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Effectiveness of squatting along with abdominal exercises on diastasis recti correction in multiparae females: A comparative study

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Abstract
Aim and Objective: To study the effectiveness of squatting along with abdominal exercises in correction of diastasis recti in multiparae female patients.
Design: Comparative study.
Method: The present study was done to see the effectiveness of squatting along with abdominal exercises on correction of diastasis recti in multiparae females assessed using vernier caliper within age of 20 – 35 years. In this study, total 100 females were included with 50 subjects in each group. Group A were given abdominal exercises and group B were abdominal exercises with squatting exercises.
Analysis: Post data analysis shows the treatment given to group B (abdominal exercises with squatting exercises) was statistically more significant than group a (abdominal exercises).
Conclusion: Squatting with abdominal exercises is more effective in correction of diastasis recti in multiparae females.

Keywords: diastasis recti, squatting, abdominal exercises, multiparae females, vernier caliper

Introduction

Diastasis recti is an anatomical term describing an acquired condition in which the left and recti abdominis muscles have separated. In this condition, the overlying fascia becomes stretched mostly due to pregnancy or body habitus [1]. It is commonly seen in women during post- partum period (Roshan *et al*. 2016) [1].

Diastasis recti can be defined as "a condition in which the medial borders of the rectus muscles slowly spread apart with thinning and stretching of the rectus sheath, resulting in a diffuse bulge in the upper midline abdomen [2].

The Inter-recti distance or IRD is created by the stretching of the linea alba, a connective collagen sheath created by the aponeurosis (or tendon) insertions of the transverse abdominis, internal oblique, and external oblique [3]. The literature suggests that abnormal separation exists between the right and left rectus abdominis muscles when the IRD exceeds 2.5 cm [4].

The prevalence of diastasis recti during post-partum is 35% to 100%, in agreement with the international literature. Diastasis is present both above and below umbilicus.

- The grades of diastasis recti are as followed (Candido *et al*., 2005) [4]

1. non-DRA: seperation<2 finger breaths
2. Mild diastasis: seperation of 2-3 finger breaths
3. Moderate diastasis: seperation of 3-4 finger breaths
4. Severe diastasis: seperation 4 or more finger breaths

Subjects suffering from diastasis recti should be concerned about the functional issues, as it will have impact on daily activities. Abdominal muscles like internal and external obliques, transverses abdominis, rectus abdominis provide dynamic stability and fine control to the spine. When diastasis recti is no longer attached there altered co-contraction of these abdominal muscles. Thus, repair of diastasis recti gives better use of torso [5].

Abdominal exercises are given to correct the diastasis recti. Crunch-free Abs exercises by Liao, S. (2012) was given to both the groups [6].

Additional squatting exercises were given to group B [6].

Materials and Method

100 multiparae females were diagnosed with diastasis recti above and below umbilicus using vernier caliper.

Examination was performed with subjects lying on their back, knees bent at 90 degrees with feet flat, head slightly lifted placing chin on chest. With muscles tense, examiners then place caliper in the ridge that is presented. Measurement of separation width between left and right rectus abdominis is then noted using vernier caliper. The participants were then allotted the group by systematic random sampling method.

Group A were given abdominal exercises while group B were given abdominal exercises along with squatting exercises.

Following exercises were given to both groups:

Transversus abdominis: Inhale, and then as you exhale gently draw in your abdominal muscles. Hold this position for several seconds while breathing normally. Repeat 20 times, resting between each pull-in. This exercise included pelvic floor muscle contraction. It can be done in either side-lying, sitting or standing [6].

The abdominal hollowing exercise: During performing this

exercise, patient should be in supine lying position with knee flexed to 90 degrees. Patient is then asked to place both hands on abdomen below umbilicus and instructed saying as you breathe out, draw in your lower stomach muscles away from your hands and towards your spine. Hold up to 10 seconds and repeat 20 times. Don't hold breath during maintaining the contraction [6].

Pelvic tilting: During performing this exercise, patient should be in supine lying position with knee flexed to 90 degrees and shoulder length apart. This exercise activates the lower stomach muscles which supports the back and pelvis. The subject is then asked to hollow the abdomen and flatten back into bed as pelvis tilts. Hold position for 3-4 seconds and repeat this for 20 times. Keep breathing normally [6].

Head lift: During performing this exercise, patient should be in supine lying position with knee flexed to 90 degrees, feet flat, slowly lift the head, chin towards the chest such that lower angle of scapula is off bed and chin is touching chest. Concentrate on isolation of the abdominal muscles and prevent hip flexors from engaging. Hold position 3 seconds, Repeat 10 times [6].

Core contraction: During performing this exercise, the patient should be in sitting position. Subject is asked to place both hands on abdominal muscles, pulling them straight back towards spine as they take small controlled breaths. Breathing should be continuous while holding the contraction for 30 seconds, Repeat 10 times [6].

Seated squeeze: During performing this exercise, the patient should be in sitting position. Subject is asked to place one hand above belly button, and other below belly button. With midway starting point, patient is asked to pull the abdominals back towards the spine. Hold contraction for 2 seconds and return midway point with controlled breaths, complete 100 contractions [6].

Following are the additional squatting exercises given to group B

Squat against the wall: Patient is asked to stand with back against wall, feet out in front of the body, slowly lower body to a seated position such that knees are bent to 90 degree angle. While retaining back the standing position, contraction of abdominal muscles towards spine is advised, repeat 20 times [6].

Seated squeeze: This is a variation to the squat against wall where, small medium resistance ball (smiley ball) is place between the knees. Subject is then asked to squeeze ball with both knees while lowering the body to the seated position, repeat 20times [6].

Findings

The diastasis recti above and below umbilicus was measured using vernier caliper. The data was entered in an excel spread sheet, and subjected to statistical analysis.

Data was analysed with the help of figure Pad InStats®.Effect of abdominal exercises and effect of abdominal exercises with squatting in multiparae females analysed using

1. Paired t-test: To see the difference between pre and post measurements within the group.
2. Unpaired t-test: To analyse the difference between pre and post measurements between the group.

The results were concluded to be statistically significant if $p<0.05$.

Table 1: shows, abdominal exercises (above umbilicus) pre-treatment and post-treatment data analysed by paired t-test and shows extremely significant result with the p-value < 0.0001[t=26.635]

Parameter	Column A	Column B	Difference
Mean	4.578	3.752	0.8260

Table 2: shows, abdominal exercises (below umbilicus) pre-treatment and post-treatment data analysed by paired t-test and shows extremely significant result with the p-value < 0.0001[t=25.336]

Parameter	Column A	Column B	Difference
Mean	4.280	3.462	0.8180

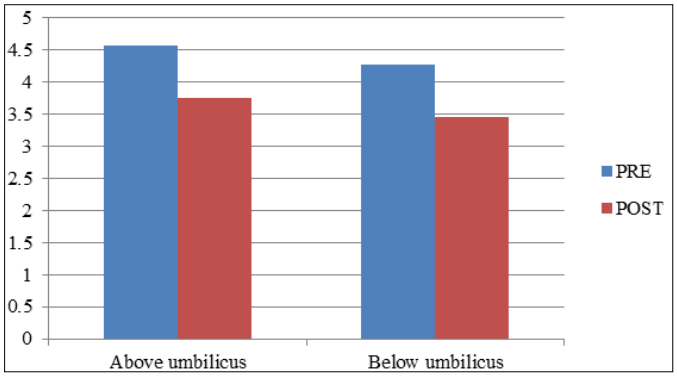

Fig 1: (a) shows pre and post data analysis of group A

Table 3: shows, abdominal exercises with squatting (above umbilicus) pre-treatment and post-treatment data analysed by paired t-test and shows extremely significant result with the p-value < 0.0001[t=14.417]

Parameter	Column A	Column B	Difference
Mean	4.478	2.772	1.706

Table 4: shows, abdominal exercises with squatting (below umbilicus) pre-treatment and post-treatment data analysed by paired t-test and shows extremely significant result with the p-value < 0.0001[t=11.740]

Parameter	Column A	Column B	Difference
Mean	3.940	2.600	1.340

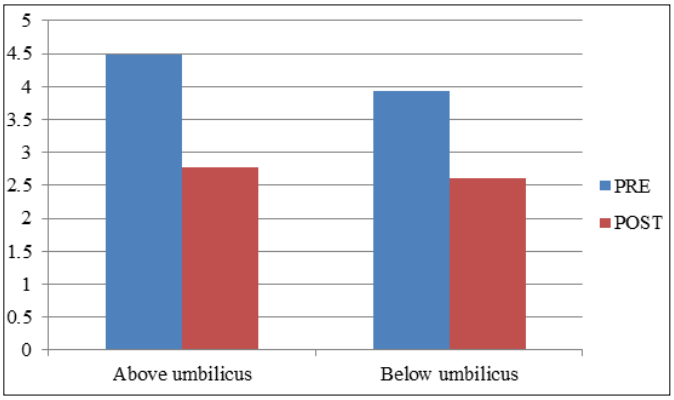

Fig 2: (b) shows pre and post data analysis of group B

Table 5: represents group A and group B post treatment data (above umbilicus) analysed by unpaired t-test and shows extremely significant result with the p-value < 0.0001[t=5.560]

Parameter	Column A	Column B
Mean	3.752	2.772

Table 6: represents group A and group B post treatment data(below umbilicus) analysed by unpaired t-test and shows extremely significant result with the p-value < 0.0001[t=6.002]

Parameter	Column A	Column B
Mean	3.462	2.600

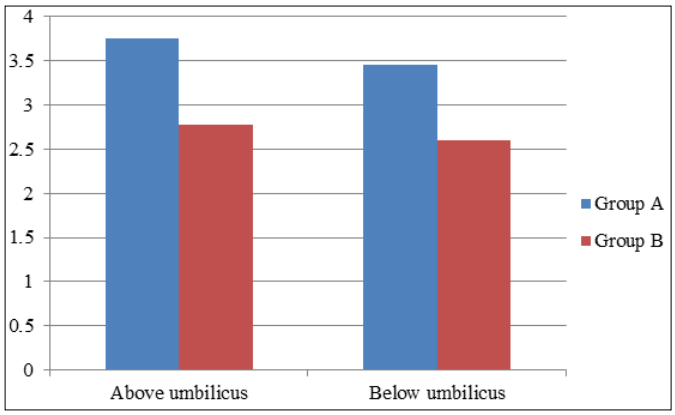

Fig 3: (c) shows post data analysis of group A and group B

Results

After analysis of data, we can see that the subjects receiving abdominal exercises and abdominal exercises with squatting, both showed significant improvement in correction of diastasis recti as compared with pretreatment data.

Our study has found out that, group B (Abdominal exercises with squatting) has shown significant improvement in diastasis recti correction as compared with group A (Abdominal exercises).

Discussion

The present study was done to see the effectiveness of squatting along with abdominal exercises on correction of diastasis recti in multiparae females. In this study total 100 females were included with 50 subjects in each group (abdominal exercises and abdominal exercises with squatting) within age of 20 – 35 years.

Boissonnault and Blaschak [7] reported a prevalence of 36% above the umbilicus and 11% below the umbilicus. Diastasis recti may be lower below the umbilicus because of the anatomical difference between the arrangements of the fasciae that cover the rectus abdominis. The formation of the rectus sheath is different according to the level of the abdomen wall. The change is located approximately midway between the umbilicus and the pubic symphysis and is marked by the arcuate line. Above the arcuate line, the sheath has an anterior layer (formed by the external oblique aponeurosis and the anterior lamina of internal oblique aponeurosis) and a posterior lamina (formed by the posterior lamina of the internal oblique aponeurosis and the transverse abdominal aponeurosis). Below the arcuate line there is only the anterior layer, formed by the respective aponeurosis of each of the three muscles. Thus, in the final portion of these muscles, the positions of the fasciae are different and prevent separation.

Crunch-free Abs exercises by Liao, S. (2012) [6] was given to the subjects. Group A subjects were given abdominal exercises and Group B subjects were given abdominal exercises along with two squatting exercises. Both groups were given exercises in supine, sitting and standing position.

Squatting was given as it is last progression position in pelvic floor muscles strengthening. Biomechanics of squatting (agonists: gluteus maximus, quadriceps; synergist : hamstring, erector spinae, adductor magnus (post fibres), gastronemius, soleus; stabilizers : transverse abdominis, multifidus, internal oblique, pelvic floor (deep abdominal muscles, close to the spine), rectus abdominis, external obliques.

Even if diastasis recti does not have symptomatic discomfort, it's correction is important because when the rectus muscles are no longer attached to each other in the linea alba or midline, they no longer contract effectively. Abdominal exercises show significant effect on diastasis recti but squatting along with abdominal exercises showed more significant effect on diastasis correction comparatively.

Conclusion

On the basis of statistical analysis, squatting with abdominal exercises is more effective in correction of diastasis recti assessed using vernier caliper in multiparae females. Thus, we conclude that there is significant effect of squatting in correction of diastasis recti in multiparae females.

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