

Inter-rectus distance in postpartum women can be reduced by isometric contraction of the abdominal muscles: a preliminary case–control study

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Abstract

Objectives To determine the effect of isometric contraction of the abdominal muscles on inter-rectus distance in postpartum women.

Design Preliminary case–control study.

Setting Research laboratory.

Participants Ten postpartum women {mean age 30 [standard deviation (SD) 4] years; mean weight 58 (SD 7) kg; mean height 159 (SD 4) cm} and 10 nulliparous (control) women [mean age 28 (SD 2) years; mean weight 56 (SD 6) kg; mean height 160 (SD 6) cm].

Interventions Ultrasound images from the anterior abdominal wall were recorded at rest (supine position) and during an abdominal isometric contraction, with the subject actively performing an abdominal crunch (crook lying position). Two-way analysis of variance was used to compare the inter-rectus distance between groups (postpartum vs control) and between levels of abdominal muscle activation (rest vs isometric contraction).

Main outcome measures Inter-rectus distance 2 cm above the level of the umbilicus.

Results The inter-rectus distance was significantly greater in the postpartum group compared with the control group [14.7 (SD 3.1) mm vs 9.6 (SD 2.8) mm; mean difference 5.1 mm; 95% confidence interval (CI) 3.4 to 6.8]. The inter-rectus distance was significantly lower during isometric contraction compared with rest [10.7 (SD 3.1) mm vs 13.4 (SD 3.1) mm; mean difference 2.8 mm; 95% CI 1.2 to 4.5]. No interaction was found between group and muscle contraction.

Conclusions The inter-rectus distance was significantly higher in postpartum women compared with controls, and significantly lower during isometric contraction of the abdominal muscles (abdominal crunch) compared with rest.

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Keywords: Inter-rectus distance; Diastasis abdominis; Ultrasound scanning; Post partum; Abdominal strength exercises

Introduction

During the postpartum period, many women continue, or begin, abdominal strength exercise programmes in order to restore their figure and fitness. However, prescription of these abdominal exercise programmes in the postpartum period is not based on evidence, and very little literature exists about the effect of exercise on abdominal muscle morphology during and after pregnancy. It is recognised that pregnancy imposes substantial morphological changes on the

abdominal muscles, with implications for the functional capacity of women during the postpartum period [1,2]. The rectus abdominis muscles, which extend along the entire length of the anterior abdomen from the xiphoid process to the pubic symphysis, undergo changes during pregnancy. As the fetus grows, the bellies of the rectus abdominis muscles, connected by a fascia tendon, the linea alba, elongate and curve round as the abdominal wall expands, with most separation occurring at the level of the umbilicus [1,3,4]. This gap, called the ‘inter-rectus distance’, may vary from 2 to 3 cm wide and 2 to 5 cm long to 20 cm wide and extending along the entire length of both rectus abdominis muscles [2]. The augmented inter-rectus distance, often referred to as ‘diastasis rectus abdominis’ [2,3], is described as a change in the abdominal musculature, specifically in the linea alba

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and rectus abdominis sheath, with onset in the last trimester of pregnancy; the incidence of diastasis rectus abdominis peaks immediately after birth [2,3]. Although some studies have suggested that diastasis rectus abdominis could reduce abdominal integrity and functional strength, contributing to pelvic instability and back pain [1,5], to the authors' knowledge, no scientific evidence exists about the functional consequences of an increased inter-rectus distance, or about the effect of exercise on prevention and/or reduction of inter-rectus distance. The available evidence suggests that diastasis rectus abdominis is common immediately after birth, with spontaneous resolution during the postpartum period [2,6]. Partial resolution of diastasis rectus abdominis has been reported by 4 weeks [1] and 8 weeks [2,3] after birth. However, for many women, diastasis rectus abdominis does not resolve spontaneously during the postpartum period, or even months or years after birth [2,3].

Most postpartum women are encouraged to attend exercise programmes to restore their figure and fitness. The rationale behind abdominal strengthening programmes 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 muscles, particularly at the level of the umbilicus [7]. However, there is no evidence that this horizontal tension will produce an approximation of the rectus abdominis muscles. The horizontal force is the result of the overall action of the deep abdominal muscles (internal and external, oblique and transversus muscles), which are attached anteriorly to the lateral side of each rectus abdominis muscle [8] and connected posteriorly to the lumbar vertebral column. Thus, the horizontal tension produced by these deep abdominal muscles could pull the rectus abdominis muscles laterally towards the fixed sites on the vertebral column, increasing the inter-rectus distance.

Knowledge about morphological adaptations of the abdominal muscles in postpartum women, and the relationship between muscle structural changes and functional ability is required in order to develop specific abdominal strength exercise programmes for prevention or resolution of diastasis rectus abdominis in postpartum women.

The main aim of this study was to determine the effect of isometric contraction of the abdominal muscles on the inter-rectus distance in postpartum women. It was hypothesised that diastasis rectus abdominis in postpartum women would be reduced by abdominal isometric contraction.

Methods

Participants

Two groups of women were included in this study: the postpartum group ($n = 10$) and the control group ($n = 10$). The postpartum group included primiparous women who were less than 6 months post partum (one woman was 1 month post

partum, one woman was 2 months post partum, four women were 3 months post partum, two women were 4 months post partum and two women were 5 months post partum). All women in the postpartum group had healthy pregnancies and vaginal deliveries, with the exception of one woman who had a caesarean section. The control group included healthy nulliparous women.

All the participants were recruited from a private physiotherapy clinic and from among colleagues, friends and family. Only women who were able to perform the abdominal crunch exercise were eligible for inclusion in the study. Before participation, the researcher gave the subjects all the relevant research information (e.g. risks and benefits), orally and in written form, allowing them to make an informed decision about participation. Only women who signed a consent form were included in the study. The study was approved by the Scientific Council of the Faculty of Human Kinetics, Technical University of Lisbon.

Instrumentation and procedures

Ultrasound images in brightness mode (B-mode) were collected from the superficial abdominal musculature, including the rectus abdominis muscles and linea alba, using an ultrasound diagnostic scanner (Sonoline Prime SLC, Siemens, Erlangen, Germany) with a 60-mm linear array transducer at 7.5 MHz.

Images were collected with the abdominal muscles at rest (supine resting position) and during an abdominal isometric contraction, with the subject actively performing an abdominal crunch (crook lying position). The abdominal crunch started from the supine resting position, and the subjects were instructed to raise their head and shoulders upwards until their shoulder blades cleared the table and their fingertips touched their knees. Subjects maintained the crook lying position for 3 to 5 seconds for data collection.

During image acquisition, the transducer was placed transversely along the midline of the abdomen, with the lower border just cephalic to the umbilicus, approximately 2 cm above the centre of the umbilicus. In order to standardise the location of the transducer, an ink mark was drawn on the desired measurement location (2 cm above the umbilicus) with the subject in the supine resting position, knees bent at 90°, feet resting on the plinth and arms alongside the trunk. This measurement location has been used previously to measure the inter-rectus distance with ultrasound [2]. Although the greatest separation between the rectus abdominis muscles occurs at the level of the umbilicus, no measurements were made at this level due to technical difficulties with ultrasound. This is consistent with other ultrasound studies that have not reported measurements at the level of the umbilicus [2,9].

The transducer was positioned on the ink mark and moved laterally until the medial borders of both rectus abdominis muscles were visualised. Images were collected immediately at the end of exhalation, as determined by visual inspection of the abdomen, following the recommendations of Teyhen *et al.*

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