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Original article

Prevalence and risk factors of diastasis recti abdominis from late pregnancy to 6 months postpartum, and relationship with lumbo-pelvic pain

Patrícia Gonçalves Fernandes da Mota [a, *], Augusto Gil Brites Andrade Pascoal [a], Ana Isabel Andrade Dinis Carita [b], Kari Bø [c]

[a] Univ Lisboa, Fac Motricidade Humana, CIPER, LBMF, P-1499-002 Lisboa, Portugal
[b] Univ Lisboa, Fac Motricidade Humana, CIPER, BIOLAD, P-1499-002 Lisboa, Portugal
[c] Department of Sports Medicine, Norwegian School of Sports Sciences, Oslo, Norway

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ABSTRACT

Diastasis recti abdominis (DRA) is an impairment characterized by a midline separation of the rectus abdominis muscles along the linea alba. It has its onset during pregnancy and the first weeks following childbirth. There is scant knowledge on both prevalence and risk factors for development of the condition.

The aim of this study was to investigate the prevalence of DRA at gestational week 35 and three timepoints postpartum, possible risk factors, and the relationship between DRA and lumbo-pelvic pain.

Ultrasound images of inter rectus distance (IRD) were recorded in 84 healthy primiparous women, at three locations on the linea alba. The IRD was measured at: gestational week 35 and 6–8, 12–14, and 24–26 weeks postpartum. Diagnosis of DRA was defined as 16 mm at 2 cm below the umbilicus. Independent sample *t*-test and binary logistic regression was used to assess differences and risk factors in women with and without DRA and women with and without lumbo-pelvic pain. $P < 0.05$ was considered statistically significant.

The prevalence of DRA decreased from 100% at gestational week 35–39% at 6 months postpartum. No statistically significant differences were found in prepregnancy body mass index (BMI), weight gain, baby's birth weight or abdominal circumference between women with and without DRA at 6 months postpartum. Women with DRA at 6 months postpartum were not more likely to report lumbo-pelvic pain than women without DRA.

DRA is prevalent at 6 months postpartum, but is not linked with lumbo-pelvic pain.

1. Introduction

Diastasis recti abdominis (DRA) has been defined as an impairment characterized by the separation of the two rectus abdominis muscles along the linea alba (Axer et al., 2001). This increased inter rectus distance (IRD) may be present congenitally, but most commonly develops during pregnancy and in the early postpartum period (Boissonnault and Blaschak, 1988; Gilleard and Brown, 1996).

Studies have found that DRA may affect between 30% and 70% of pregnant women (Boissonnault and Blaschak, 1988), and that it may remain separated in the immediate postpartum period in 35%–60% of women (Bursch, 1987). However the condition has also been found in 39% of older, parous women undergoing abdominal hysterectomy (Ranney, 1990) and in 52% of urogynecological menopausal patients (Spitznagle et al., 2007). Reported prevalence of DRA or increased IRD varies and may be inaccurate due to different cut off points for the diagnosis (Bursch, 1987; Boissonnault and Blaschak, 1988; Gilleard and Brown, 1996; Rath et al., 1996; Chiarello et al., 2005; Spitznagle et al., 2007; Beer et al., 2009) and use of different measurement methods. Most prevalence studies are based on palpation (Bursch, 1987; Boissonnault and Blaschak, 1988; Mantle et al., 2004) or calipers (Boxer and Jones, 1997; Hsia and Jones, 2000) which may be less reliable than

* Corresponding author. Faculdade de Motricidade Humana, Universidade de Lisboa, Estrada da Costa, Cruz Quebrada, 1495-688 Lisboa, Portugal. Tel.: +351 934479492.
E-mail address: patimota@gmail.com (P.G.F. Mota).

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ultrasonography (Mota et al., 2013). To date there are few studies about the normal width of the IRD in postpartum women (Coldron et al., 2008; Liaw et al., 2011), and there is scant knowledge about risk factors for DRA (Benjamin et al., 2014).

There are some theories stating that failure to treat DRA successfully can lead to long term sequelae (Candido et al., 2005), including abnormal posture (Boissonnault and Blaschak, 1988), lumbo-pelvic pain and cosmetic defects (Candido et al., 2005). However, to our knowledge there are no high quality clinical studies to support these statements.

The aims of the present study were to investigate:

1. the prevalence of DRA at gestational week 35, and 6–8, 12–14, and 24–26 weeks postpartum;
2. possible risk factors related to the presence of DRA at 6 months postpartum;
3. whether women with DRA at 6 months postpartum have more lumbo-pelvic pain than women without DRA.

2. Methods

This was a longitudinal observational study following first time pregnant women from gestational week 35 till 6 months postpartum.

2.1. Participants

One hundred and twenty-three pregnant women agreed to participate in this study. Women attending pre-natal courses in the Lisbon area were referred to the study by community gynaecologists, physiotherapists, fitness coaches and nurses.

The participants were eligible for the study if they were first time pregnant and agreed to participate in four testing sessions. Exclusion criteria were any kind of conditions affecting the ability to perform daily-living activities or with symptoms that required medical attention e.g., high-risk pregnancies, stillbirth or delivery before gestational week 37, previous spinal or abdominal surgery and neuromuscular diseases. Subjects were also excluded if one of the 4 testing sessions was missed.

The study was approved by the Review Board of the University of Lisbon, Faculty of Human Kinetics. Written informed consent was obtained before participation and the rights of the participants were provided in verbal and written form following the Helsinki declaration.

2.2. Instrumentation and procedures

To assess DRA during pregnancy and postpartum we used a reliable ultrasound method (Mota et al., 2012).

Identification of possible risk factors related to the presence of DRA at 6 months postpartum was based in former published studies (Candido et al., 2005; Spitznagle et al., 2007; Beer et al., 2009; Liaw et al., 2011) and included: women's age, pre-pregnancy body mass index (BMI), weight gain during pregnancy, BMI at 6 months postpartum, hypermobility score, baby weight at birth, abdominal circumference in late pregnancy and level of exercise training.

Lumbo-pelvic pain (low back and pelvic girdle pain (Mørkved et al., 2007)) was studied to analyse whether women with DRA at 6 months postpartum have more complaints than women without DRA.

2.3. Ultrasound data collection

An ultrasound scanner (GE Logic-*e*) with a 4–12 MHz, 39 mm linear transducer was used to collect images in brightness mode (B-mode) of both rectus abdominis muscles and linea alba. All examinations were done by the same examiner. The investigator was a physiotherapist with specific training in image capturing and measuring IRD.

The transducer was placed transversely along the midline of the abdomen, at 2 cm below the umbilicus center. The measurement location was previously marked on the skin in order to standardize the position of the transducer (Mota et al., 2012).

Still images were collected immediately at the end of exhalation (Teyhen et al., 2008) with subjects in the supine resting position (knees bent at 90° and feet resting on the plinth, arms alongside the body).

The ultrasound images recorded at 4 time points of measurements (gestational week 35, 6–8 weeks postpartum, 12–14 weeks postpartum, and 24–26 weeks postpartum) were exported in Digital Imaging and Communications in Medicine (DICOM) format for further offline processing. The investigator was blinded to the subjects' identification and to the values of the IRD from previous examinations.

2.4. Inter-rectus distance measurement and cut-off point for diastasis recti abdominis

Analyses of 2D ultrasound distances were conducted offline by the same investigator, using a customized code made on specific software (Matlab, Image Processing Toolbox, Mathworks Matlab, USA). Mota et al. (2012) found ultrasound imaging and this procedure to be a reliable method to measure IRD with intra-rater Intraclass Correlation Coefficient (ICC) values above 0.90.

Using the definition of Beer et al. (2009) the cut-off value for DRA was set at IRD >16 mm at 2 cm below the umbilicus.

2.5. Anthropometric measurements

Anthropometric parameters included: 1) height (cm) and weight (kg), obtained according the International Society for the Advancement of Kinanthropometry (ISAK) protocol (Marfell-Jones et al., 2012); 2) and the abdominal circumference (cm) measured 2 cm below the umbilicus. The measurements were collected by the same anthropometrist accredited by ISAK, using an anthropometer and a large sliding caliper (DKSH, Switzerland), a calibrated precision scale (Seca Vogel & Halke, model 761 7019009, Germany) and an anthropometric tape (Rosscraft Innovations, Vancouver, Canada). Gestational weight gain and postpartum weight loss (obtained on the basis of reported pre-pregnancy weight) was calculated for each evaluation moment.

2.6. Joint hypermobility

Hypermobility was defined as four or more positive tests out of nine on Beighton scoring system (Beighton et al., 1973). The tests include 1) passive extension of each 5th finger past 90°; 2) passive apposition of each thumb to the forearm; 3) hyperextension of each elbow past 10°; 4) hyperextension of each knee past 10°; 5) and trunk flexion to allow palms flat on the floor (Beighton et al., 1973). The scoring system has an ICC of 0.75 for intra-observer and 0.78 for inter-observer reliability (Remvig et al., 2007).

2.7. Lumbo-pelvic pain

Low back pain was defined as localized pain in the L2-L5 area with and without radiation to the lower limb. *Pelvic girdle pain* was defined as pain located at the sacroiliac joints, unilaterally or bilaterally and at the pubic symphysis (Grotle et al., 2012). Pain location was assessed with the subjects pointing out the body area