hybrid methods. While the plastic surgeon treats

DRA patients with cosmetic limitations, the general surgeon sees patients with symptomatic DRA who do not have any cosmetic problems.[23]

DRA can be effectively treated with surgery. It is not regarded as the best option, though, as it is a traumatic treatment approach that might result in wound infection, patch rejection, postoperative adhesions, postoperative scarring (even with minimally invasive surgery), and other issues.[22]

Even after a patient has surgery, DRA may still happen. A negligible recurrence rate has been documented by a small number of studies in the literature.[23]

For conservative (non-surgical) therapy of rectus diastasis, the patient may be sent to a physiotherapist by the physician. As suggested by certain research, physiotherapy might start six or eight weeks after giving birth. Exercise, back and posture education, external support in the form of a corset or an elastic tube bandage, and/or cardiovascular workouts are the conservative therapies.[24]

A key component of a healthy lifestyle is exercise, a subset of physical activity that consists of repetitive, scheduled activities to maintain or increase physical fitness. Women should be encouraged to restart or start exercising as soon as possible after giving birth. Both pregnancy and vaginal delivery have an impact on the pelvic floor muscles, which can lead to weak pelvic floor muscles in the first year after giving birth and an enlarged levator hiatus. Weaker abdominal muscles are linked to an increased inter-rectus distance, or diastasis recti abdominis. [25]

Exercise is recognized to have numerous physical and psychological advantages for the body, including better mental health, more self-esteem, and an improved sense of control over one's body image. It aids in maintaining a healthy body weight and preventing body fat from building up. Research has demonstrated that consistent exercise before pregnancy, during pregnancy, and after delivery can lower the likelihood of diastasis recti development, decrease its size, and prevent recurrence.[5]

According to the American College of Obstetricians, exercise helps pregnant women retain their muscular tone, strength, and endurance while also enhancing general health and lowering labor discomfort and low back pain.[15]

It may be possible to prevent and/or treat DRA by teaching postpartum women how to "re-train" their movements, control intra-abdominal pressure, and strengthen these muscles and activities. Women can effectively engage their muscles and breathing during the rehabilitation process by learning how to control them through exercises. Women who engage in activities that target the complete abdominal complex, including the transverse abdominis, may be able to maintain the linea alba's natural borders, which would reduce the breadth of their current DRA.[8]

Two optional therapeutic approaches are employed in therapy: activating the rectus abdominis muscles or transversus abdominis muscles. Drawing-in exercises, which target the transversus abdominis muscles, are recommended, while activities that target the rectus abdominis muscles are prohibited because they may raise IRD (abdominal sit-up/curl-up, crunch exercise). In the alternative approach, the rectus abdominis muscles are activated through a crunch exercise performed while in the supine position.[4]

There is conflicting information regarding the relationship between diastasis recti abdominis and pelvic floor dysfunction. It is well recognized that DRA does not create problems or discomfort on its own, but it may be a contributing factor to the development of pelvic floor dysfunction or lumbar pain. The strength of the pelvic floor muscles (PFMs) and abdominal muscles are crucial to pelvic and abdominal dynamics. Pelvic floor muscular weakness is more common in patients with DRA.[26]

Some abdominal and pelvic floor muscle (PFM) exercises have been proposed as viable preventative and therapeutic measures for DRA in recent decades.[2] Exercises focusing on the pelvic floor muscles (PFM) (87%) and transversus abdominis (TrA) (89%) were the most frequently suggested by women's health physical therapists.[5]

Pelvic floor refers to the composite structure that seals off the bony pelvic outflow. Pelvic floor muscles are the muscular layer of the pelvic floor. The pelvic floor serves to support the pelvic organs.By contracting and relaxing, the pelvic floor muscles carry out their duty. When the pelvic floor is at rest, it supports the pelvic organs. Three factors determine whether the support function is normal: the muscles' anatomical position, the pelvic floor muscles' activity at rest (active support), and the fascia's integrity (passive support).The superficial perineal muscles and the deep pelvic diaphragm are the two layers that make up the pelvic floor, which is a collection of muscles and

connective tissue that stretches across the base of the pelvis like a sling and supports the bladder, pelvic organs, and spinal components.[27]

The three most popular therapies were pelvic floor muscle (PFM) training, m. trans versus abdominis (TrA) strengthening exercises, and the "Elizabeth Noble technique," which includes manipulating the rectus muscle lies while the patient does a partial sit-up. Numerous studies have demonstrated that proper PFM contractions result in abdominal muscle co-contractions. Therefore, it has been proposed that the TrA can be trained via PFM contractions.[28]

Exercises for core stabilization can increase muscle strength and endurance while also activating the muscles and stimulating their proprioceptive receptors. Because of this, weak muscles are used more frequently, and their peripheral afferents provide more information to the central nervous system. Although there are several studies demonstrating the advantages of abdominal workouts for DRA, there is inconsistency in research on therapeutic activities.[29]

Exercises for the abdomen are quite beneficial in lowering interact distance and diastasis recti in early postpartum women. An RCT showed that postpartum abdominal exercise reduced the diastasis of the rectus abdominis muscle width.[30]

Exercise is the main strategy and cornerstone of IRD treatment, but due to program design heterogeneity and inconsistent data, it may not always be any more successful than no treatment at all and may even make the condition worse. Additionally, for people who are unable to conduct physical exercises, non-exercise physical therapies like electrotherapy and acupuncture provide alternate possibilities. But compared to exercise therapy, the efficacy of these treatments as stand-alone options is less established, and the evidence for them is weak.[31]

Since DRA is a concerning public health problem, it has not been given enough attention, especially for its management. Therefore, the purpose of this review was to summarize the current evidence of rehabilitative training programs for treating postpartum DRA.[32]

1.2 Need of Study

Diastasis Recti Abdominis (DRA) is a common condition in women, particularly in the postpartum period, characterized by an increased inter-recti distance (IRD). Increased IRD is associated with reduced abdominal muscle efficiency and compromised core stability. Although abdominal exercises and pelvic floor exercises are commonly used in the management of DRA, there is limited evidence comparing their effectiveness specifically in reducing IRD. Therefore, this study is needed to evaluate and compare the efficiency of these exercises using IRD as an objective outcome measure.

1.3 Significance of Study

This study will help identify the most effective exercise intervention for reducing inter-recti distance in women with DRA. It will support evidence-based physiotherapy practice by providing objective data on IRD changes. The findings may assist clinicians in selecting targeted rehabilitation strategies and improving outcomes related to abdominal muscle function. Additionally, it can serve as a basis for future research focusing on objective assessment and management of DRA.

1.4 Aims and Objectives

1. To estimate the effect of abdominal exercises on postpartum women with diastasis recti abdominis
2. To estimate the effect of pelvic floor exercises on postpartum women with diastasis recti abdominis

1.5 Hypothesis

H_1-Alternative hypothesis: There will be significant difference between the abdominal exercises in comparison to pelvic floor exercises.

II. METHODOLOGY

Study Design: Comparative study

Study Setting: Guru Nanak Dev Hospital Amritsar Punjab

Population And Sampling:

A total of 42 homogenous sample is taken who are diagnosed diastasis recti abdominis in post-partum period. A thorough explanation regarding the procedure is given to the patient. The patient is asked to sign the consent form before the commencement of the procedure.

Inclusion Criteria

- Primi- And Multiparous Women >6 Weeks Postpartum
- >18 Years Old

- <40 Years Old
- A Diagnosis of Dra
- Inter Recti Distance:
  - Supraumbilical 2 Cm (About 0.79 In) Above
  - Infraumbilical 2cm (About 0.79 In) Below

Exclusion Criteria

- Any Neurological Diseases
- Systemic Musculoskeletal Diseases
- Psychiatric Diagnoses.
- Any Underlying Abdominal condition

Parameters Dependent Variable

- Inter recti distance
- Independent Variable
- Abdominal exercises
- Pelvic floor exercises

Tools And Instruments:

- Plinth to position the subject
- Measuring tape
- Consent form
- Data recording sheet

Procedure

A total of 42 subjects diagnosed with diastasis recti meeting the inclusion criteria were enrolled in a study. The purpose and procedure of the study was explained to them and their informed consent (Appendix)was taken. All the subjects randomly assigned into two groups (Group A and Group B of 21 each). Each participant was screened, initial by using simple selection proforma relevant to the inclusion and exclusion criteria. Diastasis recti palpation and finger caliper methods ware performed to check for Diastasis recti and inter recti distance. In Finger Palpation Technique participants were in crook lying position with pillow beneath head and feet resting on plinth. The participants were instructed to lift her head and shoulder off the plinth, reaching towards her knees with outstretched arm until the spine of scapulae cleared the surface. Therapist palpate the finger horizontally on participants linea alba in such a way that, finger width could fit the distance between the internal borders of two rectus abdominis muscles. The number of fingers that can be placed between muscle bellies has been documented. Using center of umbilicus as reference, measurement was taken in, one being 2cm above umbilicus and 2cm below umbilicus. After completion of procedure participants were asked to lower down the head and return to normal position. Baseline measurements were taken for inter recti distance in each group

Group A was treated with abdominal exercises which include following:

Head lift with posterior pelvic tilt exercise: Participants were in crook lying position with her arms crossed over the diastasis for support. Instructions were given to her to exhale and lift her head and scapula off the floor or point just before buldge appeared, and asked to contract glutei, abdominal muscle and press lumbar region down on plinth. Then slowly lowered her head and relaxed.

Static abdominal exercise: Participants were in crook lying position and arm along the side. They were asked to draw in abdominal by pressing lumbar region down on plinth for 10 sec. In this position, participants were told to place the fingers on her abdominal wall at waist line. Then they were asked to activate lower abdominal wall by gently drawing inwards the area beneath. Participant has to maintain this abdominal activation for up to 10 seconds along with normal breathing throughout the treatment.

Superman exercise: Position of participants was on their hands and knees, like knees beneath hips and wrist beneath shoulders. Back was maintained straight and eyes looked towards the ground. Instructions were given to them to take deep breath in and when exhale slowly lift one arm out in front of shoulder level and same time extend opposite leg with knee straight at level of hip. The position was maintained for seconds then slowly lowers the leg and hand. Same procedure was repeated with opposite leg and hand. After completion of exercise, they were asked to slowly return to normal position.

Group B was treated with pelvic floor exercises which include following

Pelvic bridging: The subjects are positioned in crook lying and asked to lift their pelvis by flexing the knees hold it for 5 counts and relax. This was done for 10minutes which helped in increasing the stability of the pelvis.

Kegel's exercises: When the patient was in crook lying, asked to contract the pelvic floor muscles and

hold for 8 seconds. Loosen their muscle for 3 to 5 seconds. Repeated for 10 times and 3 times a day.
All exercises were performed under supervision to ensure correct technique and prevent compensatory movements. Adequate rest intervals were provided between sets. Attendance and compliance were recorded throughout the intervention period.

Statistical Tools
This data was analyzed using mean, standard deviation method
1. MEAN: It is defined as the average value of the data
Mean=$\frac{\Sigma fx}{\Sigma f}$
Where, Σf=sum of total number of occurances,
Σfx=sum of product of x

2.Standard Deviation: It is used to quantify the amount of variation of data values.

$$s = \sqrt{\frac{\sum(x - \bar{x})^2}{n - 1}}$$

Where, Σf=sum of total number of occurrences
Σfx=sum of product of x

3. Paired t- test It is the sum of the differences of each pair divided by the square root of n times the sum of the differences squared minus the sum of the squared differences,
overall n-1.

$$t = \frac{\Sigma d}{\sqrt{\frac{n(\Sigma d^2) - (\Sigma d)^2}{n-1}}}$$

where d: difference per paired value
n: number of samples

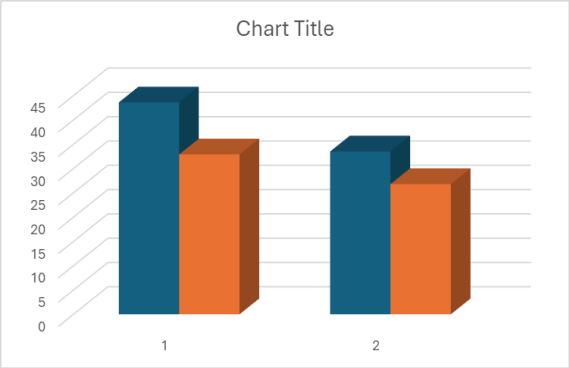
4.Unpaired t-test: It is used to compare the means between two independent groups to determine whether there is a statistically significant difference between them. In this study, it is used to compare the outcomes between the abdominal exercise group and the pelvic floor muscle exercise group.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{SE(\bar{x}_1 - \bar{x}_2)}$$

Comparison Of Pre Intervention and Post Intervention of Abdominal Exercises

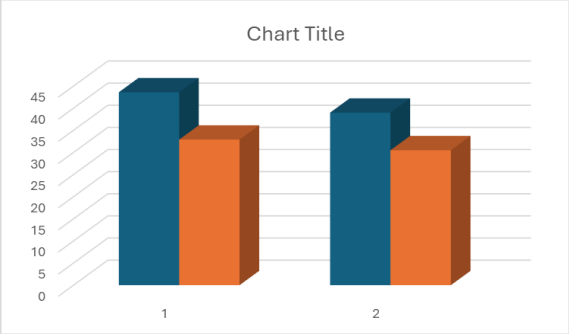
the table represents the mean Inter-Recti Distance (IRD) before and after 8 sessions of abdominal exercises at 6 weeks postpartum. In the supra-umbilical region (2 cm above the umbilicus), the mean IRD reduced from 43.6 mm to 33.5 mm, showing a mean difference (D) of 10.0 mm.In the infra-umbilical region (2 cm below the umbilicus), the mean IRD reduced from 32.9 mm to 26.8 mm, with a mean difference (D) of 6.1 mm.The reduction in IRD in both regions was found to be statistically significant ($p < 0.01$).

locations	6 weeks postpartum	D	P VALUE
Supraumbilical (2cm above)	43.6 (POST) 33.5	10.0	<.01
Infraumbilical (2cm below)	32.9(POST)26.8	6.1	<.01



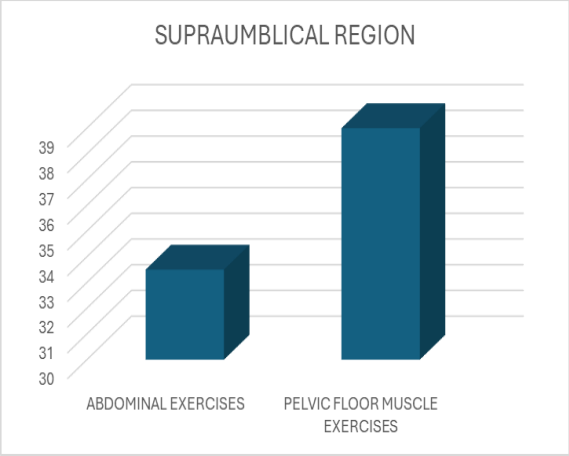
Comparison Of Pre Intervention and Post Intervention Of Pelvic Floor Exercises
The table represents the mean Inter-Recti Distance (IRD) before and after 8 sessions of pelvic floor exercises at 6 weeks postpartum. In the supra-umbilical region, the mean IRD reduced from 43.6 mm to 39.0 mm, with a mean difference (D) of 4.3 mm.In the infra-umbilical region, the mean IRD reduced from 32.9 mm to 30.5 mm, with a mean difference (D) of 2.4 mm. The reduction in IRD in both regions was found to be statistically significant ($p < 0.01$).

Locations	6 weeks postpartum	D	P VALUE
Supraumbilical (2cm above)	43.6 (POST)39.0	4.6	<.01
Infraumbilical (2cm below)	32.9 (POST)30.5	2.4	<.01



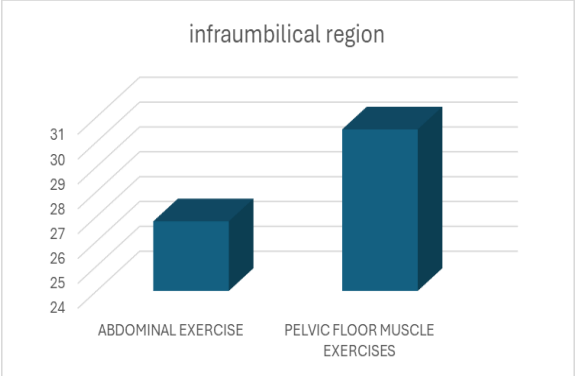
Comparison Of a Post Intervention in Supraumbilical Region of Both Abdominal and Pelvic Floor Muscles Exercises Within Group a And Group B

The graph represents the comparison between abdominal exercises and pelvic floor muscle exercises in the supraumbilical region following intervention. It is observed that the mean value in the pelvic floor muscle exercise group is higher compared to the abdominal exercise group. This indicates that pelvic floor muscle exercises were more effective than abdominal exercises in improving the supraumbilical region.



Comparison Of a Post Intervention in Infraumbilical Region of Both Abdominal and Pelvic Floor Muscles Exercises Within Group a And Group B

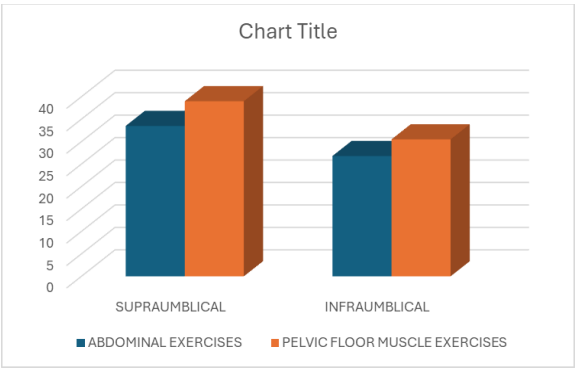
The above graph shows the comparison between abdominal exercises and pelvic floor muscle exercises in the infraumbilical region after intervention. The pelvic floor muscle exercise group demonstrates a higher mean value compared to the abdominal exercise group. This suggests that pelvic floor muscle exercises were more effective in improving the infraumbilical region.



III. COMPARISON OF BOTH GROUP A AND GROUP B

The Table Shows the Comparison of Post-Intervention Mean Inter-Recti Distance (IRD) Between Abdominal Exercises and Pelvic Floor Exercises in Both Supra-Umbilical and Infra-Umbilical Regions. In The Supra-Umbilical Region, The Post-Intervention Mean IRD For Abdominal Exercises Was 33.5 Mm, Whereas for Pelvic Floor Exercises It Was 39.0 Mm, Indicating A Greater Reduction in IRD With Abdominal Exercises. Similarly, In the Infra-Umbilical Region, The Post-Intervention Mean IRD For Abdominal Exercises Was 26.8 Mm, Compared To 30.5 Mm in Pelvic Floor Exercises, Further Demonstrating Better Improvement with Abdominal Exercises. Overall, Abdominal Exercises Showed Greater Effectiveness in Reducing IRD Compared to Pelvic Floor Exercises in Both Regions.

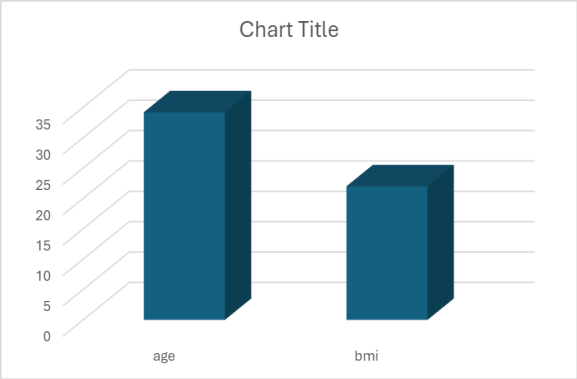
Locations	Abdominal exercises	Pelvic floor muscle exercises
Supraumbilical (2cm above)	33.5	39.0
Infraumbilical (2cm below)	26.8	30.5



Age And Bmi (Body Mass Index)

This table represents the total sample consisted of 42 participants. The mean age of the participants was 34.2 years, indicating that most subjects belonged to the adult age group. The mean Body Mass Index (BMI) was 22.0 kg/m², which falls within the normal range according to standard BMI classification. This suggests that the participants were generally within a healthy weight range.

VARIABLE	TOTAL SAMPLE (N=42)
AGE, Y, MEAN(SD)	34.2 (5.1)
BMI,kg/m, mean(sd)	22.0 (3.4)



IV. RESULTS

The study was conducted on 42 pregnant women subjects from guru nanak dev hospital Amritsar, Punjab, who were aged between 18-40 years. To evaluate the efficacy of abdominal exercises and pelvic floor muscles exercises in postpartum women with diastasis recti was studied. On the basis of random sampling the subjects are divided into Group A and Group B.

in Group A- In group A inter recti distance was measured with finger palpation method among pregnant women. The value of Group A was Post mean is 33.5 in supra umblical region and post mean in infra umblical region is 26.8 which was more significant and p value is <0.01.

Group B- In group B A inter recti distance was measured with finger palpation method among pregnant women. The value of Group B was, Post mean is 39.0 in supraumblicial region and post mean is 30.5 in infraumblical region which was less significant and p value is< 0.01.

V. DISCUSSION

The present study was undertaken to evaluate and compare the effectiveness of abdominal exercises and pelvic floor exercises in reducing inter-recti distance (IRD) among women with diastasis recti using finger palpation method. Diastasis recti is a common condition affecting postpartum women, characterized by separation of the rectus abdominis muscles, leading to compromised core stability and functional impairment. A recent study done by Hernandez Gascon et al demonstrated that the linea alba aponeuroses or recti fascia is most important unit for the mechanical stability of abdominal wall. Increasing anterior abdominal dimension may altered angle of abdominal wall muscles attachment in sagittal plan and coronal plan, resulting in rectus abdominis muscle moves laterally rather than vertically across the torso. This alternation of aponeurotic and bony attachment changes the muscles line of pull and possibly their ability to produce torque, resulting in widening of linea alba. When rectus muscle is no longer attached with each other in linea alba or midline, they no longer contract effectively. The upper arms and trunk do work, and need to push off against pressurized abdomen. With diastasis recti a lack of coordinated muscle contraction and expanded size of abdominal cavity work against effectively raising intra-abdominal pressure.[5]

The current study focused on assessing the changes in IRD following structured exercise interventions. The findings of the study demonstrated that both abdominal exercises and pelvic floor exercises resulted in a reduction in inter-recti distance; however, the magnitude of improvement was greater in the abdominal exercise group. This suggests that while both interventions are beneficial, abdominal exercises may play a more direct and significant role in the management of diastasis recti. In the abdominal exercise group, the mean pre-intervention IRD was [43.6mm]in supraumbilical region, which decreased to [33.5mm] following the intervention period. In the abdominal exercise group, the mean pre-intervention IRD was [32.9mm]in infraumbilical region, which decreased to [26.8mm] following the intervention period. The significant decrease in IRD indicates that abdominal exercises were highly effective in approximating the rectus abdominis muscles and improving the integrity of the abdominal wall.

Similarly, in the pelvic floor exercise group, the mean pre-intervention IRD was [43.6mm]in supraumbilical region, which reduced to [39.0mm] post-intervention. in the pelvic floor exercise group, the mean pre-intervention IRD was [32.9mm]in infraumbilical region, which reduced to [30.5mm] post-intervention. Although improvement was observed, the extent of reduction in IRD was comparatively less than that seen in the abdominal exercise group. The greater effectiveness of abdominal exercises observed in this study can be explained on the basis of anatomical and biomechanical principles. Abdominal exercises directly target the rectus abdominis and transverse abdominis muscles, which are primarily responsible for maintaining abdominal wall tension and reducing the separation between the recti. Activation of the transverse abdominis, in particular, plays a crucial role in drawing the abdominal wall inward, thereby facilitating approximation of the rectus muscles and reduction in IRD. On the other hand, pelvic floor exercises primarily focus on strengthening the pelvic diaphragm. However, due to the concept of core muscle synergy, the pelvic floor muscles function in coordination with the deep abdominal muscles, including the transverse abdominis. This interconnected mechanism explains why pelvic floor exercises also contributed to a reduction in IRD, although to a lesser extent. The indirect activation of abdominal musculature during pelvic floor contraction may account for the improvements observed in this group. The statistical analysis of the study revealed that the changes observed were not due to chance, as indicated by the p-values. This strengthens the validity of the findings and supports the effectiveness of exercise-based interventions in the management of diastasis recti. The greater reduction in mean values in the abdominal exercise group further highlights its superiority over pelvic floor exercises when used in isolation. The findings of the present study are in agreement with previous literature, which emphasizes the importance of abdominal strengthening, particularly activation of the transverse abdominis, in reducing inter-recti distance. Several studies have reported that targeted abdominal exercises lead to significant improvement in diastasis recti by enhancing muscular support and restoring functional stability. At the same time, existing research also supports the inclusion of pelvic floor exercises as part of a comprehensive rehabilitation program, due to their role in improving overall core stability and intra-abdominal pressure regulation. From a clinical perspective, the results of this study have important implications for physiotherapy practice. The findings suggest that abdominal exercises should be prioritized in rehabilitation protocols for women with diastasis recti, as they demonstrate greater effectiveness in reducing IRD. However, pelvic floor exercises should not be excluded, as they contribute to overall core coordination and may enhance functional outcomes when combined with abdominal training. Despite the positive outcomes observed in this study, certain limitations must be acknowledged. The sample size was relatively small, which may limit the generalizability of the findings to a larger population. Additionally, only one outcome measure, namely inter-recti distance, was assessed. Other important parameters such as core strength, functional ability, and quality of life were not evaluated. The duration of the intervention was also limited, and therefore, the long-term sustainability of the results remains uncertain. Future research should aim to address these limitations by including larger sample sizes and a broader range of outcome measures. Long-term follow-up studies are recommended to assess the durability of the improvements achieved. Furthermore, studies comparing combined exercise protocols involving both abdominal and pelvic floor training may provide more comprehensive insights into optimal management strategies for diastasis recti. In conclusion, the present study demonstrates that both abdominal exercises and pelvic floor exercises are effective in reducing inter-recti distance among women with diastasis recti. However, abdominal exercises were found to be more effective, as evidenced by greater reduction in mean IRD values and statistical significance. These findings support the incorporation of abdominal strengthening exercises as a primary component of rehabilitation programs for diastasis recti, while also recognizing the supportive role of pelvic floor exercises in enhancing overall core stability.

5.1 Limitation of Study

1.Sample size was relatively small which may limit generalizability of findings to larger population

2.Study duration was short so long-term effects of abdominal and pelvic floor exercises could not be assessed

VI. CONCLUSION

Both groups statistically showed significant responses to their interventions. Abdominal exercises signify to be more effective than the pelvic floor muscles exercise to reduce the inter recti distance in patients with diastasis recti abdominis in postpartum women.

REFRENCES

[1] H. Dave and A. Mahishale, "Effect of structured abdominal exercise programme on diastasis of rectus abdominis muscle in postpartum women—An experimental study," *Journal of Physical Education and Sport*, vol. 6, pp. 7–15, 2019.

[2] O. E. Arslan, "Anatomy of the abdominal wall," in *Aesthetic Surgery of the Abdominal Wall*. Berlin, Germany: Springer, 2005, pp. 1–28.

[3] S. Iscoe, "Control of abdominal muscles," *Progress in Neurobiology*, vol. 56, no. 4, pp. 433–506, Nov. 1998.

[4] Michalska, W. Rokita, D. Wolder, J. Pogorzelska, and K. Kaczmarczyk, "Diastasis recti abdominis—A review of treatment methods," *Ginekologia Polska*, vol. 89, no. 2, pp. 97–101, 2018.

[5] S. R. Khandale and D. Hande, "Effects of abdominal exercises on reduction of diastasis recti in postnatal women," *International Journal of Health Sciences and Research*, vol. 6, no. 6, pp. 182–191, Jun. 2016.

[6] Z. N. Pascual and M. D. Langaker, "Physiology, pregnancy," in *StatPearls*. Treasure Island, FL, USA: StatPearls Publishing, 2023.

[7] E. K. Tan and E. L. Tan, "Alterations in physiology and anatomy during pregnancy," *Best Practice & Research Clinical Obstetrics & Gynaecology*, vol. 27, no. 6, pp. 791–802, 2013.

[8] F. C. Laframboise, R. A. Schlaff, and M. Baruth, "Postpartum exercise intervention targeting diastasis recti abdominis," *International Journal of Exercise Science*, vol. 14, no. 3, pp. 400–412, 2021.

[9] [9] Y. Du, M. Huang, S. Wang, L. Yang, Y. Lin, W. Yu, Z. Pan, and Z. Ye, "Diastasis recti abdominis: A comprehensive review," *Hernia*, vol. 29, no. 1, Art. no. 222, 2025.

[10] S. B. Gluppe, M. E. Engh, and K. Bø, "Immediate effect of abdominal and pelvic floor muscle exercises on interrecti distance in women with diastasis recti abdominis who were parous," *Physical Therapy*, vol. 100, no. 8, pp. 1372–1383, Aug. 2020.

[11] N. M. Theodorsen, K. Bø, K. V. Fersum, I. Haukenes, and R. Moe-Nilssen, "Pregnant women may exercise both abdominal and pelvic floor muscles during pregnancy without increasing the diastasis recti abdominis: A randomized trial," *Journal of Physiotherapy*, vol. 70, no. 2, pp. 142–148, Apr. 2024.

[12] D. Gruszczyńska, A. Dąbek, and W. Rekowski, "Diastasis recti abdominis—What may cause it in postpartum women?" *Advances in Rehabilitation*, vol. 35, no. 2, 2021.

[13] S. Tadmare, G. Bhatnagar, R. Kamble, S. Phad, K. Landge, and V. Pawadshetty, "Comparison of abdominal exercises and neuromuscular electrical stimulation on diastasis recti abdominis muscle in postnatal females with caesarean section," *Georgian Medical News*, no. 346, pp. 63–67, Jan. 2024.

[14] Mateen, R. Amanat, H. Ali, H. Khalid, A. Ali, A. Rehman, and S. Khaliq, "Association of diastasis recti abdominis with pelvic floor muscle strength and urine incontinence in gynecological population," *American Journal of Health, Medicine and Nursing Practice*, vol. 9, no. 5, pp. 1–10, 2023.

[15] M. Chiarello, L. A. Falzone, K. E. McCaslin, M. N. Patel, and K. R. Ulery, "The effects of an exercise program on diastasis recti abdominis in pregnant women," *Journal of Women's & Pelvic Health Physical Therapy*, vol. 29, no. 1, pp. 11–16, Apr. 2005.

[16] Y. Du, M. Huang, S. Wang, L. Yang, Y. Lin, W. Yu, Z. Pan, and Z. Ye, "Diastasis recti abdominis: A comprehensive review," *Hernia*, vol. 29, no. 1, Art. no. 222, 2025.

[17] Thabet and M. A. Alshehri, "Efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis: A randomized controlled trial," *Journal of Musculoskeletal & Neuronal Interactions*, vol. 19, no. 1, pp. 62–68, 2019.

[18] Chen, X. Zhao, and Y. Hu, "Rehabilitations for maternal diastasis recti abdominis: An update on therapeutic directions," *Heliyon*, vol. 9, no. 10, 2023.

[19] S. Gluppe, M. E. Engh, and K. Bø, "What is the evidence for abdominal and pelvic floor muscle training to treat diastasis recti abdominis postpartum? A systematic review with meta-analysis," *Brazilian Journal of Physical Therapy*, vol. 25, no. 6, pp. 664–675, 2021.

[20] L. A. Werner and M. Dayan, "Diastasis recti abdominis Diagnosis, risk factors, effect on musculoskeletal function, framework for treatment and implications for the pelvic floor," *Current Women's Health Reviews*, vol. 15, no. 2, pp. 86–101, 2019.

[21] L. J. Liaw, M. J. Hsu, C. F. Liao, M. F. Liu, and A. T. 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*, vol. 41, no. 6, pp. 435–443, Jun. 2011.

[22] J. Hu, J. Gu, Z. Yu, X. Yang, J. Fan, L. You, Q. Hua, Y. Zhao, Y. Yan, W. Bai, and Z. Xu, "Efficacy of standardized rehabilitation in the treatment of diastasis rectus abdominis in postpartum women," *International Journal of General Medicine*, vol. 14, pp. 10373–10383, 2021.

[23] M. Radhakrishnan and K. Ramamurthy, "Efficacy and challenges in the treatment of diastasis recti abdominis—A scoping review on the current trends and future perspectives," *Diagnostics*, vol. 12, no. 9, Art. no. 2044, 2022.

[24] M. L. Jessen, S. Öberg, and J. Rosenberg, "Treatment options for abdominal rectus diastasis," *Frontiers in Surgery*, vol. 6, Art. no. 65, 2019.

[25] S. Vesting, A. Gutke, M. Fagevik Olsén, G. Rembeck, and M. E. Larsson, "The impact of exercising on pelvic symptom severity, pelvic floor muscle strength, and diastasis recti abdominis after pregnancy: A longitudinal prospective cohort study," *Physical Therapy*, vol. 104, no. 4, Art. no. pzad171, 2024.

[26] H. Fei, Y. Liu, M. Li, J. He, L. Liu, J. Li, T. Wan, and Y. Li, "The relationship of severity in diastasis recti abdominis and pelvic floor dysfunction: A retrospective cohort study," *BMC Women's Health*, vol. 21, no. 1, Art. no. 68, 2021.

[27] Marques, L. Stothers, and A. Macnab, "The status of pelvic floor muscle training for women," *Canadian Urological Association Journal*, vol. 4, no. 6, pp. 419–424, Dec. 2010.

[28] "Effect of a postpartum training program on the prevalence of diastasis recti abdominis in postpartum primiparous women: A randomized controlled trial," *[Complete bibliographic details required for IEEE formatting]*.

[29] Abdullah, K. A. Rehman, B. Ahmad, M. K. Arshad, H. Saeed, M. A. Keen, A. Anwar, N. U. Saleem, U. E. S. Banatwala, Z. Bilal, and M. Shahzad, "Comparative efficacy of abdominal exercises and abdominal binding on diastasis recti abdominis reduction in postpartum women: A systematic review and meta-analysis of randomized controlled trials," *Physiotherapy Research International*, vol. 30, no. 2, Art. no. e70038, Apr. 2025.

[30] P. A. Preethi, K. Vijayalakshmi, S. Moses, K. Mathipriya, and V. Pavithralochani, "Effects of kinesiotaping along with abdomen and pelvic floor exercise on diastasis recti abdominis for postpartum women in normal delivery versus LSCS," *Biomedicine*, vol. 42, no. 1, pp. 143–147, Mar. 2022.

[31] N. Bigdeli, A. Yalfani, A. Doosti-Irani, and A. Qodrati, "An evidence-based comparison of rehabilitation strategies for diastasis recti abdominis in postpartum women: A systematic review and network meta-analysis," *Scientific Reports*, vol. 15, no. 1, Art. no. 39591, Nov. 2025.

[32] B. Chen, X. Zhao, and Y. Hu, "Rehabilitations for maternal diastasis recti abdominis: An update on therapeutic directions," *Heliyon*, vol. 9, no. 10, 2023.