

Original Research Article

Effects of Abdominal Exercises on Reduction of Diastasis Recti in Postnatal Women

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ABSTRACT

Background: Diastasis recti is condition in which the rectus abdominis muscle separates in midline at linea Alba, that can be seen in women during and after pregnancy. Specific therapeutic exercises and early initiation of treatment help to reduce the diastasis recti.

Objectives: To determine effects of abdominal exercises on reduction of diastasis recti in postnatal women.

Method: For this study pre post design was incorporated. A number of (N=40) female participants immediately after delivery with diastasis recti were selected. Diastasis recti were measured by using finger palpation technique and caliper technique.

Results: A total (N=40) participants selected in this study with an age from 18- 30 years. Total 30 participants included in this study. The result of finger palpation method, mean diastasis rectus at above umbilicus pre intervention was 2.733 ± 0.254 , post intervention was 1.800 ± 0.362 . Diastasis rectus at below umbilicus at pre intervention was 2.067 ± 0.172 , and post intervention was 1.233 ± 0.365 . Diastasis rectus by caliper technique at above umbilicus pre intervention was 25.3197 ± 0.8088 , post intervention was 21.8583 ± 0.8023 Diastasis rectus at below umbilicus at pre intervention was 21.9730 ± 0.9814 , and post intervention was 19.0093 ± 1.3659 .

Conclusion: The result of this study shows that abdominal exercises are very effective in reducing diastasis recti in early postpartum women and inter recti distance. And support the prescription of an abdominal exercise programme for postnatal women and useful in reducing complications of it.

Key words: Pregnancy, Postnatal period, Diastasis Recti, Abdominal Exercises.

INTRODUCTION

“Pregnancy” is considered as the most important phase in a women’s life. [1] There is beautiful line said by one of the poet, “In pregnancy there are two bodies, one inside the other. Two people live under one skin. Sometimes when you pick up your child you can feel the map of your own bones beneath your hands, or smell the scent of your skin in nape of her neck. This is most extraordinary thing about motherhood. Finding a piece of yourself separate and

apart that, all the same you could not live without.” Pregnancy is normal physiological process which is usually experienced by healthy women in her life. Mainly the pregnant or postnatal patient present with unique gender based clinical challenge for physical therapist. [2]

There are various anatomical and physiological changes that occur during pregnancy. Uterus increases from pre-pregnant size of 5 by 10 cm to 25 by 36 cm; it increases 5 to 6 times in size. By the end

of pregnancy, each muscle cell in the uterus increases approximately 10 times over its pre-pregnancy length. Once uterus expands upward and leaves the pelvis, it becomes an abdominal organ rather than the pelvic organ. In Connective tissue, ligaments connected to the pelvic organs are more fibroelastic than ligaments supporting to joint structures. [2,3] The abdominal muscles, particularly both sides of rectus are stretched to the point of their elastic limit by the end of pregnancy, leading to greater decrease the muscle's ability to generate strong abdominal contraction. [2]

In postnatal phase, the new mother's body begins its period of recovery and returns back to normal. The pregnancy process resulted in gradual change in body shape and functions, although in first few postpartum hours she may be thrilled with softness and relative fitness of her abdomen, which will land up into many complications postnatally. Most common complication faced by postnatal women is diastasis of rectus abdominal muscle. [4]

Diastasis recti is condition in which the rectus abdominis muscle separates in midline at linea alba. The diastasis is a gap between the recti abdominal muscle greater than 25 mm². Any separation larger than 2cm or 2 finger width is considered significant. It can occur above, below or at level of umbilicus. [1,2,4,5]

The causative factors for diastasis recti during pregnancy are increased level of relaxin, progesterone and estrogen hormones that causes soften of connective tissues and weakening of the linea alba [6,7] It's tendinous raphe coursing from xiphoid process to symphysis pubis and undergoes the influence of these hormonal changes. Coupled with hormonal softening of linea alba thus the continuously increasing stretch placed on the abdominal wall by growing fetus. As a result, amount of tension on an already weakened structure produces predisposition to separation and results in diastasis recti. [4,5,8,9]

The symptoms of diastasis recti are, women with diastasis recti usually perceive

no pain at rest, whereas discomfort, pain, corset instability and bulging of the abdominal wall are symptoms appearing during physical activities. Women may have a small percentage of pain when the diastasis recti is quite large, this may be in the (lower) back or within the abdominals. It is commonly seen in multiparous women, because the muscles have been stretched many times. In the later part of pregnancy, the top of the pregnant uterus is often seen bulging out of the abdominal wall. [10]

The risk factors of diastasis recti are age, women over the age of 35, high birth weight of child, multiple birth pregnancy, caesarean section, and excessive abdominal exercises after the first trimester of pregnancy, massive weight loss occurring spontaneously or after bariatric surgery, previous or repeated abdominal surgery. [10,11]

Boissonnault and Blaschak wrote one of the descriptive studies about diastasis recti. Their study examines the relationship between stage of pregnancy and incidence of diastasis recti with it. The condition is not exclusive to childbearing women but is seen frequently in this population. In one study, Boissonnault and Blaschak tested 89 women for the separation of the rectus abdominis muscles. The incidence in this study ranged from 0 % in non pregnant and first trimester women, 27% in second trimester and 66% in third trimester. One of interesting fact is that, 36% of women between 5 week and 3 months postpartum had observed continue to displacement of separation of diastasis recti. Another study done by Bursch, found a significant diastasis in 62.5% of postpartum women tested within 92 hours of delivery. [2,5]

Abdominal musculature plays a crucial role in trunk control and function. Compromise of abdominal musculature due to diastasis recti can diminish the mechanical control of abdomen and its function. This includes cosmetic defects, psychological discomfort (i.e. body image), physical discomfort such as low back pain, bulging of the abdominal wall, abdominal

wall weakness and reduced muscular abdominal strength. Limitations during physical activity such as trunk flexion, trunk rotation, trunk side bending, respiration difficulty and support of abdominal viscera. [4,6,10-12]

Diastasis recti can be corrected conservatively and surgically. In extreme cases, diastasis recti are corrected during the cosmetic surgery procedure known as an Abdominoplasty (commonly referred to as the 'Tummy Tuck'). [10] Conservative treatment includes functional daily activities, back care/lifting, Bracing, Tupler technique, Faradic Stimulation and Exercises. Exercises program during pregnancy and after childbirth are designed to minimize impairments or regain functions while women is preparing for arrival of baby and then caring of child. The physical and emotional stresses placed upon the body during pregnancy and labour has been so intense, that expecting an immediate reverse to pre-pregnancy state is unrealistic. Exercises are known to offering many physical and psychological benefits on body such as improve mental well beings, increased self esteem and enhance body image sense of control. It helps to maintain healthy body weight and avoid accumulation of fat in body. [1,8,13,14] Hammer and Hinterman [1998] published an article that described exercises and promote maternal health fitness and weight management during postnatal. [13] Studies had been shown that regular exercises prior to pregnancy, during the antenatal period and postnatal period help to reduce the risk of developing diastasis recti and reduce the size respectively and avoid chances of recurrence. So in this study, focus is given on strengthening and facilitation training of abdominal muscles to determine effects on reduction of diastasis recti in postnatal women. This will help to prevent complications and improve functional status.

MATERIALS AND METHODS

Participants were selected from IPD of Gynecology and Obstetrics from Pravara Rural Hospital Loni between ages ranged from 18 to 30 years. Total 40 participants were selected. Each participant was screened, initial by using simple selection proforma relevant to the inclusion and exclusion criteria. The inclusion criteria were postpartum women with vaginal delivery, diastasis recti higher than 2 finger width and willing to join in this research. Participants were not included with caesarean section, pregnant at time of study, recent abdominal surgery, presence of any condition associated with pregnancy like polyhydramnios, fetal microsomia, hypertension induced by pregnancy. Commonly acceptable test for diastasis recti abdominis were perform on each participant who fulfils the inclusion and exclusion criteria. [1]

Women were randomly included into group. Then they received abdominal muscle exercises program for 30min/day, 5 times/ week for period of 8 weeks.

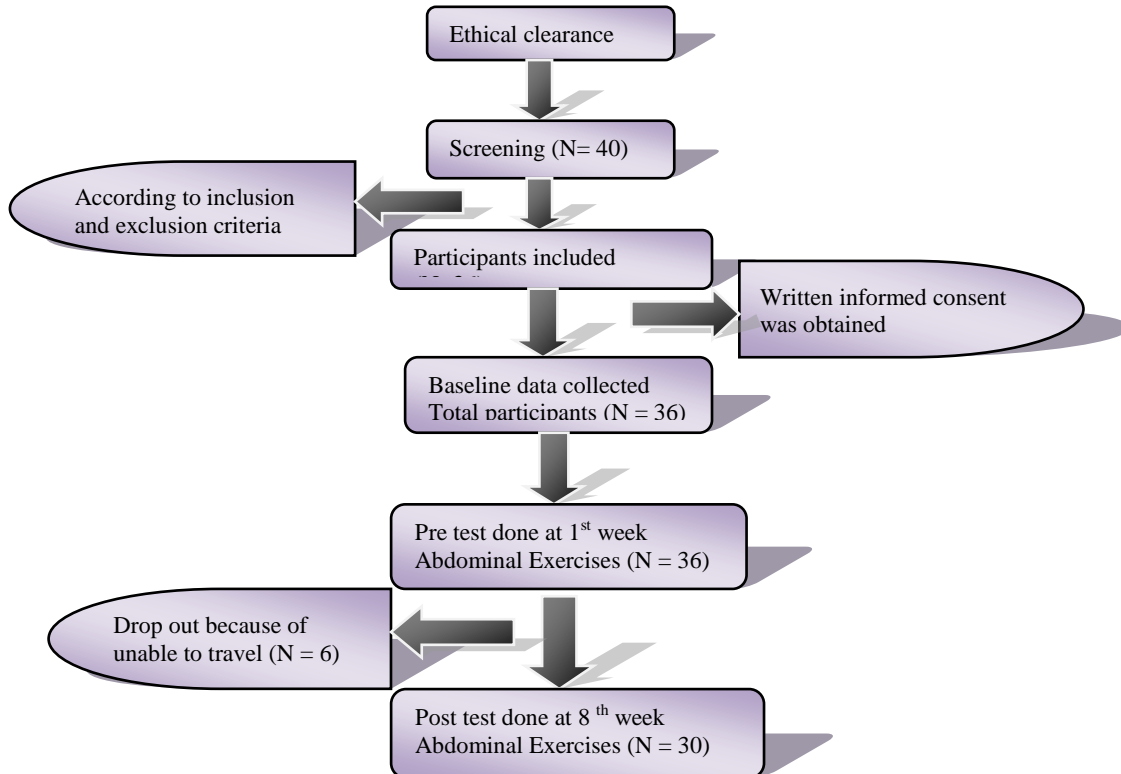
All the procedures involved in this study were illustrated to the participants and Consent forms were taken from the participants. Diastasis recti palpation and finger caliper methods were performed to check for Diastasis recti and inter recti distance.

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 were taken in, one being 2cm above umbilicus and 2cm below umbilicus. Three

trials were taken for each assessment and then mean was recorded. After completion of procedure participants were asked to

lower down the head and return to normal position. [1,2]

PROCEDURE:



Flow diagram showing the procedure used in the study

Inter recti distance was measured by Caliper Technique, the participants were in crook lying position with pillow beneath head and feet resting on plinth and arm along side of body. The desire measurement locations were marked with a water soluble pen, 4.5cm above the umbilicus midpoint and 4.5cm below the umbilicus midpoint. Each participant crossed the arms over the chest and raised the head until spine of scapulae was off the table surface. The participants were maintained partial curl up while examiner palpated the medial borders of right and left rectus abdominis muscle bellies at marked location. The inside measurement jaws of the digital nylon caliper, were positioned at the locations of palpating fingers, perpendicular to direction of muscles and adjusted to perceived inter recti distance width. The palpation and caliper measurement procedure were the

same for both measurement locations, above and below the umbilicus. Three trials were taken for each assessment and then mean was recorded. Once caliper measurement completed, participants were asked to return normal position and relaxed. [15,16] Participants were allowed to rest between measurements and were permitted to rest at any time if she feels fatigue.

Furthermore, subjects were taught a set of an abdominal exercise to correct their Diastasis Recti these included static abdominal exercises, head lift with posterior pelvic tilt exercise, pelvic clock exercise, double straight leg raising exercise, plank exercise and superman exercise.

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. [2,10,15]

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. [1,2,17]

Pelvic clock exercise: Participants were in crook line position with arm along the side. They were given instruction to visualize the face of clock on her lower abdomen. The umbilicus was 12 o'clock and pubic symphysis was 6 o'clock. Later participants began with gentle movements from 12 o'clock to 6 o'clock and from 3 o'clock (weight shifted to left hip) to 9 o'clock (weight shifted to right hip). Then in clock wise manner like from 12 o'clock to 3 o'clock, to 6 o'clock to 9 o'clock and back to 12 o'clock. Participants were on continuous relaxed breathing throughout the exercise. They were asked to visualize imagery of cutting the face of clock in half so that there was right and left side. Then participant moved her pelvis through arc on one side and back through the middle of clock and then moved the pelvis through the opposite side and again back through middle. It can be performed with clock wise or anticlock wise manner. [1,2]

Double Straight Leg Raising Exercise: Participants were in supine lying position with arm along side of body. Instruction was given to participants to slowly raise their both legs up as possible, but not more than 30cm of plinth. Position was maintained for few seconds and then participants were asked to slowly lower down both the legs and return to normal position. They were on

continuous breathing during whole exercise. [17]

Plank exercise: Participants were in front supported position resting on forearm with her shoulder directed over elbow, back and bottom in straight line position. Instructions were given to participants to draw in lower abdomen, straighten their legs out behind them and lift up their hip to form straight line from their shoulder to ankle. Participants were asked to balance themselves on their forearm and toes with their abdomen and back working together to keep their body straight. Position was maintained for few seconds and then lowers down your body and return to normal position. [18]

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. [18]

Data analysis

The results were analyzed on basis of data obtained pre and post intervention by using finger palpation method and caliper technique. Data was analyzed using Graph Pad Instat Trial Version 13.3. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as paired "t" test used for comparing the data within each group.

Demographics

A total (N=40) participants selected in this study with an age from 18- 30 years. A total 30 participants (according to exclusion and inclusion criteria) were taken. The participants were included in one group. For this study one group pretest-

posttest design was incorporated. The mean age of participants in group was 21.7 ± 4.97 (Table 1). The participants included with an age range from 18 to 30 year old. The mean BMI of 30 participants was 23.056 ± 4.425 (Table 1). In this study 43.3% female were primiparous and 56.6% were multiparous (Table 1).

The result of finger palpation technique shows mean diastasis rectus at above umbilicus pre intervention was 2.733 ± 0.254 and post intervention was 1.800 ± 0.362 (Table 2). After comparing within group it was observed that difference in pre and post intervention at above umbilicus was ($p < 0.0001$, $t = 14.000$, $df = 29$) considered to be significant. Diastasis rectus at below umbilicus at pre intervention was 2.067 ± 0.172 and post intervention was 1.233 ± 0.365 (Table 2). On comparing within group it was concluded that difference in pre and post intervention at below umbilicus was ($p < 0.0001$, $t = 15.0520$, $df = 29$) considered to be significant.

The mean difference of caliper technique shows diastasis recti pre intervention and post intervention values. Diastasis rectus above umbilicus pre intervention was 25.3197 ± 0.8088 and post intervention was 21.8583 ± 0.8023 . (Table 3) After comparing within group it was observed that difference in pre and post intervention at above umbilicus was ($p < 0.0001$, $t = 16.4852$, $df = 29$) considered to be significant. Diastasis rectus at below umbilicus at pre intervention was 21.9730 ± 0.9814 and post intervention was 19.0093 ± 1.3659 (Table 3). On comparing within group it was concluded that difference in pre and post intervention at below umbilicus was ($p < 0.0001$, $t = 11.5702$, $df = 29$) considered to be significant.

Table 1: Demographic parameters of participants

S. N.	Parameters	Mean	SD
1	Age [year]	21.7	4.97
2	BMI [kg/m ²]	23.058	4.425
No of participants		Frequency	Percentage
1	Primiparous	13	43.3%
2	Multiparous	17	56.6%

1 FINGER PALPATION TECHNIQUE:

Table 2: Pre intervention and post intervention values by finger palpation technique

S.N	Name of group	Pre intervention		Post intervention		t value	p value
		Mean	SD	Mean	SD		
1	Above umbilicus	2.733	0.254	1.800	0.362	14.0000	<0.0001
2	Below umbilicus	2.067	0.172	1.233	0.365	15.0520	<0.0001

2 CALIPER TECHNIQUES:

Table 3: Pre intervention and post intervention values by caliper technique

S.N	Name of group	Pre intervention		Post intervention		t value	p value
		Mean	SD	Mean	SD		
1	Above umbilicus	25.3197	0.8088	21.8583	0.8023	16.4852	<0.0001
2	Below umbilicus	21.9730	0.9814	19.0093	1.3659	11.5702	<0.0001

DISCUSSION

This study found that diastasis recti were significantly reduced after giving abdominal exercise in postnatal women.

We used two different techniques for evaluation of diastasis recti for this study, finger palpation and digital caliper. Finger palpation technique was used most often to measure the inter rectus distance. [19] Recently Mota et al shows that finger palpation has sufficient reliability to use in clinical practice. Another study done by

Cynthia M. Chiarello, stated that digital nylon caliper is reliable and valid tool for measuring inter recti distance. [16] Caliper can read the final friction of millimeter or inch in a simple line, and it is much less expensive and more affordable.

Those affected by diastasis recti should be concerned about functional issues because it causes greater impact on their daily activities. 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. [8] Increasing anterior abdominal dimension may alter angle of abdominal wall muscle attachment in sagittal plan and coronal plan, resulting in rectus abdominis muscle moving laterally rather than vertically across the torso. This alternation of aponeurotic and bony attachment changes the muscle line of pull and possibly their ability to produce torque, resulting in widening of linea alba. [20,21] 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. [10]

There is facilitation, concentric activation and stabilization of abdominis occurred due to these exercises. [1] All corrective exercises had been in form of pulling in an abdominal muscle rather than pushing of them outward. Number of experts suggested that strengthening or tightening of muscle can only be done through specific abdominal exercises. [10] To obtain improvement of muscle strength following abdominal exercises in study could be explained via adaptive changes in the muscle caused by exercises as metabolic capabilities of muscle are progressively overloaded. Muscle which is contractile tissue becomes stronger as result of hypertrophy of muscle fibers and increased recruitment of its motor unit. Also it has a profound influence of metabolic demand associated with producing a given muscle force causing increase in muscular endurance and power. [22] According to strengthening core control muscle of the abdominal region in postnatal period is very important as it helps in creating a muscular corset to support the spine and back. It decreases abdominal separation and alleviates muscle tension arising from repetitive physical movements like bending and lifting activities. Therefore it is

important to exercise these muscles regularly after delivery to regain strength and pre pregnancy shape. [7]

Most of the abdominal exercises are performed with exhalation and inhalation, because exhalation accompanying contracting of the abdominal muscles makes it possible to reduce intra abdominal pressure while exercising. [23] The improvement of muscle strength and decreased rectus separation could be explained via Worren et al and Ivanic et al, in which they reported that increased intra abdominal pressure that contributes to mechanical spine stability through the co activation of trunk flexors and extensors musculature. As abdominal contract increased pressure and converts the abdomen into rigid cylinder that increased stability of spine, improves abdominal strength and decreased abdominal separation. [22]

Abdominal exercises can help to bring the left and right sides of rectus abdominis muscle and won't cause extra stress on stomach or back. [20] Abdominal muscle strengthening exercises continue to be recommended during the postpartum period, particularly to reduce inter recti distance. This study shows co-relation with another study done by A.G Pascoal et al, stated that inter recti distance decreases during abdominal isometric contraction, suggesting that abdominal strengthening exercises contribute to narrowing of inter recti distance in post partum women. [8]

Muscle observed with exercises and may be explained by type of exercises instituted. Our study correlates with the another study which was done by Amel M Yussuf et al, which shows that posterior pelvic tilt exercise did not increase the amount of separation between 2 recti at upper or lower part of abdominis as well as not produce abdominal bulging when performed. Result of double straight leg raising exercise confirmed by the study of Wohlfahrt et al, who reported that slowly lift up to 30° and lower extended leg to bed can increase abdominal strength without

any harmful effects. [17] This study found that inter recti distance decreased while given abdominal exercises, suggested that abdominal strengthening exercise contributes to the narrowing of inter recti distance in postpartum women.

Diastasis management in post partum period has commonly concentrated on primary reduction of vertical stretch that is rectus abdominis. Additionally specific reduction of horizontal stretch that is transversus abdominis, serves to recover of elastic tissue creep and stretch weakness in both directions. Vertical and horizontal re education may be optimum management of gross diastasis since it suggest that transverse abdominis stabilizes the linea alba into which all abdominal musculature insert. [24] The rationally behind abdominal strengthening programme is the assumption that the contraction of all abdominal muscles will reduce the abdominal horizontal diameter in such a way that a horizontal force will be generated, which reduce the distance between of both rectus abdominis muscle particularly at level of umbilicus. However there is no evidence that this horizontal tension will produce an approximation of the rectus abdominis muscles. The horizontal force is result of overall action of deep abdominal muscles that is internal and external oblique and transversus muscle. These are attached anteriorly to lateral side of each rectus abdominis muscle and connected posteriorly to lumber vertebral column. Thus horizontal tension produce by deep abdominal muscles could pull the rectus abdominis muscle laterally towards the fixed sites on vertebral column and increased inter recti distance. [8,25] Few studies investigated that abdominal strengthening exercises included transverse abdominis muscle activation. It is deepest abdominal muscles and has strong facial links with rectus abdominis muscle and linea alba. Activation and exercises of transverse abdominis muscle draws the bellies of rectus abdominis muscle together, improve integrity of linea alba and increased facial tension, allowing efficient load

transference and torque production. Potentially transverse abdominis muscle activation could be protective of linea alba and may help to prevent or reduce diastasis recti abdominal muscle and speed up recovery, allowing women to return their usual physical and social activities more quickly. [11] The abdominal exercises should be carried out until the diastasis is reduced. While switching to more intensive exercises at beginning of session it is important to carry them slowly. So that rectus abdominis muscle become able to maintain their position counteracting against force pulling them sideway. Findings of our study correlates with Noble stated that proper therapy brings very good result just after a few weeks in majority of patients. [23]

The current study shows that a significant improvement in reduction of diastasis recti in postnatal women ($p < 0.0001$) after eight week of intervention. Abdominal exercises help in reduction of diastasis recti in early postnatal period and also help in strengthening the abdominal muscles.

CONCLUSION

The result of this study shows that abdominal exercises are very effective in reducing diastasis recti in early postpartum women. It helps to increase the abdominal muscle strength and restoring postpartum abdominal efficiency. This exercises could be effective in narrowing the inter recti distance, supporting the prescription of an exercise programme for prevention or reduction of diastasis recti in postnatal women and useful in reducing complications of diastasis recti.

Implications to practice

In the present study, participants benefited from abdominal exercises, as it showed significant results in eight weeks of intervention. All participants had better reduction in inter recti distance. Abdominal exercises were useful for reduction of diastasis recti. Hence, abdominal exercises can be used in clinical practice for cases of diastasis recti in postnatal women.

Limitations of the study

Although our findings were significant, a few limitations exist which require interpretation of results with some discretion. The limitations of the study were small sample size that is 30, so in future study more sample size can be incorporated and results can be more validated. Effects of severity on body weight of females were not considered. Both primiparous and multiparous females were included, isolation regarding number of deliveries was not done. In this study the inter recti distance was the only structural parameter.

Recommendations

Study should be conducted with large sample size and with long term follow up. Also future studies should aim at establishment of the long term effects of applying abdominal exercises in postnatal women. For further studies on diastasis recti many other regimes of exercises can be incorporated any effectiveness can be measured.

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