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Postpartum Exercise Intervention Targeting Diastasis Recti Abdominis

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ABSTRACT

International Journal of Exercise Science 14(3): 400-409, 2021. To examine the effectiveness of an online, 12-week exercise intervention on diastasis recti abdominis (DRA) width and negatively associated health outcomes (i.e. weight and core function). Non-pregnant women who were 6-24 months postpartum and ≥ 18 years of age completed the study. Participants (n = 8) were randomized to intervention (exercise) or control groups; with the intervention group completing three exercise sessions per week virtually. Both groups completed three surveys at baseline, 6-weeks, and 12-weeks. DRA width was measured with nylon calipers at baseline and 12-weeks. Repeated measures analysis of covariance examined Group x Time changes in width of DRA, core function, and weight at 12-weeks; effect sizes (i.e. Cohen's d) were calculated. An alpha level of 0.05 was used to determine statistical significance. There was a significant Group x Time interaction for two DRA width measurement sites, 2 inches above navel (rest) (p = 0.007, d = 0.67) and 2 inches above navel (active) (p = 0.005, d = 0.69). The Group x Time interaction for weight approached significance (p = 0.06), with a small between group effect size (d = 0.23). The Group x Time interaction for core function was not significant (p = 0.83). Exercise interventions delivered in a virtual setting may be effective for decreasing the severity of DRA in postpartum women. Future research should investigate the impact of similar programs on other aspects of postpartum mental and physical health, activities of daily living, and clinical practice.

KEY WORDS: Online, physical training mediation, rectus diastasis, postnatal women, abdominal rehabilitation, maternal and child health, health promotion

INTRODUCTION

The postpartum period is a time in a woman's life that is marked by drastic physiological and psychological changes. Due to the expansion of the abdominal wall that occurs during pregnancy to accommodate the growing fetus, one of the most prominent physiological changes that persists in the postpartum period is a separation (or diastasis) of the rectus abdominis muscle. Diastasis recti abdominis (DRA) refers to the separation of the rectus abdominis muscle and is quantified by the inter-recti distance (12). The linea alba is a tendinous central fibrous tissue connecting the two parts of the rectus abdominis muscle and extends from the xiphoid process (base of sternum) to the symphysis pubis (groin area) (14). Ultimately, this structured network of connective tissue, along with the rectus sheaths, are vital in maintaining the stability of the abdominal wall. Various degrees of DRA separation may occur during pregnancy along the full length of the linea alba (14).

It has been suggested that DRA exists in 90% of non-exercising women in the early postpartum period (4) and is associated with negative outcomes related to core function, urinary incontinence, pelvic girdle/low back pain, and body dissatisfaction (4, 14). In many women these symptoms persist years into the postpartum period, significantly impacting quality of life. Though DRA heals on its own in some women, research suggests that approximately 60% of women have unresolved DRA that persists after the early postpartum period (~six weeks), thereby affecting quality of life well beyond childbirth (21). Moreover, as many as 39% of women are still affected by DRA at 6 months postpartum (16).

Causal factors for DRA are likely hormonally mediated or result from the mechanical effects of pregnancy on the abdominal musculature (4). The role of a woman's abdominal musculature is crucial during pregnancy and the postpartum period as it's tasked with trunk control and function. If proper interventions and biomechanical adjustments are not implemented and the abdominal musculature are compromised due to DRA, mechanical control of the abdomen and its functions may be inhibited. These include posture, trunk stability, respiration, parturition, elimination, trunk flexion, trunk rotation, trunk side bending, and support of the abdominal visceral (4).

Teaching postpartum women to 're-train' their movements, regulate intra-abdominal pressure, and strengthen these muscles/actions may be instrumental in preventing and/or healing DRA (4). Exercises teach women how to control their muscles and breathing so they may properly engage them during the rehabilitation process (14). Women who perform exercises specifically designed to engage the entire abdominal complex, including the transverse abdominis, may be able to retain the normal borders of the linea alba, thereby minimizing the width of existing DRA (4). A change in inter-recti distance has the potential to benefit the functional performance of the abdominal muscles in postpartum women (12). Despite this, evidence on the efficacy of targeted, education and exercise interventions on healing DRA in postpartum women is lacking.

Previously published research has been primarily geared towards defining the causes and correlates of DRA and issues related to DRA women face in the postpartum period (14, 21). Few studies have focused on the prevention and treatment of DRA through exercise (1). Notwithstanding this gap in knowledge, an alarming number of women experience some degree of DRA during the third trimester and into their postpartum journey. Previous exercise interventions have shown evidence supporting a reduction in DRA width (1); however, published data are limited. Existing studies are limited by lack of randomization, and none have evaluated the effects of a completely online intervention. Therefore, the purpose of this study is to examine the effectiveness of an online 12-week exercise intervention on DRA within a sample of postpartum women. A secondary aim of this study is to examine the effects of the intervention on body weight and core function.

METHODS

Participants

Non-pregnant women with diastasis recti abdominis (DRA) were recruited through word of mouth and social media. Participants interested in the study completed an eligibility questionnaire over the phone. Eligibility criteria included: 1) > 18 years of age, 2) 6-24 months postpartum after a singleton pregnancy, 3) no history of abdominal surgery/hernia (previous cesarean section were eligible), 4) not meeting aerobic physical activity recommendations (< 150 minutes per week), and 5) not endorsing any questions on the Physical Activity Readiness Questionnaire (PAR-Q). Participants endorsing any of the PAR-Q questions, were eligible to participate if medical clearance from their physician was obtained. Women were also asked (over the phone) to perform a self-assessment to identify whether they had significant DRA.

Protocol

Eligible participants were scheduled for a baseline measurement session that took place either at 1) the participant's home (in the Great Lakes Region, MI), or 2) The Bloom Method studio (in Boulder, CO). The Bloom Method is a pre- and post-natal fitness studio based in Boulder, Colorado, with a virtual platform that reaches women across the country. At the session, participants signed an informed consent document approved by the university's institutional review board, completed an online survey, completed physical measures (including measurement to confirm the presence of DRA), and were randomized to a 12-week intervention or control group. Randomization was achieved by a blind paper drawing, denoting "intervention" or "control" by each respective participant. This research was carried out fully in accordance with the ethical standards of the International Journal of Exercise Science (17).

The course of the study varied depending upon group assignment (intervention or control). In general, both groups were presented with goals of the study, received study materials and instructions for materials (i.e. any troubleshooting with the online studio or contact information). Online surveys and physical measures were completed at baseline and 12-weeks (post-intervention).

Participants randomized to the control group were asked to continue on with life as 'normal.' Upon completion of the study, they were given a free membership to The Bloom Method's online studio.

Participants randomized to the exercise intervention group received access to The Bloom Method's "online studio" (www.thebloommethod.com). For the purposes of this study, postpartum women had access to exercise teachings, breathing methods, and biomechanical techniques all targeted towards the prevention/healing of DRA. Throughout the 12-week study, participants were asked to complete three sessions per week on The Bloom Method's online studio, from their 'CoRehab' curriculum. The respective video prescribed each week focused on various core exercises, breathing techniques, and mindfulness teachings. Each video session was grounded in diaphragmatic breathing. As the participant inhales, air travels deeply to the lower abdominal region (i.e. belly should rise); on the exhale, participants contract abdominal muscles allowing for the release of air through pursed lips (i.e. belly moves to original position) (10). The aforementioned "belly breathing" was used as a foundation, built upon using mindfulness techniques to narrow in on their diastasis within the abdominal corset; isometric abdominal contractions, with further "focusing" contractions on the affected region of DRA, as well as integration of the pelvic floor muscles was heavily utilized within each session.

To aid in DRA healing, participants were asked to perform a wide range of exercise variations (mainly utilizing isometric holds). Including glute bridges, lying supine with feet planted and knees bent at a 90 degree angle, lift glutes while shoulders stay planted; planks, isometric holding at the "top" of a pushup position; leg raises/marches while in a glute bridge, drive a straight leg into the air, complete the aforementioned glute bridge with alternating (i.e. marching) planted feet; and dead bugs, lying supine with arms and legs, bent at a 90 degree angle, in the air – one side at a time, alternate controlled contralateral arm and leg lowering toward the ground. The overall goal of the exercises was to improve core function and strength. The videos increased in complexity as the participants progressed through the study. Free access to The Bloom Method's 'online studio' ceased post intervention for this group.

Participants self-reported their age, race, education, income, marital status, employment status, health status, parity (number of previous childbirths), months postpartum, and presence of chronic health conditions.

Height to the nearest quarter inch and weight to the nearest 1/10 kilogram was obtained at baseline by trained staff to calculate BMI as $kg \cdot m^{-2}$. Weight was measured at 12-weeks as well, in order to assess weight change.

Nylon digital calipers (Mitutoyo American Corporation) were used to determine the structural integrity of the linea alba (degree of DRA width). Measurements of DRA width, in mm, took place at the navel, 2 in/4.5 cm above the navel, and 2 in/4.5 cm below the navel in two phases (rest and active). 'Resting' measurements took place as the participant's arms were lying down by their side, with a pillow underneath the head (5). 'Active' measurements took place as the participant's arms crossed over the chest and their head raised until the spine of the scapulae was off of ground surface (5). Participants were also asked to report whether they had a health care provider diagnosis of DRA prior to enrollment (yes/no/not sure). All measurements were conducted by the trained principal investigator.

The International Physical Activity Questionnaire (IPAQ) was administered to assess self-reported days per week and time spent in moderate and vigorous physical activity, walking and sitting, separately in the past 7 days. Total minutes of moderate to vigorous physical activity was calculated.

The Unilateral Hip Bridge Endurance Test (UHBE) was used to measure core stability/functionality (2). This test required the participant to maintain a neutral pelvis in both the transverse and sagittal planes for as long as possible with one leg planted and one leg extended; any deviations (i.e. drop of pelvis from transverse plane) resulted in test termination.

The UHBE is appropriate for assessing muscle/neuromuscular control facets of core stability due to its activation of muscles that stabilize this area. Two trials of the test were performed (analyzing each leg planted); the average of both was used.

Statistical Analysis
Descriptive statistics included means and standard deviations or frequencies of key variables. Using SPSS software, repeated measures analysis of covariance examined Group x Time changes in width of DRA, core function, and weight at 12-weeks.

To determine the magnitude of change, within group and between group effect sizes were computed for each outcome. The within group effect size was calculated as d = (post mean – baseline mean) / (baseline standard deviation). The between group effect size was calculated as d = ([post mean – baseline mean for the intervention group] – [post mean – baseline mean for the control group]) / (pooled baseline standard deviation). Using Cohen's effect sizes (6), $d = 0.2$ was considered a small effect, $d = 0.5$ a medium effect, and $d = 0.8$ a large effect.

RESULTS

A total of 8 participants were randomized; 7 (88%) completed the study (i.e. had post-intervention data) and are included in these analyses. Table 1 shows the demographic characteristics of the participants. Participants, on average, were 35.6 ± 3.2 years old, were 13.8 ± 7.7 months postpartum, and had a baseline body mass index of 23.5 ± 4.1 $kg \cdot m^{-2}$. All participants were married, college graduates, and most were white (62.5%). Participants reported parities of one (62.5%) and two (37.5%), respectively.

Table 2 shows the adjusted baseline and 12-week means for DRA width, weight, and UHBE; along with the within and between group effect sizes. Results showed a significant Group x Time interaction for 2 inches above navel at rest ($p = 0.007$) and 2 inches above navel active ($p = 0.005$). The magnitude of the between group effects were medium in size ($d = 0.67$) and ($d = 0.69$), respectively, favoring the intervention group. The Group x Time interaction for weight approached significance ($p = 0.06$), with a small between group effect size ($d = 0.23$). Results showed no significant Group x Time interactions for the remainder of the variables; 1) at navel rest, 2) at navel active, 3) 2 inches below navel rest, 4) 2 inches below navel active. Ultimately, there was a change in the expected direction for UHBE scores in both groups, with the intervention group seeing more improvement; despite this, statistical significance was not reached.

Table 1. Demographic characteristics of the sample.

	n	Mean (SD) or %
Age, y	8	35.6 (3.2)
Months postpartum*	8	13.8 (7.7)
Parity		
1	5	62.5
2	3	37.5
Current BMI*	8	23.5 (4.1)
Marital Status		
Married/partnered	8	100.0
Race		
White	5	62.5
Non-white	3	37.5
Income		
<$25,000	1	12.5
$25,000-$100,000	0	0.0
$100,000-$199,999	5	62.5
>$200,000	1	12.5
Prefer not to answer	1	12.5
Education		
College graduate	8	100.0

Note: BMI = body mass index; *Indicates at study enrollment.

Table 2. Baseline to 12-weeks DRA width, weight, and UHBE.

	Intervention Group			Control Group			Intervention vs. Control	
	Baseline Mean (SD)	Post Mean (SD)	*d*	Baseline Mean (SD)	Post Mean (SD)	*d*	Group x Time (*p*-value)	*d*
Two inches above navel (rest)	31.2 (8.6)	26.9 (10.5)	-0.5	21.7 (7.4)	21.9 (7.5)	0.02	0.007	-0.67
At navel (rest)	33.2 (3.8)	34.1 (8.2)	0.25	28.5 (10.0)	27.9 (7.9)	-0.06	0.753	0.23
Two inches below navel (rest)	20.1 (9.3)	17.8 (7.3)	-0.26	25.7 (10.9)	21.2 (1.5)	-0.41	0.733	0.25
Two inches above navel (active)	29.2 (10.0)	24.4 (11.5)	-0.48	21.0 (6.4)	20.4 (6.6)	-0.02	0.005	-0.69
At navel (active)	28.9 (5.4)	30.8 (9.0)	0.98	27.0 (8.6)	25.4 (7.4)	0.1	0.432	0.69
Two inches below navel (active)	19.9 (7.8)	16.0 (7.6)	-1.06	24.6 (10.1)	19.9 (1.6)	-0.28	0.904	-0.69
Weight	145.3 (29.1)	139.0 (28.9)	-0.22	132.0 (31.3)	131.6 (31.4)	-0.01	0.059	-0.23
UHBE	67.8 (29.5)	90.7 (24.2)	0.32	50.0 (21.6)	68.4 (17.1)	1.85	0.83	-1.44

Note: UHBE = Unilateral Hip Bridge Endurance Test.

DISCUSSION

The role of postpartum exercise interventions targeting the improvement of DRA is understudied. The aim of this study was to understand the impact of a 12-week online exercise intervention on linea alba separation (DRA) in a sample of postpartum women. Results from this study suggest that an online exercise intervention may be an appropriate and effective means for reducing DRA in postpartum women.

In line with our findings, previous intervention research has also reported positive outcomes related to DRA healing. A study by El-Mekawy et al. (9), found that an abdominal exercise program that began the second day post-delivery, conducted 3 times per week, for 6 weeks (in addition to an at home routine) resulted in a significant decrease in inter-recti distance and an increase in abdominal muscle efficiency. Thabet and Alshehri (23), also reported a significant decrease in inter-recti separation following the use of a deep core stability exercise program plus traditional abdominal exercises, 3 times per week, for 8 weeks. Sheppard's (20), case study used progressive abdominal exercises for 16-weeks to improve strength and function of the core; this re-education of musculature facilitated closure of DRA by 88%. Finally, Mesquita et al. (15), found a mean decrease in DRA width after intervening with two one-to-one sessions at the 6- and 18-hour post-delivery window. This intervention included individualized abdominal and pelvic floor exercises delivered by a physiotherapist. The 6-hour intervention group reported a 13% decrease in DRA width, while the 18-hour control group had a 5% decrease in DRA width (15).

Improvements in DRA can be beneficial to a woman's activities of daily living and psychological wellbeing. Decreasing the severity of DRA separation may produce improvements in abdominal strength and endurance (13). Such improvements can directly impact a woman's ability to perform recurrent functional movements related to activities of daily living, vital for the survival of both mother and child. Targeting the abdominal corset directly may also deliver the means to ameliorate abdominal protrusion, which further improves the functionality of the core and may positively impact postpartum body satisfaction (3).

In our study, the magnitude of the effect in the intervention group was medium in size for two of the six locations along the linea alba (i.e. 2 inches above navel (rest), and 2 inches above navel (active)), suggesting this type of intervention can result in meaningful improvements in the severity of DRA. Increased mind-to-muscle connection (i.e. meaningful muscle activation) on the aforementioned two locations during belly-breathing and core exercises may contribute to the observed improvement, compared to other sites. Importance of activation and exercise of the transverse abdominis muscle has been noted, as it brings together the bellies of the rectus abdominus muscle, improving the integrity of the linea alba and increasing fascial tension, thereby reducing DRA at these areas (11). Thus, the finding of an improvement in some, but not all, locations along the linea alba showcases the potential for rehabilitation (11). Ideally, quality rehabilitation has the potential to positively impact DRA and associated outcomes in the postpartum period.

Our non-significant findings may be due, in part, to our method of DRA measurement. Previous research suggests that measuring linea alba integrity (i.e. depth), in conjunction with inter-recti distance (DRA width; our study's primary outcome), may be more comprehensively useful to determine the severity of pregnancy-related DRA (7). Dufour et al. (8), reported that accomplishing the aforementioned goal may be done through fascial palpation at 1) rest and 2) tension during a voluntary contraction of the linea alba or the use of ultrasound imaging. Unfortunately, we were unable to locate any DRA-specific exercise interventions that used both width and integrity outcomes. As a result, future interventions should consider assessing both DRA width and linea alba integrity to evaluate if exercise interventions may impart their healing effects through improving integrity in addition to reducing inter-recti distance.

A secondary outcome of our study was the effect of the intervention on participants' body weight. Our intervention had a small effect on body weight. Few postnatal exercise programs seeking to target DRA, specifically, have reported their effect on weight, making comparison of our findings challenging. However, a study by El-Mekawy et al. (9), reported participation in a postnatal exercise program produced a pronounced reduction in waist hip ratio. Postpartum body weight and body satisfaction have been identified as meaningful outcomes in the literature (18, 22). As a result, future exercise interventions targeting DRA should consider expanding measures to better ascertain their effect on weight-related outcomes.

In our study, core stability (UHBE score) did not improve among women randomized to the intervention group. As stated above, there was a change in the expected direction for core stability, however statistical significance was not attained. A comparison of this study's findings is difficult, due to a gap in knowledge pertaining to UHBE testing methodology and normative values (2). Coupled with no test or measure serving as the gold standard of measuring core functionality (19). Objectively measuring core stability is important for postpartum women and herein lies a potential for future research.

The findings from this study have implications for clinical practice. Strategies assessing severity of DRA separation and linea alba integrity, using established methods, should be incorporated within postpartum health care to determine whether DRA exists so women may receive appropriate referrals/care. Follow up on such care may also be appropriate and necessary. A program such as this could be recommended to promote rehabilitation after completion of out-patient physical therapy (if deemed appropriate). Our findings suggest that a completely online exercise program may be an effective treatment option, potentially improving accessibility for many women, for whom structured, group-based programs are not feasible.

Our study did have unique strengths that should be acknowledged. First the exercise intervention was delivered 'virtually' (online), which may be critical for widespread dissemination. Additionally, participants with varying months postpartum (i.e. 6-24 months) suggests a wide range of postpartum ages that may benefit from this type of program. Enrolling women after 6-months postpartum attempted to eliminate the body's physiological response to heal itself (to some degree) in the first 6-months postpartum as a confounding variable (16, 21).

Added methodological strengths include participant randomization and the inclusion of many objective assessments.

Some limitations should be considered when interpreting the findings of this study. First was the small sample size. Second, we did not assess linea alba integrity. Third, our sample was mostly white, and highly educated women, which limits the generalizability of our findings. Despite these limitations, the findings of our study add to the limited existing literature examining the effectiveness of an exercise intervention targeting DRA in postpartum women and provides preliminary evidence for the potential efficacy of a completely online intervention.

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