DISSERTATION FROM THE
NORWEGIAN SCHOOL OF
SPORT SCIENCES
2023

Sandra Bjordal Gluppe

Diastasis Recti Abdominis – an issue postpartum?

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ISBN 978-82-502-0612-0

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"Incredible things can happen if enthusiasm is used as the motivation."

- Mom and King Olav V

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Acknowledgements

The present PhD project was performed at the Department of Sports Medicine, Norwegian School of Sport Sciences, Oslo, Norway, from 2018 to 2023. We gratefully acknowledge the Norwegian Women`s Public Health Association, fully funding this project. Hopefully, the results from this project can contribute to more attention to the field of women`s health and improved follow-up of postpartum women.

This PhD project would not have been possible without many people contributing in different ways. Especially I would like to thank all participating women. My sincere gratitude goes to all off you;

My main supervisor, Kari Bø, for daring to believe in me when I first came to your office (the rector's office at the time) and asked if you knew of any master's thesis projects on diastasis. I am deeply impressed by the hard work you have done and continue to do every single day in the field of women's health. You have encouraged me to work hard, deliver in time (almost), and be critical. I am forever thankful and hope we will keep in touch in the future. Co-supervisor and co-author of all papers, Anna Marie Ellström Engh, for helpful insight, constructive feedback, and manuscript contributions. I am inspired by the way you present your research field.

Kristina L. Skaug and Marte D. Gram, PhD-students at the Norwegian School of Sport Sciences, administrating the randomization process and follow-up of participants in the training group in study IV.

Morten Wang Fagerland, at the Norwegian School of Sport Sciences for your pedagogical statistical advice and guidance in all papers.

Bjarne Rud and Olivier Seynnes, at the Department of Physical Performance at the Norwegian School of Sport Sciences, for instruction and technical support with the Humac NORM dynamometer in study II-IV.

Celine and Henrik Warpe-Kinn at Fredrikstad Idrettsmedisin, and Kristin Benum and Frode Gabrielsen at Active Fysioterapi og Manuellterapi, for providing room for screening and testing of participants in study IV. Also, I am so grateful for being part of the fantastic working environment with so kind colleagues at Active Fysioterapi og Manuellterpi.

Collaborating health care clinics in the counties Oslo and Akershus, for providing participants for study I. Women`s health physiotherapists, other health care personnel, personal trainers, and influencers for helping to recruit eligible participants to all studies. As GDPR was introduced, the sharing of posts on social media has been an important way to recruit participants.

During this project, I have also been lucky to become part of the board of the Women`s Health Group of the Norwegian Physiotherapist Association. I feel so lucky to learn from all the fantastic and inspiring women in the board. What a job you all are doing for the field of women`s health!

Nina Theodorsen, I am so glad you also are a diastasis nerd. Thank you for conservations about diastasis, it is so valuable as you also have a lot of clinical experience in this field. I look forward to more collaboration in the future.

Jan Kåre Frøyen, a skilled surgeon, who let me hospitate on diastasis surgeries at Tynset Hospital. This was educational and many new reflections were raised after this visit.

A big thanks to librarians and Ingvild Gillerdalen at the Norwegian School of Sport Sciences for helping out with articles and printing posters.

"IIM 3-gangen", for providing a unique work environment filled with wisdom and support, and for sharing everyday work and life in general. Especially I have enjoyed all the social events with you, and hope these will continue in the future. Also, a special thanks to Nina Sølvberg for the "IIM-trim" and to Annett V. Stornæs for sharing the office and good friendship. Again, I special thanks to Kristina L. Skaug, you have increased my quality of life (in many ways!) during this period. In you, I have found a friend for life!

My friends, for your encouragement and friendship along the way. I am so lucky to have you as my friends and look forward spending more time (than the last 6 months) with you again. A special thanks to Trine and Linnea, who allowed overnight stays in Oslo after we moved to Nøtterøy. This had made my family, social, and work life easier in a hectic everyday life.

My dear family: Thank you so much for making it possible to conduct this PhD project. You have all been interested and supportive along the way, especially in helping with the children when needed. Lastly, my husband Kristoffer, and our three children, Teodor, Josefine, and Tobias. As my mom also has told me; I am not a PhD student/physiotherapist, I work as one. However, I am Sandra, a very proud and grateful wife and mother (although the last couple of months I actually was my job). I`m now looking forward to spending a lot more time with you (trolla mine). Kristoffer, thank you for not running away from me (although you run a lot), you have kept the wheels running in our family. I am so proud of you!

Nøtterøy, april 2023

Sandra Bjordal Gluppe

Summary

Background: Diastasis recti abdominis (DRA) is defined as an impairment with midline separation of the two rectus abdominis muscles bellies along the linea alba. It is a prevalent condition in the postpartum period with prevalence rates between 30 − 68% but there is limited research on how women perceive DRA, the immediate effect of abdominal exercises on DRA, and its associated risks and consequences. Furthermore, there is no consensus on the effectiveness of abdominal exercises in treating DRA.

Methods and aims: This doctorial project consist of four different studies that examined various aspects of DRA postpartum**.** Study I surveyed 460 primiparous women 6-8 months postpartum to investigate how DRA is perceived and prevalence of self-reported abdominal muscle strength and experience of protrusion. Study II assessed the immediate effect of eight abdominal muscle exercises on inter-recti distance in 38 parous women with DRA. Study III compared prevalence of pelvic floor disorders, low back, pelvic girdle, and abdominal pain and abdominal muscle strength in age and parity matched women with (n=36) and without DRA (n=36). Lastly, study IV was an assessor blinded randomized controlled trial with 70 women diagnosed with DRA 6-12 months postpartum evaluating the effect of an abdominal exercise program, containing head lift, curl-up and twisted curl-up, on inter-recti distance. Furthermore, the effect on other possible consequences related to DRA was investigated.

Results and conclusion: In study I concerns about postpartum abdominal appearance was reported in 73.3%. Almost 80% experienced weaker abdominal muscles than pre-pregnancy. Protrusion was reported in 20.9%. Significantly more women with protrusion (93.8%) reported weaker abdominal muscles than women without protrusion (75.7%). The most frequently reported treatments for DRA were exercises for the PFM (84.1%) and abdominal muscles (82.9%), which was mostly accessed via social media. Study II found a statistically significant immediate decrease in inter-recti distance during the exercises head lift, curl-up and twisted curl-up when compared to rest with mean difference in change to be 10.0 mm (95%CI 7.9-13.3), 8.7mm (95%CI 5.0-12.5), and 9.4mm (95%CI 6.3-12.5), respectively (measured 2 cm above the umbilicus). Study III found no difference in prevalence of pelvic floor disorders, low back and pelvic girdle pain between women with and without DRA. Significantly more women with DRA reported abdominal pain than women without DRA in the adjusted analyses (OR: 0.02, 95% CI 0.00 to 0.61, p=0.026). There was a significant difference in mean change between groups in maximal isometric strength at 30◦ (mean difference: −12.9 (95 % CI: −24.4, −1.5), p-value: 0.028). However, the adjusted analyses showed no difference in abdominal muscle strength

between groups. In study IV 70% of the women who underwent screening and believed they had DRA, did not meet the IRD inclusion criteria (>2.8 cm at rest). The exercise program was not effective in reducing IRD, with a mean change between groups at rest (2 cm above the umbilicus) of 1.24 mm (95% CI -0.83, 3.31). However, maximal isometric abdominal strength was significantly increased, in favour of the exercise group, with a mean difference in change between groups at 30◦ of 6.25 Nm (95% CI 0.47, 12.04) and at 10◦ 7.55 Nm (95% CI 1.94, 13.17). Also, the increase in muscle thickness for the exercise group was statistically significant (p=0.046) with a difference in change between groups of 0.58mm (95% CI 0.01 to 1.14). There was no significant difference between the exercise and control groups at post-test was in number of women reporting pelvic floor disorders, low back, pelvic girdle, or abdominal pain. At post-test 61% of the women in the exercise group and 43% in the control group reported improvement in DRA by the global rating of change scale (p=0.16). None of the participants in either groups reported worsening of the condition.

Sammendrag (Summary written in Norwegian)

Bakgrunn: Delte magemuskler, også kalt rectus diastase, defineres som en separasjon av de to muskelbukene til rectus abdominis langs midtlinjen av linea alba. Det er en utbredt tilstand etter fødsel med rapportert forekomst mellom 30-68%. Forskningen er begrenset på hvordan kvinner opplever rectus diastase, de akutte effektene av øvelser på inter-recti avstand og tilknyttede risikofaktorer og konsekvenser ved rectus diastase. Videre er det ingen konsensus om effekten av mageøvelser eller andre øvelser i behandling tilstanden.

Hensikt og metode: Dette doktorgradsprosjektet består av fire forskjellige studier som har undersøkt ulike aspekter ved rectus diastase etter fødsel. Studie I benyttet et spørreskjema hvor 460 førstegangsfødende kvinner 6-8 måneder etter fødsel svarte på hvordan rectus diastase oppleves, forekomst av selvrapprotert styrke i magemusklene og opplevelse av utbuling. Studie II vurderte akutt effekt av åtte øvelser for magemusklene på inter-recti avstand hos 38 fødende kvinner med rectus diastase. Studie III sammenlignet forekomst av bekkenbunnsplager, korsrygg-, bekkenledd- og abdominale smerte og styrke i magemusklene hos kvinner med (n=36) og uten rectus diastase (n=36). Studie IV var en randomisert kontrollert studie med 70 kvinner med rectus diastase 6-12 måneder etter fødsel. Effekten av et treningsprogram for magemusklene, bestående av hodeløft, curl-up og skrå curl-up, ble vurdert på inter-recti avstand og andre mulige konsekvenser relatert til rectus diastase.

Resultater og konklusjon: I studie I ble bekymringer om magen utseende etter fødsel rapportert hos 73,3% av utvalget. Nesten 80% opplevde svakere magemuskler enn før graviditeten. Utbuling ble rapportert hos 20,9%. Signifikant flere kvinner med utbuling (93,8%) rapporterte svakere magemuskler enn kvinner uten utbuling (75,7%). Den mest vanlige behandlingen ved rectus diastase var øvelser for bekkenbunn- (84.1%) og magemusklene (82.9%). Øvelsene ble funnet via sosiale medier. Studie II fant en statistisk signifikant akutt reduksjon i IRA under øvelsene hodeløft, curl-up og skrå curl-up sammenliknet med hvile med en gjennomsnittlig forskjell i endring på henholdsvis 10,0 mm (95% CI 7,9-13,3), 8,7 mm (95% CI 5,0-12,5) og 9,4 mm (95% CI 6,3-12,5), målt 2 cm over navlen. I studie III var det ingen forskjell i forekomst av bekkenbunnsplager, korsrygg- og bekkenleddssmerter mellom kvinner med og uten rectus diastase. Signifikant flere kvinner med diastase rapporterte abdominal smerter sammenliknet med kvinner uten diastase for de justerte analysene (OR: 0,02, 95% CI 0,00 til 0,61, p = 0,026). Imidlertid ble det funnet en signifikant forskjell i endring mellom gruppene i maksimal isometrisk styrke ved 30◦ (gjennomsnittlig forskjell: −12,9 (95 % CI: −24,4, −1,5), p-

verdi: 0,028). De justerte analysene viste imidlertid ingen forskjell i maksimal isometrisk styrke ved 30◦ mellom gruppene. I studie IV trodde 70% av kvinnene som ble undersøkt ved screening at de hadde rectus diastase, men de oppfylte ikke inklusjonskriteriene for inter-recti avstand (> 2,8 cm i hvile). Øvelsesprogrammet gav ingen signifikant effekt på reduksjon i inter-recti avstand, forskjell i endring mellom gruppene i hvile (2 cm over navlen) var 1,24 mm (95% CI -0,83- 3,31). Imidlertid økte den maksimale isometriske magemuskelstyrken til fordel for treningsgruppen, med en forskjell i endring mellom gruppene ved 30◦ på 6,25 Nm (95% CI 0,47-12,04) og ved 10◦ på 7,55 Nm (95% CI 1,94-13,17). Økningen i muskeltykkelse for treningsgruppen var statistisk signifikant (p = 0,046) med en forskjell i endring mellom gruppene på 0,58 mm (95% CI 0,01-1,14). Det ble ikke funnet signifikant forskjell mellom trenings- og kontrollgruppen ved post-test i antall kvinner som rapporterte bekkenbunnsplager, korsrygg-, bekkenledds- eller abdominale smerter. Ved posttest rapporterte 61% av kvinnene i treningsgruppen og 43% i kontrollgruppen at diastasen var forbedret sammenlignet med pretest (p=0,16). Ingen av deltakerne i noen av gruppene rapporterte forverring av tilstanden.

List of papers

This dissertation is based on the following original research papers, which are referred to in the text by their Roman numerals:

I. Gluppe, S., Ellström Engh, M., & Bø, K. (2022). Primiparous women's knowledge of diastasis recti abdominis, concerns about abdominal appearance, treatments, and perceived abdominal muscle strength 6-8 months postpartum. A cross sectional comparison study. *BMC women's health*, *22*(1), 428. https://doi.org/10.1186/s12905-022-02009-0

II. Gluppe SB, Engh ME, Bø K. Immediate Effect of Abdominal and Pelvic Floor Muscle Exercises on Interrecti Distance in Women With Diastasis Recti Abdominis Who Were Parous. *Phys Ther.* 2020 Aug 12;100(8):1372-1383. doi: 10.1093/ptj/pzaa070. PMID: 32302393.

III. Gluppe S, Ellström Engh M, Kari B. Women with diastasis recti abdominis might have weaker abdominal muscles and more abdominal pain, but no higher prevalence of pelvic floor disorders, low back and pelvic girdle pain than women without diastasis recti abdominis. *Physiotherapy.* 2021 Jun;111:57-65. doi: 10.1016/j.physio.2021.01.008. Epub 2021 Feb 13. PMID: 33691943.

IV. Gluppe S, Ellström Engh M, Kari B. Curl-up exercises does not decrease inter-recti distance but improve abdominal muscle strength in women with diastasis recti abdominis postpartum: a randomized controlled trial. Under review in *Journal of Physiotherapy*, 2023 Feb 17

Definitions

Adherence: A longer-term commitment to physical activity/exercise, such as maintaining an exercise regimen for a prolonged period following the initial adoption [1].

Diastasis recti abdominis: An impairment with midline separation of the two rectus abdominis muscles along the linea alba [2].

Exercise: A subset of physical activity that is planned, structured and repetitive, with a final or intermediate objective; the improvement or maintenance of physical fitness [3].

Multiparity: A woman who has given birth more than once [4].

Muscular strength: A health related component of physical fitness that relates to the amount of external force that a muscle can exert [3].

Nulliparous: A woman who has not given birth previously[4].

Parity: The number of times a woman has given birth to a fetus with a gestational age of 24 weeks or more, regardless of whether the child was born alive or was stillborn [4 5].

Physical activity: Any bodily movement produced by skeletal muscles that requires energy expenditure [3]. Total volume of physical activity includes duration (units of time), frequency (number of sessions per time unit), and intensity (duration x frequency x intensity)[6].

Postpartum period: The period that begins upon the delivery of the infant to 12 months after the delivery [7]

Primiparity: A woman who has given birth once [4].

Abbreviations

2D	two dimensional
ACSM	American College of Sports Medicine
BMI	body mass index
CI	confidence interval
DRA	diastasis recti abdominis
GRC	global rating of change scale
IAP	intra-abdominal pressure
ICC	intraclass correlation coefficient
IRD	inter-recti distance
MRI	magnetic resonance imaging
N	Newton
PFD	pelvic floor disorders
PFM	pelvic floor muscles
RCT	randomized controlled trial
SD	standard deviation
TrA	the transversalis muscle
VAS	visual analogue scale
WHO	the World Health Organization

Note regarding references in the background chapter:

In the background chapter references associated to the research field (diastasis recti abdominis) reflect the published literature up to 2018, when this PhD project was planned. References related to the research area published after the research started is included in the discussion chapter. Most of the theory chapters of this thesis were written prior to ChatGPT was introduced. ChatGPT was only used a few places to improve the grammar and academic English language.

Introduction

In 2018 numbers from the Medical Birth Registry of Norway showed approximately 56 000 deliveries in Norway [8]. During pregnancy and in the postpartum period there are several changes to the musculoskeletal system [9]. One highly prevalent condition is diastasis recti abdominis (DRA), with a reported prevalence of 60% and 32.5%, 6 weeks and 12 months postpartum, respectively [10]. For numerous women, it is an aesthetic concern[11] and to date, there is still no consensus on etiology, risk factors, consequences [12], and treatment methods [13]. Several theories exist with the absence of supporting evidence leading to "expert advice" and suggestions about what to do or not to do in the treatment of DRA [14-16].

During recent years there has been a strong emphasis on postpartum abdominal appearance and DRA in social media. A search on the search engine google.com, using the words "diastasis recti" and "exercise" yielded 278,000 hits. However, most of the recommendations on these sites lack references to research-based literature and randomized controlled trials (RCTs). Women`s health physiotherapists use exercises in the prevention and treatment of DRA [17]. In the literature, the exercise in-drawing with contraction of m. transversus abdominis (TrA) and mm. internal obliques has been recommended as a gentle exercise to reduce DRA, while curl-up has been discouraged in the postpartum period [13 18]. However, recent experimental research contradicts common clinical practice [19-22]. Current exercise guidelines encourage women to stay physically active and participate in exercise to maintain good physical and mental health during pregnancy and in the postpartum period [23 24]. In Norway, new mothers are encouraged to visit their general practitioner or midweek six weeks postpartum but there is no appointment with a physiotherapist covered by the public health care system. Pelvic floor disorders (PFD) with urinary and anal incontinence and pelvic organ prolapse, being the most prevalent conditions during pregnancy and postpartum, can be prevented and treated with pelvic floor muscle (PFM) training and is recommended for all women in the peripartum period [25]. Contradictory, for the abdomen, which also undergoes a major change during pregnancy, there were no national or international guidelines published up till 2018 regarding prevention or treatment for DRA. When initiating this PhD research project there was a critical need for studies to investigate risk factors, consequences, and treatments of DRA [13]. Moreover, given the immense attention on assumed consequences and treatment of DRA on social media platforms, it seems important to translate research findings into clinical practice.

Background

Diastasis recti abdominis (DRA)

DRA is defined as a separation of the two muscle bellies of the m. rectus abdominis along the midline of the linea alba[2]. The condition can occur during pregnancy, especially in the third trimester, and persist in the postpartum period[26-28].

DRA is not a new phenomenon but has received a huge amount of attention during the past years. A search on PubMed with a publication date limited up to 2018, when this PhD project started, with the following search term for DRA: "rectus diastasis" OR "recti diastasis" OR "diastasis recti abdominis" OR "rectus diastasis abdominis" OR "diastasis recti" gave 202 hits. Search with the same keywords in the database Web of Science yielded 144 hits, while the search database CINAHL yielded 59 studies identified. One systematic review and three RCTs were identified in the search database PEDro. A total of 79 studies on DRA were selected and form the theoretical basis for the background for the studies in this thesis.

Anatomy of the abdominal wall

Abdominal muscles

The muscles of the anterior and lateral sides of the thoracic cavity, described as the superficial abdominal muscles, include five, paired muscles; rectus abdominis, obliquus externus, obliquus internus, TrA, and pyramidalis [29]. The rectus abdominis muscle origin from the 5th-7th. costal cartilage and process xiphiodeus, attach to the crista pubica and the symphysis and its main function is flexion, either to tilt the anterior part of the pelvis backward, or by flexing the spine in a forward movement, as in a curl-up/crunch [30]. The external oblique muscle originates from the 5th to 12th costal cartilage and inserts at the linea alba, pubic tubercle, and anterior half of the iliac crest. The principal role of this muscle is to compress the abdominal viscera, thereby increasing intra-abdominal pressure (IAP). Additionally, this muscle contributes to trunk flexion and rotation [29 31]. The internal oblique muscle originates from the thoracolumbar fascia, anterior two-thirds of the iliac crest, or the iliac crest itself and inserts at the inferior borders of the 10th–12th costal cartilage, linea alba, and pectin pubis through the conjoint tendon. Its primary function is to provide support to the abdominal viscera, rather than serving as a primary mover [31]. Furthermore, the pyramidalis muscle can be observed in the inferior rectus abdominis [31]. An

observational study examining Western European female cadavers found that it was present in only 30% of the females [32]. Another observational study examined Greek cadavers and found a presence of the muscle in 93.8% [33]. Grey [29] stated that the pyramidalis function is to tighten the linea alba, but Lovering and Anderson [34] wrote that its function is unclear.

The abdominal muscles shift to aponeuroses that form the rectus sheath. The rectus sheath ensures that the muscles work together for movements of the ribcage, lumbar vertebrae, and pelvis [29]. In addition to the above-mentioned functions the abdominal muscles are described to have an important role in the second stage of labor, the expulsion phase, and also to give support during increased IAP [35]. IAP refers to the pressure within the abdominal cavity that is generated by the abdominal contents, including the organs and the abdominal musculature. The regulation of IAP is primarily controlled by the contraction and relaxation of the abdominal musculature where contraction leads to an increase in IAP and relaxation leads to a decrease in IAP [31]. However, the precise functions and interactions with IAP and the abdominal muscles are not yet fully understood [36].

Connection between the abdominal- and pelvic floor muscles (PFM)

The PFM, together with the ligaments and fascia in the pelvis, support the pelvic organs and regulate the openings in the pelvis [37 38]. They are composed of three layers of striated skeletal muscle and function as a coordinated unit [29]. The PFM contract both involuntarily and voluntarily. The voluntary contraction is characterized by a cranial lift and squeeze around the levator hiatus [39 40]. Vaginal delivery is a major risk factor for a weakening of the PFM [41 42]. A study reported that 52.2 % of women 1 week postpartum were unable to contract, or performed the PFM contraction incorrectly, but verbal instruction improved contraction ability in 73.6% of the women [43]. Studies have shown that the PFM and abdominal muscles co-contract in healthy individuals [44-47]. However, this natural response may be absent or delayed in individuals with weakened PFM, and co-activation of the PFM with abdominal muscle contraction cannot be assumed. However, contracting the PFM has been shown to always co-contract the abdominal muscles in several studies[48 49].

The linea alba

The tendon fibers of the rectus sheath cross the midline and are intertwined to form the linea alba [29]. Linea alba is described as a tendinous raphè, running from the xiphoid process to the symphysis and separating the anterior abdominal wall in two along the midline [29]. Lavin, et al. [50] aimed to study the effect of the first pregnancy on the connective tissue of the rectus sheath in

nulliparous (n=10) and primiparous (n=9). They found that the histological tissue samples during pregnancy were associated with more irregular elastic fibers, contained more water tissue, and reduced total collagen content. They conclude that their findings should not only be explained by stretching but indicate a remodeling process in the tissue postpartum [50]. The collagen fibers of the linea alba show the same structure as the ventral abdominal muscles with longitudinal and oblique (both directions) fibers [51 52]. An observational study by Axer, et al. [53] found a clear three-dimensional structure, a "mesh", of the passage of the collagen fibers in the tendon`s three different layers from dorsal to ventral, as well as in regions of the tendon from cranial to caudal. The ventral layer seemed to contain the most oblique collagen fibers, while the middle layer mainly contained longitudinal collagen fibers and a more equally distributed pattern in the dorsal layer of the linea alba. Subgroup analyses of females and men showed that women on average had a thinner and wider linea alba, measured below the umbilicus. In the nulliparous women, the orientation of the fibers where more similar to the males. In addition, a higher proportion of transverse fibers than oblique fibers were found in women compared to men (60% vs 37.5%). Based on this, the authors summarize that the "mesh" of the linea alba and the rectus sheath seems to adapt when exposed to stretch and increased IAP, such as during pregnancy [51 53]. Grassel, et al. [52] supports the proposed model by Axer, et al. [53]. In addition to the collagen fibers directions, collagen fiber types have also been studied. A case-control study comparing women with and without DRA found low levels of collagen type I and III in the aponeuroses of linea alba. Collagen types I and III have an important role in providing support and resistance [54].

Up till 2018 studies differs in the report of the normal width of linea alba for the general population [53 55]. Axer, et al. [53] found that the average width of linea alba, the so-called inter-recti distance (IRD), was 21 mm, measured at the level at the umbilicus in 12 women and male cadavers (average age 78). Beer, et al. [55] measured IRD by ultrasound in 150 nulliparous women and reported normal width of the linea alba up to 15 mm by proc. xiphoid, 16 mm 2 cm below the umbilicus, and 22 mm 3 cm above the umbilicus.

Abdominal and umbilical hernia

Pregnancy can contribute to the development or visibility of a pre-existing hernia due to the gradual increase in IAP, and a study found a postpartum prevalence of 0.08% [56]. An umbilical hernia is defined as a defect in the midline of the abdominal wall, specifically from 3 cm above to 3 cm below the umbilicus. It is a condition in adults, with a worldwide prevalence of 2% [57 58]. A study reported that giving birth to 5 or more children was associated with hernia [59] and another study reported that women who have undergone surgery for a hernia before becoming pregnant

have a high risk of developing another hernia postpartum [60]. Also, children from zero to three years old may have an incomplete closure of the abdominal wall fascia with or without an umbilical hernia. An umbilical hernia is classified as a "true hernia" and not a DRA[61]. Although it may sometimes be confused, DRA is not the same as a hernia, but it can be surgically treated with the same techniques [62].

Measurement methods to assess DRA

Measurement methods

DRA is diagnosed by measuring the distance between the median borders of the two rectus abdominis bellies, the so-called IRD [27]. A systematic review aimed to identify the best methods to screen for DRA presence and monitor DRA width [63]. Measurement methods in use are palpation, caliper, ultrasound, and CT/MRI [63].

Palpation

Palpation is the most commonly used assessment method in clinical practice [17]. When measuring the IRD with palpation, the assessor counts the number of finger widths that can be placed horizontally between the two muscle bellies of m. rectus abdominis. In some studies, the number of finger widths has been converted to cm, where one finger width was set to 1.5 cm [64 65]. In addition, measuring tapes can be used during palpation and the distance is given in cm [64 66]. Palpation has shown to be valid for diagnosing whether DRA is present or not, but not precise to assess change in cm/mm in women with DRA with intra and inter-tester intraclass correlation coefficient (ICC) of 0.7 and 0.5, respectively to assess IRD [63 67]. It has been concluded that palpation is a valuable measurement method due to its inexpensiveness and available for daily clinical practice [63]. However, for the scientific purpose, it is not precise enough.

Caliper

The caliper is placed between the m. rectus abdominis bellies and IRD is read digitally or manually on a millimeter scale. Three of the included studies in the review of van de Water and Benjamin [63] evaluated caliper and found a co-variation between calipers and ultrasound for measurements above the umbilicus with Pearson's r of 0.66 and ICC of 0.79. Test-retest reliability of calipers has shown ICC values between 0.93 – 0.95. The systematic review by van de Water and Benjamin [63] concluded that caliper is a reliable method for measurements above the

umbilicus, and is recommended as a replacement for palpation. Further, they highlighted that calipers are easy to use in the clinic, but that more research is warranted [63].

Ultrasound

During an ultrasound examination, ultrasound is sent into body organs, such as musculature. The ultrasound is reflected by the so-called Doppler effect and a converted image is sent to the computer[68]. This method is considered to be a more reliable measurement method than palpation and caliper based on studies showing the best intra- and inter-tester reliability with ICC > 0.9 [69]. A study that included 20 postpartum women with DRA (≥ 2 finger widths) concluded that ultrasound is a reliable measurement method for measurements taken at the level of the umbilicus and above the umbilicus by an examiner with good experience [70]. Compared to palpation and caliper, ultrasound is more time-consuming, expensive, and not often used in clinical practice [20 63].

CT/MRI

Magnetic resonance imaging (MRI) and computed tomography (CT) are both examination methods that are used to produce images of soft tissue, such as muscle. The difference between the examination methods is that MRI uses radio waves while CT uses X-rays, and both methods are contraindicated during pregnancy [71]. Three of the included studies in the systematic review by van de Water and Benjamin [63] used MRI or CT to evaluate DRA. One of the studies compared measurements made during surgery with a tape measure to measurements from CT images before an operation. There was very low agreement between these two measurement methods, with ICC values between 0.00-0.16 [66]. van de Water and Benjamin [63] concluded that it is insufficient data to be able to assess whether CT and MRI are reliable and valid measurement methods for DRA. In addition, they highlighted that these methods are unfeasible in clinical practice. We have not identified reliability studies on CT/MR on IRD.

Diagnose of DRA

Normal values of IRD

There is an absence of studies that have investigated reference values for normal IRD among nulliparous women [11 72]. Up to 2018, we have identified only three studies that have identified normal values for IRD and proposed cut-off values for diagnosing rectus diastasis based on these values. All three studies measured IRD with different measurement methods (caliper, ultrasound,

and CT). Two studies focused on nulliparous women[55 72], while one study investigated cadavers and radiological images of both genders[73]. Hence, further investigations are needed to determine when DRA should be considered pathological [74].

Cut-off value, measurement location, and measurement position

There is no agreement in the cut-off point for diagnosing DRA [11 63]. Studies use different measurement methods, measure at different locations along the linea alba in different positions and use different cut-off values. Examples are the studies by Bursch [75], Boissonnault and Blaschak [26], and Sperstad, et al. [10], who all defined DRA as IRD >two finger widths measured during a modified sit-up at the umbilicus, 4.5 cm above and 4.5 cm below the umbilicus. Noble [14] used a cut-off value of ≥three finger widths measured during a modified sit-up but did not specify the location. Gilleard and Brown [35] and Candido, et al. [64] set cut-off values of >1.5 cm and >2.5 cm, respectively, measured at the umbilicus during a modified sit-up. Chiarello, et al. [76] used a digital caliper and set a cut-off value of >2 cm measured at the umbilicus. Mota, et al. [77] measured IRD with ultrasound and set a cut-off value of ≥1.6 cm, measured 2 cm below the umbilicus.

Several studies have shown the highest prevalence of DRA measured at the umbilicus [10 26]. Based on variation in where IRD is widest, it is recommended to examine along the entire linea alba to identify and diagnose DRA [15]. Reliability coefficients are poorer for measurements below the umbilicus than above the umbilicus, with an ICC value of 0.50 below the umbilicus [63 77]. In addition, studies have compared measurements of IRD at rest to active muscle contraction, such as during a modified sit-up, showing significantly narrower IRD during active muscle contraction in postpartum women [19 78]. Therefore, different locations and measurement positions may affect the diagnosis of DRA.

Classification

According to Ranney [79] DRA is classified as mild if IRD is greater than 1 cm, but less than 3 cm. Moderate DRA falls within the range of 3 to 5 cm, while significant DRA is 5 cm or greater. However, Ranney's system does not specify the method of measurement. Noble [14] defined normal IRD as one to two finger widths, while an IRD of three finger widths or more requires special follow-up after childbirth. In Candido, et al. [64] DRA severity was classified according to Ranney's criteria. Both studies considered DRA significant if IRD was more than 5 cm, but Candido, et al. [64] classified DRA as mild if IRD was between 2.5 to 3.5 cm, or if there was a visible protrusion with IRD less than 2.5 cm. DRA was classified as moderate if IRD was

between 3.5 to 5 cm. The term protrusion, also described as bulging, is poorly described in the literature and may have been interpreted differently in studies. Akram and Matzen [11] wrote that protrusion during physical activity is considered an important sign of a more severe DRA. Lee and Hodges [21] observed that the linea alba bulges outward or "sagged" inward when IAP increased, during an automatic curl-up, but TrA activation reduced this in some patients.

To summarize, up to 2018, there is no consensus of when IRD is classified as pathological and no agreement of a normal IRD [11]. The use of different cut-off values makes it very difficult to compare results from different studies.

DRA Etiology

The exact etiology of DRA in postpartum women is not fully understood [13], and there are likely multiple factors that contribute to its development. Some of the factors that have been suggested to play a role in the development of DRA include increased IAP during pregnancy and delivery. The growing uterus and fetus during pregnancy can put pressure on the abdominal muscles, fascia, and the linea alba, which may lead to a separation of the rectus abdominis muscles [16 35 80]. In addition, hormones like relaxin have been proposed to cause the connective tissue to become laxer, which may contribute to the development of DRA [27 81 82]. Relaxin has been suggested to be related to collagen remodeling which increases during early pregnancy, lasting at this level till late pregnancy, and then reaching a state where the hormone cannot be detected through serological testing in the first days postpartum [83]. Although not studied in abdominal muscles/linea alba/DRA, several studies have investigated whether there is an association between relaxin levels and pregnancy-related pelvic girdle pain [84]. The systematic review concludes with low level of evidence that relaxin loosens the pelvic ligaments and increases instability [84]. Other factors that have been suggested to contribute to the development of DRA are genetic factors, "poor posture", and impaired abdominal muscle strength [14 15]. However, to the author`s knowledge, there was no evidence published up till 2018 to support these factors.

Prevalence of DRA

DRA affects a significant number of women during pregnancy and in the postpartum period [2]. In addition, the condition has been reported to be present in postmenopausal women, men, and infants (see abdominal and umbilical hernia, page 4-5). Spitznagle, et al. [65] studied 547 women (mean age 52.5 years) attending a university-based urogynecological medical practice, seeking evaluation for pelvic floor disorders, and compared women without DRA to women with DRA.

They found that a higher percentage of women with DRA were postmenopausal. Lockwood [85] found a prevalence of DRA in men and suggested that extra-abdominal fat deposits and age might be the cause. Research on DRA related to men and women after menopause is limited and out of the scope of this PhD project and will therefore not be further described.

During pregnancy

In the 3rd pregnancy trimester, the prevalence of DRA has been reported to vary from 66% to 100% [26 28 86]. Most women are reported to develop DRA during the third trimester [15 26], but the condition has also been found to gradually develop from gestational week 14 [35]. Sperstad, et al. [10] measured DRA with palpation and found that at gestational week 21, 33.1% of women had a DRA. Due to the use of different assessment methods in presented studies and a limited number of studies on prevalence during pregnancy, more studies are warranted in this population.

Postpartum

In the postpartum period, there is a spontaneous remission of the DRA with a reduction in prevalence described to be greatest from the first day to 8 weeks postpartum [26 27]. Measurements taken immediately after birth have shown a prevalence between 53% and 68%, measured 2 cm above the umbilicus [87 27]. Mota, et al. [28] and Sperstad, et al. [10] reported a prevalence of 52% and 60%, respectively, measured 6 weeks postpartum. Six months postpartum, the prevalence of DRA has been reported to be 39.3% [28] and 45.4% [10]. In a longitudinal study by Sperstad, et al. [10] 300 primiparous pregnant women at Akershus University Hospital in Norway were investigated. They found an additional reduction in the prevalence of DRA to 32.6% at 12 months postpartum. Although Sperstad, et al. [10] included a large sample of 300 women, they used palpation as a measurement method. Further studies with a large sample using ultrasound are warranted to achieve a more accurate picture of the prevalence of DRA in the postpartum period.

Risk factors for DRA

Nine studies published between 1999 and 2018 were found studying risk factors, both during pregnancy and in the postpartum period [10 64 65 74 80 87-90]. Proposed risk factors in studies on DRA are presented in the following.

Pre-pregnancy weight, weight gain during pregnancy, body mass index (BMI) and waist circumference

If a considerable amount of stretching of the abdominal muscles, connective tissue, and the linea has an impact on the development of DRA, factors leading to a larger waist circumference may also become a risk of developing DRA. Therefore, other weight-related factors have also been investigated, such as pre-pregnancy weight, weight gain during pregnancy, and BMI. Waist circumference over 102 cm was found to be a predictor for increased IRD in the study by Chiarello, et al. [90], but Mota, et al. [28] did not find this. In addition, Mota, et al. [28] reported that neither BMI before pregnancy and BMI 6 months postpartum, weight gain during pregnancy, nor the baby's birth weight was associated with DRA. These findings are supported by Sperstad, et al. [10] who reported no association between DRA and pre-pregnancy weight or weight gain during pregnancy. No association between DRA and pre-pregnancy weight was found in Candido, et al. [64] and neither Rett, et al. [87] nor Turan, et al. [89] reported an association between BMI and DRA. Only one study has been identified that reported a greater weight gain during pregnancy in women with DRA [80]. It is also possible to assume that the length of gestation may have an impact on the extent to which the abdominal muscles stretch. However, two studies have reported that there was no significant difference in gestational length between women with and without DRA [64 87].

Age

Age-related changes in muscle and connective tissue have been highlighted as possible factors that may affect the development of DRA [80]. Two studies have found a higher prevalence of DRA among older women [65 80] but on the other hand, four studies found no difference [10 28 64 87]. However, the mean age in the investigated population in Spitznagle, et al. [65] was over 50 years and the results are therefore not comparable to the population in the other studies. The latter study also reported a higher prevalence of menopausal women with DRA compared to women without DRA. Therefore, a hypothesis suggests a potential correlation between reduced estrogen and changes in the elasticity of connective tissue. As far as we have ascertained this has not been studied in relation to DRA.

Physical activity level

Candido, et al. [64] linked DRA to a lack of regular exercise, making physical activity level a potential risk factor. They reported that lack of general regular exercise before, during, and after pregnancy was associated with DRA when comparing women with no/mild DRA to

moderate/severe DRA. However, other studies contradict the above-mentioned findings. Mota, et al. [28] found that neither exercise level (≥ 3 times per week) before, during nor after pregnancy increased the risk of DRA 6 months postpartum. Sperstad, et al. [10] also found no association between women with and without DRA regarding performing general cardio- and strength exercises or doing abdominal- or PFM training 12 months postpartum.

Heavy lifting

The strain on the abdominal wall caused by lifting and carrying, e.g. children, has been suggested as a risk factor in one study conducted by Candido, et al. [64]. They reported an association between DRA and heavy lifting, particularly in multiparous women who looked after their children throughout the day. However, the author has not provided any direct data for this finding. Sperstad, et al. [10] also reported a greater likelihood for DRA among women reporting to be exposed to heavy lifting more than 20 times a week, calculated with an OR of 2.18 (95% CI 1.05 to 4.52). However, due to the wide CI of these results, this finding should be interpreted with caution. In addition, the measurement of DRA was assessed with palpation only.

Parity

The potential risk factor of repeated muscle and tissue stretching resulting from multiple pregnancies has been the subject of investigation in several studies. Spitznagle, et al. [65], Turan, et al. [89], Lo, et al. [80], and Chiarello, et al. [76] have reported a significant association between DRA and multiparity. Contradictory, Candido, et al. [64] and Parker, et al. [74] did not find this relationship. Based on an abstract from a Hungarian study, Gitta, et al. [86] reported a significant relationship between the number of deliveries and IRD. As discussed in Spitznagle, et al. [65], future studies should focus on comparing the prevalence of DRA in a primiparous population compared to a multiparous population as there is a discrepancy in the existing evidence on this topic.

Fetal macrosomia and multiple pregnancies are other factors that possibly can lead to a greater degree of stretching on the abdominal wall and thereby lead to a greater DRA. One study has been identified showing that women with DRA more often had pregnancies with macrosomic fetuses or a multiple pregnancies [80] but this was not supported by Candido, et al. [64]. In addition, two other studies reported that there was no difference in the birth weight of children born by women with and without DRA [10 28]. Women with multiple pregnancies have often not been included in previous studies [10 28] and this population needs further investigation.

Ethnicity

Ethnicity is another discussed risk factor. Spitznagle, et al. [65] reported a higher prevalence of DRA among Caucasian and Asian women than African American women. Candido, et al. [64] found no difference in ethnicity but did not include African American women. Therefore, the influence of ethnicity should be investigated in future studies.

Delivery method

During a cesarean section, the surgeon usually pulls, not cut, the abdominal muscles to the side, below the umbilicus, to remove the baby [91]. Whether this method leads to a higher risk of DRA compared to vaginal delivery is poorly understood. Sancho, et al. [20], Candido, et al. [64], and Spitznagle, et al. [65] found no significant association between DRA and mode of delivery. No association was also confirmed by Mota, et al. [28] and Sperstad, et al. [10], but they only included primiparous women. Contradictory, Lo, et al. [80] and Turan, et al. [89] found that cesarean section was a risk factor for DRA, but only in multiparous women in the study by Turan, et al. [89]. A quasi-experimental study by Mahalakshmi, et al. [92] also found no difference in the prevalence of DRA after a postpartum exercise period in women whit cesarean section compared vaginal delivery.

Joint hypermobility

Joint hypermobility denotes an excessive joint range of motion beyond what is considered normal and is often attributed to several factors, including an abnormality in the protein collagen leading to ligament laxity, or a hereditary predisposition to joint looseness [93 94]. Therefore, it is theoretically possible that the connective tissue of the linea alba, thereby DRA, could be influenced by general hypermobility, as this condition is associated with alterations in connective tissue [95]. The Beigthon score is a commonly used clinical test to measure joint hypermobility [96]. This test was used by Mota, et al. [28] and Sperstad, et al. [10], both reporting no difference in the prevalence of joint hypermobility in women with and without DRA.

To summarize, the studies investigating risk factors for DRA included different possible risk factors as part of the objective. Exception for Mota, et al. [28] and Sperstad, et al. [10], all studies included both primiparous and multiparous women. Two studies additionally included nulliparous women [65 89]. Interestingly, Spitznagle, et al. [65] found a prevalence of 35% in nulliparous menopausal women. This can support the above-mentioned hypothesis of hormonal

changes following menopause causing or worsening DRA. In three of the studies, women were examined at the hospital during the first few days after delivery [64 80 87]. In the other four studies, the investigations were carried out at different time points further after delivery. There are also differences in the use of cut-off values for DRA and the use of different measurement methods for DRA in the studies. As most women included in the above-mentioned studies were classified with a mild DRA, this may explain why no discernible differences were observed between the groups. More studies on women with severe DRA are highly warranted. Based on the research published up till 2018, it can be concluded that there is no consensus on risk factors associated with DRA.

Consequences of DRA

Cosmetic concerns, reduced abdominal muscle strength, increased abdominal muscle pain, low back and/or pelvic girdle pain, PFD and impaired quality of life are proposed consequences related to DRA that will be presented in the following.

Cosmetic concern/abdominal appearance

DRA can lead to changes in the abdominal appearance and be associated with both stria and loose skin[11]. Abdominal appearance has been reported as an important factor for why some women with DRA choose surgery to treat the condition [11 14 97 98]. A systematic review and meta-synthesis of women's experiences and body image in general during pregnancy and postpartum found that body dissatisfaction was particularly prevalent during the postpartum period and that many women had unrealistic expectations for their bodies [99]. Also, some research has shown that the increased media attention and use of social media can lead to body image concerns among pregnant and postpartum women [100 101]. When commencing this PhD project, as far as the research team ascertained, there were no studies on the association between DRA and reduced abdominal appearance and satisfaction or increased abdominal concerns in the postpartum population.

Abdominal muscle strength and endurance

As previously described earlier in this chapter, histological studies have documented a change in abdominal muscle and connective tissue during pregnancy [53]. Coldron, et al. [27] reported that muscle thickness of m. rectus abdominis was significantly less in women 12 months postpartum compared to controls. These changes during pregnancy have been found to affect abdominal

muscle strength and function [18 35]. In a longitudinal small study following six women from gestational week 14 to 8 weeks postpartum, Gilleard and Brown [35] found that women with IRD > 3.5 cm, measured with palpation, had reduced curl-up "capacity" and suggested that exercises that require high levels of torque production may be unsuitable. In their study, this was defined as the ability to perform a supine trunk flexion (knee flexed, feet flat, and trunk angle of 45 degrees to the horizontal), and graded from 1-5 (unable to successful) based on the women`s performance [35]. Reduced abdominal muscle strength was also supported by a study comparing 30 women 6 months postpartum to 20 nulliparous women reporting significantly weaker abdominal muscles in postpartum women [18]. The latter study also provided evidence that IRD was correlated with abdominal muscle strength. Abdominal muscle strength was measured by using manual muscle testing grading the participants` ability to raise the trunk against gravity in a supine position, similar to how it was assessed in Gilleard and Brown [35]. Endurance of the trunk flexors and rotators was measured in a hook-lying position when the participants tried to hold the position as long as possible [18]. In more recent studies, also reporting a relationship between DRA and decreased abdominal muscle strength, the women`s maximal isometric abdominal strength has been tested with dynamometers, the Biodex system Machine [102], and a custom portable dynamometer [103], respectively. Benjamin, et al. [12] were not able to conduct a meta-analysis due to the limited number of studies at that time but concluded that DRA may be associated with impaired abdominal muscle strength. They emphasized that the evidence was weak.

Abdominal muscle pain

Due to the extreme stretch on the abdominal muscles and the connective tissue during pregnancy, it is reasonable to assume that this can cause pain. A search on PubMed revealed only three studies measuring abdominal muscle pain in women with DRA and the results were contradicting. Two studies found that women with DRA reported more abdominal pain [74 104], while one study did not find more abdominal pain in women with DRA [103]. The study by Parker, et al. [74] measured combined pelvic and abdominal muscle pain with a visual analog scale (VAS) and found that women with DRA reported more pain than women without DRA. Keshwani, et al. [104] reported a significant correlation between abdominal muscle pain and IRD. They included 32 women three weeks postpartum, using ultrasound to measure IRD, and the women were asked to rate current and worst abdominal pain in the previous 24 hours on VAS. Contradictory, a study by Hills, et al. [103] reported no difference in abdominal muscle pain between women with and without DRA. They investigated primiparous women 12-14 months postpartum, and the mean IRD for the women with DRA was 2.7 cm (SD 0.4), measured at the level of the umbilicus.

Due to heterogeneity in assessment methods, time-point for the measurements postpartum, cut-off value for DRA, and no agreement in how abdominal muscle pain is defined within these three studies, further research is warranted.

Low back- and/or pelvic girdle pain

Low back pain is usually defined as pain between the 12th rib and the gluteal fold while pelvic girdle pain has been defined as pain experienced between the posterior iliac crest and the gluteal fold, particularly in the vicinity of the sacroiliac joints [105]. Recent terminology proposes to define pelvic girdle syndrome as a set of symptoms characterized by discomfort in the three pelvic joints or pain in the sacroiliac joint on one or both sides, which can occur prior to or after childbirth [7]. Several studies on DRA investigating low back- and/or pelvic girdle pain have not separated between back pain and pelvic girdle pain, and studies have often described the condition as lumbo-pelvic pain. As discussed in the research field of pelvic girdle pain, it is important to separate these two conditions, especially in the pregnant and postpartum population because the symptoms and treatments of these pain conditions are different [106 107].

Some studies have suggested that DRA may contribute to low back pain, but these studies have not directly investigated this relationship [75 89 108]. Parker, et al. [74] recognized this research gap and explored the link between DRA and low back- and pelvic pain in women > 3 months postpartum. Their results indicated that there was only a difference in one of the five measures of pain and dysfunction in the pelvic/lower back region between women with and without DRA. VAS measurements showed that significantly ($p = 0.02$) more women with DRA experienced pain in the pelvic region, but no significant difference in back pain was found between the groups [74]. In addition, Dalal, et al. [109] also reported a significant correlation between DRA and lumbopelvic pain, but no correlation coefficients (r) or p-values were presented. Contradictory, two other studies did not find any difference in the prevalence of low back or pelvic girdle pain in primiparous women 6 to 12 months postpartum between women with and without DRA [10 88]. Most of these studies included women with mild and moderate DRA.

A systematic review by Benjamin, et al. [12] concluded with no significant association between the presence of DRA and lumbo-pelvic pain and that the methodological quality of the studies was weak. The effect of different abdominal exercises to treat low back pain has recently been questioned, often described as the myth of core stability as a causal factor [110]. A systematic review by Smith, et al. [111] concluded that stabilization exercises are not more effective than any other form of active exercise in the long term. Based on the current published high-quality RCTs of

abdominal training for low back pain, they also stated that further research is unlikely to considerably change this conclusion. Nevertheless, abdominal training and especially core training with a focus on TrA continue to be highly recommended both for DRA and low back pain [21 110].

Pelvic floor disorders (PFD)

Female PFD refers to a group of conditions that affect the PFM, ligaments, and connective tissue, e.g. urinary incontinence, anal/fecal incontinence, and pelvic organ prolapse [112]. The definition of urinary incontinence is the complaint of involuntary loss of urine. The most common urinary incontinence type is stress urinary incontinence which is a complaint of involuntary loss of urine e.g. during physical exertion (sporting activities) [112]. Pelvic organ prolapse symptoms refer to women`s complaint of a "bulge" or "something coming down" towards or through the vaginal introitus. Anal incontinence is the complaint of involuntary loss of feces or flatus, while fecal incontinence is the complaint of involuntary loss of feces [112] Benjamin, et al. [12] identified three studies investigating the association of DRA with urinary incontinence [65 113 114] and three studies on the association of DRA with pelvic organ prolapse [65 114 115]. Blyholder, et al. [113] and Spitznagle, et al. [65] both reported an association between DRA and urinary incontinence. The mean age in the study by Spitznagle, et al. [65] was 52.5 years (SD 16.7) and finger width was used to measure DRA. Blyholder, et al. [113] used a survey of awareness of DRA, and participants` age or time-point postpartum were not reported. Contradictory to these studies, Bø, et al. [114] found no association between DRA and urinary incontinence nor pelvic organ prolapse in women with DRA 6 weeks, 6 months, and 12 months postpartum. Also, an age- and parity-matched case-control study by Braekken, et al. [116] reported no difference between groups in the prevalence of DRA among middle-aged women with pelvic organ prolapse (stage 2 or more) and women with pelvic organ prolapse (stage 0 and 1). Palpation with finger width was the measurement method in both Braekken, et al. [116] and Bø, et al. [114]. Differences in participants` age, time-point postpartum, and study design may explain the different results and make comparisons difficult between the above-mentioned studies. Benjamin, et al. [12] concluded with a possible weak association between DRA and pelvic organ prolapse, but not between DRA and urinary incontinence. However, they pointed out that the quality of the included studies in the systematic review was weak. A possible association between DRA presence and pelvic organ prolapse may be explained by a common pathophysiological factor of weak connective tissue. Another common factor during pregnancy is the stretching and weakening of both the pelvic floor and the abdominal muscles [117].

Quality of life and body image

According to the World Health Organization (WHO), quality of life refers to an individual's subjective evaluation of their life circumstances, taking into account their cultural and societal context, as well as their personal aspirations, expectations, values, and concerns [118]. Body image is the subjective picture of the individual`s own body, irrespective of how the body actually looks [119]. It is reasonable to assume that either pain/disorders, reduced abdominal muscle strength, or cosmetic concerns can lead to reduced quality of life or impaired body image. However, up to 2018, few studies have studied this quantitatively. Based on one trial [120] investigating health-related quality of life, Benjamin, et al. [12] concluded that DRA severity may be associated with impaired health-related quality of life, but pointed out that the quality of the study was weak. In addition, based on an abstract (article in Hungarian), a cross-sectional study measured 200 women`s IRD and reported DRA prevalence of 46.5%. The abstract showed a reduced quality of life in women with DRA [86]. We identified no studies on body image concerns up to 2018.

Women`s experience and perception of the condition

Up to 2018 we were not able to identify any studies of a qualitative study design investigating women`s experiences or perceptions of DRA. However, in a case study by Zappile-Lucis [121], a health survey questionnaire (SF36) was used to assess the effect of DRA treatment. They found that the woman was unable to participate in a physically active lifestyle and that she reported reduced scores on the questions regarding social functioning. Based on none-existing literature up to 2018 we conclude that research on how women with DRA experience or perceive this condition is highly needed.

To summarize, in addition to being a cosmetic concern for many women, it has been postulated that DRA may decrease abdominal muscle strength and cause low back-, pelvic girdle- and abdominal pain, and be related to pelvic floor disorders (PFD), such as urinary- and anal incontinence, and pelvic organ prolapse [14-16 117]. These proposed consequences have also been reported in a limited number of case studies [121-123]. In addition, recent research has documented some evidence that DRA severity may be associated with impaired health-related quality of life and reduced abdominal muscle strength [12]. In general, when commencing this PhD project there was little evidence-based knowledge on consequences of DRA and the methodological quality of the existing literature was considered weak [12].

Prevention and treatment of DRA

A systematic review by Benjamin, et al. [13] included eight studies (n=336) investigating the effect of exercise on the prevention or treatment of DRA. Only one of the eight studies had an RCT design [124] and the methodological quality of all studies was considered low according to the modified Downs and Black checklist [13 125]. The RCT by Mesquita, et al. [124] was published in Portuguese and information about this study is therefore taken from translation via google translate and information in the systematic review by Benjamin, et al. [13].

DRA is described as a musculoskeletal system defect and numerous physiotherapists treat these patients, especially those working within the women`s health discipline [15]. A survey conducted by Keeler, et al. [17] with 278 physiotherapists working within women`s health (13% response rate) reported that 89% used exercises for TrA, and 87% used PFM exercises as part of DRA treatment.

Exercise recommendations in the postpartum period

It is recommended by WHO that all healthy pregnant women begin or continue with regular physical activity and exercise during pregnancy and in the postpartum period [23 126]. The recent recommendations for physical activity in postpartum women are the same as for the general population [127 128] and WHO recommends aerobic activity every day (e.g. walking), strength training of major muscle groups 2-3/week following the general recommendations for training dosage [129], and specific strength training of the PFM during pregnancy and in the postpartum period [23]. If there are no medical restrictions, exercise can start early, under the guidance of a health care provider but it is individual when women are ready to return to or start with different forms of exercise in the postpartum period [130]. However, more evidence-based research is needed concerning vigorous intensity activity during pregnancy[128] and there is no specific mention of abdominal training.

Studies on prevention of DRA

In 1988 Boissonnault and Kotarinos [15] wrote that pregnant women who were sedentary may be more likely to have DRA and that prevention was the best method to treat DRA [15]. Four studies included in the systematic review by Benjamin, et al. [13] investigated the effect of different general exercise interventions on the prevalence of DRA during pregnancy and in the postpartum period [64 76 80 131]. None of these studies were RCTs. Pooled results showed that a form of exercise during pregnancy reduced the incidence of DRA by 35% (RR 0,65, 95% CI 0,46 till 0,92). However,

based on the studies` design and low methodological quality, in addition to variation in participants, measurement method, and intervention, Benjamin, et al. [13] pointed out that it was not possible to conclude whether general exercise during pregnancy can prevent DRA. A PubMed search of trials published up to 2018 revealed no new studies on DRA prevention published after the systematic review by Benjamin, et al. [13]. Whether strong abdominal muscles can prevent or is a risk factor for the development of DRA is not known. Athletes may exercise their abdominals regularly and are therefore likely to have stronger abdominal muscles compared to the general population [9]. To study this further an interesting population to investigate would be pregnant and postpartum elite athletes. However, there are no prevalence studies or assessments of this condition among recreational exercisers and elite athletes [9]. An interesting question is therefore whether female athletes have a higher or lower risk of DRA.

Studies on treatment of DRA

To treat DRA in postpartum women, various treatment approaches are in use, either individually or in combination. Available treatment methods will be outlined in the following. Due to the relevance of this PhD project, literature focusing on the efficacy of exercises targeting the abdominal muscles will be emphasized.

Surgery

Various surgical techniques are used to heal or reduce IRD. Along with open- or laparoscopic surgery, different suture materials, and meshes are used to tighten the linea alba and rectus sheath. Akram and Matzen [11] identified 15 studies on surgery and found only one RCT. This RCT compared the results of using two different sutures. The authors concluded that both groups had adequate correction of DRA six months after surgery. Also, Akram and Matzen [11] highlighted the lack of agreement on when DRA is pathological, different use of DRA classifications of degree, that cosmetic concerns are often the reason for choosing surgery, and that a protrusion and not IRD, should determine whether the patient should be offered surgery or not. In addition, one RCT from the same research group compared two different surgery techniques to abdominal muscle training and found significant improvement on VAS in the exercise group over the two surgery groups [98]. They recommended that future studies should compare surgery with no treatment or exercise. In addition, they suggested that long-term effect studies and studies that report complications after surgery are needed. Mommers, et al. [62] also recommend the combination of surgery and physiotherapy for future studies.

External support

External support, e.g. tubigrip or a corset is described to provide compression and give similar support as the TrA. In addition, external support has been postulated to facilitate the activation of TrA [132]. However, the evidence to support this theory is sparse. Already in 1988 Boissonnault and Kotarinos [15] suggested the use of external support in combination with exercises in the treatment of DRA. In the survey by Keeler, et al. [17] almost 60% of women`s health physiotherapists reported using external support in the treatment of postpartum women with DRA with the goal to approximate the rectus abdominis muscle bellies[17]. Two of the included studies in the systematic review by Benjamin, et al. [13] combined exercises with external support [122] [123]. These two studies were both case studies with one participant in each study. Benjamin, et al. [13] concluded that more research is essential before any conclusion can be drawn on the effect of external support in the treatment of DRA. Acharry and Kutty [133] studied the use of external support together with abdominal exercises in a pre-post-test study design with 30 postpartum women in the age of 23-34 years. The intervention consisted of teaching the participants abdominal muscle exercises with external support, lasting for only 2 weeks. The participants' IRD decreased significantly from an average of 3.5 ± 0.5 finger widths to 2.5 ± 0.5 finger widths ($p=0.001$). The researchers concluded that the abdominal exercises with external support were effective in reducing DRA postpartum. Although the study reported a significant IRD reduction, they had no control group, and the time-point postpartum is not reported. Therefore, natural remission cannot be excluded. In addition, two other RCTs have been identified including external support when conducting the abdominal muscle training in their intervention [134] [135]. These studies` characteristics and results are presented in Tables 1 and 2, respectively. Kamel and Yousif [135] reported a significant effect on IRD in their intervention, favoring not using external support. In the study by Walton, et al. [134] no difference between the experimental and traditional programs was found. As external support was applied while doing the exercise intervention in both studies it is not possible to conclude whether the effect was caused by the exercises or the external support. None of the studies compared their intervention to a nontreated control group. Therefore, the conclusion from Benjamin, et al. [13] is still valid.

Kinesiology tape

A kinesiology tape or elastic tape, often used for sports injuries, is claimed to increase blood circulation, decrease pain and give support in the area where it is applied [136]. However, systematic reviews have concluded with insufficient evidence to support the use of kinesiology tape following musculoskeletal injury and that there are few high-quality studies examining the use of

kinesiology tape following musculoskeletal injury [136 137]. Taping has been thought to be used in DRA treatment to approximate muscle bellies of the rectus abdominis [17]. We have only identified three studies that have compared the effect of kinesiology tape alone or in combination with exercises versus exercises alone or to untreated controls in women with DRA [138-140]. Gursen, et al. [138] included 24 women 4-6 months postpartum, aged between 29 to 33 years who had undergone cesarean section. DRA was assessed with palpation and the baseline measurements of DRA showed an average of 1.5 finger widths in both groups. The tape was applied twice a week over the m. rectus abdominis, m. obliques externus and the cesarean section scar. In addition, both groups performed abdominal muscle exercises five times a week for 4 weeks. There was no difference in IRD between the two groups at post-test [138]. Bobowik and Dąbek [140] reported a significant reduction in IRD of their intervention program, but the result is questionable due to the measurement of DRA with palpation 0-3 days postpartum. In addition, if this intervention program had an effect, we can only conclude that it was the whole package of the program, not solely the kinesiology tape that provided the results. However, Tuttle, et al. [139] found no significant difference in IRD between the tape and control groups. The taping was done by the participants and was applied as an x shape tape above and below the umbilicus. The women used the tape for 4-7 consecutive days, followed by a 2-4-day break before the application of a new tape, throughout the whole intervention period (12 weeks) [139]. Although the study included a small sample, with only 8 women in the tape group, the results of the present study and Gursen, et al. [138] indicate that taping may not be effective in decreasing IRD postpartum.

Exercises of the PFM

Keeler, et al. [17] found that 87 % of women's health physiotherapists reported yes to the usage of exercises for the PFM in DRA treatment. As previously described above, there is a co-contraction of abdominal muscles during a PFM contraction, in women without urinary incontinence [49]. This raises the question of whether PFM training, alone or combined with abdominal muscle exercises, can effectively increase abdominal muscle strength and function. Up to 2018, we have identified three RCTs that have investigated the effect of PFM training as part of their exercise intervention in the treatment of DRA postpartum [124 134 141]. Supplementary information about these studies is presented in Table 1 and Table 2. Mesquita, et al. [124] was the only one of these studies reporting an effect on IRD. However, their intervention was conducted as two exercise sessions only 6 and 18 hours after birth. Walton, et al. [134] and Gluppe, et al. [141] did not report any difference in IRD between groups. The exercise group in Gluppe, et al. [141] did 3 sets of PFM training every day for 4 months in addition to weekly group training with a physiotherapist, and their exercise adherence was high. Therefore, based on this RCT`s

methodological quality, scored by PEDro to 8/10 [142], we suggest that PFM is not effective in closing the DRA.

Immediate effect of exercises for the abdominal muscles on IRD

Women with DRA have been discouraged from doing sit-up/crunch exercises as it has been thought to lead to a further increase in IRD [26]. The drawing-in exercise has instead been recommended to decrease IRD because this exercise activates TrA and m. obliques internus, which has been thought to be a gentle exercise especially during pregnancy and in the postpartum period [13 18]. Benjamin, et al. [13] stated that basic research on how different exercises affect IRD is limited. Up to 2018, we have identified six experimental studies that investigated the immediate effect of various abdominal and/or BBM exercises on IRD in women with DRA [19-22 77 78]. Three studies investigated in-drawing and both reported a significant increase in IRD compared to resting value [20 22 77]. Five of the studies investigated the immediate effect of a sit-up/crunch and all studies reported that this exercise lead to a significant reduction in IRD. However, the long-term effect of these exercises is not known, and Chiarello, et al. [78] claimed that the direction of change implies that the immediate effects of the curl-up are unlikely to worsen the IRD. In the study by Lee and Hodges [21] curl-up with pre-activation of TrA via a PFM contraction led to less IRD narrowing than a normal curl-up without the pre-activation, thus supporting the findings from the other short-term experimental studies. Based on their findings, they proposed a new theory and suggested a new measure called the distortion index. The distortion index concept is that an intact and unstrained linea alba does not distort during a curl-up due to tension created by pre-contraction of the TrA [21]. They suggested that contraction of TrA, although widening the IRD, could strengthen the linea alba and that this is an important factor in the rehabilitation of DRA. Whether contraction of the TrA can have this effect on the linea alba is a hypothesis and needs to be studied more. Up to 2018, the distortion index has not been validated.

Effect of abdominal muscle exercises on DRA

Benjamin, et al. [13] included only one RCT [124] in their systematic review and concluded that exercise for the abdominal muscle may or may not affect DRA prevalence. A search with a time limit up to 2018 was undertaken to identify relevant studies in the electronic databases MEDLINE/Pubmed, Embase, CINAHL, Web of Science, PEDro, and Sport Discus. Also, a manual search of reference lists and related studies was conducted. The following search was performed in PubMed; (“randomized controlled trial” OR "randomised controlled trial") AND (“recti abdominis” OR “abdominal rectus diastasis” OR “diastasis recti”) AND (postpartum OR postnatal). Eligible studies included postpartum women in an RCT- or pilot

RCT design, abdominal training, PFM training, or a combination of both in at least one arm of the trial and had the presence of DRA or change in IRD (cm/mm) as their primary outcome measure. We identified four additional RCTs [134 135 140 141] and one pilot RCT [139] published after the systematic review by Benjamin, et al. [13]. These studies` characteristics are presented in Table 1, and the description of interventions and results in the studies are presented in Table 2. The number of participants in the RCTs varied greatly, ranging from nine[134] to 175 [141]. The RCTs used various measurement methods, and there was considerable variability in what time point the women were included postpartum. Furthermore, the duration of the intervention periods ranged from two training sessions[124] to 16 weeks[141]. The methodological quality, assessed by PEDro rating scale [143] of vary between four [124] and eight [141] of ten possible scores of internal validity. It's difficult to assess the effect of individual exercises in interventions that have multiple elements. Conclusions can only be drawn based on the overall impact of the intervention. Of the studies comparing abdominal and/or PFM training to an inactive control group, Mesquita, et al. [124] and Bobowik and Dąbek [140] found a significant reduction in IRD between groups. However, due to low methodological quality, the measurement method used, and that their intervention was carried out at an early stage postpartum the results should be interpreted with caution. Therefore, up till 2018, there is no consensus on which abdominal exercises to recommend to narrow IRD permanently in postpartum women with DRA. High-quality RCTs based on an understanding of how the exercises may close IRD and using responsive, reliable, and valid outcome measures are therefore needed to guide clinical practice.

Effect of strength training on the connective tissue of the linea alba in women with DRA

Strength training of the abdominal muscles is often recommended in the postpartum treatment of DRA [17]. The most common primary outcome measure for this condition is IRD [144]. However, measuring the IRD means measuring the connective tissue (linea alba), not the strength of the abdominal muscles. The question is therefore to what extent strength training of the abdominal muscles can decrease IRD or tighten the connective tissue of the linea alba. Experimental studies suggest that connective tissue and muscle fibers can undertake adaptations to physical training, which in turn can lead to increased tissue mass and improved maximum tensile strength. These adaptations are especially apparent and a result of resistance training and load bearing [145]. Folland and Williams [146] reviewed the morphological adaptions to resistance training and found an increase in the cross-sectional area of muscles. Another possible adaption included a change in the structure of the connective tissue of tendons. It is found that weak tendons among elderly people can cause disability and injuries [147]. Joint hypermobility syndrome, such as e.g. Ehlers-Danlos Syndrome, is a condition with genetically altered connective tissue and higher tendon

laxity than normal [94]. Resistance training in patients with Ehlers-Danlos Syndrome has been shown to improve both skeletal muscle and tendon properties, e.g. increased tendon stiffness [148]. Hypermobility has been discussed as a risk factor for DRA, but published studies have found no association [10 28]. To summarize, there are studies investigating adaptions to strength training on the connective tissue in other tendons/ligaments, but there is limited knowledge on the effect of strength training on the connective tissue of the linea alba in women with DRA. This is also supported by Coldron, et al. [27] who highlighted the non-existing literature in humans on the histochemical effect of the prolonged stretch on the abdominal muscles, and stated that the reported feeling of "lack of support" in women with DRA, could be caused by a change in the facia as well as weak abdominal muscles.

Table 1. Study characteristics of studies investigating effect of abdominal muscle exercises on DRA postpartum up to 2018

Authors	Study	Participants (N, age, time PP)	Parity and delivery mode	Cut off value DRA	Main outcome measure	Secondary outcome measures
Mesquita et al. 1999	RCT	N=50 6-18 hours PP			• DRA measured with a pachymeter	
Walton et al. 2016	RCT	N=9 18-45 years 3 months to 3 years PP	Parity not reported. Cesarean section and vaginal delivery (n=1)	Not reported	• IRD measured with ultrasound and caliper 4.5 cm above, at, and 4.5 cm below umbilicus	• ODI • PFDI
Kamel & Jousif 2017	RCT	N=60 25-35 years 2 months PP	Primi- and multiparous. Vaginal delivery	> 2.5 cm measured any place along linea alba during a curl-up	• IRD measured with ultrasound at X-U/2 and U-P/2	• Abdominal muscle strength
Bobowik & Dąbek 2018	RCT	N=40 32.3 ± 5.9 years 0-3 days PP	Parity and delivery mode not reported	≥ 2 cm	• DRA measured with palpation (one finger width = 1.3 cm)	
Tuttle et al. 2018	Pilot RCT	N=30 32.03 ± 4.3 years 6-12 weeks PP	Primi- and multiparous. Delivery mode not reported	≥ 2 finger widths during head lift	• IRD measured with ultrasound 4.5 cm above and below umbilicus during rest and head lift	• PFDI-20 • RDQ
Gluppe et al. 2018	RCT	N=175 29.8 ± 4.1 years 6 weeks PP	Primiparous. Vaginal delivery	≥ 2 finger widths or a visible protrusion during a curl-up	• DRA measured with palpation 4.5 cm above, at, and 4.5 cm below umbilicus during a modified sit-up Measurements 6 and 12 months PP	

DRA, diastasis recti abdominis; IFSAC, inventory of functional status after childbirth; IRD, inter-recti distance; ODI, Oswestry Disability Index; PFDI, Pelvic Floor Distress Index; PP, postpartum; RCT, randomized controlled trial; RMQ, the Roland-Morris Disability Questionnaire; X-U/2, halfway between umbilicus and xiphoid process; U-P/2, halfway between umbilicus and symphysis

Table 2. Interventions, dosage, drop-out and adherence, results of primary and secondary outcomes, and adverse effects in studies investigating effect of abdominal muscle exercises on DRA postpartum up to 2018

Study	Interventions, number of participants and exercises	Dosage	Drop-out and adherence	Results for DRA presence or IRD in cm, mean ± SD	Results for secondary outcomes	Adverse effects
Mesquita et al. 1999	**Control group (n=25)** **Treatment group (n=25)** A protocol for physiotherapeutic assistance	6 and 18 hours after labor		At 18 h after parturition, the control group presented a diastasis reduction of 5.4%, and the treatment group of 12.5%, as related to the first measure (6 h after delivery) ($p < 0.001$, with a confidence interval of 99%).		
Walton et al. 2016	**Experimental group (n=5)** • Plank (10 sec. on knees or toes) **«Traditional» training (n=4)** • Modified sit-up Both programs contained; • Posterior pelvic tilt • PFM exercises • Exercises for oblique abdominals • Use of abdominal binding during exercise	Duration: 6 weeks Dosage: 3x10 repetitions, 3x/week. (Gradually increase repetitions during the period)	Total drop-out: 1 Adherence: Not reported	Post-test: Experimental: IRD: 0.76 ±0.2 Traditional: IRD: 0.66 ± 0.17 No significant difference in decrease in IRD between groups, at the level at the umbilicus: 0.10 (95% CI: -0.14, 0.34)	• ODI: No significant difference between groups (p=0.569) • PFDI: No significant difference between groups (UDI score; p=0.117)	Not reported
Kamel & Jousif 2017	**Abdominal exercise + NMES (n=30)** *Group A* NMES was applied first, followed by the abdominal exercises	Duration: 8 weeks Dosage: 20 repetitions, 3x/week (Increase with 4 repetitions/week)	Total drop-out: 3 Abdominal exercise (n=2) Abdominal exercise + NMES (n=1)	Post-test: Abdominal exercise + NMES: IRD: 1.43 ± 0.38 Abdominal exercise:	• Abdominal muscle strength: Significant difference in group A	Not reported

	Abdominal exercise with abdominal binding (n=30) *Group B* • Sit-up • Reverse sit-up • Reverse trunk twist • U-seat • Respiratory rehabilitation maneuver during exercises		Adherence: Analysis on patients who finished all sessions (same as described in drop-out)	IRD: 2.09 ±0.35 Significant difference in decrease in IRD between groups: -0.65 (95% CI: -0.85, -0.46)	compared to group B in peak torque (N/m): 5.22 (95% CI: 1.95, 8.5)	
Bobowik & Dąbek, 2018	**Physical therapy program (n=20)** Part 1: Prone lying for 20 minutes. Part 2: Three supine abdominal exercises with respiratory maneuver (headlift, sit-up, and "cycling") Part 3: Education (in/out of bed, lifting the baby, breastfeeding++) (Elastic tape was used once a week) **Minimal intervention group (n=20)** Contained no exercise or tape, only education	Duration: 6 weeks Dosage: Hold: 10 sec, 10 repetitions/exercise, every day	Drop-out and adherence not reported	Post-test: Minimal intervention: DRA: 1.68 ± 0.7 Physical therapy: DRA: 0.4 ±0.23 Significant difference in IRD between groups: -1.28 (95% CI: -1.60, -0.69)		Not reported
Tuttle et al. 2018	**TRA training (n=10)** Home exercise, in-drawing in four different positions with respiratory maneuver **Tape (n=8)** Participants taped themselves with a x-shape, and used the	Duration: 12 weeks Dosage: 10 repetitions, 4-5 days/week	Total drop-out: 3 TRA (n=1), TRA + tape: (n=1), tape (n=1) Adherence: Average all groups: 79%	Post test[1] TRA: IRD: 1.34 ± 0.37 Minimal intervention: IRD: 2.1 ± 0.99 Close to a significant difference in IRD between groups: -0.76 (95% CI: -1.53, 0.01)	• PFDI-20: No significant difference between groups (p >0.05). • **RMDQ:** No significant difference	Not reported

	tape for 4-5 days, then 2-4 days off before a new intervention period with tape **TRA+tape (n=5)** Combination of TRA training and kinesiotape **Minimal intervention group (n=7)** Instructed to maintain normal level of activity		TRA training only: 95%	Significant better decrease in IRD at rest and during head lift in the groups with TRA training compared to control/tape (post hoc t test)	between groups (p >0.05).	
Gluppe et al. 2018	**Postpartum training program (n=87)** Weekly supervised exercise class with strength training of PFM in 5 different positions in addition to strength exercises for abdominal,[2] back, arm, and thigh muscles. Daily PFM training at home **Minimal intervention group (n=88)** Received only standard information about exercise postpartum	Duration: 16 weeks Dosage: 3 x 8-12 repetitions. PFM training daily, group training once a week	6 months Total drop-out: 13; intervention (n=10), control (n=3) 12 months Total drop-out: 5; intervention (n=1), control (n=4) Adherence: Postpartum training program: 80% adherence to training for 96% of women	Post-test 6 months: Exercise: DRA, 43.7% Minimal intervention: DRA, 44.3% 12 months: Exercise: DRA, 41.4% Minimal intervention: DRA, 39.8% No significant difference between groups 6 months PP, (RR: 0.99 [0.71, 1.38]) or 12 months PP, (RR: 1.04 [0.73, 1.49])		Not reported

DRA, diastasis recti abdominis; IFSAC, inventory of functional status after childbirth; IRD, inter-recti distance; NMES, neuromuscular electrical stimulation; ODI, Oswestry Disability Index; PFDI, Pelvic Floor Distress Index; PFM, pelvic floor muscle; PP, postpartum; RCT, randomized controlled trial; RMDQ, the Roland-Morris Disability Questionnaire; TrA, transversus abdominis; UDI, Urinary distress inventory (1/3 subscales of PFDI)

[1]Results are presented for measurements at the level at the umbilicus at rest.

[2]The weekly exercise class included 3 sets of 8-12 contractions of each of the following abdominal exercises; draw-in (on all fours), draw-in (prone), half-plank, side-plank, oblique sit-up or sit-up.

Gaps of knowledge

In spite of the high prevalence of DRA in the postpartum period, the above review of the scientific literature finds scant knowledge on how women perceive the condition. There is a lack of studies investigating the immediate effect of different exercises on IRD in women with DRA. Also, the scientific evidence regards to risk factors, consequences for low-back, pelvic girdle and abdominal pain, and PFD is limited. Lastly, there is no agreement in the effect of abdominal exercises in the treatment of women with DRA [13].

Aims of the thesis

Overall aim

This PhD project aimed to investigate how postpartum women perceive DRA, the immediate effect of different exercises on DRA, possible risk factors and consequences related to DRA, and the effect of abdominal exercises in the treatment of DRA.

Specific aims

Paper I: To explore primiparous women`s knowledge about DRA, whether they have concerns about abdominal appearance, and perceive impaired abdominal muscle strength 6-8 months postpartum. Further to study whether there are differences between women with and without reported abdominal protrusion regarding knowledge about DRA, concerns about abdominal appearance, and perceived abdominal muscle strength 6-8 months postpartum.

Paper II: To study the immediate effect of eight different abdominal and PFM exercises on IRD in parous women diagnosed with DRA. Further, to study whether these exercises` influence on IRD differed between measurements above and below the umbilicus.

Paper III: To investigate whether parous women with DRA have weaker abdominal muscles and higher prevalence of PFD, low back, pelvic girdle, and abdominal pain than women without DRA. Further, to compare these variables in subgroups of women with moderate and severe DRA.

Paper IV: To evaluate the effect of an exercise program, containing head lift and abdominal curl-ups, found in study II to reduce IRD, on IRD in primi- and multiparous women with DRA 6-12 months postpartum. Further, to investigate the exercise program`s effect on clinical observation of DRA, perceived change of the condition, abdominal muscle strength and endurance, the thickness of m. rectus abdominis, abdominal-, low-back and pelvic girdle pain, and PFD.

Materials and methods

Study design

The four studies had the following study design;

Paper I: A descriptive observational cross-sectional comparison study consisting of 460 primiparous women 6-8 months postpartum.

Paper II: A cross-sectional short-term experimental study with a convenience sample of 38 parous women with DRA >6 weeks postpartum.

Paper III: A cross-sectional study comparing consequences of DRA in 36 women with DRA to 36 age and parity-matched women without DRA, >6 weeks postpartum.

Paper IV: An assessor-blinded RCT starting between 6-12 months postpartum comparing an abdominal training intervention (n=35) to no intervention (n=35).

Study sampling

Data collection for study I was conducted between March 2019 and August 2020. To be able to report the response rate and address generalizability we originally planned to recruit women from healthcare clinics and physiotherapists working within women`s health in Oslo and Akershus counties, Norway. all healthcare clinics in Oslo and Akershus counties received an invitation but most of them did not respond or answered that they did not have time to participate. We ended up with 12 healthcare clinics that agreed to participate, with only a couple of participants signing up for the study in three months. Therefore, due to low interest and slow general recruitment, we applied to the Regional Committee for Medical and Health Research Ethics of Norway to change recruitment to social media (Facebook and Instagram). The participants signed up by sending an email to the researcher or by clicking on a registration link. Before inclusion, they had to confirm that they fulfilled the inclusion criteria. They subsequently received an email with the informed consent and a link to an electronic questionnaire (SurveyXact). Despite starting the PhD project with recruitment of participants for study I, because of slow recruitment this study was delayed, and it was ultimately published after study II of III. Also, the study was further compounded by the lengthy publication process during the COVID-19 pandemic. Data collection for study II and III was performed at the laboratory of the Norwegian School of Sport Sciences, Oslo, from

February to October 2019. In study IV data collection was conducted mainly at the Norwegian School of Sport Sciences from March 2020 to December 2022. Due to slow recruitment, we also applied to the Regional Committee for Medical and Health Research Ethics of Norway to expand our inclusion criteria from 6-8 to 6-12 months postpartum. Due to the covid-19 pandemic, we also applied to conduct screening and data collection outside of Oslo, at two physiotherapy institutes, one in Fredrikstad and one at Nøtterøy, Norway. Participants in study II-IV were recruited through women's health physiotherapists, personal trainers, midwives and gynecologists/obstetricians, friends, and acquaintances, but mostly from advertising in social media. The women signed up by sending an email to the researcher or by clicking on a registration link, but in study IV they had to pass the initial screening to be included. In study II and III participants had a single visit for the clinical assessments, while in study IV participants were clinically assessed at baseline and follow up after 12 weeks of intervention or no intervention.

Inclusion criteria and sample size

Inclusion criteria

Paper I: Primiparous women 6-8 months postpartum with a single- or multiple pregnancies, any mode of delivery, and who were able to understand a Scandinavian language were included. Exclusion criteria were multiparous women, being <6 months and >8 months postpartum, and being <18 years old.

Paper II-III: Primi- and multiparous women more than 6 weeks postpartum (with no upper limit to time since birth), between 18–70 years old, and able to understand instructions in Norwegian were included. In study II only women with a diagnosis of DRA were included. In study III women with and without DRA were included and there was a maximum age difference of ±3 years between the matched woman with and without DRA. Women with DRA from study II constituted the cases in study III. Exclusion criteria were any neurological or systemic musculoskeletal diseases or psychiatric diagnoses.

Paper IV: Primi- and multiparous women with a diagnosis of DRA 6-12 months postpartum with a single- or multiple pregnancies, any mode of delivery, and who were able to understand a Scandinavian language were included. Exclusion criteria were being < 6 months and 12 months postpartum and <18 years old.

Sample size

Paper I: There was no a-priori power calculation for this study.

Paper II: Based on a former study [77] reporting IRD change (rest vs drawing-in) of 2.5 mm (SD 5.2), an a-priori power calculation was performed. With 80% power and a 5% significance level, at least 36 women were needed for this study.

Paper III: There was no a-priori power calculation for study III.

Paper IV: An a-priori power calculation was conducted with associate professor, statistician Morten Wang Fagerland at the Norwegian School of Sport Sciences. The calculation was based on a conservative approach. The effect size for the training group was set to 0.8 cm with an SD of 0.8, for the control group the effect size was set to 0.2 and SD 0.8 (IRD measured at rest). These numbers were based on results from a previously published RCT [139], but the effect size was slightly adjusted upwards due to that study`s low power. In addition, the adjustment was based on another previously published RCT with no reported effect [149]. Based on the adjusted calculation we planned to include N=58 with 29 women in each group. Considering a possible drop-out of 20% the final estimation was 70 women; 35 women in the training group and 35 women in the control group.

Primary and secondary outcomes

Paper I: This was a descriptive cross-sectional study with many "primary" outcomes. These were prevalence of knowledge about DRA, concerns and satisfaction with abdominal appearance, and perceived abdominal muscle strength in women with and without self-reported abdominal protrusion. Secondary outcomes were prevalence of PFD, low back, pelvic girdle, and abdominal pain in women with and without self-reported abdominal protrusion. The secondary outcomes will be published later as they are part of a master thesis and the results are currently under analysis.

Paper II: The primary outcome measure was the change in IRD during the eight different exercises compared to resting values.

Paper III: The primary outcome measure was differences in abdominal muscle strength, PFD, low back, pelvic girdle, and abdominal pain in women with and without DRA. Secondary outcome measures were to compare these variables in subgroups of women with moderate and severe DRA.

Paper IV: The primary outcome measure was the change in IRD between groups. Secondary outcome measures were the clinical observation of DRA, perceived change of the condition with the Global Rating of Change scale (GRC), change in abdominal muscle strength and endurance, change in muscle thickness of m. rectus abdominis, and differences in PFD, low-back-, pelvic girdle-, and abdominal pain between groups.

Data collection

Questionnaire data

For all studies (study I-IV) participating women responded to electronic questionnaires gathering information about background variables.

Questions about DRA, protrusion, abdominal pain, and appearance included in the questionnaire in study I was developed from a focus group of a convenient sample of 20 parous women. The response options for these questions were a mix of 11-point Likert scales, close-ended, and semi-close-ended questions. The questions and response categories were piloted among members of our research group and women in the focus group and the questions were revised accordingly for clarity.

Prior to the clinical assessments (study III-IV) all participants responded to the following questions in the electronic questionnaire; "Do you have symptoms in your bowel, bladder, or pelvic region that bother you (e.g. urinary leakage, bowel leaks, or feeling any bulge in the vagina)?", "Do you have low back pain?", "Do you have pelvic girdle pain?" and "Do you have pain in your abdomen?". If answering yes to these questions, participants were asked to respond to the following; The Pelvic Floor Distress Inventory-short form 20 (PFDI-20) [150], the Oswestry Disability Index (ODI) [151], and the Pelvic Girdle Questionnaire (PGQ) [107]. If participants responded yes to having abdominal pain, they were asked to indicate the location, and to what degree (from zero = not at all, to ten = a lot) it affected their activities of daily living.

In study I, III, and IV physical activity level was self-reported. Participants reported their current level of participation in physical activity of moderate or high intensity (short of breath and/or sweating), as an average number of minutes per week [152].

At the post-test in study IV women in both groups were asked to report whether they perceived improvement in their DRA compared to the pre-test on GRC. The GRC includes classifications

from very much worse to fully healed on a numerical 11-point scale. The instrument has shown good intra-test reliability (ICC = 0.9)[153].

Clinical observation of DRA

In study II-IV the assessor observed the abdomen while the women performed a curl-up and registered whether the following; "protrusion", "sink-in", "no", or "uncertain" was seen.

IRD measurements and cut-off value for DRA

In study II and III palpation was used prior to the ultrasound assessment as an initial screening. The assessor palpated along the entire linea alba, to confirm or exclude DRA. DRA was diagnosed initially if the assessor palpated two finger widths or more, or observed abdominal protrusion, during an abdominal curl-up. The final diagnosis of DRA for inclusion in study II-III was confirmed by ultrasound with a cut-off value set to IRD was > 25 mm, 2 cm above or, 2 cm below the umbilicus during a curl-up [64 77]. Women with an observable protrusion during a curl-up were included in the analyses, even if IRD was less than 25 mm, above or below the umbilicus. In study IV DRA was diagnosed by using ultrasonography with a cut-off value for IRD set to ≥ 2.8 cm at rest [154] or ≥ 2.5 cm during a curl-up [64], measured 2 cm above or 2 cm below the umbilicus. DRA was also diagnosed if a protrusion along the linea alba was observed, women were included even if the IRD was less than our cut-off values. For the ultrasound assessments, a portable 2D (two dimensional) ultrasound machine with a linear transducer (GE Healthcare –Logiq e R7, GE > 12 L-RS—5-13 MHz Wideband Linear Probe) was used to assess IRD. To standardize the measurement locations, two marks were made on the skin: one 2 cm above and one 2 cm below the center of the umbilicus. This measurement procedure is in line with the procedure described by Mota, et al. [69]. Ultrasound gel was used during the IRD measurements, and the transducer was placed transversely and cantered over each skin mark. To avoid a reflexive response of the abdominal muscles, the assessor tried not to apply any pressure on the abdomen [69]. Panoramic imaging was used when the investigator was unable to visualize the entire width of the linea alba [155]. This imaging method has shown excellent reliability (ICC >0.90) when compared to conventional ultrasound imaging [155].

Abdominal muscle strength assessments

Muscle thickness of m. rectus abdominis was measured with 2D real-time ultrasonography and defined as the distance between the inside edges of the superior and inferior fascial borders [27]. Participants rested in a standardized supine position with arms alongside and knees bent with the

feet on the bench. Three ultrasound images were taken of the left rectus abdominis muscle at rest 2 cm above the umbilicus, and the average was calculated. The transducer was moved transversely over the midpoint of the right m. rectus abdominis. This protocol was modified from Coldron, et al. [27].

In study III and IV a Humac NORM isokinetic dynamometer (CSMi, Soughton, MA) was used to assess maximal isometric trunk flexion. Trunk flexion assessments followed a standardized protocol and were conducted standing in two different positions; hip flexion of 10◦ and 30◦ from zero.

Abdominal endurance was assessed as the number of repetitions of a standardized abdominal curl-up to exhaustion following the protocol of the American College of Sports Medicine (ACSM) curl-up test in study III and IV [156 157]. This variable was analyzed as a continuous variable in study III and as a dichotomous variable (0 or 1+ curl up) in study IV.

PFM measurements

In study II ability to perform a correct PFM contraction was assessed by transabdominal real-time ultrasound imaging using a portable 2D ultrasound machine with a convex transducer (GE Healthcare –Logiq e R7, GE > 8C-RS—2-5 MHz Convex) following a bladder-filling protocol [38]. A correct PFM contraction assessed with this method is defined as observing a cranioventral displacement of the PFM in the sagittal plane with a visible inward movement of the bladder [38]. This method has shown good reliability, with average ICCs for within-session inter-rater reliability between 0.86 and 0.88 (95% CI 0.68 to 0.97) and inter-session intra-rater reliability between 0.81 and 0.89 (95% CI 0.51 to 0.96).

Joint hypermobility

All participants in study II-IV was tested for hypermobility with the Beighton score [96]. The score evaluates hypermobility in five joints/regions, including the spine, knee, elbow, thumb, and little finger and a score of one is allocated to each positive test, with a maximum score of nine, given that both extremities undergo assessment [96]. The tool has demonstrated high reliability with good intra- and inter-tester agreement, exhibiting Spearman rho values of 0.86 and 0.87, respectively, among women aged 15 to 45 years [158]. The Beigthon score was analysed as a dichotomous variable (hypermobile/not hypermobile), using a cut-off value of ≥5 points. In study II-III the Beigthon score was reported, but not in study IV, as there were no differences between the two randomized groups and due to word limit of the manuscript.

Other assessments

Height, weight, and waist circumference were measured clinically by the PhD candidate at the clinical visits in study II-IV. Height was measured to the nearest 0.5 cm using a portable stadiometer (SECA 123, Hamburg, Germany). Weight was measured to the nearest 0.1 kg using a SECA 899 electronic scale (SECA 899). BMI was calculated using weight in kilograms divided by the square of height in meters (kg x m-2).

Randomization and blinding

Blinding study II-IV: A single investigator, the PhD candidate, with specific training in ultrasound imaging of the abdomen, conducted all IRD images. Blinding of the investigator was ensured by converting all images to a digital format and allocating them a random number, and then performing all measurements offline at a later stage using the MicroDicom software.

Randomization study IV: After baseline testing, the women were randomly allocated to either exercise or control group. Randomization was computer-generated, in blocks of 4 with concealed allocation. Randomization was provided by a person not involved in the project. The outcome assessor was blinded for group allocation at pre-and post-test.

Intervention paper IV

The intervention in the RCT started 6-12 months postpartum and lasted for 12 weeks. The intervention group was taught an abdominal muscle training program based on findings from study II. A 10 min 5 days/week standardized exercise program was prescribed. Due to the covid-19 pandemic, the instruction on how to perform the exercises was given digitally to most of the participants by phone or demonstrated on Facetime. This was conducted by the same physiotherapist who provided the randomization. The exercise program contained progression and is described in detail in Figure 1. The intervention group was also provided with a smartphone app (Athlete Monitoring) reminding them to exercise and to register adherence. In addition, a weekly SMS was given to encourage participants in the intervention group to adhere to the program. This was also done by the physiotherapist who conducted the randomization.

The control group received no intervention and was discouraged from conducting specific abdominal exercises.

Exercise program

Week 1-4: Perform one set of exercise 1, 2 and 3 in the order described below.
Week 5-8: Perform two sets of exercise 1, 2 and 3 in the order described below with a 1 min pause between.
Week 9-12: Perform three sets of exercise 1, 2 and 3 in the order described below with a 1 min pause between sets.

*Perform all exercises **slowly** and check that exercises are performed correctly without causing a significant protrusion (please observe your abdomen while doing the exercises). You may conduct the exercises while lying on the floor with your child).*

Exercises with explanation			
	1.) Head lift *Lie on your back with your legs bent and arms alongside* • Slowly inhale and exhale • After exhaling, lift your head up with your chin towards your chest • Lower slowly	**2.) Oblique curl-up (both right and left side)** *Lie on your back with your legs bent and one arm alongside, the other hand behind your head* • Slowly inhale and exhale • After exhaling, lift your head and bend the upper part of your back obliquely up until one shoulder blade is free from the floor • Lower slowly	• Curl-up *Lie on your back with arms crossed over your chest* • Slowly inhale and exhale • After exhaling, lift your head and bend the upper part of your back up until both shoulder blades are free from the floor • Lower slowly Progresjon for week 11-12
Progression			
Week 1+2	1 x 8 rep.	1 x 8 rep.	1 x 8 rep.
Week 3+4	1 x 10 rep.	1 x 10 rep.	1 x 10 rep.
Week 5+6	2 x 10 rep.	2 x 10 rep. Holding time: 1 sec.	2 x 10 rep. Holding time: 1 sec.
Week 7+8	2 x 12 rep.	2 x 12 rep. Holding time: 2 sec.	2 x 12 rep. Holding time: 2 sec.
Week 9+10	3 x 10 rep.	3 x 10 rep. Holding time: 2 sec.	3 x 10 rep. Holding time: 2 sec.
Week 11+12	3 x 12 rep.	3 x 12 rep. At the top you «tilt» forward 3 times	3 x 12 rep. Place your hands in a grip behind your neck (avoid picking up speed with your arms on the way up!)

Figure 1. The exercise program of the randomized controlled trial (study IV).

Statistics

For all studies, demographic data and descriptive variables are described as mean values with standard deviations (SD), or in the case of categorical data as frequencies with percentages (%). Differences in background variables are analyzed as an independent t-test for continuous data and with a Chi-square test of independence for categorical data. If the expected count in a variable is less than five, the Exact Sig (two-sided) value is used. For all studies, the level of significance is set to ≤ 0.05. Normality tests were performed. Data for all studies are analyzed using SPSS, version 24-28 (SPSS, Inc., Armonk, NY, USA).

Paper I: Paired sample t-tests were used to compare the participants` mean scores for continuous variables pre-pregnancy, during pregnancy, and postpartum. The Chi-square test of independence (with Yates Continuity Correction) and independent sample t-tests were used to compare differences between women with and without protrusion for categorical and continuous variables, respectively.

Paper II: All the IRD data are normally distributed. Paired t-tests were used to examine the differences between IRD at rest to the eight exercises. Results are presented as means with 95% CI.

Paper III: An independent t-test or Fisher's Exact Test was used to compare differences between groups in the main analyses. In addition, linear or logistic regression was used to adjust for possible confounders; age, height, physical activity level, BMI, parity, time since birth, and DRA severity. For subgroup analyses the number of confounding factors was reduced according to the number of participants. Unadjusted and adjusted mean scores with 95% confidence intervals (CI) were presented for continuous data. For categorical data unadjusted and adjusted data with percentages were reported

Paper IV: Within- and between-group comparisons of continuous and categorical data were analyzed by the Independent sample t-test and Chi-square test for independence, respectively. For continuous variables, we used an ANCOVA as a linear regression with post-test value as the dependent variable and grouping and pre-test variable as the independent variables. The difference in change between groups from pre- to post-test are reported with 95% CI. Analyses were based on intention-to-treat. In the case of missing values and dropouts, the method of last observation carried forward was used. Based on women adhering to ≥80% of the prescribed training sessions, an additional per-protocol analysis was performed. This analysis also excluded women who dropped out.

Ethics

- The study procedures are in accordance with the World Medical Association, Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects (updated 2013) [159].
- Study I-IV were approved by the Regional Committee for Medical and Health Research Ethics of Norway (REK South East 2018/2312) and the Norwegian Centre for Research Data (440860) (Appendix I). The RCT (study IV) was also registered at ClinicalTrials.gov (NCT04122924).
- The Regional Committee for Medical and Health Research Ethics of Norway and the Norwegian Centre for Research Data approved all changes for study I-IV during the project period (Appendix 2).
- Information about study I was sent to the participant by email and the participants gave their written consent by ticking boxes before entering the electronic questionnaire (Appendix 3). (Participating women in study I was included in a draw of three gift vouchers worth 500 NOK.)
- Information about study II-IV was given and written consent was taken from all participants before entering the study (Appendix 4-6).

Funding Source

The Norwegian Women's Public Health Association fully funded this PhD project. The funder played no role in the design, conduct, or reporting of the studies.

Results

The following section summarizes the main findings from study I-IV.

Paper I

Four hundred and sixty women, 6-8 months postpartum, mostly recruited through social media, responded to the electronic questionnaire. The mean age was 30.4 (±3.6) years, and the mean BMI was 24.5 (±4.3). Knowledge about DRA was reported by 415/440 (94.3%) women. A total of 73.3% reported having been worried during pregnancy about abdominal appearance postpartum. The mean degree of concern about present abdominal appearance was 5.5/10 (SD 2.4). Almost 80% of the sample experienced weaker abdominal muscles than pre-pregnancy. Ninety-six women (20.9%) reported a protrusion along the midline of their abdomen. Significantly more women with protrusion (90/96 (93.8%)) reported weaker abdominal muscles than women without protrusion (259/342 (75.7%)). The most frequent treatments women with DRA reported were exercises for the PFM (84.1%) and abdominal muscles (82.9%), mostly accessed via social media. The mean score on the EDE-Q, shape concern questions, was higher in women with reported protrusion (mean score: 2.37 (SD 1.6) than in women without protrusion (mean score: 2.14 (SD 1.4), p=0.175.

When we were about to submit this thesis, we unfortunately discovered errors in table 2 in the published article of study I; the numbers and percentages reported in women with and without protrusion were reported as percentages within protrusion and not the percentages within the reported variable (e.g. lax skin). However, the reported results (difference between groups) are correct. We have sent an errata to BMC Women`s Health journal.

Paper II

The study included 38 parous women diagnosed with DRA, with a mean age of 36.2 years (±5.2) and a mean BMI of 23.2 (±3.6). Two women had 1 twin birth each. The mean parity was 2.1 (range 1–4). An observable protrusion was found in 19 women (50%). Ultrasound of PFM revealed that 5 (13.1%) were unable to perform a correct PFM contraction.

For measurements taken 2 cm above the umbilicus mean IRD was 33.5 mm ±10.9 during a head lift, 34.5 mm ±10.6 during curl-up, and 34.2 mm ±11.0 during twisted curl-up. These three exercises showed a statistically significant decrease in IRD when compared to the resting value

(43.6 mm ±12.7), with a mean difference of 10.0 mm (95% CI 7.9-13.3), 8.7mm (95% CI 5.0-12.5), and 9.4mm (95% CI 6.3-12.5), respectively. For measurements 2 cm below the umbilicus mean IRD was 26.8 mm ±9.4 during head lift and 29.4 mm ±9.9 during twisted curl-up. These two exercises also showed a significant decrease in IRD when compared to rest (32.9 mm ±13.1), with a mean difference of 6.1 mm (95% CI 3.2-8.9) and 3.5 mm (95% CI 0.5-6.4), respectively. For measurements above the umbilicus, none of the investigated exercises increased the IRD. We found that three out of eight exercises led to an immediate significant increase in IRD. Mean IRD for these exercises, all measured below the umbilicus, were; 35.2mm ±15.3 during a PFM contraction, 37.6mm ±16.1 during a maximal in-drawing, and 37.3mm ±14.5 during maximal in-drawing + PFM contraction, compared to resting value below the umbilicus (32.9 mm ±13.1), the mean difference in change for these exercises were −2.8mm (95% CI −5.2 to 0.5), −4.7mm (95% CI −7.2 to −2.1), and −5.0mm (95% CI −7.9 to −2.1), respectively.

Paper III

This study included 72 women with a mean age of 36 years (±5) and a mean BMI of 24 (±4.1). The oldest woman was 58 years old. There was no statistically significant difference in background variables between women with and without DRA. Mean IRD measured 2 cm above the umbilicus at rest in women with and without DRA were 43.5 mm ±13.1 and 23.3 mm (±7.1), respectively. According to the classification of DRA severity [64] 18/35 (51%) women were classified with mild, 13/35 (37%) with moderate, and 4/35 (11%) with severe DRA.

Results from the abdominal muscle strength tests showed that the mean number of ACSM curl-ups in women with DRA were 5.1 (±10.6) and 4.5 (±8.9) in women without DRA. The mean Nm for the maximal isometric strength test at 10◦ and 30◦ in women with DRA was 73.9 (±17.5) and 96.1 (±20.6), respectively. For women without DRA mean Nm was 82.9 (±22.4) at 10◦ and 109 (±26.7) at 30◦. There was a significant difference between women with and without DRA in mean maximal isometric strength at 30◦ (mean difference: −12.9 (95% CI: −24.4, −1.5), p-value: 0.028). However, when adjusted for possible confounders; age, height, physical activity level, BMI, parity, time since birth, and DRA severity, no difference in abdominal muscle strength between groups was found. Subgroup analyses of women with severe and moderate DRA compared to women without DRA showed no differences in the abdominal muscle strength tests, neither adjusted nor unadjusted.

There were no significant differences in the numbers of women with and without DRA experiencing PFD, low back, pelvic girdle, and abdominal pain in the unadjusted analyses. When

adjusted for the possible confounders, significantly more women with DRA reported abdominal pain than women without DRA (OR: 0.02, 95% CI 0.00 to 0.61, P = 0.026). Subgroup analyses comparing women with moderate and severe DRA to women without DRA found no differences in the numbers of women experiencing PFD, low back, pelvic girdle, and abdominal pain (unadjusted and adjusted analyses for age, height, physical activity, BMI, and parity).

Paper IV

In the RCT, 247 women underwent ultrasound screening for DRA, of whom 177 (72%) were excluded primarily due to not meeting the inclusion criteria for IRD. Seventy women who met the inclusion criteria, with a mean age of 33.9 (±3.4) years and a mean BMI of 24.9 (±5.6), were enrolled in the study, with 35 women allocated to either the exercise or control group. In the exercise group 21 (66%) women adhered to 80% or more of their prescribed exercise sessions.

Out of the different measurement locations/sites, the widest IRD at the pre-test was measured at rest 2 cm above the umbilicus, showing a mean IRD of 36.95 mm (±8.08) and 39.82 mm (±10.08) in the exercise and control group, respectively.

Mean IRD decreased from pre- to post-test for all measurements in both groups, except for a minor increase in IRD below the umbilicus at rest in the control group. The difference in mean change between groups with 95% CI at rest 2 cm above and below the umbilicus was 1.24 mm (-0.83, 3.31) and -2.78 mm (-5.81, 0.26), respectively. In measurements taken during a crunch, the mean change in difference with 95% CI was 0.08 mm (-2.94, 2.79) above the umbilicus and -1.15 mm (-4.62, 2.33) below the umbilicus between groups.

At post-test 20 (61%) women in the exercise group and 15 (43%) women in the control group reported improvement in DRA by the GRC (p = 0.16). None of the participants in either group reported worsening of the condition.

At pre-test, an observable protrusion was seen in 14 (40%) and 12 (34.3%) women in the exercise and control groups, respectively. Regards to an observable “sink-in”, this was seen in 5 (14.3%) women in the exercise group and 2 (5.7%) women in the control group. At post-test, there was no significant difference between the exercise and control groups in the number of women with an observed protrusion or an abdominal "sink-in".

No significant difference between the exercise and control groups at post-test was found in the number of women reporting PFD, low back, pelvic girdle, or abdominal pain.

Measurements of mean maximal isometric strength at 30◦ at pre-test showed 118.5 Nm (±26.9) for the exercise group and 114 Nm (±28.1) for the control group. The mean Nm at 10◦ and for the exercise and control group were 91.1 Nm (±26.6) and 87.7 Nm (±24.0), respectively. The difference in change between groups with 95%CI at 30◦ was 6.25 Nm (0.47, 12.04) and at 10◦ 7.55 Nm (1.94, 13.17). There was a statistically significant difference in maximal isometric strength change in favor of the exercise group at both 30◦ (p=0.035) and 10◦ (p=0.009).

Mean muscle thickness for m. rectus abdominis at pre-test was 8.30 mm (±2.19) for the exercise group and 8.48 mm (±1.48) for the control group. At post-test mean muscle thickness in the exercise group increased to 9.20 mm (±2.37) and to 8.80 mm (±1.78) in the control group. The increase in muscle thickness for the exercise group was statistically significant (p=0.046) with a difference in change between groups of 0.58 mm (95%CI 0.01 to 1.14).

At the pre-test, 25 (71.4%) women in the exercise group and 28 (80%) women in the control group were not able to perform a single curl-up according to the ACSM curl-up test procedure. At post-test, the prevalence of women that were not able to perform one repetition decreased in both groups, to 22 (64.7%) women in the exercise group and 23 (67.6%) women in the control group. There was no significant difference between groups on post-test in the number of women able to perform zero or more than one curl-up.

Per-protocol analyses did not change any of the reported primary or secondary outcomes.

Discussion

Summary of main findings

In study I we found that most women are concerned about abdominal appearance. Those reporting protrusion experience more reduced abdominal strength than those without protrusion. Postpartum women mostly learn about exercises for DRA through social media and exercises for the PFM and abdominals were the most reported treatments. In study II we found that head lift, curl-up, and twisted curl-up significantly decreased the IRD in women with DRA. Contradictory, PFM contraction, maximal in-drawing, and maximal in-drawing +PFM contraction increased the IRD below the umbilicus. The results of study III did not find that women with DRA had a higher prevalence of PFD, and low back and pelvic girdle pain than women without DRA. Adjusted analyses showed no difference between groups in abdominal muscle strength, but there was a significant higher prevalence of abdominal pain in women with DRA. Study IV investigated the effect of performing head lift, curl-up and twisted curl-ups over a period of 12 weeks in an RCT. The results showed no significant difference in the mean change of IRD, between the exercise- and the control group. However, there was a significantly difference in the increase in maximal isometric muscle strength and muscle thickness in favor of the exercise group. No significant effect was found on low back-, pelvic girdle- and abdominal pain, or PFD.

Methodological strengths and limitations

Paper I

Strengths of study I are a large sample of 460 women and 92% of the participants responded to the entire questionnaire. Secondly, the sample`s background variables were comparable to Norwegian primiparous women in the official statistics of the Norwegian Institute of Public Health`s Medical Birth Register [8]. Further, the use of protrusion as inclusion criteria for being classified with DRA in comparison with no DRA may indicate a more robust diagnosis compared with a simple question on whether the women experience DRA.

A limitation was the lack of a clinical assessment of DRA and protrusion, as self-reported protrusion may be considered a less reliable method compared to clinical measures. Vesting, et al. [160] measured protrusion clinically, and their reported numbers with protrusion are in accordance with the present study. Vesting, et al. [160] conducted a multicenter inter-rater reliability study

showing a moderate agreement (kappa value, 0.51 (95% CI 0.29 to 0.73) of assessment of protrusion. However, further validation is needed due to moderate kappa value and wide range in the 95%CI. Other limitations of the present study were that no power calculation was conducted for the study, the use of self-reported measures that may be subject to response bias, and that the study was of a cross-sectional design, limiting causal inference [161]. However, we hope that this relatively large cross-sectional study on DRA has provided new information about the population of young parous women, given valuable in-depth insights on women`s experiences and perceptions of the condition, identifying patterns and trends, and generated some new hypotheses to be tested in future [162].

Paper II

Strengths of study II include the use of 2D real-time ultrasonography to measure IRD. This measurement method was used in study II-IV and is found to be a reliable measurement method with ICC of intra- and inter-tester reliability > 0.9 [69]. In addition, van de Water and Benjamin [63] recommend ultrasound over palpation and caliper for measurements of change in IRD, which was the main purpose of study II. Also, a trained physiotherapist conducted all IRD assessments. Another strength was the use of ultrasound to verify the activation of TrA during an in-drawing [163] and to verify a correct PFM contraction [38]. Offline analyses of IRD images allowed the assessor to be blinded during the assessments of the eight exercises and the exercises were performed randomly with standardized instructions. In addition, the sample heterogeneity may be considered a strength of the study, including both primi- and multiparous women in addition to women with both vaginal births and cesarean sections. The statistical power calculations enabled detecting significant differences between rest and exercises.

A limitation of this study is that the assessments were not limited to a single time point after delivery. While 65.8% of the total sample had a timespan since the last birth of ≥12 months, earlier studies included women up to 12 months postpartum with time since the last birth ranging from 10 weeks to 1 year [20 22 77 164]. The present study's results may not be generalized to women less than one year postpartum. Unfortunately, small sample sizes precluded statistical analysis of subgroup differences. To test the effect of each of the eight exercises on decreasing DRA above and below the umbilicus, each t-test related to a specific exercise. Four out of eight tests were statistically significant both above and below the umbilicus, suggesting trustworthy findings. Using a Bonferroni correction would have been appropriate in intervention studies with multiple outcomes where multiple testing can yield statistical significance by chance. However, using

Bonferroni or other adjustments for multiple testing has documented disadvantages and was not advised to be used in this study [165 166].

Paper III

Strengths of study III include the use of ultrasound to measure IRD both at rest and during a curl-up. Previous studies assessing DRA have mainly measured IRD during a crunch but recent experimental studies have shown that IRD decreases in women with DRA during a crunch [20 22 77]. Therefore, to perform a complete examination and to avoid overseeing women with a possible severe DRA we assessed IRD also during rest. Another strength is the blinding of the physiotherapist to the women's IRD and her reported symptoms. The study also used recommended and validated questionnaires to assess PFD, low back, and pelvic girdle pain. To secure transparency when reporting study III the STROBE checklist was used [167]. Moreover, the study included a larger proportion of women with moderate and severe DRA compared to previous studies [20 21 78 164].

Limitations of this study were the absence of reliability studies for the ACSM curl-up test and the maximal isometric strength in the Humac NORM dynamometer. However, studies with comparable dynamometers have shown good intra-tester reliability [108 168]. Another limitation is the lack of an a-priori power calculation. The study included 36 women in each group, which has been estimated to be sufficient to detect differences in strength measurements [103]. However, the study's results are limited to flexion and should not be generalized to other abdominal motions such as trunk rotation. Additionally, the study sample consisted of highly educated Caucasian women, which limits the generalization of the findings to other populations. There is also a possibility of a type II error due to small samples in the sub-group analysis.

Paper IV

Study IV has several strengths, firstly a randomized controlled design. Triple blinding was not possible to implement in this exercise trial, but the assessor was blinded to group allocation [169 170]. To minimize inaccuracy, the same assessor performed all assessments, using ultrasound to assess IRD [63]. The allocation was concealed, which is associated with higher confidence in the results [171 172]. Also, an a-priori power calculation was conducted, leading to adequate statistical power and thereby decreasing the likelihood of a type II error [173]. Only three women, all from the exercise group, dropped out of the study. Drop-out can result in selection bias, which can threaten the internal validity of studies [174]. However, our sensitivity analyses, including both per-protocol and intention-to-treat analyses, did not yield any significant differences, thereby minimizing the

likelihood of bias. To handle missing values in the ITT analysis, the "last observation carried forward" technique was utilized. This technique is commonly used in clinical trials to address missing data [175], but can have resulted in conservative estimates which potentially can have underestimated the possible treatment effect [176]. However, our results did not change when a per-protocol analysis was conducted, indicating that participants who dropped out or did not meet the 80% attendance requirement were not significantly different from those who completed the study [177]. Therefore, we can be reasonably confident about the validity of our conclusions. Other strengths were that we used the CONSORT checklist that helps secure transparency when reporting clinical trials [178] and the Consensus on Exercise Reporting Template (CERT) was used when reporting the exercise intervention [179]. Moreover, the participants were homogeneous as they were parous women 6-12 months postpartum. Additional strengths are that we used validated questionnaires to obtain information on PFD, low back, pelvic girdle and abdominal pain, and GRC.

A potential limitation is that unsupervised training may have resulted in reduced adherence, incorrect performance, and reduced intensity of the training. This is elaborated below under interventional quality. Additionally, the abdominal muscle strength tests, also used in study III, have not been tested for reliability. The results may not be generalizable to women with severe DRA as our sample consisted of a limited number of women classified with severe DRA. Furthermore, the study sample was limited to women who were able to speak and understand Scandinavian languages, and the results may not be generalizable to other ethnic groups.

Using the PEDro scale to study our RCT`s internal validity, 8 out of 10 points on the PEDro checklist were fulfilled [142]. PEDro scores for previously published RCTs on exercise programs to reduce IRD range between two [180] and eight [181]. High internal validity is a prerequisite for concluding that the intervention, in this case, the exercise program, has or has not produced the effect [171]. Our study found no effect in the primary outcome IRD, and we trust we can be reasonably certain that this exercise program did not decrease IRD in women with DRA compared to a control group receiving no intervention. However, the lack of an effect on IRD could be attributed to other factors related to the interventional quality of the study[182].

Interventional quality study IV

A thorough assessment of interventional quality may be considered equally important as evaluating the methodological quality in RCTs. [179 182]. Therefore, interventional quality in study IV

will be discussed according to the criteria "risk of effectiveness" listed in the i-CONTENT tool [182].

Patient selection

The purpose of our exercise program was to investigate the effect of abdominal training in postpartum women with DRA, and we included only women with DRA postpartum. The present study used a higher cut-off value for DRA as inclusion criteria compared to other RCTs [140 149]. Recent research has suggested increasing the cut-off value for diagnosing DRA [183 184]. Therefore, we believe we selected a patient group with a "low risk" of ineffectiveness.

Dosage of the exercise intervention

Regarding the relationship between dosage and the effect of strength training, the training effect is dependent on frequency, intensity, and duration of training [185 186]. In strength training, load is often used interchangeably with intensity and is defined as a percentage of the maximum contraction known as a repetition maximum (1 RM) [129]. The exercises in the present study`s intervention used body weight as load/intensity. Calculation of 1RM or 10RM was not possible for these exercises. However, the exercise program included progression in load and volume every second week. One example is that the requirement for the internal load was increased by placing the hands behind the neck during the curl-up. Therefore, we argue that the principle about intensity was reached, also based on previous studies showing a generally weaker abdominal muscle strength in postpartum women [27]. The latter was confirmed in study II. Our exercise intervention`s frequency and duration of training were in accordance with the recommendation to increase muscular strength [129]. Hence, we consider the dosage of the exercise program with "Low risk" of ineffectiveness.

Types of exercises

Our choice of intervention was based on three exercises shown to provide an immediate reduction in IRD (study II). We have not identified other RCTs with an exercise intervention including only exercises shown to cause an immediate IRD reduction. However, two studies have investigated isolated TrA exercise interventions [139 149]. The other RCTs investigating the effect on DRA postpartum [144] have used a combination of different types of abdominal- and/or PFM exercises, in addition to adding e.g. binders, electro-acupuncture, or other modalities in their intervention. For these studies, it is impossible to conclude with effect of single exercises and the intervention must be assessed as an exercise package. We consider it especially important in this

relatively new field of research on DRA to investigate exercises with a proven rationale based on anatomical relevance to the condition. Therefore, studies investigating the effect of programs containing exercises proven to cause immediate increase or decrease in IRD are interesting. However, we also emphasize the importance of the exercises` functionality and transferability to ADL. Therefore, the type of the exercise is considered with "low risk" of ineffectiveness [182].

Qualified supervisor

Our exercise intervention was home-based and scoring on this item is therefore not applicable. However, the teaching of the participants in how to conduct the exercises were conducted by two physiotherapists either in person or online. The exercises were also shown in the written exercise program.

Type and timing of outcome assessment

Our primary outcome measure was IRD assessed with ultrasound. In addition, we used the ASCM curl-up test, the Humac NORM dynamometer to assess maximal abdominal muscle endurance and strength, and ultrasound to assess muscle thickness as secondary outcome measures. However, as discussed in the theory chapter, measuring IRD to assess the effect of an abdominal muscle strength training regarding the morphological changes in the linea alba in women with DRA, can be discussed as a limitation, but to date there is no other valid outcome measure available for the strength of the linea alba [63]. According to timing of outcome measurements, we conducted the post-test after a 12-week intervention, and this is within the period of which the optimal effect can be expected in strength training [129]. Our measures reflect the goals and purpose of the exercise program and we therefore consider the criteria "type and timing of outcome assessment" with "low risk" of ineffectiveness.

Safety of the exercise program

To our knowledge, we have not identified adverse events in previous similar published RCTs that have used abdominal muscle exercises in their interventions to investigate the effect on DRA[144]. No women in the present RCT reported worsening of the condition shown in the GRC. Therefore, the present study`s program is considered safe and with a "low risk" of ineffectiveness according to this criterion.

Adherence to the exercise program

Sixty-six women in our exercise intervention adhered to 80% or more of the prescribed exercise sessions. Therefore, the lack of an effect on IRD could be attributed to low adherence to training. This might be due to the use of a home-based exercise intervention, but weekly exercise reminders were sent out to try to reach enough adherence to training. Although a per-protocol analysis was conducted only including the women with an exercise adherence of more than 80%, showing no change in results, we cannot exclude that low exercise adherence may have resulted in a non-optimal effect on IRD measurements. However, we found increased abdominal muscle strength and therefore we can be quite confident that the program influenced the performance-based outcomes. Adherence in our program in relation to the effect on IRD can therefore be considered with a "moderate risk" of ineffectiveness according to this criterion.

No overall score is calculated for our study, in accordance with the recommendations in the i-CONTENT [182]. Except for adherence, we judge all the criteria with a low risk of ineffectiveness. However, the dose-response relationship in strength training depends on the type of exercises, dosage (frequency, intensity, and duration of training), and adherence [185 186]. Therefore, awareness of the suboptimal adherence found in our study by using the i-CONTENT can assist in the planning of future, high-quality, exercise interventions [182].

Comparing the interventional quality in our study to other RCTs is challenging due to differences in content and inadequate described exercise interventions in some studies [187]. Therefore, it cannot be ruled out that differences in the quality of exercise interventions can have caused the heterogeneity in the results of RCTs investigating the effect on IRD [182].

Interpretation

Paper I

When planning this project, we found no studies with qualitative study design investigating women`s experiences or perceptions of DRA. In addition, there were few studies of quantitative design showing that health-related quality of life might be lower in women with DRA [12]. However, a recent interview study by Eriksson Crommert, et al. [188] investigated women`s experiences of living with DRA postpartum. They reported that body dissatisfaction seems to be high in women with DRA. They highlighted the complexity of DRA and that it may affect women in numerous ways. Although our study was not a qualitative study design, the results are in accordance with the findings reported by Eriksson Crommert, et al. [188].

The reported prevalence of protrusion among women in the present study was 20.9%. We have not been able to identify other studies that have reported prevalence of self-reported protrusion. However, Vesting, et al. [160] assessed protrusion clinically in a study including women (n=159) recruited via Swedish maternity care units 3 months postpartum and reported a prevalence of protrusion of 12%. Another study, by the same research group, reported bulging in 20.7% of women with pelvic girdle pain (n=353) and 15.2% in women without pelvic girdle pain (n=151) [189]. The protrusion was assessed by physiotherapists using observation during a curl-up. We consider the reported prevalence of protrusion in our study in accordance with prevalence rates in Vesting, et al. [189]. The present study`s reported prevalence of protrusion is however lower than the reported DRA prevalence by Sperstad, et al. [10], with 45% in primiparous women 6 months postpartum. We are not surprised by this lower prevalence, as protrusion was observed in 50% of women diagnosed with DRA in study II, ranging between 30-40% at pre-test for the intervention- and control group in study IV.
A limitation is that the term protrusion may have been interpreted differently among participating women. To date, there is scarce scientific reports and knowledge on the term protrusion, and to our knowledge there is currently no consensus on the definition or measurement method of protrusion.

Ninety-four percent of the women in the present study were aware of DRA. Social media was reported as one of the most common sources of information, also for treatment options. This finding is confirmed by Zhu, et al. [190] reporting a shift in pregnancy-related information-seeking from caregivers to social media. Hayman, et al. [191] also showed that women searched for information and advice from social media influencers, who for the most part, are trusted and perceived as experts. In addition, Gustavsson and Eriksson-Crommert [192] reported no consensus among healthcare professionals on how to best approach DRA, and that they also used social media to update their knowledge of the condition and treatment options. Based on the present study, we agree with the study by Hayman, et al. [191] claiming that due to the popularity of social media, this platform may provide a unique place for evidence-based information dissemination [191]. Regards to social media, the present study also showed that more than 2/3 of women agreed or strongly agreed that there was too much media focus on regaining a "flat abdomen" postpartum. This is in accordance with a systematic review and meta-synthesis showing that women in general may have unrealistic expectations for their postpartum body [99]. Therefore, it seems important to share evidence-based information on social media on the natural remission of DRA during the first year postpartum [10]. Also, for those women reporting to have tried treatments for DRA, the most frequently reported treatments were PFM exercises (84.1%) and

abdominal muscle exercises (82.9%), and these exercises were mostly accessed through social media. This finding is in accordance with Keeler, et al. [17] who reported that women`s health physiotherapists use these exercises in the treatment of women with DRA. However, when social media is the most common place these patients report to access information, it seems of great importance that clinicians and researchers also communicate evidence-based information through these platforms.

Women with protrusion reported to be significantly less satisfied with abdominal appearance than women without protrusion. This is supported by a recent study by Tuominen, et al. [183] showing that satisfaction with abdominal contour, using a Likert scale from 0 (being totally satisfied) to 5 (not satisfied at all), was 2.2 in women without DRA(<3 cm) and 2.9 in women with DRA (>3 cm), (p=0.04). Although the clinical significance of this relatively small difference is not known, it can be argued that women with DRA seem to have lower satisfaction with abdominal appearance. Although not reporting specifically on abdominal appearance a study by Keshwani, et al. [104] also support these findings, reporting that increased IRD was associated with lower body image.

The present study`s subscale score on the shape concern questions from the EDE-Q 6.0 for women reporting protrusion was high, indicating a possible clinical eating disorder. We have not identified other studies reporting the prevalence of eating disorders in women with DRA. However, due to only using the shape concern questions of the EDE-Q 6.0 it is not possible to report on eating disorders in the present population. The results might indicate that questions on eating disorders are important to include in future studies.

Significantly more women with protrusion reported weaker abdominal muscles than women without protrusion. We have not identified other studies reporting abdominal muscle strength subjectively. However, the result of weaker abdominal muscles in women with DRA is in accordance with studies containing clinical measures [18 102 103], also shown in study III. In addition, 80% of the total sample reported weaker abdominal muscle strength compared to the pre-pregnancy level. We were not surprised by this number as studies have shown that postpartum women are weaker than nulliparous women[27]. Also, in study III the mean number of curl-ups for women with and without DRA were 5.1 (SD 10.6) and 4.5 (SD 8.9), indicating generally impaired abdominal strength in this population.

Paper II

Prior to this PhD project, a few studies had reported the immediate effect on the exercises in-drawing and PFM contraction leading to increased IRD [20 77] and curl-up leading to decreased IRD [19-21 77 78]. Our findings confirmed these results and they are also in accordance with other studies that have been published after commencing this PhD project. Three studies have been identified also showing that curl-up decreases IRD [164 193-195] and two studies have been identified reporting that in-drawing and PFM contraction increase IRD [194 195]. Although the studies measure IRD at different sites along linea alba, at different time points postpartum, and define DRA differently, we believe that we can be reasonably confident to conclude that these specific exercises cause an immediate increase or decrease in IRD in women with mild to moderate DRA. In contrast to the above-mentioned studies, the present study included more women classified with moderate DRA, but only four women were diagnosed with severe DRA. We have not identified other studies investigating the immediate effect of these exercises in the population of women with severe DRA (>5 cm). Therefore, future studies on women with severe DRA are warranted.

Although studies report a statistical significant decrease in IRD, the mean difference between rest and curl-up varies between 8.7 mm (95% CI 5.0 to 12.5) in the present study and 11.9 mm (95% CI -14.5, -9.3) in the study by Lee and Hodges [21] and down to 3.4 mm in the study of Chiarello, et al. [78]. It is interesting to compare these results to RCTs reporting a statistically significant effect of abdominal exercise interventions compared to inactive controls, with reported mean difference in change between groups of 27.6 mm [196], 12.8 mm (95% CI -1.60, -0.69) [140], and -0.76 mm (95% CI: -1.53, 0.01) [139]. Although the results of these RCTs are above and in the range of the immediate effects from short-term experimental studies, the clinical relevance of the magnitude of IRD can be questioned and needs further investigation.

We found that head lift and twisted curl-up decreased IRD significantly both above and below the umbilicus. To our knowledge, while the project was running, two new studies investigated head lift [164 193], while no other studies investigated twisted curl-ups. The present study`s result is in agreement with Beamish, et al. [164] finding an immediate decrease in IRD when comparing IRD during head lift to rest in women with DRA. However, they included both nulliparous and parous women, women with and without DRA, and a limited number of women classified with DRA. Hence, results might not be comparable. Out of the eight exercises studied in the present study, head lift was the exercise leading to the most IRD reduction. This is in contrast to Djivoh and De Jaeger [193] who reported that both curl-up (12.2 ± 3.0 mm) and sit-up (12.2 ± 3.6 mm) lead to a greater decrease in IRD than head lift (20.3 ± 3.9 mm). The reasons for the different

findings might be due to the lower cut-off value for DRA (15 mm) and the use of a caliper as the measurement method in Djivoh and De Jaeger [193]. However, recent research has shown that calipers have a very good positive correlation with ultrasound (r = 0.85 to 0.99) and excellent inter-rater (ICC = 0.80 to 0.99) and retest (ICC = 1.00) reliability [197]. Also, Vesting, et al. [160] reported that calipers yielded good reliability with inter-rater ICC of 0.83 (95% CI 0.76 to 0.87). A caliper is easily available and a low-cost method and can be recommended for use in clinical practice. However, it has only been tested during a head lift and not at rest. The study by Djivoh and De Jaeger [193] also highlights that there is a difference between a sit-up and a curl-up. Their objective was to investigate whether IRD was more reduced during a sit-up than a curl-up. To our knowledge, previous experimental studies have included only curl-up/crunch. Djivoh and De Jaeger [193] found that IRD was similarly reduced during sit-up and curl-up. More research is needed investigating the sit-up exercise, but interestingly, that these two exercises lead to similar IRD reduction.

As previously presented in the theory chapter, Lee and Hodges [21] developed the "distortion index", a concept and method that has not yet been validated. Beamish, et al. [164] evaluated the relationship between the distortion index and IRD and found that ICCs for between-rater reliability for the distortion index were moderate (ICC = 0.746–0.766). Therefore, the researchers questioned the implication of the distortion index in women with DRA. Another study by Arranz-Martín, et al. [195] investigated the immediate effect of hypopressive exercise on IRD. They reported a nonsignificant difference when comparing IRD at rest and during hypopressive exercise. However, they suggested that hypopressive exercise could improve the tensile responses of linea alba without increasing the IRD. Their suggestion is based on the distortion index concept. However, the distortion index is still only a proposed measure that has not been tested for reliability and validity [198]. Vesting, et al. [160] highlighted the need for a reliable and clinically applicable assessment method or rating scales in clinical practice to measure tension/stiffness of the linea alba [160], a conclusion that our research group agree upon.

Paper III

Several studies and systematic reviews have been published on the consequences of DRA after commencing this PhD project. Fuentes Aparicio, et al. [199] included 14 studies in their systematic review. Some of these were also included in Benjamin et al. (2018) but Fuentes et al.(2020) also included abdominal muscle pain in their review.

The present study showed no difference between women with and without DRA in relation to low back and pelvic girdle pain, in accordance with Benjamin, et al. [12] and Fuentes Aparicio, et al. [199]. A recent systematic review by Sokunbi, et al. [200] investigated the relationship between DRA and low back pain, including 13 studies, whereas five studies found a positive association and eight studies did not find any association. The most common assessment for back pain was based on a yes/no question such as "Do you have low back pain?" [200]. This question was also used in the present study. Also, the present study found no association between DRA and low back and pelvic girdle pain in the subgroup analyses comparing women with severe and moderate DRA to women without DRA. This was supported in a prospective cohort study following (n=933) reporting that moderate DRA alone does not seem to explain low back pain or functional disability [183]. Another important factor to account for is that the reported prevalence of low back and/or pelvic girdle pain is expected to be high, with prevalence varying between 9% and 48% in all postpartum women [74 201-203]. The prevalence of low back and pelvic girdle pain in our study was within this range, suggesting that there is no association between lumbo-pelvic pain and DRA. Subgroup analyses comparing women with moderate and severe DRA to women without DRA also found no difference in the prevalence of low back and/or pelvic girdle pain. This finding is contradicted in a matched case-control study with (n=28) and without (n=28) clinically confirmed pelvic girdle pain, showing that women with pelvic girdle pain presented with larger IRDs ($p = 0.046$) [204]. The latter study analyzed the question from a different perspective, used palpation to assess DRA, and included women at an earlier stage postpartum, making a comparison to the present study difficult. Also, another recent study by Vesting, et al. [189] found in a subgroup analysis that a DRA width of ≥35 mm predicted an increased PGQ score (β = 5.38 [95% CI = 1.21 to 9.55]) in women with pelvic girdle pain. This is an interesting finding because most research has been conducted on women with mild DRA and supports that more research is needed on women with severe DRA.

We found no difference in the prevalence and severity of PFD between women with and without DRA. This was observed both in the sum score of the PFDI-20 and for the three scale scores (UDI-6, POPDI-6, and CRADI-8), also when comparing the subgroup of women with severe DRA. These findings are consistent with the conclusion of the systematic review by Benjamin, et al. [12], Fuentes Aparicio, et al. [199], and Fei, et al. [205] who reported no significant association between DRA and urinary incontinence. In contrast, Benjamin, et al. [12] found a small correlation between DRA and pelvic organ prolapse. Also, in contrast to our results regarding urinary incontinence Tuominen, et al. [183] reported that women with DRA (≥3 cm) reported significantly (p=0.001) more urinary incontinence than women without DRA(< 3 cm). The median for measuring DRA

was 15±2.1 gestational week in Tuominen et. al (2020). Hence, we argue that incongruities in the data might be due to the measurement of IRD during pregnancy.

After adjusting for potential confounding factors, the present study found that more women with DRA experienced abdominal pain than those without DRA. This finding is supported by Fuentes Aparicio, et al. [199] who reported a significant positive correlation between the presence of DRA and abdominal pain. However, due to variations in evaluation methods and populations, additional research is necessary. Also, variations in definitions used and how abdominal pain is assessed may lead to different results. There is a need for consensus on how to measure abdominal pain in women with DRA.

The present study showed that women with DRA had weaker abdominal muscle strength, which is in accordance with Benjamin, et al. [12] and with study I reporting weaker abdominal strength in women with protrusion. Also, a recently published study supports the present results, reporting that a reduction in abdominal force and endurance was according to the severity of DRA in primiparous women with pelvic floor trauma [206]. In accordance with the present study, Denizoglu Kulli and Gurses [207] reported that IRD did not show an association with abdominal muscle endurance. However, due to the use of different test methods for abdominal endurance and different cut-off values for DRA, with 2.8 cm in the present study and 2 cm in the latter study, results cannot be compared. Seventy-two percent of the women in the present study were unable to perform a single curl-up as per the ACSM curl-up test protocol, and there was no significant difference between women with and without DRA. As this test was not specifically designed for postpartum women, it is possible that the ACSM curl-up test is too difficult for women with DRA postpartum, and should only be used to measure the ability to perform a single curl-up in future studies. Also, the process of postpartum recovery has been shown to have an impact on abdominal strength, which can have affected the outcome [18]. We also argue that finding appropriate tests that directly assess abdominal muscle strength, excluding the hip flexors, can be challenging. The mean number of ACSM curl-ups in the present study was 5.1 (±10.6) and 4.5 (±8.9) in women with and without DRA, respectively. It is interesting to compare these numbers to Porcari, et al. [208] who reported a mean number of 29 (SD 14) curl-ups in non-pregnant exercising women. As reliability data on the ACSM curl-up test is lacking, our results should be interpreted with caution.

To summarize, the present and identified studies indicate that abdominal muscle strength is decreased in women with DRA, but similar to Benjamin, et al. [12]`s conclusion, there is still a low methodological quality of the published studies.

Paper IV

We found no significant difference in mean change between groups in the primary outcome IRD (1.24 mm, CI -0.83, 3.31, p=0.24), measured at rest 2 cm above the umbilicus. This effect size is far below our power calculation (8 mm in the exercise group and 2 mm in the control group), indicating not close to an effect. Therefore, the numbers needed in such an RCT would be very high and based on our results not recommended.

Due to the covid-19 pandemic, there was a stop of inclusion to our RCT for several weeks. In this period a systematic review was conducted in case the RCT was not going to be fulfilled [209]. Seven RCTs totaling 381 women were included and three of the included RCTs corresponded with our results of no effect of an exercise program with abdominal or PFM exercises on IRD [134 141 149]. Contradictory to the present study`s intervention containing head lift and two different forms of curl-ups, two studies compared TrA training with minimal intervention and provided data to be included in a meta-analysis [209]. This meta-analysis found very low-level quality evidence that TrA training reduced IRD (MD = -0.63 cm, 95%CI: -1.25, -0.01). Although the decrease in IRD might be considered small, this is contrary to experimental short-term studies showing an immediate increase in IRD. The reason why these studies have found an effect on IRD might be due to a low number of participants. Therefore, further studies should investigate TrA training in a well-powered high-quality RCT, and in addition compare TrA training with an equal dosage of curl-up or head lift training. Furthermore, two other systematic reviews have also been identified, with Berg-Poppe, et al. [210] including nine RCTs and Benjamin, et al. [144] including 16 RCTs. In the latter systematic review evidence from six trials (n = 161) showed that abdominal exercise led to a small reduction in IRD (MD -0.43 cm, 95% CI -0.82 to -0.05). However, their conclusion is in accordance with the present study`s result; abdominal training does not lead to clinically significant reductions in IRD postpartum.

Our study compared abdominal exercise to untreated controls. As there is a natural remission of DRA in the postpartum period [10], we would argue that the effect of interventions should be compared with untreated controls. We have identified seven RCTs comparing abdominal training with an untreated control group [124 139-141 149 180 196]. Two of these RCTs [141 149] are in line with our negative result on IRD. We have not identified other RCTs containing curl-ups only in their intervention. Contradictory to our results, five RCTs have found a significant positive effect on IRD over untreated controls [139 140 180 196 211]. These studies are hampered by small sample sizes, e.g. n=10 [139], and the cut-off values for DRA in one study indicate no DRA[140]. Only one of the RCTs [139] measured IRD with ultrasound, but this study was a pilot RCT. In addition, as discussed in

study II, the mean change in the difference between groups varied from 3.6 mm [212] to 94 mm [139]. The clinical relevance of a change in IRD of 3.6 mm is considered small. Hence, we argue that the results of the studies showing a positive effect in IRD are associated with uncertainty. Our result indicates that women with mild to moderate DRA can do abdominal curl-ups with no risk of worsening DRA, and agrees with the conclusion in the recently published systematic review by Benjamin, et al. [144] saying that conservative interventions do not lead to clinically significant reductions in IRD in postpartum women.

Although not statistically significant, a higher percentage of women in the exercise group (61%) than the control group (43%) in the present study reported improvement in DRA at the post-test by the GRC. We have not identified other studies reporting subjective improvement. With this result in mind and the increased knowledge on an association between DRA and impaired psychological impairment [12 188] it could be interesting to include patient-reported outcomes, e.g. use the Patient-Specific Functional Scale [213] as used in a study by Bjorbækmo, et al. [214] investigating its usefulness in clinical physiotherapy in patients with neck pain. Also, to gain a deeper understanding and strengthen confidence in the conclusions, the inclusion of a mixed-method approach in future studies would be interesting [215]

According to the secondary outcomes in the present RCT, the exercise group showed a significant increase in mean change of maximal isometric muscle strength and muscle thickness compared to the control group. The difference in change between groups in maximal isometric strength was 6.25 Nm (95% CI 0.47, 12.04) and 7.55 Nm (95% CI 1.94, 13.17), at 30◦ and 10◦ respectively. This was a little higher, but the CIs were slightly wider compared to Kamel and Yousif [135] who reported an average difference of 5.22 Nm (95% CI 1.95-8.50). They compared two exercise interventions, one by adding neuromuscular electrical stimulation. Therefore, comparisons between studies are not possible. We have only been able to find one other RCT comparing exercise to an untreated control group measuring trunk flexion strength and endurance [149]. Even though the test was different, their results correspond with our findings. Also, the present study`s program significantly increased the muscle thickness of m. rectus abdominis. This corresponds with increased m. rectus abdominis thickness in both intervention arms (delivered in person or via ZOOM) by Kim, et al. [216]. Participants` characteristics, time since the last birth, and the ultrasound protocol is comparable to the present study. The mean muscle thickness values at pre-test in the present study were similar to the mean thickness 6 months postpartum in Coldron, et al. [27] (n=39, mean 8.44 mm (SD 1.48).

The non-effect of abdominal strength assessed with the ACSM curl-up test did not correspond with the positive effect found with the dynamometer. Interestingly, more than 70% of our participants were unable to perform one single curl-up according to this test. This is in accordance with the findings in study III (the mean curl-ups in women with DRA was 5 (SD 11), and hence the ACSM curl-up test might be too difficult for women with DRA postpartum. In addition, there is no reliability data on this test and the results should therefore be interpreted with caution. In contradiction to the present study, Botla and Saleh [217] found that their participants were able to do 24 curl-ups, but compared to the present study the mean IRD values were smaller in their study (mean IRD for study- and control group was 27.6 mm (SD 2.1) and 27.3 (SD 1.4), respectively, and also below the normal IRD values in postpartum women according to Mota, et al. [154].

The present study did not find any effect of curl-up training on PFD, low-back, pelvic girdle-, or abdominal pain in women with DRA. These results are supported by the systematic review of RCTs by Gluppe, et al. [209] and also supported by the results of study III. Contradictory, a recent study by Yalfani, et al. [196] found a positive effect of abdominal training on low back pain and disability in women with DRA. The present study`s pain scores were generally low for those women reporting pain (meaning little or no pain), and this might be the reason for not finding an effect.

To summarize, according to the present RCT, postpartum women with DRA can increase their abdominal muscle strength even though IRD remains the same. Women with mild and moderate should therefore not be discouraged from doing curl-ups and head lift postpartum.

Clinical implications

- Published studies might have used a too small cut-off value for diagnosing DRA, as there is no consensus in the literature on a valid cut-off point. To avoid overtreatment we agree with recent studies that propose to increase the cut-off value for diagnosing DRA [183 184 218].

- Ultrasound is recommended as the best assessment method for IRD[63], and this method should be used in further research on DRA. However, this is expensive and seldom accessible in clinical practice. Physiotherapists could use a caliper, as recent studies have found it to be of high measurement quality and a better method than palpation [63 160].

- Experience from our studies shows that many women are concerned about doing abdominal exercises in the postpartum period due to fear of worsening DRA. An important finding from study IV is that conducting curl-ups and head lift do not widen IRD or worsen DRA. Therefore, women with mild and moderate DRA can be encouraged to start or continue doing these exercises.

- We have only been able to find one national guideline for diagnosing and treating DRA. This is a consensus document created by a group of Swedish surgeons[219] recommending physiotherapy as the first-hand treatment. Further, they recommend that surgery only should be considered if the patients have a functional impairment, have tried a standardized 6-month abdominal exercise program, that at least 2 years should have elapsed since the last childbirth, and that the width of DRA should be at least 5 cm. We agree with these recommendations and that this information should be communicated to patients in clinical practice with questions about surgery.

- Based on the results of study IV, evidence-based recommendations for clinical practice should encourage women with mild and moderate DRA to follow the national/international recommendations for general exercise in the postpartum period[127]. Also, a recent systematic review [144] stated that clinicians should be cautious promising effect of, or advocating specific exercises, in the treatment of DRA with the aim to decrease IRD further than natural remission.

Conclusions

I. Primiparous women are concerned about abdominal appearance both during pregnancy and after birth. Those reporting abdominal protrusion are less satisfied with their abdominal appearance and they report weaker abdominal muscles than women without protrusion. The most common treatments for women with DRA were PFM and abdominal training, and these treatments were mostly accessed through social media.

II. Head lift, curl-up, and twisted curl-up exercises decreased the IRD both above and below the umbilicus, whereas maximal in-drawing and PFM contraction exercises increased the IRD below the umbilicus.

III. Women with DRA tend to have weaker abdominal muscles (disappearing with adjusted analysis) and a higher prevalence of abdominal pain, but no higher prevalence of PFD, low back, or pelvic girdle pain than women without DRA.

IV. An abdominal exercise program containing head lift, curl-up, and twisted curl-up was not effective in decreasing IRD or low-back-, pelvic girdle-, abdominal pain, or PFD in women with DRA. However, the exercise program was effective in increasing abdominal muscle strength, muscle thickness, and self-reported DRA improvement. A combination of head-lift, curl-up, and twisted curl-up training for 3 months does not worsen DRA, and the results indicate that parous women with mild to moderate DRA should not be discouraged from doing such exercises.

To summarize, despite the passage of time and the publication of numerous studies since we initially planned this project, we can still rely on Benjamin et al.'s 2014 conclusion and additional later systematic reviews[12 144 209 210] that there is a significant need for high-quality studies to investigate the prevalence, etiology, risk factors, consequences, prevention, and treatment of DRA.

Further research

- Studies assessing self-reported symptoms, e.g. satisfaction with abdominal appearance, quality of life, and body image in relation to DRA are warranted. In addition, self-reported abdominal muscle strength vs measurement of function should be studied. There is a need for a more qualitative approach to capture in-depth knowledge of women's quality of life in relation to DRA.
- There is a need to investigate the immediate effect of other types of exercises, whether passage of time postpartum affects IRD, and whether IRD is affected in the same way in women with severe DRA.
- Further studies on DRA pathophysiology, etiology, and mechanisms. Especially studies on the linea alba/connective tissue properties and morphological adaptions to resistance training.
- Reliability studies for the Humac NORM and the ACSM curl-up test are needed.
- To study women with severe DRA in relation to possible consequences and effect of treatment using abdominal exercises on IRD. Also, studies on women with multiple pregnancies, postmenopausal women, nulliparous women and men are warranted.
- There is currently a lack of studies comparing the effect of abdominal training to surgery in women with DRA and more studies are warranted regarding the effect and complications of surgery.
- There is a need for consensus on the cut-off value for diagnosing DRA, the optimal measurement site and position, and definitions of protrusion and a "sink-in".
- There is a need for well-powered high methodological and interventional quality RCTs in women with severe DRA. We recommend including measurement of abdominal muscle function, self-reported perceived improvement, and other psychological measures, e.g. body image as primary outcome measures. Further studies should also investigate the preferable start of the intervention, as there is a natural remission of IRD during the first year postpartum.

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Paper I-IV

Paper I

Gluppe *et al. BMC Women's Health* (2022) 22:428
https://doi.org/10.1186/s12905-022-02009-0

BMC Women's Health

RESEARCH Open Access

Primiparous women's knowledge of diastasis recti abdominis, concerns about abdominal appearance, treatments, and perceived abdominal muscle strength 6–8 months postpartum. A cross sectional comparison study

Sandra Gluppe[1*], Marie Ellström Engh[2,3] and Kari Bø[1,2,3]

Abstract

Background Diastasis recti abdominis (DRA) is a prevalent condition in the postpartum period. To date, there is scant knowledge on how DRA influences physical, mental, and emotional health. This study investigates primiparous women`s knowledge about DRA, concerns about abdominal appearance, and perceived abdominal muscle strength, comparing women with and without reported DRA.

Methods This was a cross-sectional comparison study. Data were collected by a web-based questionnaire, mainly through social media in Norway. To be included in the study women had to be primiparous 6–8 months postpartum. The questionnaire contained questions regarding women`s knowledge about DRA, perceived protrusion, received treatment, concerns with abdominal appearance and muscle strength. Abdominal body image was measured through the shape concern questions from The Eating Disorder Examination questionnaire (EDE-Q 6.0). Demographic and other descriptive variables are presented as means with standard deviations (SD) or as frequencies with percentages. Chi-square test of independence and independent sample t-tests were used to compare differences between women with and without abdominal protrusion for categorical and continuous variables, respectively.

Results Our sample consisted of 460 women. Knowledge about DRA was reported by 415/440 (94.3%) women. A total of 73.3% reported to have been worried during pregnancy about abdominal appearance postpartum. Mean degree of concern about present abdominal appearance was 5.5/10 (SD 2.4). Almost 80% experienced weaker abdominal muscles than pre-pregnancy. Ninety-six women (20.9%) reported a protrusion along the midline of their abdomen. Significantly more women with protrusion reported weaker abdominal muscles than women without protrusion. The most frequent treatment women with protrusion reported were exercises for the abdominal muscles

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(92.6%). Mean score on the EDE-Q, shape concern questions, was higher in women with reported protrusion (mean score: 2.37 (SD 1.6) than women without protrusion (mean score: 2.14 (SD 1.4), p = 0.175.

Conclusion Primiparous women are concerned about abdominal appearance both during pregnancy and after birth. Those reporting abdominal protrusion are less satisfied with their abdominal appearance and they report weaker abdominal muscles than women without protrusion. This study may contribute to improved knowledge about women`s health concerns, and assessment of DRA should be part of routine follow-up of postpartum women.

Keywords Appearance, Diastasis Recti Abdominis, Function, Health, Postpartum

Background

Pregnancy and childbirth bring anatomical and morphological changes to the lower back, pelvic girdle, abdomen and pelvic floor [1]. The most obvious change is related to growth of the fetus and stretching of the abdominal muscles, potentially influencing the mother's posture and balance [1]. A possible link between injuries and weakness of the abdominal muscles and pelvic floor dysfunction (defined as urinary incontinence, anal incontinence, and pelvic organ prolapse), low back and pelvic girdle pain has been suggested, but results are conflicting[2, 3].

Diastasis recti abdominis (DRA) is defined as an impairment with midline separation of the two rectus abdominis muscles along the linea alba, and is diagnosed by measuring the distance between the medial border of the two rectus abdominis muscles, the inter-recti distance (IRD)[4, 5]. Candido, Lo, and Janssen (2005) [6] judge DRA as present if women present with protrusion/bulging during a crunch, and protrusion during physical activity is considered an important sign of a more severe DRA [7]. DRA affects a significant number of women during the antenatal- and postnatal period and postpartum the prevalence rates of DRA vary between 30 −68% [8, 9]. In a longitudinal study of 300 primiparous women who gave birth at a public hospital in Norway, Sperstad, Tennfjord, Hilde, Ellstrom-Engh, and Bø (2016) [10] found that prevalence rates changed from 60% 6 weeks postpartum to 45.4% and 32.6%, 6 months and 12 months postpartum, respectively. Impaired abdominal strength in women with DRA has been reported [11–13], but a systematic review concluded that the evidence for such associations was weak [2]. Strength training of the abdominal muscles is one proposed method to treat DRA, yet there is currently very low-quality scientific evidence to recommend specific exercise programs in the treatment of DRA postpartum [14].

Recent research has documented a connection between increased media attention and body image concerns among pregnant and postpartum women [15–17]. A systematic review and meta-synthesis of women`s experiences in pregnancy and postpartum body image found that body dissatisfaction dominated the postpartum period and that women may have unrealistic expectations for their postpartum body [18]. Also, a study exploring appearance-related images and messages in pregnancy magazines found that a substantial portion of advertisements promoted products for postpartum weight loss. The research concluded that these magazines may contribute to body dissatisfaction [19]. A recent systematic review found that the focus for investigation on DRA had been on associations with physical challenges such as pelvic floor dysfunction, low back and pelvic girdle pain, and there were few studies on associations with body image, physical appearance and body satisfaction [20].

The aims of the present study were to investigate primiparous women`s knowledge about DRA, whether they have concerns about abdominal appearance and, perceive impaired abdominal muscle strength 6–8 months postpartum. Further to study whether there are differences between women with and without reported abdominal protrusion regarding knowledge about DRA, concerns about abdominal appearance, and perceived abdominal muscle strength 6–8 months postpartum.

Methods

This was a descriptive cross-sectional comparison university initiated and conducted study. The study was conducted between March 2019 and August 2020. Healthcare clinics in Oslo and Akershus county, Norway and social media (Facebook and Instagram) were used to recruit women. The participants signed up by sending an email to the researcher or by clicking on a registration link. Before inclusion they had to confirm that they fulfilled the inclusion criteria. They subsequently received an email with the informed consent and a link to the electronic questionnaire.

Inclusion criteria were primiparous women 6–8 months postpartum with a single or multiple pregnancy, any mode of delivery, and who were able to understand a Scandinavian language. Exclusion criteria were multiparous women, being <six months and >eight months postpartum, and being <18 years old. In addition, we excluded responses with no answers, duplicates and no postpartum data.

The participants were invited to respond to an electronic survey (SurveyXact) via their personal phone or computer. Up to three reminders were sent to non-responders.

The questionnaire was a new web-based questionnaire developed for the present study, containing a combination of validated instruments and new questions developed from a focus group of a convenient assembly of parous women. The response options for the new questions were a mix of 11-point Likert scales, close-ended, and semi-close-ended questions. The new questions and response categories were piloted among members of our research group and women in the focus group, and the questions were revised accordingly for clarity.

Response to all 162 questions in the questionnaire required a maximum of 30 min to complete. However, less time was required for those who reported no abdominal, low back-, or pelvic girdle pain, or pelvic floor dysfunction.

Demographic variables

Participants` demographics included age, height, pre-pregnancy weight, current weight, weight gain in pregnancy, single/twin pregnancy, time since birth, mode of delivery, child`s birth weight and length, physical activity level (frequency and min/week) and self-reported health, smoking habits, workload, breastfeeding, menstrual cycle, education level, and ethnic origin.

The questions about exercise frequency and exercise duration were from The Physical Activity and Pregnancy Questionnaire, which has been found to be an acceptable measure of habitual physical activity and exercise among pregnant women at group level [21]. Questions about self-reported health were from the Norwegian Mother and Child Cohort Study, available at www.fhi.no/morogbarn. We have not been able to find specific questionnaires on physical activity in the postpartum period.

Knowledge about DRA

- Have you heard about separation of the abdominals/ DRA related to pregnancy or the postpartum period? Response options: "yes" or "no".

Only women responding yes to the above question, were asked to respond to the following questions;

- Where did you hear about DRA? Response options: "scientific literature", "the health service system (doctor, midwife, nurse, physiotherapists)", "friends/ acquaintances", "social media", "TV/ media", "women's magazines", or "other". Multiple response categories were allowed.
- Have you tried one or more treatments to decrease the separation between your abdominals postpartum? Response options: "yes" or "no".

Only women responding yes to the above question were asked to respond to the following questions;

- What type of treatment have you tried to resolve DRA? Response options: "surgery", "application of specific creams to the abdomen", "external support/corset", tape (e.g. kinesio tape)", "electrical stimulation", "exercises for the pelvic floor muscles (PFM)", "exercises for the abdominals", or "other". Multiple response categories were allowed.
- From where/whom have you found/received treatment/exercises for DRA? "internet sites/ social media", "physiotherapist", "naprapath/chiropractor/ osteopath", "fitness center/ personal trainer", or "others (family/friends)". Multiple response categories were allowed.
- How would you describe your DRA now compared to before treatment? The participants rated their recovery on a scale from − 5 to 5, where − 5 represented "very much worse", 0 represented "unchanged", and 5 represented complete recovery.

Abdominal protrusion, appearance and perceived abdominal muscle strength

All women responded to how they perceived their abdominal appearance using categorical responses and numeric rating on scales from 0 to 10.

- Do you experience a protrusion along the midline of your abdomen? "no, never", "yes, sometimes", "yes, all the time", or "do not know". This variable was dichotomized to yes and no, where "do not know" was classified as no.
- How would you describe the strength of your abdominal muscles? "stronger than pre-pregnancy", "the same as pre-pregnancy", "somewhat weaker than pre-pregnancy", "much weaker than pre-pregnancy", or "do not know".
- Do you feel that the skin on your abdomen is flabby/ lax? "no", "yes, somewhat", or "yes, to a great extent".
- Have you developed striae on your abdomen during pregnancy/postpartum? "no", "yes, a few", "yes, several", or "yes, a lot".

Only women responding yes to flabby/lax skin and/ or striae rated bothersomeness on a scale from 0 to 10 where 0 represented "not at all" and 10 "to a great extent". In addition, all women answered the following questions;

- Have others (e.g. friends or family) been concerned about your abdominal appearance postpartum? "no", "yes, to some degree", or "yes, to a great extent". In the comparison analysis between women with and without reported protrusion this variable was dichotomized into "yes" (to some degree/ great extent) and "no".
- Do you find there is too much focus from the media, TV, internet, magazines, about having a flat abdomen postpartum? "strongly disagree", "disagree", "neither", "quite agree", or, "agree to a great extent". In the comparison analysis between women with and without reported protrusion this variable was

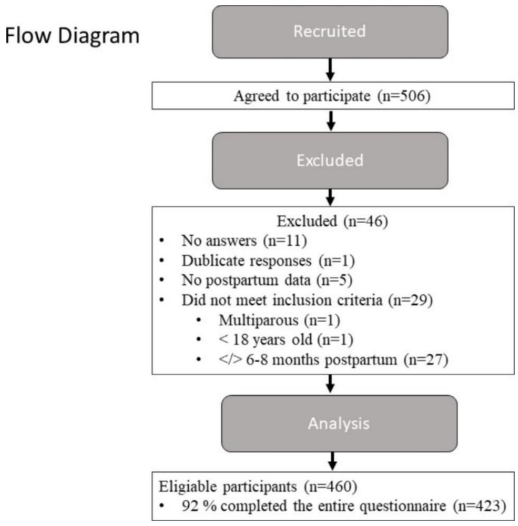

Fig. 1 Flow diagram of study particpants

dichotomized into "yes" (quite agree/agree in great extent) and "no" (neither/disagree/strongly disagree).

- While you were pregnant, were you worried about how your abdomen would look postpartum? "no", "yes, to some degree", "yes, to a great extent". In the comparison analysis between women with and without reported protrusion this variable was dichotomized into "yes, worried" (some degree/great extent) and "no".
- To what extent are you concerned about your abdominal appearance today on a scale from 0 to 10 where 0 represents "not at all" and 10 "to a great extent"?
- Overall, how satisfied are you with your abdominal appearance postpartum on a scale from 0 to 10 where 0 represents "very dissatisfied" and 10 "very satisfied"?

Abdominal body image

- The Eating Disorder Examination questionnaire (EDE-Q 6.0) is a self-reported measure of eating disorder psychopathology focusing on the previous 28 days and consisting of 28-item divided into four subscales. The Norwegian EDE-Q version has shown good test-retest reliability with a Spearman's correlation coefficients of 0.82–0.91 for the subscales. Norms for the subscale; shape concern for healthy women is 1.8 (SD 1.6) and 4.7 (SD 1.4) in women with an eating disorder [22]. Due to a possible link between abdominal appearance and the shape concern questions, and for the purpose of the present study, only the eight questions from EDE-Q 6.0; shape concern, were included to assess abdominal body image [23].

All statistical analyses were performed using SPSS statistical software package version 24 (SPSS Inc., Chicago IL, USA). Demographic and other descriptive variables are presented as means with standard deviations (SD) or as frequencies with percentages. Shapiro-Wilk test was used to test normality of distribution. Paired sample t-tests were used to compare the participants mean score for continuous variables pre-pregnancy, during pregnancy and postpartum. Chi-square test of independence (with Yates Continuity Correction) and independent sample t-tests were used to compare differences between women with and without protrusion for categorical and continuous variables, respectively. P-value was set at <0.05.

Results

Our sample comprised 460 women, recruited mainly through social media in Norway. Flow diagram of included women with reason for exclusion are presented are Fig. 1.

Table 1 presents the background variables of the participants. Most women were married/cohabitating, had a college/university education and were of Scandinavian origin.

Knowledge of DRA

Knowledge about DRA was reported by 415/440 (94.3%) women. Friends and acquaintances, social media and health personnel were the most common sources of this information. Approximately 20% of the women who knew about DRA had tried one or more treatment options to reduce it postpartum. The most frequently reported treatments were PFM exercises (84.1%) and abdominal muscle exercises (82.9%). These were mostly assessed through social media 44/82 (53.7%). No change in abdominal recovery after treatment was reported in 14/81 (17.3%) women and 23/81 (28.3%) reported complete recovery.

Abdominal appearance and perceived abdominal strength

Table 2 shows concerns and satisfaction with abdominal appearance and perceived abdominal strength for the total sample. More than 2/3 of the participants agreed or strongly agreed that there is an excessive social media focus on regaining a "flat abdomen" postpartum. Almost 70% reported laxity of the abdominal skin and 33% the development of striae on the abdomen during pregnancy or in the postpartum period. A total of 73.3% of the women were worried during pregnancy about abdominal appearance after childbirth. Mean degree of overall satisfaction with abdominal appearance was 5.8/10 (SD 2.6). When splitting the data into women with a singleton- and twin pregnancy the mean degree of overall satisfaction

Table 1 Characteristics of included primiparous women at 6–8 months postpartum. N = 460

Variable	
Age, years	30.4 (3.6)
Education level	
University	400 (87.0)
High school/college	56 (12.2)
Elementary school	3 (0.7)
Other	1 (0.2)
BMI, kg/m^2 [a]	24.5 (4.3)
Weight gain in pregnancy, kg[b]	16.2 (9.8)
Weight pre-pregnancy, kg[c]	67.7 (12.3)
Single pregnancy	455 (98.9)
Twin pregnancy	5 (1.1)
Time since birth	
6 months	203 (44.1)
7 months	150 (32.6)
8 months	107 (23.3)
Mode of delivery	
Vaginal	378 (82.2)
Cesarean	82 (17.8)
Week of delivery	
Between week 26 and 30	3 (0.6)
Between week 31 and 36	38 (8.3)
Week 37 or later	419 (91.1)
Child`s birth weight, gram	
> 4500	10 (2.2)
4000–4500	61 (13.3)
3000–3999	326 (70.9)
2500–2999	49 (10.7)
1500–2499	13 (2.8)
1000–1499	1 (0.2)
Child`s birth length, cm[d]	50.2 (2.9)
Current use of contraceptives	
Yes	182 (39.6)
No	278 (60.4)
Current breastfeeding	
> 3 times or more/day	352 (76.5)
1–2 times/day	21 (4.6)
4–6 times/week	1 (0.2)
1–3 times/week	3 (0.7)
Rarely/never	83 (18.0)
Back to work postpartum	
Yes	54 (11.7)
No	406 (88.3)
Heavy lifting at work[e]	
Perform heavy lifting	18 (33.3)
Rarely/never perform heavy lifting	36 (66.7)
Physical activity, n/week[f]	
Never	15 (3.4)
< 1/week	46 (10.3)
1/week	67 (15.0)
2/week	110 (24.6)
3–4/week	151 (33.8)
≥ 5/week	58 (13.0)
Physical activity, min/week[f]	147 (SD 132.3)
< 149 min/week	259 (57.9)
≥ 150 min/week	188 (42.1)
Self-reported health[g]	

Table 1 (continued)

Variable	
Very good	109 (23.7)
Good	248 (54.0)
Neither good nor bad	80 (17.4)
Bad	21 (4.6)
Very bad	1 (0.2)
Smoking	
Yes, every day	2 (0.4)
Yes, rarely	3 (0.7)
No	455 (98.9)
Menstruating	
Yes	195 (42.4)
No	211 (45.9)
Unknown	54 (11.5)

The table shows means with standard deviation (SD) or numbers with percentages (%)

[a]Total n=432; 28 women did not want to answer the question about current weight in the questionnaire

[b]Total n=451; 9 women did not want to answer the question about weight gain in the questionnaire

[c]Total n=439; 21 women did not want to answer the question about weight gain in the questionnaire

[d]Total n=455; 5 women did not enter child length in the questionnaire due to breech birth

[e]Total n=54 women responded yes to be back to work postpartum

[f]Total n=447; 13 women did not answer this question (valid percent reported)

[g]Total n=459; 1 woman did not answer this question (valid percent reported)

with abdominal appearance was 5.8 (SD 2.6) and 3.8 (SD 3.6), respectively. Splitting data on the women`s delivery week the mean overall degree of satisfaction with abdominal appearance was 6.7 (SD 1.5) for week 26–30, 5.9 (SD 2.6) for week 31–36 and 5.8 (SD 2.6) for week 37+. Splitting data on the child`s birth weight the overall degree of satisfaction with abdominal appearance was 4.6 (SD 3.4) (˃ 4500 g), 5.0 (SD 2.7) (4000-4500 g), 5.8 (SD 2.5) (3000-3999 g), 6.1 (SD 2.5) (2500-2999 g), 6.9 (SD 3.0) (1500-2499 g), and 8.0 (1000-1499 g).

Almost 80% reported weaker abdominal muscles after childbirth compared with pre-pregnancy levels.

Abdominal body image

Four hundred and thirty-three women responded the EDE-Q, subscale shape concern questions. Mean subscale score for included women was 2.19/6.0 (SD 1.48). A mean subscale score above 4.7 was reported in 32/433 (7.4%) women.

Women reporting abdominal protrusion

Ninety-six women (20.9%) reported a protrusion along the midline of their abdomen. There was no statistically significant difference in background variables between women with and without protrusion. In women who reported protrusion the prevalence of Caesarean section was 31.1% compared to 20.1% of women with vaginal delivery (p=0.053). One or more treatment methods were tried in 27/92 (29%) of women with reported protrusion. The most frequent reported interventions were exercises for the abdominal muscles (92.6%) and the PFM (81.5%). The exercises were mostly sourced through social media 14/27 (51.9%). 22% of the women with reported protrusion who had tried any form of treatment for DRA (n=27) reported no improvement and 11% reported complete recovery.

Table 2 shows concerns and satisfaction with abdominal appearance and perceived abdominal strength for women with and without reported protrusion. Women reporting abdominal protrusion were significantly more preoccupied with the appearance of their abdomen and less satisfied with their abdominal appearance. Significantly more women with protrusion reported weaker abdominal muscles compared to women without protrusion.

There was no significant difference in mean score on the EDE-Q shape concern questions in women with reported protrusion (mean score: 2.37 (SD 1.6)) compared to women without protrusion (mean score: 2.14 (SD 1.4)), p=0.175.

Discussion

The results of the present study showed that primiparous women are concerned about abdominal appearance both during pregnancy and in the postpartum period and most seek advice of treatment through social media. Women reporting protrusion of the abdominal wall are less satisfied with their abdominal appearance and they report weaker abdominal muscles than women without protrusion. In addition, those reporting abdominal protrusion report weaker abdominal muscles than women without protrusion.

Table 2 Concerns and satisfaction with abdominal appearance and perceived abdominal strength in primiparous women 6–8 months postpartum

	Total sample	Women reporting protrusion	Women without protrusion	Difference between groups, p-value
Worries during pregnancy about abdominal appearance postpartum Yes, to some/great extent No	321/438 (73.3%) 117/438 (26.7%)	76/321 (23.7%) 20/117 (17.1%)	245/321 (76.3%) 97/117 (82.9%)	0.153
Present degree of abdominal appearance concern	5.5 (SD 2.4)[a]	6.16 (SD 2.3)[b]	5.35 (SD 2.4)[c]	0.003 (MD -0.8, 95% CI -1.3,-0.3)
Striae Yes, some/many No, none	145/438 (33.1%) 293/438 (66.9%)	27/145 (18.6%) 69/293 (23.5%)	118/145 (81.4%) 224/293 (76.5%)	0.270 0.423 (MD -0.6, 95% CI -1.9, 0.8)
Bothersomeness of striae	3.7 (SD 3.2)[d]	4.11 (SD 3.66)[e]	3.56 (SD 3.11)[f]	
Lax skin Yes, in some/great extent No	298/438 (68.1%) 140/438 (31.9%)	69/298 (23.2%) 27/140 (19.3%)	229/298 (76.8%) 113/140 (80.7%)	0.388 0.082 (MD -0.67, 95% CI -1.42, 0.09)
Bothersomeness of lax skin	4.1 (SD 2.8)[g]	4.64 (SD 2.95)[h]	3.97 (SD 2.74)[i]	
Overall degree of satisfaction with abdominal appearance	5.8 (SD 2.6)[a]	5.29 (SD 2.8)[b]	5.90 (SD 2.54)[c]	0.043 (MD 0.61, 95% CI 0.02–1.19)
Too much focus in social media about flat abdomen postpartum Yes, quite/strongly agree No, quite/strongly disagree or neither	310/438 (70.8%) 128/438 (29.2%)	73/310 (23.5%) 23/128 (18%)	237/310 (76.5%) 105/128 (82%)	0.253
Concerns from family/friends (abdominal appearance) Yes, to some/great extent No	152/438 (34.7%) 286/438 (65.3%)	33/152 (21.7%) 63/286 (22%)	119/152 (78.3%) 223/286 (78%)	1.000
Weaker abdominal muscles than pre-pregnancy. Yes, slightly/very much No, similar/stronger	349/438 (79.6%) 89/438 (20.4%)	90/349 (25.8%) 6/89 (6.7%)	259/349 (74.2%) 83/89 (93.3%)	< 0.001

Values are presented for the total sample and women with and without reported protrusion as means with standard deviations (SD) or as frequencies with percentages (valid percent reported). There are dissimilar numbers of women responding to each question in the table

[a]Total n = 438; 22 women did not answer the questions about abdominal appearance in the questionnaire

[b]Total n = 96 women reported protrusion in the questionnaire

[c]Total n = 342 women did not reported protrusion in the questionnaire

[d]Total n = 145; only responded by women who reported striae in the questionnaire

[e]Total n = 27; women with stria who reported striae in the questionnaire

[f]Total n = 118; women with striae, who reported no protrusion in the questionnaire

[g]Total n = 298; only responded by women who reported lax skin in the questionnaire

[h]Total n = 69; women with lax skin who reported protrusion in the questionnaire

[i]Total n = 229; women with lax skin who reported no protrusion in the questionnaire

Knowledge of DRA

Most of our study participants knew about DRA and this information mostly came from social media. Eriksson-Crommert, Petrov Fieril, and Gustavsson (2020) [24] found that women with DRA reported a lack of understanding of their condition and that the health care system showed little interest and insufficient knowledge of the condition. This underpins the search for information through social media, and social media may therefore have impacted our participants' expectation regarding their abdominal shape postpartum. Although they report to be concerned about the protrusion of their abdominal wall, few women had searched for treatment within the health care system. Zhu et al. (2019) [17] confirmed

a shift in pregnancy-related information seeking from caregivers to social media. Gustavsson and Eriksson-Crommert (2020) [25] reported no consensus among health care professionals on how to best approach DRA, and that health personnel also used social media and other webpages to seek knowledge of the condition and treatment options.

We found that more than 2/3 of our participants agreed or strongly agreed that there is too much media focus on regaining a "flat abdomen". Studies have shown that media influence on body image is common in women and adolescent girls[26, 27]. Coyne et al. (2018) [15] reported lower body image in pregnant women after only five minutes of exposure to magazines containing glamorized media portrayals of pregnant/postpartum women, compared to women reading a control magazine. Although regular physical activity and regaining pre pregnancy weight may have several advantages for health in the postpartum period [28], the postpartum period can be a vulnerable period for the women's self-esteem and body image. A systematic review and meta-synthesis of women`s experiences in pregnancy and postpartum body image found that body dissatisfaction dominated the postpartum period and that women may have unrealistic expectations for their postpartum body [18]. It is therefore important to share evidence-based information on the natural remission of DRA during the first year postpartum on social media [10].

Abdominal appearance and perceived abdominal strength

Although several studies have investigated how postpartum women feel about their body[18, 29], as far as we have ascertained this is the first study to ask specifically about satisfaction and concerns with abdominal appearance, striae and loose skin. We found that mothers are concerned and dissatisfied with abdominal appearance. This adds to existing data from a systematic review and meta-synthesis showing that body dissatisfaction dominated the postpartum period and that women may have unrealistic expectations for their postpartum body [18]. Rallis, Skouteris, Wertheim, and Paxton (2007) [30] found that 6 months postpartum was when women reported most concern about their body. This confers with the time period of our study. Whether further recovery may occur after this time period or whether women later accept the postpartum body needs further investigation. In addition, we found that women who gave birth at term or had a normal weight child were less satisfied with their abdominal appearance compared to those giving birth preterm or having an underweight child. Also, women who had a twin delivery where less satisfied compared to women with a singleton pregnancy.

Almost 80% of our sample reported weaker abdominal muscles. This is based on women`s perceptions only, and not clinical assessment. There are few clinical studies of abdominal function after birth and there is a great diversity in how the studies assess abdominal muscle strength. Gilleard and Brown (1996) [31] assessed the functional capability of the abdominal muscle group to stabilize the pelvis against resistance. Six primiparous women were assessed < 8 weeks postpartum and the authors found decreased abdominal muscle function in the early postpartum period. Hills et al. (2018) [12] reported an association between ability to perform a sit-up and trunk rotation strength and DRA in primiparous women 1 year postpartum, while the result of Gluppe et el. (2021) [3] did not confer with these results. Benjamin et al. (2018) [2] concluded in 2018 with week evidence, and there is still a need for further studies to understand the influence of DRA on muscle strength.

Abdominal body image

The mean subscale score for shape concern the total sample in our study was higher than the mean subscale score for healthy Norwegian women (n = 1845); 1.8 (SD 1.6) [22]. Although we only used the shape concern questions from the EDE-Q 6.0, our results are in line with the results of the general postpartum population. Our result was not statistically significant, but we found a higher mean score for the shape concern questions in women with reported abdominal protrusion than in women without. Eating disorder symptoms is prevalent in the postpartum period [32–34]. The present study`s reported subscale score for women with a possible DRA is high and might therefor indicate a possible clinical eating disorder. However, we only used the shape concern questions of the EDE-Q 6.0 and can therefore not report on eating disorder in our population. We suggest this is an important aspect to include in future studies and in the follow up of women with DRA postpartum.

Women reporting abdominal protrusion

In the present study there was no clinical assessment with observation of protrusion. Self-report of DRA and protrusion may be considered less valid than assessment by health personnel. However, the prevalence of 26.5% in women reporting abdominal protrusion in the present study is in line with previous research, although a bit lower than was found in a clinical study from the same country [10]. Sperstad et al. (2016) [10] included only primiparous women, pointing towards the likelihood of underestimation of the prevalence of DRA in our study. Due to natural remission of DRA in about 30% of women during the first year postpartum [10], we chose to include women 6–8 months postpartum. We also wanted to be able to compare reported prevalence of protrusion with other studies that evaluated women at this time-point.

We found that women reporting protrusion reported significantly weaker abdominal muscle strength postpartum compared to pre-pregnancy. Several clinical studies comparing women with and without DRA confer with these results[11, 12, 35]. However, in a recently published study by Gluppe et al. (2021) [3] no significant difference in abdominal muscle strength was found in the adjusted analysis of women with and without DRA diagnosed with ultrasound. To date there is no consensus on how to best capture abdominal muscle strength, and the published studies have used different methods to assess it. Direct comparison between studies is therefore not possible.

We found no difference in bothersomeness about striae or lax skin between women with or without reported protrusion. However, women with reported protrusion showed a tendency of more lax skin than women without reported protrusion. Lax skin may be a marker of weak connective tissue and subsequent risk factor for DRA [36]. Further basic studies are needed to investigate mechanisms for striae, lax skin and DRA.

The findings of less satisfaction with abdominal appearance in women reporting protrusion confer with a qualitative study finding that women with increased IRD might experience body dissatisfaction [24]. Also, Keshwani et al. (2018) [37] reported a significant correlation between IRD and body image. In addition, the same research group reported that a physiotherapy intervention had a positive effect on body image in women with DRA [38]. A systematic review on self-reported symptoms in women with DRA did not find any other studies reporting on body image in women with DRA [20]. Interestingly, most women in our study had followed treatment programs found through social media. However, although advocated as highly effective, these programs have not been tested in randomized controlled trials, and the effect is therefore unknown. Women with reported protrusion in our study had mostly used programs containing exercises for the abdominals or the PFM, or a combination of both in the treatment of DRA. This is in accordance with a study from the United States showing that women`s health physiotherapists reported exercises for transversus abdominis (89%) and PFM (87%) as treatment for women with DRA [39]. A recent systematic review of efficacy of different abdominal and PFM training concluded with very low-level evidence that transversus abdominis training is more effective than minimal intervention, and low to very low-level evidence that PFM training is not more effective than minimal intervention for treating DRA[14, 40]. Based on our findings, we agree with Fuentes Aparicio et al. (2020) [20], who suggested inclusion of perception of body image in future studies of treatment of women with DRA.

As response rate and generalizability is not possible in web-based surveys, we may compare our participants with the official statistics of the Norwegian Institute of Public Health`s Medical Birth Register. In 2019 54 407 births were registered. 43% of these were primiparous, 98.5% were single deliveries and 15.9% gave birth by Cesarean section. Mean age in primiparous women was 29.7 years (SD 4.8), women's mean BMI prior to pregnancy was 24.6 (SD 4.9) and the baby`s mean birth weight was 3500 g (SD 592). Our sample is comparable to the official characteristics of these background variables in Norwegian primiparous women, which may be considered a strength of the study. A limitation is that no power calculation was performed for the present study, however we consider the study`s sample size a major strength and that 92% responded to the entire questionnaire. Further, the use of DRA with a protrusion as an inclusion criteria for being classified with DRA in comparison with no DRA, may indicate a more robust diagnoses compared with a simple question on whether the women experience DRA. Inclusion of women with twin pregnancy, delivery between the 26th and 30th gestational week, and child`s birth weight (1000-1499 g) might be considered a limitation. However, the numbers of women in these groups are few and we therefore decided to include them and report the result of these subgroups separately. The results may serve as background for future studies.

Although background variables of the participants are comparable with the total population, we cannot ensure generalizability as selection bias may have occurred due to recruitment mainly through social media as more women with more concerns about this topic might have been recruited. Our participants had a high educational level. Norway has a high uptake of mobile phones, and access to internet and social media is also commonly used by new mothers in other countries [17], but this may not be the case in all societies. Another limitation is lack of clinical assessment both of DRA and muscle strength. The use of a questionnaire allowed us to include a large sample but asking about protrusion may have underestimated the number of women with DRA. Thus, this can be both a strength and a limitation. In addition, the term protrusion may have been interpreted differently among participating women, and the prevalence of women with DRA in our study may be both over or underestimated.

Conclusion

Our study found that primiparous women are concerned about abdominal appearance and that women reporting DRA with protrusion experience reduced abdominal strength in comparison with pre-pregnancy level. In the postpartum period women learn about exercises for the abdominals from social media where there is no quality assurance of the information. There is a need for future follow-up assessments of women in the postpartum period concerning DRA, abdominal strength, and

abdominal body image. Further high quality RCTs on the effect of different exercise programs in prevention and treatment of DRA are warranted to be able to guide women returning to exercise after childbirth.

Abbreviations

DRA	Diastasis recti abdominis.
EDE-Q	The Eating Disorder Examination questionnaire.
IRD	inter-recti distance.
PFM	Pelvic floor muscles.
SD	Standard deviations.

Acknowledgements
The authors thank Gill Brook MCSP DSA(CSP) MSc, independent women's health physiotherapist and immediate past President of the International Organization of Physical Therapists in Women's Health, Otley, United Kingdom for language editing.

Author contributions
SG planned the study, collected the data, analyzed and wrote the manuscript. KB planned the study and was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

Funding
The study was fully funded by The Norwegian Women's Public Health Association. The funders played no role in the design, conduct, or report of results.

Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study has been performed in accordance with the Declaration of Helsinki and informed consent was obtained from all participants. The study was approved by the Regional Medical Ethics Committee (REK South East 2018/2312) and the Norwegian Centre for Research Data (440860).

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interest.

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Received: 16 August 2022 / Accepted: 11 October 2022
Published online: 02 November 2022

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Publisher's note

Paper II

Original Research

Immediate Effect of Abdominal and Pelvic Floor Muscle Exercises on Interrecti Distance in Women With Diastasis Recti Abdominis Who Were Parous

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[Gluppe SB, Engh ME, Bø K. Immediate effect of abdominal and pelvic floor muscle exercises on interrecti distance in women with diastasis recti abdominis who were parous. *Phys Ther.* 2020;100:1372–1383.]

Published Ahead of Print: April 17, 2020
Accepted: February 29, 2020
Submitted: September 5, 2019

Objective. There is a lack of consensus on which abdominal or pelvic floor muscle (PFM) exercises to recommend for the treatment of diastasis recti abdominis (DRA). The objective of this study was to investigate the immediate effect of abdominal and PFM exercises on interrecti distance (IRD) in women with DRA who are parous.

Methods. In this cross-sectional study, 38 women who were parous, with a mean age of 36.2 years (SD = 5.2), diagnosed with DRA participated. IRD was assessed with 2-dimensional real-time ultrasonography during rest and during 8 randomly ordered different exercises. A paired *t* test was used to compare the IRD at rest with the IRD recorded during each exercise as well as the differences between exercises. Means with 95% CI are reported.

Results. Head lift and twisted curl-up exercises significantly decreased the IRD both above and below the umbilicus. Above the umbilicus, the mean IRD difference from rest during head lift was 10 mm (95% CI = 7 to 13.2), whereas during twisted curl-up it was 9.4 mm (95% CI = 6.3 to 12.5). Below the umbilicus, the corresponding values were 6.1 mm (95% CI = 3.2 to 8.9) and 3.5 mm (95% CI = 0.5 to 6.4), respectively, but PFM contraction, maximal in-drawing, and PFM contraction + maximal in-drawing increased the IRD (mean difference = −2.8 mm [95% CI = −5.2 to 0.5], −4.7 mm [95% CI = −7.2 to −2.1], and − 5.0 mm [95% CI = −7.9 to −2.1], respectively).

Conclusions. Head lift and twisted curl-up exercises decreased the IRD both above and below the umbilicus, whereas maximal in-drawing and PFM contraction exercises only increased the IRD below the umbilicus. A randomized controlled trial is needed to investigate whether head lift and twisted curl-up exercises are effective in permanently narrowing the IRD.

Impact. To date there is scant scientific knowledge of which exercises to recommend in the treatment of DRA. In-drawing and PFM contraction leads to an acute increase in IRD, while head lift and twisted curl-up leads to an acute decrease in IRD in postpartum women. There is a need for high-quality randomized controlled trials to investigate if there is a long-term reduction in IRD by doing these exercises over time. The acute IRD increase and decrease during the different exercises is also present in a sample of women with larger separations.

Diastasis recti abdominis (DRA) is defined as an impairment caused by midline separation of the 2 rectus abdominis muscles along the linea alba.[1] Pregnancy brings several physiological and anatomical changes to the female body.[2] Among these is the increase in girth, which stretches, on average, 115%.[3] DRA affects a significant number of women during the antenatal and postnatal periods, with a prevalence rate of 32.6% at 12 months postpartum.[4] The muscles of the abdominal wall, *M. rectus* abdominis, *M. obliquus* externus and internus, and *M. transversus* abdominis (TrA), invest in an aponeurosis to form the rectus sheath, with tendon fibers crossing the midline and intertwining with the linea alba.[5] The linea alba has been described as a "tendinous raphe" running from the symphysis to the xiphoid process.[6] Unlike other tendinous structures in which the collagen fibers are organized in parallel with the line of action of the tendon, in vitro studies of linea alba architecture show a more complex structure with arrangements of longitudinal, transverse, and oblique collagen fibers.[7–9] A higher proportion of transverse collagen fibers has been reported in parous women.[7]

While it is a cosmetic concern for many women, DRA has also been postulated to increase low back and pelvic girdle pain and to be related to pelvic floor dysfunctions, including urinary incontinence, anal incontinence, and pelvic organ prolapse.[10–12] The scientific support for this is, however, sparse.[13]

DRA is diagnosed by measuring the distance between the medial borders of the 2 rectus abdominis muscles, the so-called inter-rectus distance (IRD). Measurement methods include palpation and estimates with finger widths, calipers, or ultrasound.[14] Ultrasound has been found to have the best intra- and inter-tester reliability with intraclass correlation coefficients (ICC) having values >0.9.[15] However, there is as yet no agreement on the definition and cut-off values for DRA or normal IRD values.[14] For example, using palpation, Candido et al[12] classified a mild DRA as an IRD >25 mm while holding a curl-up position immediately after delivery, whereas Mota et al[16] used ultrasonography to report normal IRD values ranging from 17 to 28 mm when measured 2 cm 6 months postpartum.

Over the last decades, it has been suggested that certain abdominal and pelvic floor muscle (PFM) exercises are effective in preventing and treating DRA. For example, Noble suggested that the condition should be treated using a head lift with a simultaneous active manual "pull together" of the abdomen with the patient's hands.[17] Sapsford et al[18] questioned the relevance of the trunk curl and suggested exercises to provide stability of the spine, such as in-drawing via a co-contraction of the PFM. Recently, Tupler suggested a combination of in-drawing and head lift while wearing a splint.[19] Throughout the years, the in-drawing exercise has been commonly recommended to treat low-back pain.[20] However, several researchers have disputed this effect,[21,22] and results from systematic reviews conclude that the effect of in-drawing is not superior to other exercises in the general adult population.[22,23] A systematic review found only low-quality evidence that exercises may reduce pregnancy-related low-back pain.[24]

Curl-ups, in-drawing, and PFM exercises are examples of exercises included in randomized controlled trials (RCTs) to investigate the effect of conservative treatment in women with DRA.[25,26] Due to inconsistent results and the use of different training interventions, different cut-off points for DRA as well as outcome measures in the published RCTs,[25–31] there is as yet no consensus on which exercises are the most effective. Keeler et al[32] found that the most common exercises used by physical therapists to treat DRA were in-drawing (89%) and PFM exercises (87%). Several studies have shown that a correct PFM contraction causes co-contraction of TrA.[33–36] However, recent experimental studies have found that in-drawing and PFM contraction increase the IRD,[15,37,38] while curl-ups close the diastasis.[37–42]

Different theories have been espoused as to whether treatment for DRA should include exercises that lead to an immediate increase or an immediate decrease in IRD. Some authors have suggested that exercises that narrow the IRD during abdominal maneuvers may cause permanent reduction of IRD.[38,39] Others argue that tension caused by activating the TrA should be maintained on the linea alba during abdominal exercises to transfer force between the sides of the abdominal wall and thereby prevent protrusion of the abdominal contents.[41]

Apart from curl-up and in-drawing, the scientific evidence is sparse regarding the effects on IRD of other commonly used abdominal and PFM exercises. Therefore, in light of the current lack of evidence, we have included 8 exercises in the present study. We do not believe head lift, pelvic tilt, and twisted curl-up have been investigated previously.

The objective of the study was to investigate the immediate effect of 8 different abdominal and PFM exercises on the IRD in parous women diagnosed with DRA.

Methods

Study Design

This was a cross-sectional study investigating the immediate effect of 8 different abdominal and PFM exercises on the IRD in parous women diagnosed with DRA. Written informed consent was obtained from all participants prior to participation, and the study was conducted in accordance with the Helsinki Declaration. The study was approved by the Regional Medical Ethics

Committee (REK South-East 2018/2312) and the Norwegian Centre for Research Data (440860).

Setting

This was a university-initiated and conducted study. All participants took part in a single visit to the laboratory of the Norwegian School of Sport Sciences for the clinical assessments between February and May 2019.

Participants

A convenience sample of 38 women diagnosed with DRA was recruited through women's health physical therapists, personal trainers, midwives and gynecologists/obstetricians, and friends and acquaintances and by advertising in social media. Inclusion criteria were primi- and multiparous women >6 weeks postpartum, >18 years old, a diagnosis of DRA, and being able to understand instructions in Norwegian. Exclusion criteria were any neurological or systemic musculoskeletal diseases or psychiatric diagnoses.

Variables

The main outcome measure was the change in IRD.

Data Sources: Measurements

An initial screening of participants using palpation to confirm DRA was performed prior to ultrasound assessments. DRA was confirmed if the assessor palpated an IRD of 2 finger widths or more during a curl-up or if there was an observable protrusion during an abdominal curl-up. Following this initial screening, 2-dimensional (2D) real-time ultrasonography was conducted to ultimately include the participants using a cut-off point of DRA >25 mm at 2 cm above or 2 cm below the umbilicus.[12] Women with an observable protrusion during a curl-up were included in the analyses, even if IRD was <25 mm above and below the umbilicus. Ability to perform a correct PFM contraction was also assessed by transabdominal real-time ultrasound imaging.[43] The abdominal and PFM exercises were conducted in random order. One trained physical therapist who had undergone specific training in ultrasound imaging of the PFM and abdomen prior to data collection performed all assessments. Twenty images were captured for each participant. To blind the assessor, images were transferred from the hard disk to a software program (MicroDicom) and analyzed offline. The same physical therapist performed both the ultrasound assessments and the offline analyses.

Electronic questionnaire. Two days before the scheduled clinical assessments, an electronic questionnaire was emailed to all participants to gather information on background variables. This had to be completed prior to the clinical assessment.

Other assessments. Height and weight were measured at the clinical assessment, and BMI was calculated for all participants.

Measurement of ability to perform a correct PFM contraction and the in-drawing exercise. Prior to their assessment, women were instructed verbally on how to perform a correct PFM contraction using an anatomical model. A correct voluntary PFM contraction is defined as an inward lift and a constriction of the pelvic openings.[44,45] Ability to contract the PFM was assessed by a portable 2D ultrasound machine with a convex transducer (GE Healthcare –Logiq e R7, GE > 8C-RS—2-5 MHz Convex) following a bladder-filling protocol.[43] The protocol involved consuming 600–750 mL of water during a 30-minute period completed half an hour before the PFM testing. Participants lay supine with flexed hips and knees with feet resting on a plinth[43] while being assessed for their ability to contract their PFM. The transducer was placed suprapubically in the mid-sagittal plane and confirmation of a correct PFM contraction came from observing a cranioventral displacement of the PFM in the sagittal plane.[43] The ultrasound screen was used to provide biofeedback to the participants during their attempts to contract their PFM. After completing the test of ability to contract the PFM, participants were asked to empty their bladder.

The ability to perform in-drawing, which is mainly conducted by activating TrA, if performed correctly,[15] was tested in all women prior to conducting the 8 experimental exercises. A correct in-drawing can be confirmed by observing the change of muscle thickness in TrA via real-time ultrasound imaging of the lateral abdominal wall at the level of the umbilicus.[36,38,46] All other exercises were instructed by the same physical therapist following a standard procedure, and the participants practiced the exercises under supervision before ultrasound assessment of their IRD began.

IRD measurements. A portable 2D ultrasound machine with a linear transducer (GE Healthcare –Logiq e R7, GE > 12 L-RS—5-13 MHz Wideband Linear Probe) was used to assess any changes in IRD. Ultrasound imaging has shown to be a reliable method to measure IRD with good intra-rater reliability (ICC > 0.90) and acceptable inter-rater reliability (ICC 0.74–0.90).[15] To standardize the measurement locations, 2 marks were made on the skin: one 2 cm above and one 2 cm below the center of the umbilicus.[15,38,40] Ultrasound gel was used during the IRD measurements, and the transducer was placed transversely and centered over each skin mark. To avoid a reflexive response of the abdominal muscles, the assessor tried not to apply any pressure on the abdomen.[15] Panoramic imaging was used when the investigator was unable to visualize the entire width of the linea alba.[47] Images were taken 2 cm above and 2 cm below[38] the umbilicus during

Table 1.
Operational Definitions of the 8 Exercises in the Study[a]

Exercise	Operational Definition
Head lift	Supine position with flexed knees and hips and feet resting on the plinth. Arms resting alongside the body. Instruction: Lift head so the chin rest against the chest. The ending position is illustrated in Figure 1.
Curl-up	Supine position with flexed knees and hips and feet resting on the plinth. Arms crossed above the chest. Instruction: Lift head so the chin rests against the chest and lift the upper back until shoulder blades are off the plinth. The ending position is illustrated in Figure 1.
PFM contraction	Supine position with flexed knees and hips and feet resting on the plinth. Arms are resting alongside the body. Instruction: Contract muscles around all pelvic openings, lifting upward and forward inside the pelvis. The test position is illustrated in Figure 2.
PFM contraction + curl-up	Supine position with flexed knees and hips and feet resting on the plinth. Arms crossed above the chest. Instruction: Contract muscles around all pelvic openings, lifting upward and forward inside the pelvis. Hold contraction while you perform a curl-up. The test position is illustrated in Figure 2, and the ending position during a curl-up is illustrated in Figure 1.
Maximal in-drawing	Supine position with flexed knees and hips and feet resting on the plinth. Arms are resting alongside the body. Instruction: Pull the lower part of the abdominal wall in towards the spine as far as possible. The test position is illustrated in Figure 2.
PFM contraction + maximal in-drawing	Supine position with flexed knees and hips and feet resting on the plinth. Arms are resting alongside the body. Instruction: Contract and lift upward and forward the muscles around all pelvic openings. Hold contraction while you perform a maximal in-drawing. The test position is illustrated in Figure 2.
Pelvic tilt	Supine position with flexed knees and hips and feet resting on the plinth. Arms are resting alongside the body. Instruction: Tilt your pelvis backwards and push the lower back down against the plinth. The ending position is illustrated in Figure 1.
Twisted curl-up	Supine position with flexed knees and hips and feet resting on the plinth. One arm resting alongside the body and the other hand behind the neck. Instruction: Lift head and the upper back obliquely up until the raised shoulder blade is off the plinth. The ending position is illustrated in Figure 1.

[a]PFM = pelvic floor muscles.

rest and during the following exercises, the order of which were randomized: head lift, curl-up, PFM contraction, PFM contraction + curl-up, maximal in-drawing, PFM contraction + maximal in-drawing, pelvic tilt, and twisted curl-up. For the 2 combined exercises, indicated here with a "+" sign, the participants contracted in the following order: PFM contraction + curl-up, and PFM contraction + maximal in-drawing. For each image, participants were instructed to first inhale and then exhale so an image could be taken at the end of the exhalation. The participants were instructed to hold each contraction for 3 seconds. Operational definitions of the 8 exercises are presented in Table 1. The end position for the ultrasound assessment of IRD during the head lift, curl-up, pelvic tilt, and twisted curl-up exercises is illustrated in Figure 1. Likewise, the position for IRD measurements during rest, maximal in-drawing, PFM contraction, and PFM contraction + maximal in-drawing are illustrated in Figure 2.

Bias

To address potential sources of biases, 1 physical therapist conducted all measurements in blinded fashion, was trained in correct assessments, and followed standardized protocols.

Sample Size

Based on a former study[38] reporting IRD change (rest vs drawing-in) of 2.5 mm (SD 5.2), a priori power calculation was performed. With 80% power and a 5% significance level, at least 36 women were needed for the present study.

Quantitative Variables

The main outcome measure was change in IRD, and the sample was analyzed as 1 group. While IRD during twisted curl-up was assessed for both left and right side, a mean of left and right measurements was used for the analysis.

Statistical Methods

All statistical analyses were performed using SPSS statistical software package, version 24 (SPSS Inc., Chicago IL). Background variables are presented as means with SD or numbers with percentages. Checks showed that all the IRD data were normally distributed. Paired *t* tests were

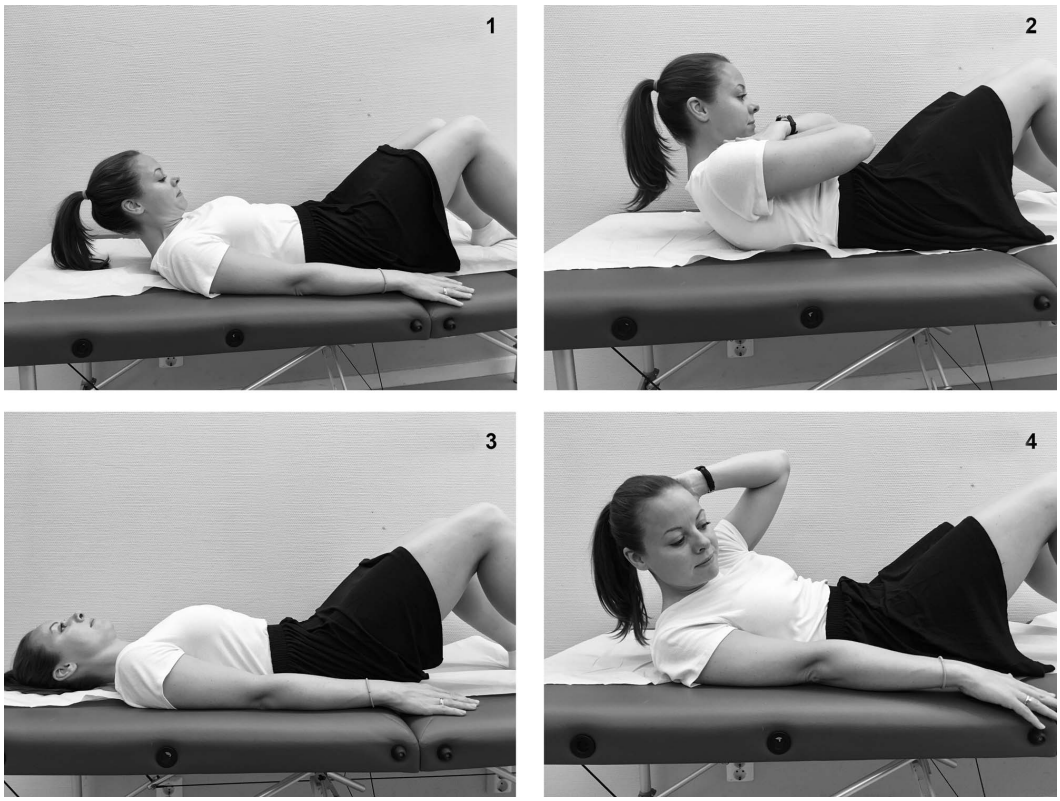

Figure 1.
Illustration of 4 of the exercises performed in the study: (1) head lift, (2) curl-up, (3) pelvic tilt, (4) twisted curl-up. Reproduced with permission by Kristina L. Skaug.

used to examine the differences between IRD at rest and during all of the 8 exercises. Results are presented as means with 95% CI, and a P value of $< .05$ was used.

Role of the Funding Source

The funder of this study, the Norwegian Women's Public Health Association, played no role in the design, conduct, or reporting of this study.

Results

Forty-five women agreed to participate in the study. Four women were excluded after the initial palpation screening. In addition, 2 women were excluded from the analyses as they did not meet the cut-off value for mild DRA on ultrasound assessment.[12] One woman was excluded from participation due to neurological disease. Hence, 38 women were finally included in the study. Table 2 presents the background variables of the participants.

Of the total sample, 97.4% were married/cohabitating, had a college/university education, and were of Caucasian genetic origin. Two women had 1 twin birth each. Mean parity was 2.1 (range 1–4).

An observable protrusion was found in 19 women (50%). Two of these women had an observable protrusion with an IRD assessed by ultrasound of <25 mm above and below the umbilicus. According to the cut-off point by Candido et al,[12] 19 women (51.4%) were classified with mild DRA (<25 mm), 14 (37.8%) with moderate DRA (25–50 mm), and 4 (10.8%) with severe DRA (>50 mm). Transabdominal real-time ultrasound revealed that 5 (13.1%) were unable to perform a correct PFM contraction. Therefore, the IRD measurements involving a PFM contraction for these women are reported as missing.

Table 2.
Demographic and Other Characteristics of the Women Classified as Having DRA (N = 38)[a]

Variable	Total Sample (N = 38)
Age, y, mean (SD)	36.2 (5.2)
BMI, kg/m^7, mean (SD)	23.2 (3.6)
Weight gain last pregnancy, kg, mean (SD)[b]	15.8 (10.2)
Waist circumference, cm, mean (SD)	79.8 (8.7)
Parity	
1	4 (10.5)
2	28 (73.7)
3	5 (13.2)
4	1 (2.6)
Time since last birth	
<6 months	2 (5.3)
6–11 months	11 (28.9)
1–3 years	19 (50.0)
>3 years	6 (15.8)
Mode of delivery	
Vaginal	26 (68.4)
Cesarean	8 (21.1)
Both vaginal and caesarean	4 (10.5)
Birthweight, g	
>4500	1 (1.2)
4000–4500	19 (24.0)
3000–3999	45 (57.0)
2500–2999	9 (11.4)
1500–2499	3 (3.8)
1000–1499	2 (2.6)
<1000	0 (0.0)
Use of contraceptives	
Yes	15 (39.5)
No	23 (60.5)
Current breastfeeding[c]	
>3 times or more/d	13 (40.6)
1–2 times/d	2 (6.3)
Rarely/never	17 (53.1)
Heavy lifting at work[d]	
Perform heavy lifting	5 (16.7)
Rarely/never perform heavy lifting	25 (83.3)

[a]Values are presented as numbers (percentages) of women unless otherwise indicated. BMI = body mass index; DRA = diastasis recti abdominis; PFM = pelvic floor muscles.
[b]Total n = 35; 3 women did not answer this question in the questionnaire.
[c]Total n = 32; this question was only given to women who were <3 years since last birth (valid percentages are reported).
[d]Total n = 30; this question was only given to women who were working (valid percentages are reported).

Table 3.
Mean IRD (mm) With SD at Rest and During Each of the 8 Exercises Measured 2 cm Above and 2 cm Below the Umbilicus (N = 38)

Exercise	Measurement Location	
	2 cm Above Umbilicus Mean (SD)	2 cm Below Umbilicus Mean (SD)
Rest	43.6 (12.7)	32.9 (13.1)
Head lift	33.5 (10.9)	26.8 (9.4)
Curl-up	34.5 (10.6)	30.2 (10.0)
PFM contraction	43.9 (12.2)	35.2 (15.3)
PFM contraction + curl-up	39.0 (10.7)	32.7 (10.5)
Maximal in-drawing	44.8 (13.6)	37.6 (16.1)
PFM contraction + maximal in-drawing	43.8 (12.8)	37.3 (14.5)
Pelvic tilt	43.4 (12.5)	32.7 (14.6)
Twisted curl-up	34.2 (11.0)	29.4 (9.9)

[a]IRD = interrecti distance; PFM = pelvic floor muscles.

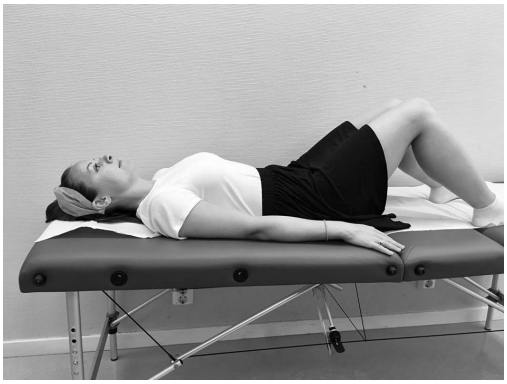

Figure 2.
Illustration of the test position during rest, maximal in-drawing, pelvic floor muscle (PFM) contraction, and PFM contraction + maximal in-drawing. Reproduced with permission by Kristina L. Skaug.

Table 3 presents the mean IRD at rest and during the 8 different exercises.

Mean differences in IRD between rest and during each of the 8 exercises are presented in Table 4.

Exercises Decreasing the IRD

There was a significant decrease in IRD during head lift and twisted curl-up compared with rest, both at 2 cm above and 2 cm below the umbilicus. Above the umbilicus, a significant decrease in IRD was found during curl-up compared with rest and during PFM contraction + curl-up compared with rest. Other exercises that did not cause statistically significant decreases are shown in Table 3.

Exercises Increasing the IRD

A statistically significant increase in the IRD, below the umbilicus, was found during PFM contraction compared with rest, maximal in-drawing compared with rest, and maximal in-drawing + PFM contraction compared with rest. For measurements above the umbilicus, none of the exercises increased the IRD.

Discussion

Key Results

Head lift and twisted curl-up were the only exercises that significantly decreased the IRD both above and below the umbilicus. In addition, curl-up decreased the IRD above the umbilicus. PFM contraction, maximal in-drawing, and maximal in-drawing +PFM contraction increased the IRD below the umbilicus.

Exercises Decreasing the IRD

Head lift led to a statistically significant decrease in IRD above and below the umbilicus. This corroborates a recent study[42] that also used ultrasound imaging as well as standardized measurement locations and procedures to measure IRD. However, since those authors included women both with and without DRA, only 11 women were classified with DRA and no measurements were included below the umbilicus. Hence, the results might not be comparable.

To our knowledge, this is the first study to investigate the immediate effect of twisted curl-up on IRD in women diagnosed with DRA. The study showed that twisted curl-up decreased the IRD significantly both above and below the umbilicus.

When measured above the umbilicus during a curl-up, the decrease in the IRD relative to resting IRD values

Table 4.
Mean IRD Differences, Measured 2 cm Above and 2 cm Below the Umbilicus, Between the Measurement at Rest and During Each of the 8 Different Exercises[a]

Probe Location	Exercise	Mean Difference	95% CI of Difference	*P*	Cohen d
2 cm above umbilicus	Rest vs head lift	10.0	7.0 to 13.2	<**.01**[b]	1.06
	Rest vs curl-up	8.7	5.0 to 12.5	<**.01**[b]	0.77
	Rest vs PFM contraction	−0.2[c]	−2.5 to 2.2	.89	0.03
	Rest vs PFM contraction + curl-up	4.3	1.1 to 7.4	**.01**[b]	0.49
	Rest vs maximal in-drawing	−1.2[c]	−3.7 to 1.2	.31	0.16
	Rest vs PFM contraction + maximal in-drawing	−0.1[c]	−2.9 to 2.6	.93	0.17
	Rest vs pelvic tilt	0.2	−2.0 to 2.4	.84	0.03
	Rest vs twisted curl-up	9.4	6.3 to 12.5	<**.01**[b]	0.99
2 cm below umbilicus	Rest vs head lift	6.1	3.2 to 8.9|	<**.01**[b]	0.71
	Rest vs curl-up	2.3	−0.9 to 5.6	.15	0.24
	Rest vs PFM contraction	−2.8[c]	−5.2 to 0.5	**.02**[b]	0.41
	Rest vs PFM contraction + curl-up	−0.9[c]	−4.2 to 2.3	.57	0.10
	Rest vs maximal in-drawing	−4.7[c]	−7.2 to −2.1	<**.01**[b]	0.60
	Rest vs PFM contraction + maximal in-drawing	−5.0[c]	−7.9 to −2.1	<**.01**[b]	0.61
	Rest vs pelvic tilt	0.2	−2.2 to 2.5	.90	0.03
	Rest vs twisted curl-up	3.5	0.5 to 6.4	**.02**[b]	0.40

[a]The 95% confidence interval (CI) and effect size is also provided. IRD = inter-recti distance; PFM = pelvic floor muscles.
[b]Stastistically significant ($P > .05$) values in bold.
[c]Negative value represents an increase in IRD.

corroborated previously published studies.[37–42] In contrast to the present study, 1 of those studies[39] found a significant decrease in IRD during curl-up for measurements below the umbilicus ($P = .012$).

Above the umbilicus, PFM + curl-up showed a statistically significant decrease in the IRD compared with rest. To our knowledge, this combination of exercises has not been investigated in earlier studies. Theodorsen et al[48] reported an increased IRD during PFM contraction. Our results indicate that curl-up may counteract the negative effect of the PFM contraction on the IRD.

Exercises Increasing the IRD

In accordance with other ultrasound studies,[37,38,48] the present study found that in-drawing causes a statistically significant increase in the IRD for measurements below the umbilicus. Mota et al[38] and Sancho et al[37] also measured above the umbilicus, but, as in the present study, they found a significant increase only in measurements below the umbilicus. Time since last birth was greater in the present study compared with that in previous studies (24–26 weeks[38] and 10 weeks postpartum[37]). However, the population in those studies was similar to our study in the distribution of the mode of delivery. Hence, the results may be comparable and show that IRD increases during the in-drawing exercise in women with longer time intervals since their last birth.

For measurements above the umbilicus, Lee and Hodges[41] found that a curl-up with pre-activation of TrA via a PFM contraction led to less IRD narrowing than a normal curl-up without the pre-activation. In spite of this, they developed their distortion index and suggested that contraction of TrA may strengthen the linea alba and that this is a key factor in the rehabilitation of DRA. To date, the distortion index has not been validated. The concept of the distortion index is that an intact and unstrained linea alba does not distort during a curl-up due to tension created by contraction of the TrA.[41] However, whether contraction of the TrA can have this effect on the linea alba is a hypothesis and needs further investigation. The relationship between the distortion index, IRD, and mean

and peak linea alba stiffness was evaluated by Beamish et al.[42] They reported that women with DRA demonstrated a higher distortion index compared with women without DRA. In addition, they reported that ICCs for within-rater reliability for the distortion index ranged from ICC = 0.433 to ICC = 0.869. Between-rater reliability ranged from ICC = 0.746 to 0.766. Based on this, the researchers questioned the implication of the distortion index in women with DRA.

Contrary to the results of the experimental studies on the immediate effect of a single contraction, a pilot RCT[29] found a significant difference in IRD in 2 groups training with in-drawing compared with an untreated control group. However, the study was small with only 5–10 participants in each group, and the authors concluded that larger, robust, and high-quality RCTs are needed to confirm these results.

Measurements Above and Below the Umbilicus

In agreement with other studies,[37,49,50] the present study found a narrower IRD at rest below the umbilicus than above the umbilicus (Table 3).

It is noteworthy that poorer reliability coefficients have been reported for measurements below compared with above the umbilicus.[14,15] For example, only moderate intra-rater reliability with an ICC of 0.50 was found below the umbilicus.[15]

The present study found an immediate decrease in the IRD during head lift and twisted curl-up both above and below the umbilicus. Curl-up led to a decrease only for measurements above the umbilicus. However, an increase in the IRD during PFM contraction and maximal in-drawing was found only for measurements below the umbilicus. A possible explanation for the observed differences below and not above the umbilicus might be due to the different tendinous fibers from the abdominal muscles in the anterior and posterior rectus sheath above and below the umbilicus. In addition, a regional variation in the morphology of the linea alba, with more transverse collagen fibers than oblique collagen fibers below the umbilicus being reported in women, may also explain the observed differences being below but not above the umbilicus.[7–9]

Interpretation

The mean IRD above the umbilicus during a curl-up in the present study was 34.5 mm (SD 10.6). The highest reported mean IRD during a curl-up in previously published studies[37,39,41,42] was 23 mm (SD 11.5) above the umbilicus.[42] Although all studies found a significant decrease in the IRD compared with rest, the mean IRD values during curl-up in the above-mentioned studies do not classify as a DRA according to Candido et al.[12] We chose the cut-off point set by Candido et al[12] because they classified DRA into severity groups. In addition, a cut-off of ≥2 finger widths has been used in several studies[4,51] and is the most commonly used method in clinical practice.[32] That is the reason we used palpation as the inclusion criteria prior to the real-time ultrasound assessment in the present study. Moreover, van de Water and Benjamin[14] concluded that finger widths can be a valid assessment to separate between presence or no presence of DRA, but not to measure changes in the IRD. That is the reason we used real-time ultrasound to measure change in the IRD during each of the 8 exercises.

Limitations and Strengths

One limitation of the present study was that the assessments were not limited to a single time point after delivery. Time since last birth was ≥12 months in 65.8% of the total sample. By contrast, the time since last birth varied between 10 weeks and 1 year postpartum in earlier studies.[37,38,42,48] Results of the present study may therefore not be comparable with the studies assessing women up to 12 months postpartum. Unfortunately, the small sample sizes of our subgroups (mild, moderate, and severe DRA, or women with vaginal birth or Cesarean section) precluded statistical analysis of any subgroup differences. Regarding our statistical analyses, the present study aimed to test whether each of the 8 exercises decreased DRA above and below the umbilicus. Each *t* test relates to 1 of the 8 specific exercises. Four of 8 tests were significant both for measurements above and below the umbilicus. Therefore, these findings are likely to be reliable. Some might argue that we should have used a Bonferroni correction, but such a correction would be appropriate only if multiple outcomes were used in an intervention study where multiple testing could yield statistical significance by chance. Moreover, the disadvantages of using Bonferroni or other adjustments for multiple testing are well documented.[52,53]

The strengths of the present study include the use of 2D real-time ultrasonography to measure both IRD and the confirmation of correct in-drawing and PFM contraction. We also included head lift and twisted curl-up, exercises that, as far as we know, had not been studied when the protocol for this study was finalized. An additional strength is that 2D ultrasonography has been shown to be a reliable and valid method to assess IRD.[14,15] In addition, a trained physical therapist conducted all the ultrasound assessments. Furthermore, because the analyses of the ultrasound images were performed offline, this allowed the assessor to be blinded for the IRD measurements during the 8 different exercises. In addition, the 8 exercises were performed in random order with standardized instructions. As earlier studies assessing the immediate effect of exercises have included only women with normal and mild diastasis,[37–42,48] we aimed to also include women with moderate (n = 14) and severe diastasis (n = 4).[12] Finally, our study was based on a power

calculation enabling us to detect statistically significant differences between rest and the different exercises.

Recommendations for Clinical Practice

In recent years, women with DRA have been discouraged from doing curl-ups[51] while in-drawing has been recommended as a gentle exercise to decrease the IRD.[49,54] The majority of women's health physical therapists have reported prescribing in-drawing and PFM exercises for the treatment of DRA,[32] a practice that might be questioned based on the results of the present study. Head lift, twisted curl-up, and curl-up all decreased the IRD. Whether these exercises might be able to cause a permanent reduction in IRD over time is a hypothesis that should be tested in a future RCT. Finally, results can differ between participants, so clinicians should assess the IRD both above and below the umbilicus during chosen exercises.

Generalizability

The sample in the present study represents a heterogeneous population of women with DRA. We included both primi and multiparous women in addition to women with vaginal births and Caesarean sections. However, more than one-half of these women were 1 year postpartum, so we cannot generalize these results to women less than a year postpartum. Finally, the results are limited to Caucasian women with a high educational level.

Conclusions

Head lift and twisted curl-up exercises decreased the IRD both above and below the umbilicus. Maximal in-drawing and PFM contraction increased the IRD below the umbilicus. An RCT is needed to investigate whether the head lift and twisted curl-up exercises can permanently narrow the IRD.

Author Contributions and Acknowledgments

Concept/idea/research design: S.B. Gluppe, K. Bo
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The authors thank Professor James A. Ashton Miller, University of Michigan, Ann Arbor, Michigan, for language editing and Associate Professor Morten Wang Fagerland, Norwegian School of Sport Sciences, Department of Sport Medicine, for statistical advice.

Ethics Approval

This study was approved by the Regional Medical Ethics Committee (REK South East 2018/2312) and the Norwegian Centre for Research Data (440860). Written consent was obtained from all participants.

Funding

The authors gratefully acknowledge full funding from the Norwegian Women's Public Health Association.

Disclosures

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

DOI: 10.1093/ptj/pzaa070

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Paper III

ELSEVIER

Physiotherapy

Physiotherapy 111 (2021) 57–65

Women with diastasis recti abdominis might have weaker abdominal muscles and more abdominal pain, but no higher prevalence of pelvic floor disorders, low back and pelvic girdle pain than women without diastasis recti abdominis

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Abstract

Objective To investigate whether women with diastasis recti abdominis (DRA) have weaker abdominal muscles and higher prevalence of pelvic floor disorders (PFD), low back, pelvic girdle and abdominal pain than women without DRA.
Design Cross sectional study of women with and without DRA.
Setting University study.
Participants Seventy-two parity and age matched women with and without DRA.
Main outcome measures Maximal abdominal muscle strength and endurance were assessed with a dynamometer and with a curl-up test. Women reported whether they experienced PFD, low back pain, pelvic girdle pain or abdominal pain. Those experiencing PFD or pain completed the Pelvic Floor Distress Inventory-short form 20 (PFDI-20), the Oswestry Disability Index (ODI), the Pelvic Girdle Questionnaire (PGQ) or questions about abdominal pain, respectively.
Results Maximal abdominal strength standing with 30° hip flexion was significantly lower in women with DRA (mean difference −12.9 Nm, 95%CI: −24.4 to −1.5; $P = 0.028$), but adjusted analyses showed no significant difference (mean difference −11.9 Nm, 95%CI: −26.5 to 2.6; $P = 0.106$). Adjusted analyses showed significant higher prevalence of abdominal pain in women with DRA (OR: 0.02, 95%CI: 0.00 to 0.61, $P = 0.026$). There was no difference between the groups in PFD, low back and pelvic girdle pain.
Conclusion Women with DRA tend to have weaker abdominal muscles and higher prevalence of abdominal pain, but no higher prevalence of PFD, low back or pelvic girdle pain than women without DRA.

Keywords: Abdominal muscle strength; Abdominal pain; Diastasis recti abdominis; Lumbo-pelvic pain; Pelvic floor dysfunctions

Introduction

Diastasis recti abdominis (DRA) is defined as an impairment with midline separation of the two rectus abdominis muscles along the linea alba [1]. Prevalence of DRA has been reported as 60%, 45% and 33%, 6 weeks, 6 months and 12 months postpartum, respectively [2]. To date there is no consensus on the cut-off point for diagnosing DRA, but two fingerbreadths on palpation is commonly used [3]. Candido et al. 2005 [4] classified severity of diastasis as: mild (25–35 mm or visible protrusion with diastasis less than 25 mm), moderate (35–50 mm) and severe (>50 mm). Most women present with mild diastasis postpartum. The prevalence of moderate and severe DRA has been reported to be just 1% and 0% at six months and 12 months postpartum

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https://doi.org/10.1016/j.physio.2021.01.008
0031-9406/

respectively [2]. DRA has also been found to be prevalent in middle-aged women, both parous (52%) and nulliparous (35%) [5].

The inter-recti distance (IRD) is the distance between the medial borders of the two rectus abdominis muscles, measured in palpation with finger widths, with calipers, or using ultrasound [3]. Ultrasound has the best intra- and inter-tester reliability with intraclass correlation coefficients (ICC) above 0.9 [6], and is the recommended measurement method [3].

Two studies [7,8] reported higher prevalence of pelvic girdle or low back pain in women with DRA and three [2,9,10] found no difference between women with or without DRA. A recent systematic review found only weak evidence that DRA severity may be associated with impaired abdominal muscle strength and low back pain severity [11].

The objective of this study was to investigate whether parous women with DRA have weaker abdominal muscles and higher prevalence of pelvic floor disorders (PFD), low back, pelvic girdle and abdominal pain than women without DRA. Further, to compare these variables in subgroups of women with moderate and severe DRA.

Material and methods

Design

This was a cross sectional study comparing abdominal muscle strength, PFD and low back, pelvic girdle and abdominal pain in women more than six weeks postpartum with and without DRA.

Setting

An equivalent number of controls were added in this study. The study was conducted at the laboratory of the Norwegian School of Sport Sciences between February and October 2019.

Participants

Thirty-six women diagnosed with DRA, recruited through women's health physiotherapists, personal trainers, midwives and gynecologists/obstetricians, friends and acquaintances and by advertising in social media were included in the study. In addition, 36 age and parity matched women without DRA were recruited from friends and acquaintances of women with DRA. There was a maximum age difference of ±3 years between the matched woman with and without DRA. All participants had a single visit for clinical assessment. Inclusion criteria were: Primi- and multiparous women more than 6 weeks postpartum (with no upper limit to time since birth), 18–70 years old and able to understand instructions in Norwegian. Exclusion criteria were any neurological, and systemic musculoskeletal diseases or psychiatric diagnoses.

Inter-recti distance measurement and cut-off point for DRA

An initial screening of participants using palpation to confirm or exclude DRA was done prior to ultrasound assessment. DRA was diagnosed initially if the assessor palpated two finger widths or more, or observed abdominal protrusion, during an abdominal curl-up. Study recruits were those with DRA > 25 mm, 2 cm above or, 2 cm below the umbilicus during a curl-up, measured with 2D real-time ultrasonography [4]. Women with an observable protrusion during a curl-up were included in the analyses, even if IRD was <25 mm above or below the umbilicus. To assess IRD in women with and without DRA the authors used a portable 2D ultrasound machine with a linear transducer (Logic e R7, GE Healthcare, Chalfont St Giles, United Kingdom). To standardize the measurement locations, two marks on the skin were made with the centre of the umbilicus as the point of reference [6,12,13]. The ultrasound imaging protocol used is described in detail in Gluppe et al. [14]. Measurements of the ultrasound images were coded and undertaken off-line with the physiotherapist blinded to the results of the clinical assessments and questionnaire data. One trained physiotherapist performed all assessments, in addition to the off-line measurements.

Main outcome measures

Differences in abdominal muscle strength, PFD and low back, pelvic girdle and abdominal pain in women with and without DRA.

Abdominal muscle strength

Isometric trunk flexion assessments with dynamometers in a sitting position has shown excellent test–retest reliability and strong correlation with IRD [7,15]. The authors used the Humac NORM isokinetic dynamometer (CSMi, Soughton, MA) to assess maximal isometric abdominal wall strength, limited to trunk flexion. The Humac software 2015 was installed on the computer and the dynamometer was calibrated prior to the study according to the operating manual. Trunk flexion assessments followed a standardized protocol and were conducted standing in two different positions; hip flexion of 10° and 30° from zero (Fig. 1). Testing in a standing position was considered functional and transferable to situations where postpartum women need abdominal strength, e.g. carrying and lifting the baby. After the participants were placed in the dynamometer, adjustments were made for body height. To avoid compensatory movements women were attached above and below their knees, over their thighs and at their chest level. Prior to the maximal strength tests, participants performed three submaximal attempts for familiarization of the test protocol. The highest maximal test of three was registered and results measured in Newton metre (Nm). The participants were instructed to take a deep breath, breathe out, bend forward and gradually increase to maximal force during a five second recording. Standardised verbal

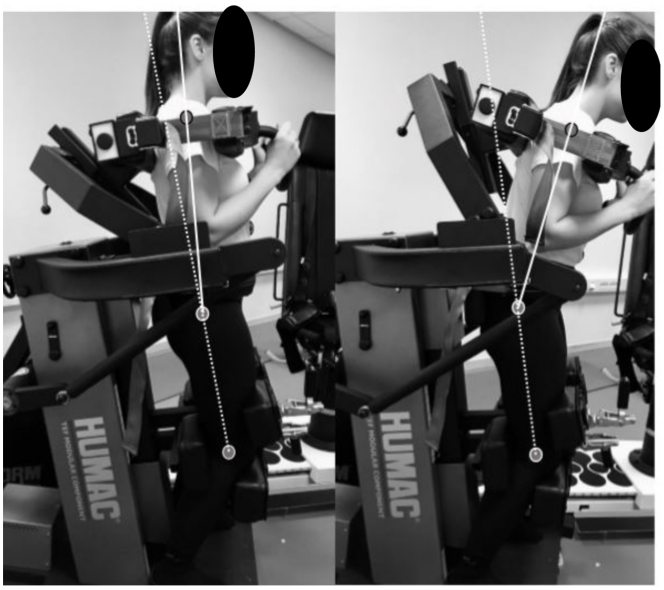

Fig. 1. Illustration of test positions (10° and 30°) in the Humac NORM. Reproduced with permission by Kristina L. Skaug.

encouragement was given to all participants during the test. A 60 second rest period was given between the maximal test repetitions. During the test participants could watch the screen for real time feedback on their effort.

Abdominal endurance was assessed as number of repetitions of a standardized abdominal curl-up to exhaustion following the protocol of the American College of Sports Medicine (ACSM) curl-up test [16,17] (Fig. 2). Participants were asked to lift their head and shoulder blades off the mat and slide their fingertips from one tape to another, 8 and 12 cm away, for women ≥45 years and <45 years, respectively. A metronome set to 40 beats per minutes regulated the speed of movement. There was no verbal encouragement during the test. The participants performed as many curl-ups as possible and the test was terminated if the participants could not reach the second tape, follow the speed of the metronome, or made compensatory movements. All participants were given three warm-up repetitions before commencing the test.

Electronic questionnaire

Prior to the clinical assessments, participants completed an electronic questionnaire which gathered information on background variables and asked; "Do you have symptoms in your bowel, bladder or pelvic region that bother you (e.g. urinary leakage, bowel leaks or feeling any bulge in the vagina)?", "Do you have low back pain?", "Do you have pelvic girdle pain?" and "Do you have pain in you abdomen?". If answering yes to these questions, participants were asked to respond to the following; The Pelvic Floor Distress Inventory-short form 20 (PFDI-20) [18], the Oswestry Disability Index (ODI) [19] and the Pelvic Girdle Questionnaire (PGQ) [20] as appropriate to their reported symptoms. The PFDI-20 consists of three scales: Pelvic Organ Prolapse Distress Inventory 6 (POPDI-6), Colorectal-Anal Distress Inventory 8 (CRADI-8) and Urinary Distress Inventory 6 (UDI-6) [18]. Each scale score in the PFDI-20 ranges from 0 to 100 and the summary score from the three scales together range from 0 to 300. The sum score in the ODI is calculated in percent from 0 (not disabled) to 100 (disabled) and PGQ is calculated in percent from 0 (not at all) to 100 (to a large extent). All three instruments have been validated and are recommended for assessment of symptoms of PFD, functional measure of disability due to low back pain, and limitation in activities/participation due to pelvic girdle pain [18–20]. If participants responded yes to having abdominal pain, they were asked to indicate the location, and to what degree (from zero = not at all, to ten = a lot) it affected their activities of daily living.

Physical activity level was self-reported. Participants reported their current level of participation in moderate or high intensity (short of breath and/or sweating) physical activity [21] (average number of minutes per week).

Joint hypermobility

The Beighton score was used to assess benign joint hypermobility [22]. Hypermobility was defined if five or more tests out of nine were positive. Intra- and intertester reliability has been found to be <0.7 [23].

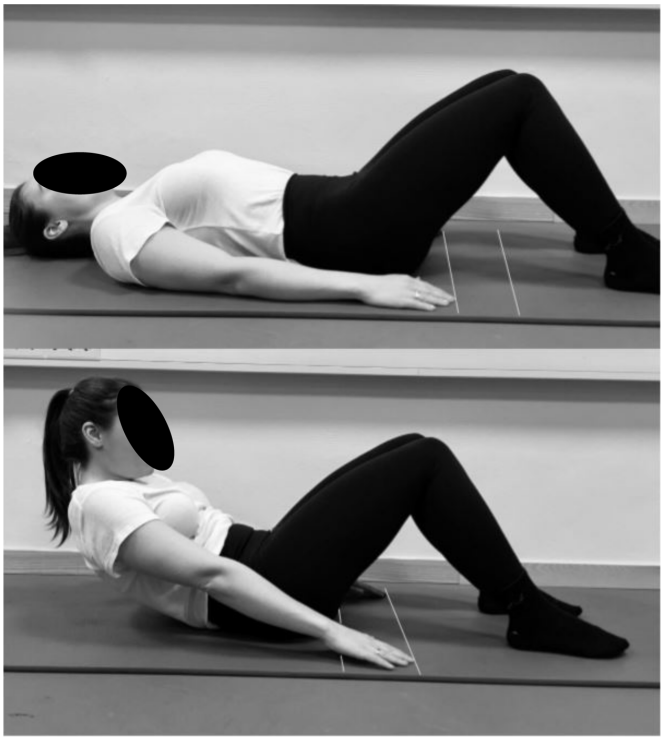

Fig. 2. Illustrations of start and ending postion during the ASCM curl-up test. Reproduced with permission by Kristina L. Skaug.

Data analysis

Background variables are presented as means with SD or numbers with percentages. All the IRD data were normally distributed. Differences in background variables were analyzed with an independent *t*-test for continuous data and with Chi Square of independence for the categorical data. If the expected count in a variable was less than five, the Exact Sig (two-sided) value was used. An independent *t*-test or Fisher's Exact Test was used to compare differences between groups in the main analyses. In addition, linear or logistic regression were used to adjust for possible confounders; age, height, physical activity level, BMI, parity, time since birth and DRA severity. For subgroup analyses the number for confounding factors was reduced according to the number of participants. Unadjusted and adjusted mean scores with 95% confidence intervals (CI) are presented for continuous data. For categorical data unadjusted and adjusted data with percentages are reported. Statistical significance was defined as $P < 0.05$.

Results

Seventy-two women were included in this study. Table 1 presents background variables for women with and without DRA. The oldest woman was 58 years old. There was no statistically significant difference in background variables between women with and without DRA.

Table 2 shows mean inter-recti distance (mm) with standard deviation (SD) at rest and during a curl-up in women with and without DRA. According to the classification of DRA severity [4] 18/35 (51%) women were classified with mild, 13/35 (37%) with moderate and 4/35 (11%) with severe DRA.

Table 3 presents mean numbers and scores (Nm) of abdominal muscle strength tests, unadjusted and adjusted for age, BMI, height, parity, DRA severity, time since last birth and physical activity. Subgroup analyses of women with severe and moderate DRA compared to women without DRA showed no differences in the abdominal muscle strength tests, neither adjusted nor unadjusted.

Table 4 presents women with and without DRA experiencing PFD, low back, pelvic girdle, and abdominal pain, unadjusted and adjusted for age, BMI, height, parity, DRA severity, time since last birth, and physical activity. There were no significant differences in numbers of women with and without DRA experiencing PFD, low back, pelvic girdle and abdominal pain in the unadjusted analyses. When adjusted for possible confounders, significantly more women with DRA reported abdominal pain than women without

Table 1
Difference in background variables between women with and without diastasis recti abdominis (DRA).

	Total sample ($n = 72$)	With DRA ($n = 36$)	Without DRA ($n = 36$)	*P*-value
Age, years, mean (SD)	36 (5.0)	36 (5.0)	35 (5.0)	0.59
Height, m, mean (SD)	1.68 (0.06)	1.68 (0.05)	1.67 (0.06)	0.67
BMI, kg/m^2, mean (SD)	24 (4.1)	23 (3.6)	24 (4.5)	0.25
Weight gain last pregnancy, kg, mean (SD)	14 (4.7)	14 (4.7)[a]	13 (4.6)[b]	0.21
Waist circumference, cm, mean (SD)	80 (8.7)	80 (8.8)	81 (8.7)	0.72
Parity				
1	8 (11.1)	4 (11.1)	4 (11.1)	1.0
2	54 (75.0)	27 (75.0)	27 (75.0)	1.0
3	8 (11.1)	4 (11.1)	4 (11.1)	1.0
4	2 (2.8)	1 (2.8)	1 (2.8)	1.0
Time since last birth				
<6 months	5 (6.9)	1 (2.8)	4 (11.1)	0.18*
6 to 11 months	18 (25.0)	12 (33.3)	6 (16.7)	
1 to 3 years	35 (48.6)	18 (50.0)	17 (47.2)	
<3 years	14 (19.4)	5 (13.9)	9 (25.0)	
Heavy lifting at work				
Perform heavy lifting	11 (19.9)	5 (17.2)[c]	6 (23.0)[d]	0.59
Rarely/never perform heavy lifting	44 (80.0)	24 (82.8)[c]	20 (76.9)[d]	
Menstruation postpartum				
Yes	40 (69.0)	21 (67.7)[e]	19 (70.4)[f]	0.83
No	18 (31.0)	10 (32.3)[e]	8 (29.6)[f]	
Mode of delivery				
Vaginal	53 (73.6)	27 (75.0)	26 (72.2)	0.86*
Cesarean	11 (15.3)	6 (16.7)	5 (13.9)	
Both vaginal and caesarean	8 (11.1)	3 (8.3)	5 (13.9)	
Birthweight, g				
<4500	3 (2.0)	1 (1.4)	2 (2.7)	
4000 to 4500	28 (18.9)	18 (24.3)	10 (13.5)	
3000 to 3999	96 (64.9)	45 (60.8)	51 (68.9)	
2500 to 2999	15 (10.1)	7 (9.5)	8 (10.8)	
1500 to 2499	4 (2.7)	3 (4.1)	1 (1.4)	
1000 to 1499	0 (0.0)	0	0	
<1000	2 (1.4)	0	2 (2.7)	
Use of contraceptives				
Yes	33 (45.9)	16 (44.4)	17 (47.2)	0.81
No	39 (54.2)	20 (55.6)	19 (52.8)	
Current breastfeeding				
≥1 times/day	25 (43.1)	14 (45.2)[e]	11 (40.7)[f]	0.74
Rarely/never	33 (56.9)	17 (54.8)[e]	16 (59.3)[f]	
Physical activity, minute/week	121.6 (111.8)	123.6 (118.3)	119.5 (106.5)	0.88
Total Beigthon score	0.6 (1.0)	0.6 (1.0)	0.6 (0.7)	1.0
Striae				
During teenage	31 (43.1)	16 (44.4)	15 (41.7)	0.81
During pregnancy	28 (38.9)	14 (38.9)	14 (38.9)	1.0
Postpartum	11 (15.3)	7 (19.4)	4 (11.1)	0.33

Values are presented as numbers (percentages) of women unless otherwise indicated. BMI = body mass index.
* Exact sig (2-sided) reported were expected cells are <5.
[a] Total $n = 32$; four women did not answer this question in the questionnaire.
[b] Total $n = 35$; one woman did not answer this question in the questionnaire.
[c] Total $n = 29$; this question was only given to women who were working (valid percentages are reported).
[d] Total $n = 26$; this question was only given to women who were working (valid percentages are reported).
[e] Total $n = 31$; this question was only given to women who were <3 years since last birth (valid percentages are reported).
[f] Total $n = 27$; this question was only given to women who were <3 years since last birth (valid percentages are reported).

DRA (OR: 0.02, 95%CI 0.00 to 0.61, $P = 0.026$). Subgroup analyses comparing women with moderate and severe DRA to women without DRA found no differences in numbers of women experiencing PFD, low back, pelvic girdle and abdominal pain (unadjusted and adjusted analyses for age, height, physical activity, BMI and parity). In women who experienced PFD, no statistically significant difference was found between women with and without DRA in the sum score for the PFDI-20, ODI, and PGQ. Mean sum score for women reporting abdominal pain that interfered with their activities of daily living was 3.9 (SD 2.5) and 2.5 (SD 1.3) in women with and without DRA, respectively. The most common location of abdominal pain was above the umbilicus ($n = 5$). None of the controls ($n = 4$) reported such pain.

Table 2
Mean inter-recti distance (mm) with standard deviation (SD) at rest and during a curl-up measured 2 cm above- and 2 cm below the umbilicus in women with DRA ($N = 36$) and without DRA ($N = 36$).

IRD		With DRA ($n = 36$)	Without DRA ($n = 36$)
Above umbilicus			
	Rest, mean (SD)	43.5 (13.1)	23.3 (7.1)
	Curl-up, mean (SD)	34.6 (10.7)[a]	17.2 (5.7)
Below umbilicus			
	Rest, mean (SD)	32.8 (13.4)	15.4 (7.8)
	Curl-up, mean (SD)	30.2 (10.2)[a]	12.6 (5.6)

DRA, diastasis recti abdominis.
[a] Total $n = 35$; one woman was not able to perform a curl-up.

In women classified with severe DRA ($n = 4$), two women experiencing PFD showed a PFDI-20 total sum score of 33.3 and 36.5 with the following scale score on POPDI-6; 8.33 and 25.0, CRADI-8; 3.13 and UDI-6; 25.0 and 8.33. One woman with severe DRA experienced low back pain and her score on the ODI was 12%. No women with severe DRA experienced pelvic girdle pain and one woman reported abdominal pain.

One woman was not able to perform a curl-up during the IRD assessments and classification of DRA severity was therefore not possible. Her IRD measurement during rest indicated a severe DRA. She experienced PFD, low back, pelvic girdle, and abdominal pain and her total score on the PFDI-20 was the highest reported with 212.5 (POPDI-6: 50, CRADI-8: 62, UDI-6: 100), the ODI was 10% and the PGQ was 34%. The reported abdominal pain was 9/10 on a VAS.

Discussion

This study found that women with DRA had no higher prevalence of PFD, low back and pelvic girdle pain than women without DRA. Adjusted analyses showed no difference between groups in abdominal muscle strength, but higher prevalence of abdominal pain in women with DRA. Subgroup analyses comparing women with severe and moderate DRA with women without DRA showed no difference in abdominal strength, report of PFD, low back, pelvic girdle and abdominal pain than women without DRA.

In agreement with others [7,24,25], this study found reduced abdominal strength in women with DRA. Benjamin et al. [11] concluded that there is weak evidence that DRA severity may be associated with impaired abdominal muscle strength. Similar to this study, Gunnarsson et al. [25] used a dynamometer to measure isometric strength, but in a sitting position. However, this position may activate the hip flexors and results are therefore not directly comparable to results measured in standing. A recently published case-control study including 18 women with, and 22 women without DRA, found that the former demonstrated significant lower trunk muscle rotation torque than the latter [7]. The authors have not found any other studies evaluating rotation, and our apparatus could only assess flexion and extension. So, although both Hills et al. [7] and our study found reduced

Table 3
Unadjusted and adjusted mean score with 95% confidence intervals (CI) for ACSM curl-up test and maximal isometric strength (Nm) in 10° and 30° position in women with DRA and no DRA.

Variable	With DRA ($n = 36$)	Without DRA ($n = 36$)	Mean difference (95% CI); P-value	Adjusted mean difference (95% CI); P-value
Numbers of ACSM curl-ups, mean (SD)	5.1 (10.6)[a]	4.5 (8.9)[b]	0.6 (−4.0, 5.2); 0.80	6.1 (−3.3, 15.6); 0.20
Maximal isometric strength 10°, mean Nm (SD)	73.9 (17.5)[c]	82.9 (22.4)	−9.0 (−18.8, 0.68); 0.07	−5.3 (−17.3, 6.7); 0.38
Maximal isometric strength 30°, mean Nm (SD)	96.1 (20.6)[d]	109 (26.7)	−12.9 (−24.4, −1.5); 0.028	−11.9 (−26.5, 2.6); 0.11

DRA = diastasis recti abdominis, Nm = Newton meter.
[a] Total $n = 11$; 25 women were not able to perform the test.
[b] Total $n = 9$; 27 women were not able to perform the test.
[c] Total $n = 35$; one woman was not able to perform the test.
[d] Total $n = 34$; two women were not able to perform the test.

Table 4
Women with DRA and without DRA experiencing pelvic floor disorders, low back, pelvic girdle and abdominal pain. Results presented as numbers and percentages (%).

Variable	With DRA ($N = 36$)	Without DRA ($N = 36$)	P value	Adjusted P value	OR (95% CI)
Pelvic floor disorders	17 (47)	13 (36)	0.47	0.59	1.78 (0.22 to 14.2)
Low back pain	16 (44)	10 (28)	0.22	0.28	0.31 (0.04 to 2.65)
Pelvic girdle pain	11 (31)	4 (11)	0.08	0.27	0.16 (0.01 to 4.00)
Abdominal pain	10 (28)	4 (11)	0.14	0.048	0.19 (0.38 to 0.99)[a]

DRA = diastasis recti abdominis.
[a] The confounder "DRA severity" was not included in the adjusted analysis.

strength, they are not directly comparable. In addition, the reported mean IRD in women with DRA (mean 26 mm, SD 4) in the study of Hills et al. [7] was almost equal to the mean IRD for women *without* DRA in the present study (mean 23.3 mm, SD 7.1). Hence, the populations in Hills et al. [7] and this study are very different, and any comparison of the results should be undertaken with caution. Another interesting finding of our study was that the unadjusted analysis demonstrated a difference in abdominal muscle strength for the 30° position between the women with and without DRA. However, this statistically significant difference disappeared with the adjusted analysis controlling for possible confounders. There is a need for further studies to verify whether these variables are risk factors for DRA.

This study found no difference in ACSM curl-up test between the two groups. This contrasts with others [7,24] who reported a significantly lower score on their sit-up test in women with DRA. All three studies used different curl-up tests and were conducted at different timepoints postpartum. The time factor may influence abdominal strength as a natural recovery after childbirth is expected [24]. The use of different tests might reflect the difficulty in finding tests that directly assess abdominal muscle strength and endurance. Interestingly, 72% of participants in our study were unable to perform a single curl-up according to the ACSM curl-up test protocol, and there was no difference between women with and without DRA. Although the test was not developed for women postpartum, the authors argue that this finding is interesting because it may reflect that postpartum women in general have been discouraged from doing sit-ups postpartum [26] and thus have lost this function of the abdominal muscles. It may also be that this test is too difficult for women with DRA postpartum, and therefore should only be used as a test for ability to perform a single curl-up in future studies. Porcari et al. [27] found that in a group of eight exercising women, mean age 40 (SD 6), the average number of repetitions of the ACSM curl-up test was 29 (SD 14). The authors were unable to find reliability data on the ACSM curl-up test, and the results should therefore be interpreted with caution.

There was no difference in prevalence and severity of PFD between women with and without DRA, neither in sum score nor the three scale scores, and when comparing the subgroup with more severe DRA. This is in line with the results of a systematic review [11] that found no significant association between DRA and urinary incontinence and only a small association between DRA and pelvic organ prolapse. Our results also concur with two recent studies that did not find an association between PFD and DRA [28,29]. Contrary to these findings, a study including women with different lumbo-pelvic diagnoses reported that 25/30, 83% of the women had DRA [8]. The same study found a relationship between pelvic pain and dysfunction (PFDI) and DRA. However, the mean sum score in the PFDI was only 5.5 out of 300.

The authors found no difference in prevalence of low back or pelvic girdle pain between women with and without DRA. This result is in line with the results of the systematic review by Benjamin et al. [11]. However, their included studies consisted mainly of women with mild or moderate DRA whereas our study included a higher proportion of women with moderate and severe DRA. Despite this, the results of our subgroup analyses were still in line with their conclusion [11]. Our study used the ODI to undertake a functional measure of disability due to low back pain. The same questionnaire was used by Parker et al. [9] and Dalal et al. [8]. In addition, a recent study by Hills et al. [7] used the Roland-Morris Disability Questionnaire Score and found no difference in disability due to low back pain between women with and without DRA. Reported lumbo-pelvic pain is expected to be high and may affect between 9% and 48% of women postpartum [9,30]. The prevalence of low back and pelvic girdle pain in our study was within this range, suggesting that there is no association between lumbo-pelvic pain and DRA.

This study found a higher prevalence of abdominal pain in women with, than those without, DRA when adjusted for possible confounders. A connection between DRA and abdominal pain and discomfort concur with anecdotal experience from clinical physiotherapy practice. However, as far as the authors have ascertained, only two previous studies have measured abdominal pain. Parker et al. [9] measured combined abdominal and pelvic pain using a visual analogue scale and found that women with DRA reported more pain than women without it. Hills et al. [7] found no difference in abdominal pain between women with and without DRA. As there were differences in assessment methods and populations within our and these studies, further research is warranted.

Strengths

The strengths of this study include the use of ultrasound to measure IRD, and that measurements were taken both at rest and during a curl-up. Measurements of the ultrasound images were performed off-line after the clinical assessments, and the physiotherapist was blinded to the women‘s IRD and any symptoms reported. One physiotherapist performed all the tests. The study used recommended and validated questionnaires to assess PFD, low back and pelvic girdle pain. In addition, compared to previous published studies, the authors have included a larger proportion of women classified with moderate and severe DRA.

Limitations

A limitation of this study is the absence of reliability studies for the Humac NORM and the ACSM curl up test. However, reliability studies with comparable dynamometers to measure maximal trunk flexion have showed good to excellent intra-tester reliability [15,31]. Another limitation is the absence of an a-priori power calculation. All women with DRA were part of an earlier study where the sample size was estimated with the purpose of detecting the immediate change in IRD during different abdominal and pelvic floor muscle

exercises [14]. Hills et al. [7] estimated that 52 women (26 in each group) were needed to detect a difference in trunk flexion endurance time between women with and without DRA. A similar test was done in this study, and the authors therefore suggest that the inclusion of 36 women in each of our groups was enough to detect a difference for the strength measurements. The reported reduction in abdominal strength was only tested in two different positions for trunk flexion. Therefore, our results are limited to flexion and cannot tell the influence of DRA on other abdominal motions, e.g. trunk rotation. Due to low power in the sub-group analysis the possibility of a type II error should also be considered. In addition, our study sample consisted of highly educated Caucasian women, which limits generalization of our results to other populations.

Conclusion

The results of this study support a growing body of knowledge that DRA may be associated with impaired abdominal muscle strength and abdominal pain but cast some doubt on the common belief that DRA can cause PFD, low back and pelvic girdle pain. Physiotherapists working within an evidence-based paradigm should be cautious when addressing a causal inference between PFD, low back, and pelvic girdle pain in women with DRA. Further studies are warranted on the consequences of DRA, especially in the small subgroup of women with severe diastasis.

Key messages

- This study found that women with DRA tend to have weaker abdominal muscle strength and higher prevalence of abdominal pain than women without DRA.
- To the authors' knowledge, this is the first study to investigate possible consequences of DRA in a subgroup of women with moderate and severe diastasis.
- The results contradict the common belief that there is an association between DRA and PFD, low back and pelvic girdle pain and add important information to the existing body of knowledge.

[5pt]*Ethics approval*: The study was approved by the Regional Medical Ethics Committee (REK South East Ref. No. 2018/2312) and the Norwegian Centre for Research Data (Ref. No. 440860). Written informed consent was obtained from all participants.

Funding: The study was fully funded by The Norwegian Women's Public Health Association.

Conflict of interest: There was no conflict of interest in this study.

Acknowledgements

The authors thank Associate Professor Morten Wang Fagerland, Norwegian School of Sport Sciences, Department of Sport Medicine for statistical advice and Gill Brook MCSP DSA(CSP) MSc, independent women's health physiotherapist and immediate past President of the International Organization of Physical Therapists in Women's Health, Otley, United Kingdom for language editing.

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Paper IV

Curl-up exercises does not decrease inter-recti distance but improve abdominal muscle strength in women with diastasis recti abdominis postpartum: a randomized controlled trial

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Abbreviated title: Effect of curl-ups on DRA
Key words: Curl-up, Diastasis recti abdominis, Exercise, Postpartum, Randomized Controlled Trial
Word Count: 249 (Abstract)
3684 (Introduction, Method, Results, Discussion)
References: *38*
Tables: 5
Figures: 4
Ethics approval: The Regional Medical Ethics Committee (REK South-East 2018/2312) and the Norwegian Centre for Research Data (440860) approved this study. All participants gave written informed consent before data collection began.

Competing interests: None
Source of support: The Norwegian Women`s Public Health Association fully funded the study.
Acknowledgements: The authors thank Associate professor Morten Fagerland, PhD, for statistical advice; physiotherapists Kristina L. Skaug and Marte D. Gram for randomizations of participants and teaching the exercise program and follow-up of the exercise group through Athlethe Monitoring; Kristin Benum and Henrik Warpe-Kinn, for providing physiotherapy rooms for testing at Nøtterøy and in Fredrikstad.
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ABSTRACT

Question: Does an abdominal exercise program including curl-ups reduce inter-recti distance (IRD) in postpartum women with diastasis recti abdominis (DRA)? **Design**: This was an assessor blinded two-arm parallel group randomized controlled trial with intention-to-treat analysis. **Participants**: Seventy primi- or multiparous women 6-12 months postpartum, having a single- or multiple pregnancy following any mode of delivery, with a diagnosis of DRA (IRD >28mm at rest or >25 mm during a curl-up). **Intervention**: A 12-weeks, 5-days a week standardized exercise program including head lift, abdominal curl-up and twisted abdominal curl-up was prescribed for the exercise group. The control group received no intervention. **Outcome measures**: The primary outcome measure was change in IRD measured with ultrasonography. Secondary outcomes were prevalence of DRA, change in abdominal muscle strength, endurance, and thickness, and prevalence of abdominal-, low-back and pelvic girdle pain, pelvic floor disorders (PFD), and perceived change of the condition. **Results**: There were no statistically significant differences in changes between the two groups in IRD; difference in change of IRD at rest 2 cm above umbilicus (1.24 mm, CI -0.83, 3.31, p=0.24). Women in the exercise group had significant increase in abdominal muscle strength and thickness compared to the control group. There was no effect on low back-, pelvic girdle- and abdominal pain, or PFD. **Conclusion**: An exercise program containing curl-ups for women with DRA was not effective in decreasing IRD or low-back-, pelvic girdle-, and abdominal pain, or PFD. However, the exercise program was effective in increasing abdominal muscle strength and thickness. **Trial registration**: NCT04122924

INTRODUCTION

Diastasis recti abdominis (DRA) is defined as an impairment with midline separation of the two rectus abdominis muscles along linea alba[1]. To diagnose DRA the inter-recti distance (IRD) is measured[2], but there is no consensus on the cut-off point[3]. Ultrasound is the recommended method to measure IRD with intra- and inter-rater intraclass correlation coefficients >0.9[4].

The condition has been reported to be highly prevalent in the postpartum period with prevalence rates up to 45% at 6 months, and 30% at 12 months postpartum[5]. To date, two systematic reviews[6,7] have evaluated consequences of DRA, and DRA has been associated with weaker abdominal muscles[7-9] and more abdominal pain[6,8]. An association with low-back and pelvic girdle pain or pelvic floor disorders (PFD), such as urinary incontinence, anal incontinence and pelvic organ prolapse has been suggested but not substantiated in studies of women with mild or moderate DRA[6-8,10]. Keeler et al[11] reported that women's health physiotherapists mostly applied pelvic floor muscle (PFM)- (89%) and transversus abdominis (TrA) training (87%) in the treatment of DRA. These results were confirmed in a recent study by Gluppe, Ellström Engh, Bø[12]. Three systematic reviews have evaluated the effect of different exercise programs in the treatment of DRA, concluding with low-quality methodology, small sample sizes, and insufficient evidence to recommend any specific exercise protocol[13-15]. Curl-up have traditionally been discouraged in the treatment of women with DRA, but in a short-term experimental study we found that head-lift and abdominal curl-ups reduced the IRD during the exercises[16].

Therefore, the research questions were:

1. What is the effect of a 12 weeks home-based abdominal exercise program, containing head lift and abdominal curl-ups, on IRD in primi- and multiparous women with DRA 6-12 months postpartum?
2. What is the effect on of the exercise program on clinical observation of DRA, perceived change of the condition, abdominal muscle strength and endurance,

thickness of m. rectus abdominis, and abdominal-, low-back and pelvic girdle pain, and PFD?

METHOD

Design

This is an assessor blinded two-arm parallel group RCT with the primary aim of evaluating the effect of a 12 weeks abdominal exercise program on IRD and prevalence of DRA in primi- and multiparous women, starting 6-12 months postpartum.

After baseline testing, all women were randomly allocated equally to either exercise or control group by a person not involved in the assessments. Randomization was computer-generated, in blocks of 4 with concealed allocation.

One trained physiotherapist who had undergone specific training in ultrasound imaging of the abdominal muscles prior to data collection performed all assessments. Images taken at pretest were transferred from the hard disk to a software program (MicroDicom) and analyzed offline. The same physiotherapist, blinded for group allocation, performed both the ultrasound assessments and the offline analyses. All participants were thoroughly informed at the start of the post-test not to reveal group allocation.

Participants and procedure

Participants were recruited through women's health physiotherapists, personal trainers, midwives, gynecologists/obstetricians, friends and acquaintances and by advertising in social media. The numbers of women screened and excluded with reasons for exclusion are presented in Fig. 1. The RCT was performed mainly at the Norwegian School of Sport Sciences in Oslo and at two physiotherapy centers in Norway from January 2020 to December 2022. Inclusion of participants was stopped when we reached the number estimated to need. Posttest assessment was conducted after 12 weeks of the intervention period by one physiotherapist blinded to group allocation.

Inclusion criteria were being a primi- or multiparous woman with a diagnosis of DRA 6-12 months postpartum, having a single or multiple pregnancy following any mode of delivery, and being able to understand a Scandinavian language. The diagnosis of DRA was based on previous studies, and IRD cut-off was set to ≥ 2.8 cm at rest or ≥ 2.5 cm during a curl-up 2 cm above or 2 cm below the umbilicus[17,18]. In addition, if a protrusion along the linea alba was observed, women were included even if the IRD was less than our cut-off values. Exclusion criteria were being < six months and > twelve months postpartum, being <18 years old, and unable to understand a Scandinavian language.

To be included in the study all participants had to be diagnosed with DRA according to the IRD inclusion criteria. Diagnose of DRA was confirmed with ultrasound prior to pre-test or when signing up for screening.

Prior to pre-test, the participating women responded to an electronic questionnaire gathering information about background variables and comorbidities such as neurological, and systemic musculoskeletal diseases or psychiatric diagnoses (Table 1). Height, weight and waist circumference were measured at the clinical assessment, and BMI was calculated for all participants.

Intervention

The focus of the exercise protocol was to strengthen the abdominal muscles, based on findings from a short-term experimental study[16]. The specific exercises and progression of the program are shown in Fig 2. A 10 minutes 5 days a week standardized individual exercise program was prescribed, lasting for 12 weeks. Due to the covid-19 pandemic the instruction on how to perform the exercises was given digitally by a physiotherapist by a phone or demonstrated on Facetime. We added extra exercise sessions for three participants where the posttest was delayed due to lock-down during the covid-19 pandemic. In addition, the exercises were captured and described in detail in a document sent to all participants in the

intervention group (Fig. 2). The intervention group was also provided with a smartphone app (Athlete Monitoring) where adherence to training could be registered. Furthermore, a daily reminder to exercise and a weekly SMS was given to encourage participants in the intervention group to adhere to the program. The physiotherapist providing the training program was not involved in any assessment of the condition.

The control group received no intervention and was discouraged from conducting specific abdominal training/exercises. However, general physical activity and training of other muscle groups could not be restricted.

Outcome measures

Primary outcome

Change in IRD

One physiotherapist performed the clinical examinations of all participants at baseline and at post-test after 12 weeks intervention. To diagnose DRA the IRD was assessed with transabdominal ultrasound, a portable 2D ultrasound machine with a linear transducer (Logic e R7, GE Healthcare, Chalfont St Giles, United Kingdom). The ultrasound imaging protocol is described in detail by Gluppe, Engh, Bø[16].

To standardize the measurement locations, 2 marks were made on the skin: one 2 cm above and one 2 cm below the center of the umbilicus (Fig. 3)[4]. Images were captured at rest and during a curl-up at both measurement locations. During the curl-up the women were in a standardized supine position with arms crossed over the chest. The curl-up was performed till the shoulder blades were off the bench. The end position of the ultrasound assessment of IRD during the curl-up is illustrated in Fig. 4.

Secondary outcomes

Clinical observation of DRA

The assessor observed the abdomen while the women performed a curl-up and registered if the following; “protrusion”, “sink-in”, “no”, or “uncertain” was seen at pre- and posttest.

Perceived change of the condition with GRC

At post-test women in both groups were asked to report whether they perceived improvement of their DRA compared to pre-test on a Global rating of change scale (GRC). The GRC includes classifications from very much worse to fully healed in a numerical 11-point scale. The instrument has shown good intra-test reliability (ICC = 0.9)[19].

Abdominal muscle strength and endurance

Humac NORM isokinetic dynamometer (CSMi, Soughton, MA) was used to assess maximal isometric abdominal wall strength, limited to trunk flexion. Isometric trunk flexion assessments with dynamometers in a sitting position has shown excellent test–retest reliability with ICC > 0.9[20,21] and strong correlation with the width of the IRD[9,20]. Eighteen women did not perform the maximal isometric strength with the Humac NORM isokinetic dynamometer due to lock-down in Oslo during the covid-19 pandemic. Abdominal muscle endurance was assessed as number of repetitions of a standardized abdominal curl-up to exhaustion test following the protocol of the American College of Sports Medicine (ACSM) curl-up test[22,23]. This variable was dichotomized into “0” and “1+” in the analyses. The protocol for these two strength tests is described in detail in Gluppe, Ellström Engh, Bø[8].

Muscle thickness of m. rectus abdominis

Muscle thickness was defined as the distance between the inside edges of the superior and inferior fascial borders [2]. Participants rested in a standardized supine position with arms alongside and knees bent with the feet on the bench. Three ultrasound images were taken at rest 2 cm above the umbilicus. The transducer was moved transversely over the midpoint of

the right m. rectus abdominis and the average was calculated. This protocol was modified from Coldron, Stokes, Newham, Cook[2].

Abdominal-, low-back, pelvic girdle pain, and PFD

Prior to pre- and post-test all participants responded to the following questions in the electronic questionnaire; "Do you have symptoms from your bowel, bladder or pelvic region that bother you (e.g. urinary leakage, bowel leaks or feeling of bulge in the vagina)?", "Do you have low back pain?", "Do you have pelvic girdle pain?" and "Do you have pain in you abdomen?". If answering yes to these questions, participants were asked to respond to the following; The Pelvic Floor Distress Inventory-short form 20 (PFDI-20)[24], the Oswestry Disability Index (ODI)[25] and the Pelvic Girdle Questionnaire (PGQ)[26]. If participants responded yes to having abdominal pain, they were asked to indicate the location of the pain, and to what degree (from zero = not at all, to 10 = a lot) the pain affected their activities of daily living. Each scale score of the PFDI-20 ranges from 0 to 100 and the sum score from the three scales together range from 0 to 300. The sum score in the ODI is calculated in percent from 0 (not disabled) to 100 (disabled) and the PGQ is calculated in percent from 0 (not at all) to 100 (to a large extent). All three instruments have been validated and are recommended for assessment of symptoms of PFD, functional measure of disability due to low back pain, and limitation in activities/participation due to pelvic girdle pain[24-26].

Data analysis

An a-priori power calculation was conducted with statistician and associate professor Morten Wang Fagerland at the Norwegian School of Sport Sciences. The calculation was based on a conservative approach. The effect size for the training group was set to 0.8 cm with SD of 0.8, for the control group the effect size was set to 0.2 and SD 0.8. These numbers are based

on results from a previously published RCT[27], but the effect size was slightly adjusted upwards due to that study`s low power. In addition, the adjustment was based on other studies with no effect[28,29]. Therefore, we planned to include N=58 with 29 women in each group. To allow for some loss to follow-up, the final estimation was increased to 70 women; 35 women in each group.

Data were analyzed using SPSS 28. Background variables are reported as means with standard deviations (SD) or numbers with percentages. Within- and between-group comparisons of continuous and categorical data were analyzed by the Independent sample t-test and Chi Square test for independence, respectively. For continuous variables we used an ANCOVA as a linear regression with posttest value as the dependent variable and grouping- and pretest variable as the independent variables. Difference in change between groups from pre- to posttest are reported with 95% CI. P values < .05 were considered statistically significant. Analyzes were based on intention-to-treat. Based on women adhering to ≥80% of the prescribed training sessions, an additional per protocol analysis was performed. This analysis also excluded women who dropped out.

RESULTS

Flow of participants through the study

Two hundred and forty-seven women were screened with ultrasound for DRA. One hundred and seventy-seven (72%) was excluded mostly due to not meeting the IRD inclusion criteria. Of the 70 women who met the inclusion criteria, 35 women were randomized to the exercise group and 35 to the control group (Fig. 1). Three women (8.6%) dropped out of the exercise group and none in the control group. The reasons for drop-out are described in Fig. 1. Women in the exercise group completed 74% (SD 26) of their prescribed exercise sessions. Twenty-one (66%) of women in the exercise group adhered to 80% or more of their

prescribed exercise sessions.

Table 1 shows the characteristics of the participants. Ninety-seven percent of the women had a college/university education and were of Caucasian genetic origin. Of the total sample, 99% were married/cohabitating and non-smokers. Six (8.6%) women of the total sample had one twin delivery each, four women in the exercise group and two women in the control group.

Change in IRD

For all women, the widest IRD was measured at rest 2 cm above the umbilicus (Table 2). Mean IRD decreased from pre- to posttest for all IRD measurements in both groups, except from a minor increase in IRD measured below the umbilicus at rest in the control group. There were no statistically significant differences in any IRD measurements between groups at post-test and no difference in change between the two groups from pre- to posttest (Table 2).

Clinical observation of DRA and GRC

There was no significant difference between the exercise- and control group at posttest in number of women with an observed protrusion or an abdominal “sink-in” (Table 2).
At posttest 20 (61%) women in the exercise group and 15 (43%) women in the control group reported improvement in DRA by the GRC ($p = 0.16$). None of the participants in either groups reported worsening of the condition.

Abdominal muscle strength and endurance, and muscle thickness of m. rectus abdominis

Table 4 shows the measurement of maximal isometric strength at 30◦ and 10◦, and m. rectus abdominis muscle thickness at pre- and post-tests. The exercise group had statistically significantly greater maximal isometric strength and muscle thickness and at post-test than the control group and a statistically significant difference in change in favor of the exercise group (Table 4). At pretest 76% of all women were not able to perform one single curl-up according to the ACSM curl-up test procedure. There was no significant difference between the exercise- and control group on posttest in number of women able to perform zero or more than one curl-up on the ACSM curl-up test (Table 4).

Low back-, pelvic girdle- and abdominal pain, and PFD

There was no significant difference between the exercise- and control group on posttest in numbers of women reporting low back-, pelvic girdle- and abdominal pain or PFD. There were no statistically significant differences in ODI, PGQ and PFDI-20 scores between groups at post-test and no difference in change between the two groups from pre- to posttest (Table 5).

Per-protocol analyses did not alter any of the reported primary or secondary outcomes.

DISCUSSION

No significant difference was found in the primary outcome, mean change of IRD, between groups. The exercise group showed a significant increase in mean change of maximal isometric muscle strength and muscle thickness compared to the control group. No significant effect was found on low back-, pelvic girdle- and abdominal pain or PFD.

Our choice of intervention was based on a short-term experimental study showing an immediate significant IRD reduction during head-lift and abdominal curl-ups[16]. This effect was not found when the women were performing the same exercise for 12 weeks in this RCT. A non-effect may be due to the choice of exercises, that only 66% of women in the exercise group adhered to ≥80% of the prescribed exercise and that the exercises was home-based and not supervised. It is difficult to make direct comparison between other RCTs applying abdominal training to reduce IRD. The studies differ in measurement methods to assess IRD (palpation, caliper, ultrasound), choice of cut-off value for diagnosing DRA, and inclusion of primi- and/or multiparous women. In addition, onset of the training intervention, type of exercises and training programs, training dosage, supervision of the exercise interventions and methodological quality of the studies[13-15] make comparison between studies challenging. As there is a natural remission of DRA in the postpartum period[5], the effect of interventions should be compared with untreated controls. We have found seven RCTs comparing abdominal training with an untreated control group. Two RCTs[28,29] found no significant effect of their exercise intervention. Keshwani, Mathur, McLean[28] included exercises for isolated activation of TrA and Gluppe et al[29] evaluated the effect of PFM training including weekly group training containing abdominal exercises. The latter study measured IRD with palpation. Hence, comparison to the present results is difficult. Five RCTs have found significant positive effect on IRD over untreated controls[27,30-33]. The participants in these studies are comparable to our study with regards to parity and onset of training postpartum. However, the studies are hampered with sample sizes, e.g. n=10[27] and the cut-off values for DRA in some studies indicate no DRA[33]. Only one of the RCTs[27] measured IRD with ultrasound and this study was a pilot RCT[27].

The present study found positive effects on maximal isometric muscle strength and muscle thickness. We have only been able to find one other RCT comparing exercise to a untreated control group measuring trunk flexion strength and endurance[28]. Although the test was different, their results corresponds with our findings. A limitation of the measurement method used in the present study (Humac NORM) is lack of reliability data. However, reliability studies with comparable dynamometers to measure maximal trunk flexion have showed good to excellent intra-tester reliability[20,21]. We also found that our program significantly increased muscle thickness of m. rectus abdominis. This corresponds with increased m. rectus abdominis thickness in both intervention arms (delivered in person or via ZOOM) by Kim, Yi, Yim[34]. Participants characteristics, time since last birth and the ultrasound protocol are comparable with our study. The non-effect of abdominal strength assessed with the ACSM curl-up test does not correspond with the positive effect found with dynamometer. Interestingly, more than 70% of our participants were unable to perform one single curl-up according to this test. Hence, the ACSM curl-up test might be too difficult for women with DRA postpartum[8]. In addition, there is no reliability data on this test and the results should therefore be interpreted with caution. In contradiction to our study group, Botla & Saleh[35] found that their participants were able to do 24 curl-ups, but the mean IRD values were smaller in their participants compared to ours and below the normal IRD values in postpartum women according to Mota et al[17].

Despite the finding that our participants did not reduce the IRD, they were able to increase maximal abdominal muscle strength and m. rectus abdominis thickness, with no widening of the IRD. For long, performing crunches and sit-ups were discouraged because these exercises were believed to worsen DRA. However, several short-term experimental studies have now found that contracting the TrA and the PFM widens, while crunches narrow the IRD[16,36,37].

Our results of no negative effect of conducting head-lift, crunch and twisted crunches regularly for 3 months imply that women with mild to moderate diastases can do these exercises safely and that the exercises improve abdominal strength.

A postulated association between DRA and low-back, pelvic girdle-, and abdominal pain and PFD has not been substantiated in many studies[6,10]. The present study did not find any effect of curl-up training on any of these conditions, and our results support the findings in the systematic review of RCTs by Gluppe, Engh, Bø [14]. A recent study by Yalfani, Bigdeli, Gandomi [30] found positive effect of abdominal training on low back pain and disability in women with DRA. Further studies are needed to explore effects on abdominal training on these conditions in women with DRA.

An interesting finding of the present study was that 72% of women screened for participation believed they had a DRA but were excluded due to not meeting our IRD inclusion criteria. This may reflect the huge focus on DRA in social media and young mothers` concerns about their abdomen postpartum [12]. Even small and possible neglectable DRAs may result in fair avoidance and drop-out from physical activities both during pregnancy and following childbirth. WHO recommends all women to start or continue a regular exercise program during pregnancy and in the postpartum period[38]. Mota et al[17] suggested that the upper limit for normal IRD during pregnancy and postpartum needs to be re-evaluated, and our results indicate that women with mild to moderate diastasis can do abdominal crunches with no risk of worsening DRA. However, the effect on abdominal exercises in women with severe DRA needs further investigations.

Strengths and limitations

Strengths of the present study are the randomized design, an a-priori power calculation, low drop-out, blinding of the assessor and the use of an exercise program including three exercises shown to give an immediate reduction of IRD in a short term experimental study[8]. The exercise program also included progression in load and volume every second week. The same assessor performed all assessments, ultrasound was used to assess IRD, the assessment procedures were standardized with the aim to minimize inaccuracy, and we included a homogeneous group of parous women six to twelve months postpartum. Limitations are that unsupervised training may have reduced adherence and intensity of the training, and that the abdominal muscle strength tests have not been tested for reliability. In addition, our sample consisted of a limited number of women with severe diastasis, and our results might therefore not be generalizable to women with severe DRA. Our study sample consisted of women able to speak and understand Scandinavian languages and the results can therefore not be generalized to other ethnic groups.

Conclusion

A 10 minutes 5 days a week standardized abdominal exercise program lasting for 12 weeks was not effective in decreasing IRD or low-back-, pelvic girdle-, and abdominal pain, or PFD. However, the exercise program was effective in increasing abdominal muscle strength and m. rectus abdominis thickness. A program including head-lift, curl-up and twisted curl-up did not worsen DRA, and the results indicate that parous women with mild to moderate DRA should not be discouraged from doing such exercises. Further high quality RCTs of different exercise programs including women with severe DRA are warranted.

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Table 1 Baseline characteristics of included women 6-12 months postpartum at pretest. Values are presented as numbers (percentages) or means with standard deviations (SD).

Variable	Total sample (n=70)	1) Exercise group (n=35)	2) Control group (n=35)
Age, years, mean (SD)	33.9 (3.4)	34.7 (3.5)	33 (3.1)
Height, m, mean (SD)	1.67 (0.1)	1.68 (0.1)	1.66 (0.1)
Weigth (kg) (SD)	69.4 (15.4)[1]	69.7 (15.6)	69.1 (15.4)
BMI, kg/m^2, mean (SD)	24.9 (5.6)[1]	24.8 (5.4)	25.0 (5.8)
Waist circumference, cm, mean (SD)	85.2 (13.9)	85.3 (13.0)	85.1 (14.9)
Weight gain last pregnancy, kg, mean (SD)	15.5 (5.6)	15.9 (6.1)	15.1 (5.2)
Heavy lifting at work[3]			
Perform heavy lifting	6 (24)	3 (23.1)	3 (25)
Rarely/never perform heavy lifting	19 (76)	10 (76.9)	9 (75)
Singleton parity[2]			
1	14 (21.9)	5 (16.1)	9 (27.3)
2	41 (64.1)	21 (67.7)	20 (60.6)
3+	9 (14.0)	5 (16.1)	4 (12.1)
Mode of delivery			
Vaginal	44 (68.8)	25 (80.6)	19 (57.6)
Cesarean	9 (14.1)	1 (3.2)	8 (24.2)
Both vaginal and cesarean	11 (17.2)	5 (16.1)	6 (18.2)
Use of contraceptives			
Yes	25 (35.7)	13 (37.1)	12 (34.3)
No	45 (64.3)	22 (62.9)	23 (65.7)
Breastfeeding			
≥1 times/day	57 (81.4)	27 (77.1)	27 (77.1)
Rarely/never	13 (18.6)	8 (22.9)	8 (22.9)
Striae			
During teenage	30 (42.9)	12 (34.3)	18 (51.4)
During pregnancy	39 (55.7)	23 (65.7)	16 (45.7)
Postpartum	14 (20)	7 (20)	7 (20)
Menstruating			
Yes	38 (54.3)	17 (48.6)	21 (60)
No	24 (34.3)	14 (40)	10 (28.6)
Uncertain	8 (11.4)	4 (11.4)	4 (11.4)
Physical activity, minute/week	136 (118)	150 (115)	120 (121)

BMI=body mass index; m=meter
[1]Total n=69; missing data for one woman who did not want to measure weight from control group (valid percent reported).
[2]Total n=64; missing data on 6 women had a twin delivery (valid percent reported)
[3]Total n=25; 25 women reported to be back to work and therefor responded to this question

Table 2 Mean millimeter (mm) inter-recti distance (IRD) measurements in the exercise- and control group with standard deviations (SD) at pre- and posttest and mean difference in change between groups from pre-to posttest with 95 % confidence interval (CI) from pre-to posttest. P value for differences between groups.

	Pretest	Posttest	Difference in change between groups with 95%CI	p-value
IRD at rest 2 cm above umbilicus			1.24 (-0.83, 3.31)	0.24
Exercise group	36.95 (8.08)	36.33 (8.40)		
Control group	39.82 (10.08)	37.76 (10.47)		
IRD at rest 2 cm below umbilicus			-2.78 (-5.81, 0.26)	0.072
Exercise group	28.57 (10.07)	27.52 (11.86)		
Control group	28.33 (10.07)	30.07 (10.79)		
IRD during a curl-up 2 cm above umbilicus			0.08 (-2.94, 2.79)	0.96
Exercise group	28.33 (10.07)	26.01 (11.37)		
Control group	30.13 (13.20)	28.33 (11.71)		
IRD during a curl-up 2 cm below umbilicus			-1.15 (-4.62, 2.33)	0.51
Exercise group	22.60 (11.56)	20.79 (12.33)		
Control group	23.94 (12.75)[1]	23.87 (12.81)		

[1]Total n=34; missing data on one woman (valid percent reported)

Table 3 Clinical observation of protrusion or "sink-in" with numbers and percentages (%) of women in the exercise- and control group at pre- and posttest. P value for differences between groups.

	Pretest			Posttest		
	Exercise group (n=35)	Control group (n=35)	p value	Exercise group (n=35)	Control group (n=35)	p value
DRA clinical observation						
Protrusion	14 (40)	12 (34.3)	0.4	6 (18.8)	5 (14.3)	0.5
"Sink-in"	5 (14.3)	2 (5.7)		5 (14.3)	3 (8.6)	
No or uncertain	16 (45.7)	21 (60.0)		24 (66.9)	27 (77.1)	

Table 4 Mean score with 95% confidence intervals (CI) for ultrasound measure of muscle thickness of m. rectus abdominis, ACSM curl-up test and maximal isometric strength (Nm) in 10◦ and 30◦ position in exercise- and control group at pre- and posttest. P value for differences between groups.

	Pretest	Posttest	Difference in change between groups with 95%CI	p-value
Muscle thickness RA, mean mm (SD)				
Exercise group	8.30 (2.10)	9.20 (2.37)	0.58 (0.01, 1.14)	0.046
Control group	8.48 (1.48)	8.80 (1.78)		
Maximal isometric strength 30◦, mean Nm (SD)				
Exercise group	118.5 (26.9)[1]	125.4 (27.3)[3]	6.25 (0.47, 12.04)	0.035
Control group	114 (28.1)[2]	115.2 (27.4)[2]		
Maximal isometric strength 10◦, mean Nm (SD)				
Exercise group	91.1 (26.6)[1]	98.8 (26.1)[3]	7.55 (1.94, 13.17)	0.009
Control group	87.7 (24.0)[2]	88.6 (23.4)[2]		
Numbers of ACSM curl-ups				
Exercise group				
0	25 (71.4)	22 (64.7)[4]		
1+	10 (28.6)	12 (35.3)		
Control group				
0	28 (80.0)	23 (67.6)[4]		
1+	7 (20.0)	11 (32.4)		

Nm=Newton meter; ACSM=American Collage of Sport Medicine; RA=m.rectus abdominis
[1]Total n=24; 25 women performed the test, but missing pretest data from one woman who got dizzy.
[2]Total n=27; 27 women performed the test
[3]Total n=25
[4]Total n=34: 1 woman was not to perform the test

Table 5 Numbers and percentages (%) of women in the exercise- and control group at pre- and posttest reporting yes to pelvic floor disorders (PFD), low back-, pelvic girdle- and abdominal pain. The total score in percent for the ODI, PFDI-20 and PGQ is presented as mean with SD. P value for differences between groups.

	Pretest		Posttest		
	Exercise group (n=35)	Control group (n=35)	Exercise group (n=34)	Control group (n=35)	p-value
PFD	18 (51.4)	12 (34.3)	13 (38.2)	10 (28.6)	0.5
PFDI-20	75.3 (32.3)	66.9 (17.6)	57.3 (19.9)	85.1 (41.3)	0.8
Low back pain	18 (51.4)	16 (45.7)	16 (45.7)	14 (40.0)	0.8
ODI	12.3 (9.1)	12.0 (9.4)	12.8 (10.8)	12.3 (9.8)	0.2
Pelvic girdle pain	12 (34.3)	13 (37.1)	7 (20.0)	9 (25.7)	0.4
PGQ	31.9 (19.6)	26.4 (23.2)	26.5 (13.2)	28.4 (15.0)	0.3
Abdominal pain	6 (17.1)	4 (11.4)	6 (7.6)	4 (11.4)	0.5

ODI=Oswestry Disability Index; PFDI-20=Pelvic Floor Distress Inventory-short form 20; PGQ=Pelvic Girdle Questionnaire

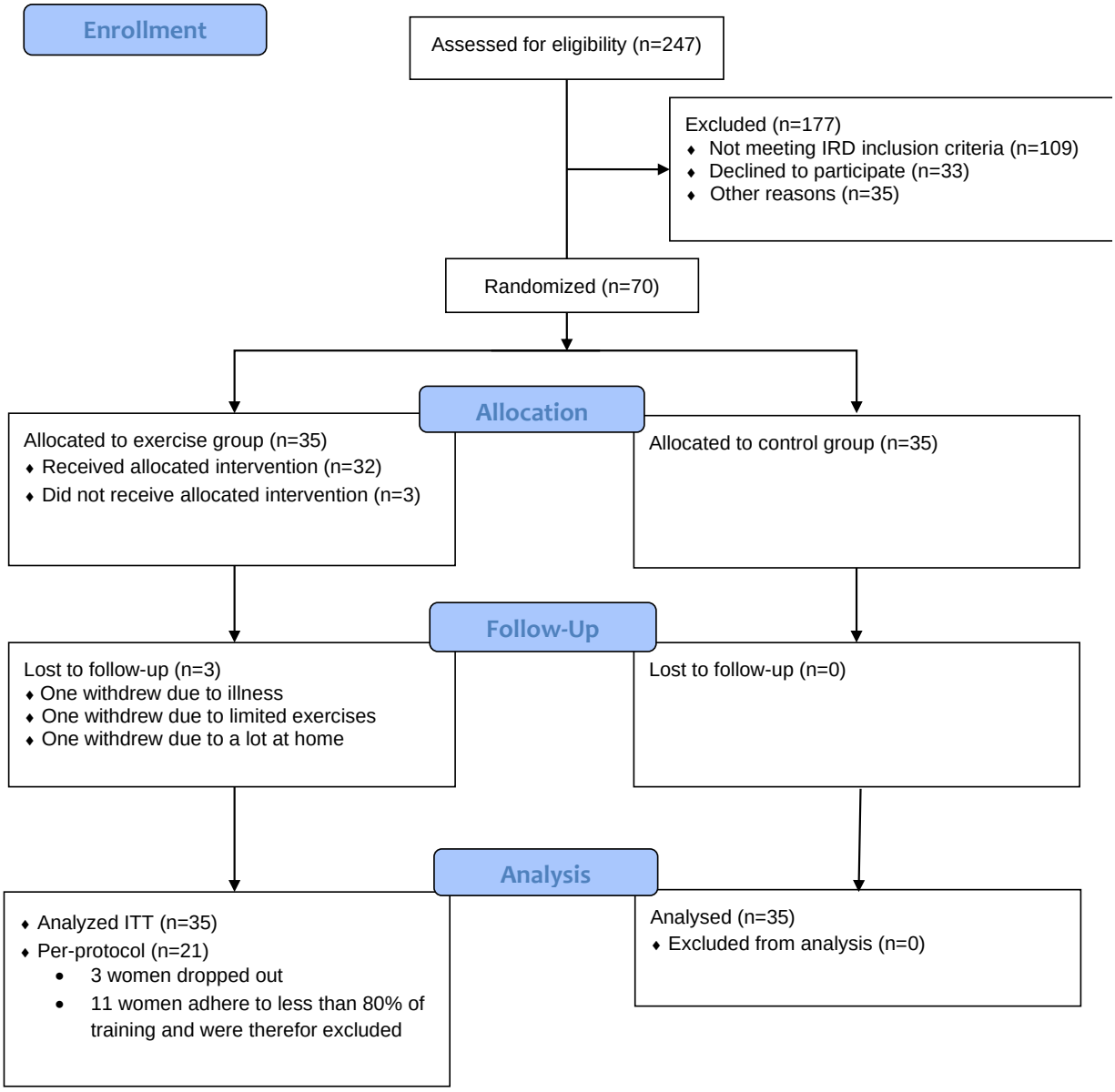

Figure 1. The flow chart of the study.

Exercise program

Week 1-4: Perform one set of exercise 1, 2 and 3 in the order described below.
Week 5-8: Perform two sets of exercise 1, 2 and 3 in the order described below with a 1 min pause between.
Week 9-12: Perform three sets of exercise 1, 2 and 3 in the order described below with a 1 min pause between sets.

*Perform all exercises **slowly** and check that exercises are performed correctly without causing a significant protrusion (please observe your abdomen while doing the exercises). You may conduct the exercises while lying on the floor with your child).*

Exercises with explanation			
	1.) Head lift *Lie on your back with your legs bent and arms alongside* • Slowly inhale and exhale • After exhaling, lift your head up with your chin towards your chest • Lower slowly 	**2.) Oblique curl-up (both right and left side)** *Lie on your back with your legs bent and one arm alongside, the other hand behind your head* • Slowly inhale and exhale • After exhaling, lift your head and bend the upper part of your back obliquely up until one shoulder blade is free from the floor • Lower slowly 	**3.) Curl-up** *Lie on your back with arms crossed over your chest* • Slowly inhale and exhale • After exhaling, lift your head and bend the upper part of your back up until both shoulder blades are free from the floor • Lower slowly Progresjon for week 11-12
Progression			
Week 1+2	1 x 8 rep.	1 x 8 rep.	1 x 8 rep.
Week 3+4	1 x 10 rep.	1 x 10 rep.	1 x 10 rep.
Week 5+6	2 x 10 rep.	2 x 10 rep. Holding time: 1 sec.	2 x 10 rep. Holding time: 1 sec.
Week 7+8	2 x 12 rep.	2 x 12 rep. Holding time: 2 sec.	2 x 12 rep. Holding time: 2 sec.
Week 9+10	3 x 10 rep.	3 x 10 rep. Holding time: 2 sec.	3 x 10 rep. Holding time: 2 sec.
Week 11+12	3 x 12 rep.	3 x 12 rep. At the top you «tilt» forward 3 times	3 x 12 rep. Place your hands in a grip behind your neck (avoid picking up speed with your arms on the way up!)

Figure 2. The exercise program of the randomized controlled trial.

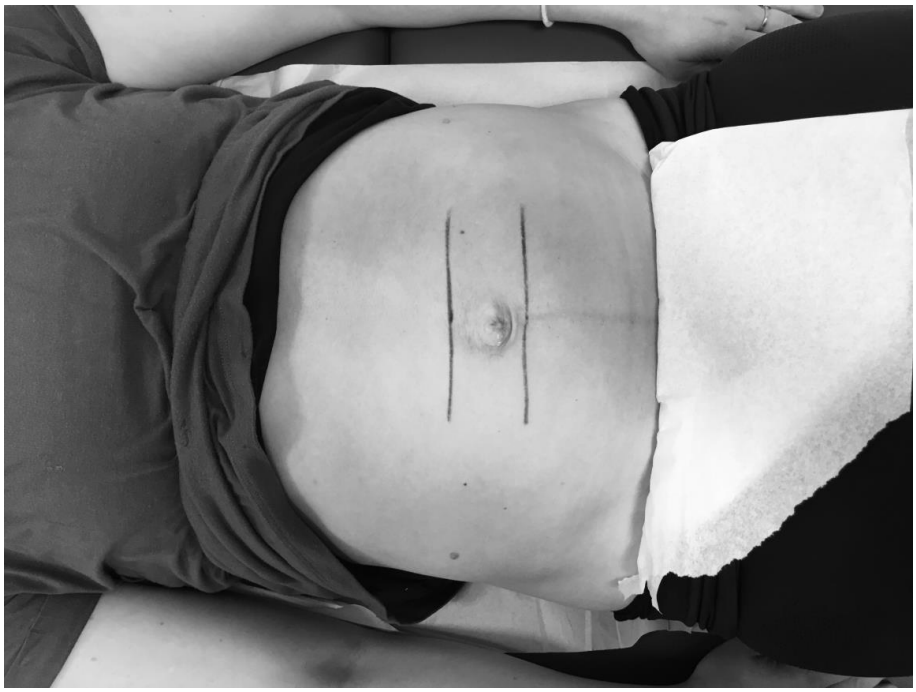

Figure 3. Inter-recti distance measurement locations during ultrasound assessment.

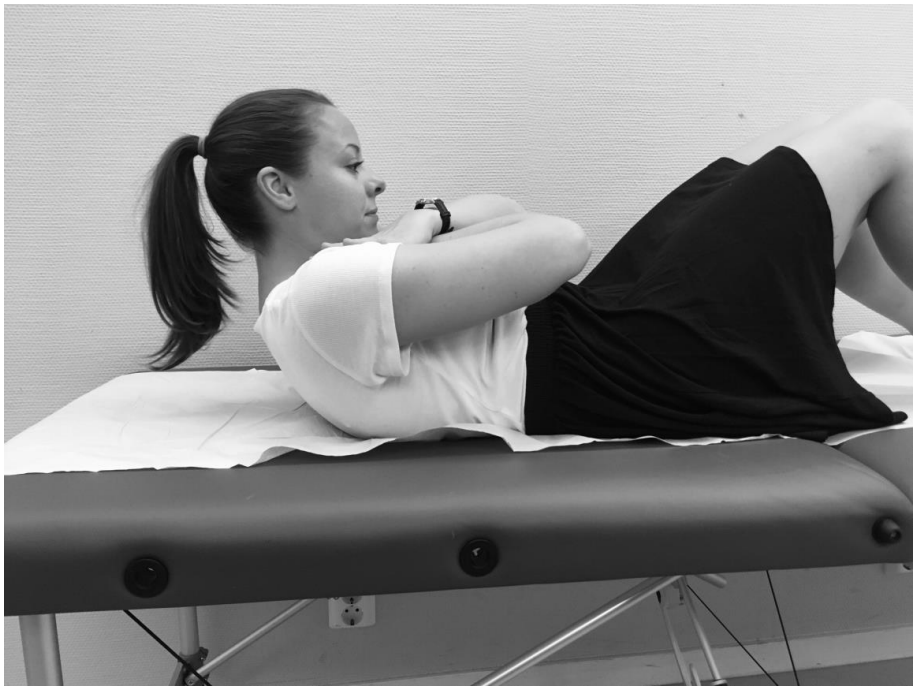

Figure 4. The end position during curl-up in the ultrasound assessment of IRD. Reproduced with permission by Kristina L. Skaug.

Appendix 1

Paper I-IV

Approvals from the Regional Committee for Medical and Health Research Ethics of Norway (REK South East 2018/2312) and the Norwegian Centre for Research Data (440860).

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst	Hege Cathrine Finholt, PhD	22857547	18.12.2018	2018/2312 REK sør-øst D
			Deres dato:	**Deres referanse:**
			06.11.2018	

Vår referanse må oppgis ved alle henvendelser

Sandra Lødeng Gluppe
Norges idrettshøgskole

2018/2312 Mammamage - et problem etter fødsel?

Forskningsansvarlig: Norges idrettshøgskole
Prosjektleder: Sandra Lødeng Gluppe

Vi viser til søknad om forhåndsgodkjenning av ovennevnte forskningsprosjekt. Søknaden ble behandlet av Regional komité for medisinsk og helsefaglig forskningsetikk (REK sør-øst D) i møtet 05.12.2018. Vurderingen er gjort med hjemmel i helseforskningsloven (hforsknl) § 10.

Prosjektleders prosjektbeskrivelse
Formålet med prosjektet er å undersøke separasjon av de rette magemusklene (rectus diastase) etter fødsel. Det er for tiden stor oppmerksomhet på denne tilstanden, særlig i sosiale medier, men det foreligger lite forskning på forekomst, årsak, risikofaktorer, mulige følger og behandling. Prosjektet tar opp fire forskningsspørsmål som besvares gjennom 4 studier med ulike studiedesign; 1. Hvordan oppleves helse, utseende og funksjon av kropp og mage etter fødsel? En tverrsnittstudie. 2. Hva er den akutte effekten av ulike type mage- og bekkenbunnsøvelser på rectus diastase? En eksperimentell studie. 3. Er det forskjell mellom kvinner med og uten rectus diastase med tanke på funksjon og plager etter fødsel? Et case control design. 4. Hva er effekten av et styrketreningsprogram på rectus diastase etter fødsel? En randomisert kontrollert studie. Vi benytter bl.a. web-baserte spørreskjemaer, 2D ultralydmålinger av rectus diastase og muskelstyrketester for å samle inn kliniske data.

Vurdering
Studiens hensikt er å undersøke hvordan kvinner opplever kroppen og magen sin etter fødsel og om de har andre helseplager. Mer spesifikt skal man undersøke separasjon av de rette magemusklene (rectus diastase) etter fødsel, og hva dette har å si for kvinner. Studien består av følgende fire deler:

1: Helseplager og hvordan kvinner opplever kroppen og magen etter fødsel.
2: Hvordan ulike magemuskeløvelser påvirker de rette magemusklene.
3: Om det er forskjell mellom kvinner med og uten de rette magemusklene i funksjon og plager etter fødsel.
4: Effekten av et styrketreningsporgram på de rette magemusklene.

Komiteen har ingen innvendinger til studien. Komiteen har imidlertid en kommentar til informasjonsskrivet og spørreskjemaene. Det oppgis det at det vil ta 5-15 minutter å svare på spørreskjemaet. Gitt lengden på spørreskjemaet mener komiteen at det vil ta lenger tid enn 5-15 minutter å svare på disse spørsmålene og ber derfor om at det oppgis en mer realistisk tid for deltakernes tidsbruk. Komiteen ber også om at veileder for doktorgradsprosjektet settes som prosjektleder, jfr. Helseforkningsloven § 4 som krever at prosjektleder skal ha forskerkompetanse.

På denne bakgrunn setter komiteen følgende vilkår for godkjenning:
- Informasjonsskrivet og spørreskjemaene må oppgi en realistisk tidsbruk for besvarelse av spørreskjemaet
- Prosjektleder må byttes ut med doktorgradsstipendiatens veileder. Dette må sendes inn som en prosjektendring til REK.

Vedtak
REK har gjort en helhetlig forskningsetisk vurdering av alle prosjektets sider. Prosjektet godkjennes med hjemmel i helseforskningsloven § 10, under forutsetning av at ovennevnte vilkår er oppfylt.

Vi gjør samtidig oppmerksom på at etter ny personopplysningslov må det også foreligge et behandlingsgrunnlag etter personvernforordningen. Det må forankres i egen institusjon.

I tillegg til vilkår som fremgår av dette vedtaket, er godkjenningen gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknad og protokoll, og de bestemmelser som følger av helseforskningsloven med forskrifter.

Tillatelsen gjelder til 30.09.2021. Av dokumentasjonshensyn skal opplysningene likevel bevares inntil 30.09.2026. Forskningsfilen skal oppbevares atskilt i en nøkkel- og en opplysningsfil. Opplysningene skal deretter slettes eller anonymiseres, senest innen et halvt år fra denne dato.

Forskningsprosjektets data skal oppbevares forsvarlig, se personopplysningsforskriften kapittel 2, og Helsedirektoratets veileder for «Personvern og informasjonssikkerhet i forskningsprosjekter innenfor helse og omsorgssektoren».

Dersom det skal gjøres vesentlige endringer i prosjektet i forhold til de opplysninger som er gitt i søknaden, må prosjektleder sende endringsmelding til REK.

Prosjektet skal sende sluttmelding på eget skjema, senest et halvt år etter prosjektslutt.

Komiteens avgjørelse var enstemmig.

Klageadgang
REKs vedtak kan påklages, jf. forvaltningslovens § 28 flg. Klagen sendes til REK sør-øst D. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK sør-øst D, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag for endelig vurdering.

Vi ber om at alle henvendelser sendes inn på korrekt skjema via vår saksportal: http://helseforskning.etikkom.no. Dersom det ikke finnes passende skjema kan henvendelsen rettes på e-post til: post@helseforskning.etikkom.no.

Vennligst oppgi vårt referansenummer i korrespondansen.

Med vennlig hilsen

Finn Wisløff
Professor em. dr. med.
Leder

Hege Cathrine Finholt, PhD
Rådgiver

Kopi til: s.a.anderssen@nih.no
Norges idrettshøgskole ved øverste administrative ledelse: postmottak@nih.no

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst	Hege Cathrine Finholt, PhD	22857547	20.12.2018	2018/2312/REK sør-øst D
			Deres dato:	**Deres referanse:**
			20.12.2018	

Vår referanse må oppgis ved alle henvendelser

Sandra Lødeng Gluppe
Norges idrettshøgskole

2018/2312 Mammamage - et problem etter fødsel?

Forskningsansvarlig: Norges idrettshøgskole
Prosjektleder: Sandra Lødeng Gluppe

Vi viser til søknad om prosjektendring datert 20.12.2018 for ovennevnte forskningsprosjekt. Søknaden er behandlet av sekretariatet for REK sør-øst D på fullmakt, med hjemmel i helseforskningsloven § 11.

Endringene innebærer:
Ny prosjektleder: Kari Bø, professor, Norges Idrettshøgskole.
Ny prosjektmedarbeider: Sandra Lødeng Gluppe.
Oppdatert forespørsel om deltakelse og samtykkeerklæring, i tråd med komiteens opprinnelige vilkår.

Vurdering
REK har vurdert søknaden og har ingen forskningsetiske innvendinger til endringene av prosjektet.

Vedtak
REK har gjort en forskningsetisk vurdering av endringene i prosjektet, og godkjenner prosjektet slik det nå foreligger, jf. helseforskningsloven § 11.

Klageadgang
REKs vedtak kan påklages, jf. forvaltningslovens § 28 flg. Eventuell klage sendes til REK sør-øst D. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK sør-øst D, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag for endelig vurdering.

Vi ber om at alle henvendelser sendes inn på korrekt skjema via vår saksportal: http://helseforskning.etikkom.no. Dersom det ikke finnes passende skjema kan henvendelsen rettes på e-post til: post@helseforskning.etikkom.no.

Vennligst oppgi vårt referansenummer i korrespondansen.

Med vennlig hilsen

Knut Ruyter

Avdelingsdirektør
REK sør-øst sekretariatet

Hege Cathrine Finholt, PhD
Rådgiver

Kopi til: *s.a.anderssen@nih.no; postmottak@nih.no*

NSD sin vurdering

Skriv ut

Prosjekttittel
"Mammamage" - et problem etter fødsel?

Referansenummer
440860

Registrert
13.11.2018 av Sandra Lødeng Gluppe - s.l.gluppe@nih.no

Behandlingsansvarlig institusjon
Norges idrettshøgskole / Seksjon for idrettsmedisinske fag

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)
Kari Bø, kari.bo@nih.no, tlf: 99047363

Type prosjekt
Forskerprosjekt

Prosjektperiode
14.01.2019 - 30.09.2021

Status
10.01.2019 - Vurdert

Vurdering (1)

10.01.2019 - Vurdert
BAKGRUNN Prosjektet er vurdert og godkjent av REK etter helseforskningsloven (hfl.) § 10, jf. § 11, (REK sin ref.: 2018/2312/REK sør-øst) NSD vurderer at behandlingen vil være i samsvar med personvernlovgivningen, så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet 9.1.2018 med vedlegg, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte. MELD ENDRINGER Dersom behandlingen av personopplysninger endrer seg, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. På våre nettsider informerer vi om hvilke endringer som må meldes. Vent på svar før endringen gjennomføres. TYPE OPPLYSNINGER OG VARIGHET Prosjektet vil behandle særlige kategorier av personopplysninger om helse, og alminnelige personopplysninger, frem til 30.09.2021. Deretter skal data oppbevares frem til 30.9.2026, for etterprøvbarhet og kontroll. Vi minner om at eventuelle nye prosjekter på dataene må meldes til NSD, evt. også til REK, fortløpende. LOVLIG GRUNNLAG Prosjektet vil innhente samtykke

fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 nr. 11 og art. 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse, som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes uttrykkelige samtykke, jf. personvernforordningen art. 6 nr. 1 a), jf. art. 9 nr. 2 bokstav a, jf. personopplysningsloven § 10, jf. § 9 (2). PERSONVERNPRINSIPPER NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen: - om lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen - formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke viderebehandles til nye uforenlige formål - dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet - lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet DE REGISTRERTES RETTIGHETER Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20). NSD vurderer at informasjonen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13. Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned. FØLG DIN INSTITUSJONS RETNINGSLINJER NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32). For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og eventuelt rådføre dere med behandlingsansvarlig institusjon. OPPFØLGING AV PROSJEKTET NSD vil følge opp underveis (hvert annet år) og ved planlagt avslutning for å avklare om behandlingen av personopplysningene pågår i tråd med den behandlingen som er dokumentert. Lykke til med prosjektet! Kontaktperson hos NSD: Pernille E. Grøndal Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Appendix 2

Paper I-IV

Approvals of changes during the project period from the Regional Committee for Medical and Health Research Ethics of Norway (REK South East 2018/2312) and the Norwegian Centre for Research Data (440860).

REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst D	Finn Skre Fjordholm	+47 22 84 58 21	24.10.2019	12547
			Deres referanse:	

Kari Bø

12547 Mammamage - et problem etter fødsel?

Forskningsansvarlig: Norges idrettshøgskole

Søker: Kari Bø

REKs vurdering

Vi viser til søknad om prosjektendring datert 02.10.2019 for ovennevnte forskningsprosjekt. Søknaden er behandlet av leder for REK sør-øst D på fullmakt, med hjemmel i helseforskningsloven § 11

Endringene innebærer:

-Endring i rekruttering. Det åpnes for rekruttering fra hele landet via sosiale medier.
-Ny ordning for innhenting av samtykke: Kvinner som melder seg frivillig vil gi samtykke elektronisk og få tilgang til spørreskjemaet

-Nye prøver og måling: I studiens del 4 vil det hentes inn muskeltverrsnitt av rectus abdominis målt med ultralyd. En app, Athlete Monitoring, vil bli brukt til registrering av treningsdagbok for å måle gjennomføringsgrad av treningsprogrammet. Kvinnene i treningsgruppen vil bli lagt inn i programmet med mailadresse, telefonnummer og navn. Deltagerne får påminnelser via SMS. Det foreligger en databehandleravtale for appen.

-Endring i treningsprogram: Treningsprogrammet skal gjøres 5 ganger pr uke og deltakerne følges opp ukentlig via appen i stedet for å møte til ukentlig individuell trening. Alle kvinner gjennomfører et standardisert treningsprogram.

-Nytt spørsmål: Det er lagt til et spørsmål om barnets/barnas fødselsvekt, noe som kan ha betydning for rectus diastase

Komiteens leder har vurdert de omsøkte endringene, og har ingen forskningsetiske innvendinger til endringene slik de er beskrevet i skjema for prosjektendring.

Vedtak

Godkjent

REK har gjort en forskningsetisk vurdering av endringene i prosjektet, og godkjenner prosjektet slik det nå foreligger, jf. helseforskningsloven § 11.

Tillatelsen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden, endringssøknad, oppdatert protokoll og de bestemmelser som følger av helseforskningsloven med forskrifter.

Vi gjør samtidig oppmerksom på at etter ny personopplysningslov må det også foreligge et behandlingsgrunnlag etter personvernforordningen. Det må forankres i egen institusjon.

Med vennlig hilsen,

Finn Wisløff
leder
Professor em. dr. med.

Finn Skre Fjordholm
rådgiver
REK sør-øst D

Kopi til: postmottak@nih.no

Klageadgang
Du kan klage på komiteens vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes til REK sør-øst D. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK sør-øst D, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering.

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst D	Finn Skre Fjordholm	+47 22 84 58 21	10.02.2020	12547
			Deres referanse:	

Kari Bø

12547 Mammamage - et problem etter fødsel?

Forskningsansvarlig: Norges idrettshøgskole

Søker: Kari Bø

REKs vurdering

Vi viser til søknad om prosjektendring datert 23.01.2020 for ovennevnte forskningsprosjekt. Søknaden er behandlet av leder for REK sør-øst D på fullmakt, med hjemmel i helseforskningsloven § 11

Endringen innebærer:

Utvidelse av inklusjonskriteriene i studiens del 4 til DRI “defined as more than 2.5 cm IRD during a crunch or more than 2.8 cm in rest on 2D ultrasound or with a protrusion/insoation along the linea alba even without a palpated separation 2.5 cm)”

Endringen er gjengitt i en revidert versjon av forskningsprotokollen, som fulgte vedlagt søknaden.

I søknaden begrunnes utvidelsen med at praksis viser at flere kvinner har rectus diastase enn de som ble omfattet av de tidligere inklusjonskriteriene.

Komiteens leder har vurdert den omsøkte endringen, og har ingen forskningsetiske innvendinger til endringen slik den er beskrevet i skjema for prosjektendring.

Vedtak

Godkjent

REK har gjort en forskningsetisk vurdering av endringen i prosjektet, og godkjenner prosjektet slik det nå foreligger, jf. helseforskningsloven § 11.

Tillatelsen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden, endringssøknad, oppdatert protokoll og de bestemmelser som følger av helseforskningsloven med forskrifter.

Vi gjør samtidig oppmerksom på at etter ny personopplysningslov må det også foreligge et behandlingsgrunnlag etter personvernforordningen. Det må forankres i egen institusjon.

Med vennlig hilsen,

Finn Wisløff
Professor em. dr. med.
Leder

Finn Skre Fjordholm
rådgiver
REK sør-øst D

Kopi til: postmottak@nih.no

Klageadgang
Du kan klage på komiteens vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes til REK sør-øst D. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK sør-øst D, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering.

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst D	Finn Skre Fjordholm	+47 22 84 58 21	30.04.2020	12547
			Deres referanse:	

Kari Bø

12547 Mammamage - et problem etter fødsel?

Forskningsansvarlig: Norges idrettshøgskole

Søker: Kari Bø

REKs vurdering

Vi viser til søknad om prosjektendring datert 28.04.2020 for ovennevnte forskningsprosjekt. Søknaden er behandlet av leder for REK sør-øst D på fullmakt, med hjemmel i helseforskningsloven § 11

Endringene innebærer:

Utvidelse av inklusjonskriteriet i studie 4 til kvinner med rectus diastase fra 6-8 mnd etter fødsel til 6-12 mnd etter fødsel.

Komiteens leder har vurdert den omsøkte endringen, og har ingen forskningsetiske innvendinger til endringen slik den er beskrevet i skjema for prosjektendring.

Vedtak

Godkjent

REK har gjort en forskningsetisk vurdering av endringen i prosjektet, og godkjenner prosjektet slik det nå foreligger, jf. helseforskningsloven § 11.

Tillatelsen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden, endringssøknad, oppdatert protokoll og de bestemmelser som følger av helseforskningsloven med forskrifter.

Vi gjør samtidig oppmerksom på at etter ny personopplysningslov må det også foreligge et behandlingsgrunnlag etter personvernforordningen. Det må forankres i egen institusjon.

Med vennlig hilsen,

Finn Wisløff
Professor em. dr. med.
Leder

Finn Skre Fjordholm
rådgiver
REK sør-øst D

Kopi til: Norges idrettshøgskole

Klageadgang
Du kan klage på komiteens vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes til REK sør-øst D. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK sør-øst D, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering.

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst D	Finn Skre Fjordholm	+47 22 84 58 21	17.09.2020	12547
			Deres referanse:	

Kari Bø

12547 Mammamage - et problem etter fødsel?

Forskningsansvarlig: Norges idrettshøgskole

Søker: Kari Bø

REKs vurdering

Vi viser til søknad om prosjektendring datert 25.08.2020 for ovennevnte forskningsprosjekt. Søknaden er behandlet av sekretariatet for REK sør-øst D på fullmakt, med hjemmel i helseforskningsloven § 11.

Sakens tidligere REK-referanse er 2018/2312.

Endringene innebærer:

-Innføring av en forundersøkelse på helsestasjon og treningsstudio med måling av diastase med ultralyd for å avgjøre om deltagerne oppfyller inklusjonskriteriene

Sekretariatet i REK har vurdert de omsøkte endringene. Slik vi forstår det er det blitt nødvendig å finne en praktisk enkel måte å undersøke potensielle deltagere for å avklare om de oppfyller inklusjonskriteriene, slik at de slipper å reise langt til klinikken for så å finne ut at de ikke oppfyller kriteriene.

Det legges til grunn at deltagerne må registreres på en eller annen måte i forkant av undersøkelsen, og at det er den samme risikoen for å gjøre uforutsette funn som under de ultralydundersøkelsene som har vært utført frem til nå. Etter REKs syn gjør risikoen for uventede funn at det er behov for å inkludere de aktuelle personene i forskningsprosjektet, selv om det på undersøkelsestidspunktet ikke er klart om de tilfredsstiller kravene til deltagelse i selve studien.

Det legges til grunn at det vil være den samme beredskapen ved forundersøkelsene som for resten av studien.

REK stiller derfor som vilkår for godkjenningen at det legges frem et forenklet informasjonsskriv der det informeres om formålet med forundersøkelsen, hvem som er ansvarlig for undersøkelsen, hvilke opplysninger som lagres, hvilken bedskap som er planlagt og for øvrig hvilke rettigheter som følger med det å være deltager i et forskningsprosjekt.Informasjonsskrivet bør utformes etter REKs mal for informasjonsskriv.

Det fremmes ingen øvrige forskningsetiske innvendinger til endringene slik de er beskrevet i skjema for prosjektendring.

Det nye informasjonsskrivet kan sendes inn ved å besvare oppgaven «Innfri vilkår» i REK-portalen. Tilbakemeldingen må være oss i hende innen seks måneder.

Vedtak

Godkjent med vilkår

.

REK har gjort en forskningsetisk vurdering av /e i prosjektet, og godkjenner prosjektet slik det nå foreligger, jf. helseforskningsloven § 11. under forutsetning av at ovennevnte vilkår er oppfylt.

Tillatelsen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden, endringssøknad, oppdatert protokoll og de bestemmelser som følger av helseforskningsloven med forskrifter.

Vi gjør samtidig oppmerksom på at etter ny personopplysningslov må det også foreligge et behandlingsgrunnlag etter personvernforordningen. Det må forankres i egen institusjon.

Med vennlig hilsen,

Finn Wisløff
Professor em. dr. med.
Leder

Finn Skre Fjordholm
rådgiver
REK sør-øst D

Kopi til: Norges idrettshøgskole

Klageadgang
Du kan klage på komiteens vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes til REK sør-øst D. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK sør-øst D, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering.

Sikt

Meldinger

Skriv melding...

Merk: Meldingen vil bli synlig for din institusjon og alle prosjektet er delt med.

Send melding

Påminnelse (planlagt)
22.01.2029 01:00

Sluttvurdering (planlagt)
15.01.2029 01:00

Underveisvurdering (planlagt)
16.12.2026 01:00

Underveisvurdering (planlagt)
16.12.2024 01:00

Vurdert
16.12.2022 08:31

Behandlingen av personopplysninger er vurdert.

Les vår vurdering

Sendt til vurdering
15.12.2022 16:09

Melding fra Sandra Bjordal Gluppe
15.12.2022 16:08

Okei, da skal jeg få lastet opp vedlegget og endre til 5 år etter prosjektslutt

Melding
09.12.2022 12:34

Hei.

Takk for tilbakemelding og oppdatering av meldeskjema.

Jeg ser at opplysningene skal oppbevares videre til 29.2.2028. Er dette etter vilkår fra REK? REK setter ofte vilkår om 5 års oppbevaring etter prosjektslutt, men dette er bare 4 år etter prosjektslutt, og jeg kan ikke se et vedtak fra REK hvor videre oppbevaring er satt som vilkår. Jeg ber deg derfor laste opp det første vedtaket fra REK hvor prosjektet godkjennes, og eventuelt korrigere dato for videre oppbevaring ut fra dette. Send så meldeskjemaet i retur, og jeg vil sende deg en vurdering dersom alt ser greit ut.

Vennlig hilsen
Lisa

Sendt i retur
09.12.2022 12:34

Sendt til vurdering
06.12.2022 15:19

Melding fra Sandra Bjordal Gluppe
06.12.2022 15:16

Hei,
Ja, det har vært forsinkelser pga covid og at jeg har vært i mammapermisjon
1.) Ja, vi har endret dato i informasjonsskriv/samtykkeskrivet, og ny dato ligger inne på nih sine nettsider.
2.) Ja, REK har godkjent endring av sluttdato

Melding
06.12.2022 09:36

Hei.

Takk for melding om endring av skuttdato for prosjektet. Før jeg kan sende deg en vurdering, har jeg noen spørsmål:

1. Siden prosjektet er forlenget med over to år (fra 30.9.2021) lurer jeg på om utvalgene har fått informasjon underveis om ny sluttdato? Hvis nei, kan dere nå utvalget med slik informasjon eller har dere en prosjektnettside e.l. hvor informasjonen kan legges ut? Oppgi gjerne under "Tilleggsopplysninger".

2. Har dere søkt REK om endring av sluttdato? Vi ber om at endringsvedtak fra REK legges ved i meldeskjema.

Ta gjerne kontakt her i dialogen dersom du har spørsmål.

Vennlig hilsen
Lisa

Sendt i retur
06.12.2022 09:36

Sendt til vurdering
30.11.2022 09:50

Skjult melding

Vurdert
12.08.2021 15:28

Behandlingen av personopplysninger er vurdert.

Les vår vurdering

Sendt til vurdering
05.08.2021 09:34

Skjult melding

Vurdert
28.09.2020 11:03

Behandlingen av personopplysninger er vurdert.

Les vår vurdering

Melding fra Silje Fjelberg Opsvik
22.09.2020 10:08

Kopi av e-post:

Fra: Kari Bø <karib@nih.no>
Sendt: mandag 21. september 2020 13:29
Til: personverntjenester@nsd.no
Kopi: Sandra Bjordal Gluppe <sandralk@nih.no>
Emne: Prioritert godkjenning endringsmelding ref 440860?

Rådgiver NSD
Stipendiat Sandra B Gluppe, Norges idrettshøgskole, har i dag sendt inn endringsmelding og lastet opp informasjonsskrivet for en forundersøkelse til sitt dr.grads prosjekt; ref 440860. Vi håper med dette å få prioritert behandling. Søknaden gjelder mulighet for å gjøre en forundersøkelse for å rekruttere personer med rectus diastase (delte magemuskler) til en randomisert kontrollert studie (RCT). Studien var akkurat kommet i gang da corona pandemien nådde Norge, og det har gått tregt med inklusjon etter 12. mars. Det viser seg også at omtrent halvparten av kvinnene som melder seg og mener at de har diastase ikke har dette i tilstrekkelig grad til å fylle inklusjonskriteriene. Stipendiaten bruker derfor uforholdsmessig mye tid på å teste personer som ikke fyller inklusjonskriteriene. Stipendiaten flyttet i august fra Oslo til Tønsberg, men selve testingen i RCTen må fortsatt foregå ved Norges idrettshøgskole da vi er avhengig av testapparatur der. Hun bruker nå unødig tid på å reise frem og tilbake for å teste personer som likevel ikke kan være med i studien. Ved å gjøre en rask ultralyd forundersøkelse (informert samtykke for forundersøkelsen er godkjent av REK) ved Kvinnehelse klinikker og treningssentre i Vestfold håper vi å kunne få rask økning i inklusjonen. Vi har svært godt samarbeid med Kvinnehelse fysioterapeuter i området som vil hjelpe til med rekruttering .
Stipendiaten er svært forsinket i RCTen pga pandemien, men har arbeidet svært godt med de andre studiene i avhandlingen. Hun går i disse dager inn i sitt 3. og siste år som stipendiat (NKS finansiert), og vi håper derfor å få prioritert behandling av søknaden.

Mvh/Best regards

Kari Bø
Professor, dr. scient/Professor, PhD
Physical therapist, Exercise scientist
Institutt for idrettsmedisinske fag/Department of Sports Medicine

Skjult melding

Sendt til vurdering
21.09.2020 12:25

Melding fra Sandra Bjordal Gluppe
18.09.2020 09:16

Hei, jeg lurer på om jeg må sende inn endringsmelding på følgende;
I studie 4 har rekruttering gått sakte og en del av kvinnene som stiller opp til testing kommer ikke med på grunn av for liten diastase. Jeg har derfor bestemt at jeg skal jeg ha noen dager hvor jeg sitter på aktuelle klinikker med ultralydapparat og har en forundersøkelse. Altså for å sjekke om de har diastase eller ikke, før de møter opp til testing på Norges idrettshøgskole. Denne forundersøkelsen melder kvinnene seg på frivillig dersom de tror de har diastase og booker tid gjennom et timebookingssystem. I dette systemet oppgir de navn, tlf og e-post. Når de møter til forundersøkelsen gjøres ultralydundersøke for å screene om de kan være med eller ikke i selve studien. Dersom de ikke kommer med lagres ingen sensitiv informasjon om de. Dersom de kommer med og ønsker å bli med vil det bli avtalt tidspunkt for testing og de skriver under på samtykket for selve studien da. Jeg har fått godkjent av REK å gjøre dette, under forutsetning av at jeg utarbeider et forenklet informasjonsskriv som omhandler selve forundersøkelsen, som kvinnene skriver under på når de kommer til forundersøkelsen.

Skal jeg søke om endring for dette også hos dere og laste opp det nye informasjonsskriver for forundersøkelsen?

Mvh
Sandra Gluppe

Skjult melding

Vurdert
30.04.2020 13:32

Behandlingen av personopplysninger er vurdert.

Les vår vurdering

Skjult melding

Sendt til vurdering
29.04.2020 12:25

Vurdert
18.12.2019 09:32

Behandlingen av personopplysninger er vurdert.

Les vår vurdering

Skjult melding

Sendt til vurdering
11.12.2019 11:43

Skjult melding

Melding fra Øyvind Straume
11.12.2019 09:08

Hei og beklager sent svar!

Nei, det trenger du ikke. Men dersom du endrer informasjonsskrivet, ber jeg om at du laster opp den siste versjonen.

vennlig hilsen
Øyvind Straume

Melding fra Sandra Bjordal Gluppe
27.11.2019 10:57

Hei, jeg har et spørsmål ang rekruttering av deltakere. Jeg ønsker at deltakere som besvarer spørreskjemet i et av mine studier er med i trekningen av gavekort (verdi 500 kr). Bør jeg sende endringsmeldin til dere om dette?
Mvh
Sandra Gluppe

Vurdert
18.10.2019 12:57

Behandlingen av personopplysninger er vurdert.

Les vår vurdering

Skjult melding

Melding fra Sandra Bjordal Gluppe
16.10.2019 13:03

Hei, jeg sendte inn en endringsmelding til dere for ca. 3 uker siden. Kan dere gi et estimat på ca. hvor lang tid det tar før jeg får svar på endringsmeldingen? Mvh Sandra Gluppe

Skjult melding

Sendt til vurdering
25.09.2019 12:09

Melding fra Sandra Bjordal Gluppe
25.09.2019 10:31

Hei, jeg ønsker å melde endring i prosjektet ang. rekrutteringsmåte i en av studiene. Endrer jeg det bare direkte skjemaet og trykker lagrer? Vil jeg da få beskjed fra dere når endringen er godkjent?
Mvh
Sandra Gluppe

Skjult melding

Vurdert
10.01.2019 10:30

Behandlingen av personopplysninger er vurdert.

Les vår vurdering

Melding fra Sandra Bjordal Gluppe
09.01.2019 11:45

Hei igjen, takk for tilbakemeldingen! Feilen er nå rettet opp i og meldeskjemaet er oppdatert.

Mvh
Sandra Gluppe

Skjult melding

Sendt til vurdering
09.01.2019 11:44

Melding
08.01.2019 15:17

Det innsendte meldeskjemaet med referansekode 440860 må kompletteres for at NSD kan fortsette vurderingen.

Når du har gjort oppdateringene i skjemaet, må du gå til siden "send inn" og trykke "bekreft innsending".

Dersom du har ytterligere kommentarer eller spørsmål kan du skrive en melding i dialogfeltet over og trykke "send melding".

Følgende kommentar er gitt av NSDs personvernrådgiver:

Hei igjen,

Ser at du har skrevet i informasjonsskrivene at at Datatilsynet har vurdert prosjektet. Det er jo altså ikke riktig, ettersom NSD ikke er Datatilsynet, og må rettes opp i. Når dette er gjort, vil vi ferdigbehandle prosjektet.

Sendt i retur
08.01.2019 15:17

Melding fra Pernille Ekornrud Grøndal
08.01.2019 15:05

Hei igjen,

1) Ok
2) Det er Rambøll som leverer Surveyxact, det er tilstrekkelig at avtalen er mellom surveyxact og dere. Du trenger ikke laste den opp, ville bare minne om dette ettesrsom du ikke hadde skrevet noe om det.

Skal ta en ny titt på meldeskjema, kommer tilbake til deg fortløpende.

Melding fra Sandra Bjordal Gluppe
08.01.2019 14:25

Hei,
takk for tilbakemeldingene.
Meldeskjemaet er nå oppdatert etter deres tilbakemeldinger og sendt inn.
Har et par spørsmål/svar til deres spørsmål:
- I prosjektbeskrivelsen refereres det til et "studie 1", men dette finnes ikke i listen over utvalg i meldeskjema. Kan du utdype hvorfor, eventuelt legge til dette som et eget utvalg? Svar: Studie 1 er beskrevet under utvalg 3 i meldeskjemaet (de kom inn i litt feil rekkefølge).
- Ettersom Rambøll er databehandler, må du krysse av for databehandler under "Behandling". Minner om at det skal inngås databehandleravtale med Rambøll. Svar: Databehandler er krysset av og oppgitt under "Behandling" – det foreligger en databehandleravtale mellom Nih og SurveyXact, trenger dere denne?

Mvh
Sandra Gluppe

Skjult melding

Sendt til vurdering
08.01.2019 14:15

Melding fra Pernille Ekornrud Grøndal
08.01.2019 07:55

Et ytterligere spørsmål: Du har krysset av for genetiske opplysninger, men jeg kan ikke finne noe informasjon om dette i prosjeksbeskrivelsen. Kan du forklare hvordan dette er aktuelt, evt. fjerne avkrysningen hvis den ikke er treffende? Viser til at genetisk materiale ikke automatisk er det samme som å innhente biologisk materiale; genetisk materiale betegenr personoppplysninger om en persons nedarvede eller ervervede egenskaper fremkommet etter analyse av en biologisk prøve.

Melding
07.01.2019 16:39

Det innsendte meldeskjemaet med referansekode 440860 må kompletteres for at NSD kan fortsette vurderingen.

Når du har gjort oppdateringene i skjemaet, må du gå til siden "send inn" og trykke "bekreft innsending".

Dersom du har ytterligere kommentarer eller spørsmål kan du skrive en melding i dialogfeltet over og trykke "send melding".

Følgende kommentar er gitt av NSDs personvernrådgiver:

Hei,

Vi har nå gjort en første gjennomgang av skjemaet ditt, og har følgende tilbakemeldinger/kommentarer:
- I prosjektbeskrivelsen refereres det til et "studie 1", men dette finnes ikke i listen over utvalg i meldeskjema. Kan du utdype hvorfor, eventuelt legge til dette som et eget utvalg?
- Under samtlige utvalg har du ikke krysset av for innsamling av adresse/telefonnummer. Ber om at du krysser av denne, eventuelt at du fjerne denne kategorien under fanen "Personopplysninger", dersom det ikke er aktuelt å samle inn slike opplysninger.
- Under utvalg 3 må du huske å krysse av for innsamling av navn, ettersom du skal innhente skriftlig samtykke.
- I informasjonsskrivene må du opplyse om at NSD, må vegne av NIH har vurdert at prosjektet er i overensstemmelse med personvernregelverket.
- I tillegg må samtykkeerklæringen spesifiseres, dvs. at dere lager bokser hvor deltakere kan huke av for de enkelte elementene i datainnsamlingen (dsv. en boks for elektronisk spørreskjema, og en for medisinske/fysiske tester). I tillegg må det fremgå eksplisitt at de samtykker til lagring av den gitte varigheten.
- Ettersom Rambøll er databehandler, må du krysse av for databehandler under "Behandling". Minner om at det skal inngås databehandleravtale med Rambøll.

Sendt i retur
07.01.2019 16:39

Melding fra Sandra Bjordal Gluppe
07.01.2019 12:52

Ok, takk for svar.
Prosjektansvarlig er endet til Kari Bø og meldeskjemaet er oppdatert i tråd med REKs vilkår nå.

MVH
Sandra Gluppe

Melding fra Lasse Andre Raa
07.01.2019 11:07

Hei

Du kan nå oss på telefonnummer 55 58 21 17 (tast 1 for personverntjenester). Vi er tilgjengelig mellom kl. 10 og 12.

Prosjektet er for øvrig tildelt en personvernrådgiver, og vil følges opp snarlig.

Vi ber i første omgang om at meldeskjemaet oppdateres i tråd med REKs vilkår, det vil si at prosjektansvarlig endres til Kari Bø. I tillegg må opprinnelig REK-godkjenning av 5.12.2018 lastes opp under Tillatelser.

Melding fra Sandra Bjordal Gluppe
07.01.2019 10:30

Hei, hva er tlf nr til NSD?

MVH Sandra L Gluppe

Melding fra Lisa Lie Bjordal
03.01.2019 14:51

Vi bekrefter samtidig at REK godkjennelsen er lastet opp i meldeskjemaet.

Melding fra Lisa Lie Bjordal
03.01.2019 14:50

Hei.

Vi har for tiden stor pågang grunnet overgangen til ny personvernforordning og nytt system, men en rådgiver vil gjennomgå ditt skjema så snart det lar seg gjøre. Du kan lese mer om vår vurderingstid og hvordan du kan redusere denne her: nsd.uib.no/personvernombud/vurderingstid.html

Dersom du har behov for å få prioritert ditt skjema, kan du sende en henvendelse om prioritering til personverntjenester@nsd.no. Husk i så tilfelle å begrunne godt hvorfor du ønsker prioritering og oppgi referansenummeret til ditt skjema.

Melding fra Sandra Bjordal Gluppe
03.01.2019 11:02

Hei,
Kan dere si noe om behandlingstiden?
Vi har stort hastverk med å komme i gang med prosjektet da vi kun har 3 år til rådighet.
Mvh Sandra Gluppe og Kari Bø

Melding fra Sandra Bjordal Gluppe
02.01.2019 15:06

ok, takk. Kan du se om det ble lastet opp nå?

Melding fra Kajsa Catharine Amundsen
02.01.2019 12:42

Hei Sandra. Vennligst last opp bekreftelsen nederst på siden Tillatelser.

Melding fra Sandra Bjordal Gluppe
02.01.2019 08:21

Hei,
godt nytt år.
Jeg har nå fått godkjennelse fra REK på dette prosjektet, hvordan sender jeg/laster jeg opp denne bekreftlesen til dere?
Mvh Sandra Lødeng Gluppe

Skjult melding

Sendt til vurdering
13.11.2018 12:25

Sikt

Vurdering av behandling av personopplysninger

Referansenummer
440860

Vurderingstype
Standard

Dato
16.12.2022

Prosjekttittel
"Mammamage" - et problem etter fødsel?

Behandlingsansvarlig institusjon
Norges idrettshøgskole / Institutt for idrettsmedisinske fag

Prosjektansvarlig
Kari Bø

Prosjektperiode
14.01.2019 - 15.01.2024

Kategorier personopplysninger
Alminnelige
Særlige

Lovlig grunnlag
Samtykke (Personvernforordningen art. 6 nr. 1 bokstav a)
Uttrykkelig samtykke (Personvernforordningen art. 9 nr. 2 bokstav a)

Behandlingen av personopplysningene er lovlig så fremt den gjennomføres som oppgitt i meldeskjemaet. Det lovlige grunnlaget gjelder til 15.01.2029.

Meldeskjema

Kommentar
Personverntjenester har vurdert endringen i prosjektsluttdato.

Vi har nå registrert 15.1.2024 som ny sluttdato for behandling av personopplysninger. Opplysningene oppbevares så i 5 år av kontrollhensyn.

Endringen i prosjektperioden er godkjent av REK og forskningsdeltakerne er informerte om forlengelsen via informasjonsskriv på NIH sine nettsider.

Vi vil følge opp ved ny planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Kontaktperson: Lisa Lie Bjordal
Lykke til videre med prosjektet!

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst D	Finn Skre Fjordholm	+47 22 84 58 21	12.10.2020	12547
			Deres referanse:	

Kari Bø

12547 Mammamage - et problem etter fødsel?

Forskningsansvarlig: Norges idrettshøgskole

Søker: Kari Bø

REKs vurdering

Vi viser til søknad om prosjektendring datert 09.10.2020 for ovennevnte forskningsprosjekt. Søknaden er behandlet av leder for REK sør-øst D på fullmakt, med hjemmel i helseforskningsloven § 11.

Sakens tidligere REK-referanse er 2018/2312.

Endringene innebærer:

-For deltagere som ikke ønsker å reise til Oslo som følge av økt smittetrykk, vil testingen i hovedstudien (studie 4) foregå på aktuelle klinikker utenfor Oslo. Dette medfører at testingen vil gjennomføres som tidligere, bortsett fra DRA og muskelstyrke, som må utføres på NIH.

-Randomiseringen og opplæringen av treningsprogrammet for disse deltakerne vil foregå digitalt

-Revidert protokoll i tråd med endringene

Komiteens leder har vurdert de omsøkte endringene, og har ingen forskningsetiske innvendinger til endringene slik de er beskrevet i skjema for prosjektendring.

Det stilles som vilkår at informasjonsskrivet revideres slik at alle deltagerne får informasjon om muligheten til å gjennomføre testingen lokalt.

Det reviderte informasjonsskrivet må legges frem for REK før det tas i bruk og kan sendes inn ved å besvare oppgaven «Innfri vilkår» i REK-portalen.

Vedtak

Godkjent med vilkår

.

REK har gjort en forskningsetisk vurdering av endringene i prosjektet, og godkjenner prosjektet slik det nå foreligger, jf. helseforskningsloven § 11, og under forutsetning av at ovennevnte vilkår er oppfylt.

Tillatelsen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden, endringssøknad, oppdatert protokoll og de bestemmelser som følger av helseforskningsloven med forskrifter.

Vi gjør samtidig oppmerksom på at etter ny personopplysningslov må det også foreligge et behandlingsgrunnlag etter personvernforordningen. Det må forankres i egen institusjon.

Med vennlig hilsen,

Finn Wisløff
Professor em. dr. med.
Leder

Finn Skre Fjordholm
rådgiver
REK sør-øst D

Kopi til: Norges idrettshøgskole

Klageadgang
Du kan klage på komiteens vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes til REK sør-øst D. Klagefristen er tre uker fra du mottar dette brevet. Dersom vedtaket opprettholdes av REK sør-øst D, sendes klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering.

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst D	Anne Åbyholm-Brodal	22845511	16.08.2021	12547

Kari Bø

Prosjektsøknad: Mammamage - et problem etter fødsel?
Søknadsnummer: 2018/2312
Forskningsansvarlig institusjon: Norges idrettshøgskole

Prosjektsøknad: Endring godkjennes.

Søkers beskrivelse

Formålet med prosjektet er å undersøke separasjon av de rette magemusklene (rectus diastase) etter fødsel. Det er for tiden stor oppmerksomhet på denne tilstanden, særlig i sosiale medier, men det foreligger lite forskning på forekomst, årsak, risikofaktorer, mulige følger og behandling. Prosjektet tar opp fire forskningsspørsmål som besvares gjennom 4 studier med ulike studiedesign; 1. Hvordan oppleves helse, utseende og funksjon av kropp og mage etter fødsel? En tverrsnittstudie.
2. Hva er den akutte effekten av ulike type mage- og bekkenbunnsøvelser på rectus diastase? En eksperimentell studie.
3. Er det forskjell mellom kvinner med og uten rectus diastase med tanke på funksjon og plager etter fødsel? Et case control design.
4. Hva er effekten av et styrketreningsprogram på rectus diastase etter fødsel? En randomisert kontrollert studie.
Vi benytter bl.a. web-baserte spørreskjemaer, 2D ultralydmålinger av rectus diastase og muskelstyrketester for å samle inn kliniske data.

Vi viser til søknad om prosjektendring mottatt 12.8.2021 for ovennevnte forskningsprosjekt. Søknaden er behandlet av sekretariatet i Regional komité for medisinsk og helsefaglig forskningsetikk (REK) på delegert fullmakt fra komiteen, med hjemmel i forskningsetikkforskriften § 7, første ledd, tredje punktum. Søknaden er vurdert med hjemmel i helseforskningsloven § 11.

REKs vurdering

REK har vurdert følgende endring:

- Utsatt sluttdato for prosjektet. Ny sluttdato er 28.2.2023.

Prosjektslutt er utsatt både grunnet covid-19 og fordi prosjektleder har foreldrepermisjon t.o.m juli 2022. Revidert protokoll er vedlagt, endringen fremgår under punkt Time line.

Sekretariatet i REK sør-øst D har vurdert den omsøkte endringen, og har ingen forskningsetiske innvendinger til endringen slik den er beskrevet i skjema for prosjektendring.

Vedtak

REK har gjort en forskningsetisk vurdering av endringen i prosjektet og godkjenner prosjektet slik det nå foreligger, jfr. helseforskningsloven § 11 annet ledd.

Vi gjør oppmerksom på at etter ny personopplysningslov må det også foreligge et behandlingsgrunnlag etter personvernforordningen. Det må forankres i egen institusjon.

Tillatelsen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden, endringssøknad, oppdatert protokoll og de bestemmelser som følger av helseforskningsloven med forskrifter.

Sluttmelding
Prosjektleder skal sende sluttmelding til REK på eget skjema via REK-portalen senest senest 6 måneder etter sluttdato 28.02.2023, jf. helseforskningsloven § 12. Dersom prosjektet ikke starter opp eller gjennomføres meldes dette også via skjemaet for sluttmelding.

Søknad om endring
Dersom man ønsker å foreta vesentlige endringer i formål, metode, tidsløp eller organisering må prosjektleder sende søknad om endring via portalen på eget skjema til REK, jf. helseforskningsloven § 11.

Klageadgang
Du kan klage på REKs vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes på eget skjema via REK portalen. Klagefristen er tre uker fra du mottar dette brevet. Dersom REK opprettholder vedtaket, sender REK klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering, jf. forskningsetikkloven § 10 og helseforskningsloven § 10.

Med vennlig hilsen

Jacob C. Hølen
sekretariatsleder REK sør-øst

Anne Åbyholm-Brodal
førstekonsulent

Kopi til:

Norges idrettshøgskole
Sandra Bjordal Gluppe

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst D	Finn Skre Fjordholm	+47 22 84 58 21	06.12.2022	12547

Kari Bø

Prosjektsøknad: Mammamage - et problem etter fødsel?
Søknadsnummer: 2018/2312
Forskningsansvarlig institusjon: Norges idrettshøgskole

Prosjektsøknad: Endring godkjennes

Søkers beskrivelse

Formålet med prosjektet er å undersøke separasjon av de rette magemusklene (rectus diastase) etter fødsel. Det er for tiden stor oppmerksomhet på denne tilstanden, særlig i sosiale medier, men det foreligger lite forskning på forekomst, årsak, risikofaktorer, mulige følger og behandling. Prosjektet tar opp fire forskningsspørsmål som besvares gjennom 4 studier med ulike studiedesign; 1. Hvordan oppleves helse, utseende og funksjon av kropp og mage etter fødsel? En tverrsnittstudie.
2. Hva er den akutte effekten av ulike type mage- og bekkenbunnsøvelser på rectus diastase? En eksperimentell studie.
3. Er det forskjell mellom kvinner med og uten rectus diastase med tanke på funksjon og plager etter fødsel? Et case control design.
4. Hva er effekten av et styrketreningsprogram på rectus diastase etter fødsel? En randomisert kontrollert studie.
Vi benytter bl.a. web-baserte spørreskjemaer, 2D ultralydmålinger av rectus diastase og muskelstyrketester for å samle inn kliniske data.

REK viser til endringssøknad for ovennevnte forskningsprosjekt mottatt 30.11.2022. Søknaden er behandlet av sekretariatet på delegert fullmakt fra REK sør-øst D med hjemmel i helseforskningsloven § 11.

Endringene innebærer:
- Sluttdato for prosjektet er endret til 15.01.2024

REKs vurdering

REK har vurdert søknaden og har ingen forskningsetiske innvendinger til endringen av prosjektet.

Vedtak

REK har gjort en forskningsetisk vurdering av endringen i prosjektet og godkjenner prosjektet slik det nå foreligger, jfr. helseforskningsloven § 11 annet ledd.

Vi gjør oppmerksom på at etter ny personopplysningslov må det også foreligge et behandlingsgrunnlag etter personvernforordningen. Det må forankres i egen institusjon.

Tillatelsen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden, endringssøknad, oppdatert protokoll og de bestemmelser som følger av helseforskningsloven med forskrifter.

Sluttmelding
Prosjektleder skal sende sluttmelding til REK på eget skjema via REK-portalen senest 6 måneder etter sluttdato 28.02.2023, jf. helseforskningsloven § 12. Dersom prosjektet ikke starter opp eller gjennomføres meldes dette også via skjemaet for sluttmelding.

Søknad om endring
Dersom man ønsker å foreta vesentlige endringer i formål, metode, tidsløp eller organisering må prosjektleder sende søknad om endring via portalen på eget skjema til REK, jf. helseforskningsloven § 11.

Klageadgang
Du kan klage på REKs vedtak, jf. forvaltningsloven § 28 flg. Klagen sendes på eget skjema via REK portalen. Klagefristen er tre uker fra du mottar dette brevet. Dersom REK opprettholder vedtaket, sender REK klagen videre til Den nasjonale forskningsetiske komité for medisin og helsefag (NEM) for endelig vurdering, jf. forskningsetikkloven § 10 og helseforskningsloven § 10.

Med vennlig hilsen

Jacob C. Hølen
Sekretariatsleder REK sør-øst

Anne Cathrine Bjercke
Førstekonsulent REK sør-øst

Kopi til:

Norges idrettshøgskole
Sandra Bjordal Gluppe

Appendix 3

Paper I

Study information and consent form

Questionnaire

NORGES IDRETTSHØGSKOLE

Norske Kvinners Sanitetsforening

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

"MAMMAMAGE" – ET PROBLEM ETTER FØDSEL?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt for å undersøke seperasjon av de to magemusklene "rectus diastase" etter fødsel. Rectus diastase kan oppstå hos gravide kvinner og for en del vedvarer tilstanden etter fødsel. Det er for tiden stor oppmerksomhet rundt denne tilstanden, spesielt i sosiale medier, men det foreligger lite forskning om både forekomst, årsak, risikofaktorer, mulige følger og behandling. Forskningsprosjektet omfatter fire studier hvor formålene er å undersøke 1. helseplager og hvordan kvinner opplever kroppen og magen sin etter fødsel, 2. hvordan ulike magemuskeløvelser påvirker rectus diastase, 3. om det er forskjell mellom kvinner med og uten rectus diastase i funksjon og plager etter fødsel og 4. effekten av et styrketreningsprogram på rectus diastase. Kunnskap om disse forholdene er viktig for å kunne gi forskningsbaserte råd til kvinner etter fødsel. Du forespørres om å delta i studien hvor vi skal undersøke helseplager og hvordan førstegangsfødende kvinner opplever kroppen og magen sin etter fødsel. Forskningsprosjektet er fysioterapeut Sandra Lødeng Gluppes doktorgradsprosjekt ved Norges idrettshøgskole (NIH), Seksjon for idrettsmedisinske fag, finansiert av Norske kvinners Sanitetsforening. Hovedveileder er professor, dr. scient og fysioterapeut Kari Bø ved NIH, Seksjon for idrettsmedisinske fag. Biveileder er Marie Ellström Engh, professor og gynekolog, Kvinneklinikken, Akershus universitetssykehus. NIH er ansvarlig institusjon for forskningsprosjektet.

HVA INNEBÆRER PROSJEKTET?

Kvinner som har født for 6-8 måneder siden inviteres til å delta i denne studien. Deltakelse i studien innebærer å svare på et elektronisk spørreskjema. Du vil få tilsendt en mail med en link for å få tilgang til spørreskjemaet. Spørreskjemaet inneholder spørsmål om relevant bakgrunnsinformasjon, helseplager og spesifikke spørsmål om hvordan du opplever kroppen og magen din etter fødsel og spørsmål om mulige risikofaktorer for og konsekvenser av rectus diastase. Spørreskjema tar 15-30 min å besvare.

MULIGE FORDELER OG ULEMPER

En ulempe med deltakelse i dette forskningsprosjektet kan være at det vil ta 15-30 min å besvare det elektroniske spørreskjemaet.

Som deltaker i spørreundersøkelsen vil du være med i trekningen av tre gavekort på 500 kr hver. I tillegg vil du kunne bidra til mer kunnskap om hvordan kvinner opplever kroppen sin etter fødsel samt kunnskap om rectus diastase med tanke på funksjon og plager. Økt kunnskap om dette vil kunne gi bedre behandlingstilbud til kvinner etter fødsel.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, trykker du på en sikker lenke til spørreundersøkelsen tilsendt via mail. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke. Dette vil ikke få konsekvenser for din videre behandling. Dersom du trekker deg fra prosjektet, kan du kreve å få slettet innsamlede prøver og opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte prosjektleder eller annen varig kontaktperson, se telefonnummer og mailadresse til disse under kontaktopplysninger.

HVA SKJER MED OPPLYSNINGENE OM DEG?

Opplysningene som registreres om deg skal kun brukes slik som beskrevet i hensikten med prosjektet. Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert. I tillegg har du rett til få utlevert en kopi av dine personopplysninger og sende klage til Datatilsynet om behandlingen av dine personopplysninger. Du har også rett til å få innsyn i sikkerhetstiltakene ved behandling av opplysningene.

Svar fra det elektroniske spørreskjemaet overføres sikkert fra SurveyXact by Rambøll og vil lagres avidentifisert og analyseres elektronisk på en beskyttet server på NIH. En kode knytter deg til dine opplysninger gjennom en navneliste. Det er kun Sandra Lødeng Gluppe som har tilgang til denne listen. Alle opplysningene vil bli behandlet uten navn, fødselsnummer eller andre direkte gjenkjennende opplysninger.

Prosjektet skal etter planen avsluttes 30.09.2021. Opplysningene om deg vil bli anonymisert eller slettet senest fem år etter prosjektslutt.

GODKJENNING

Vi behandler opplysninger om deg basert på ditt samtykke. Regional komité for medisinsk og helsefaglig forskningsetikk har vurdert prosjektet, og har gitt forhåndsgodkjenning (2018/2312/REK sør-øst D). Etter ny personopplysningslov har behandlingsansvarlige NIH og Sandra Lødeng Gluppe et selvstendig ansvar for å sikre at behandlingen av dine opplysninger har et lovlig grunnlag. Norsk senter for forskningsdata (NSD) har, på vegne av NIH, vurdert at prosjektet er i overensstemmelse med personvernregelverket. Dette prosjektet har rettslig grunnlag i EUs personvernforordning artikkel (referansekode 440860).

Du har rett til å sende klage til personvernombudet eller Datatilsynet på behandlingen av dine personopplysninger.

KONTAKTOPPLYSNINGER

Dersom du har spørsmål til prosjektet kan du ta kontakt med:
Prosjektleder: Sandra Lødeng Gluppe, 97523133, sandra.l.gluppe@hotmail.com
Hovedveileder: professor, dr.scient Kari Bø, 99047363, kari.bo@nih.no

Du kan ta kontakt med institusjonens personvernombud dersom du har spørsmål om behandlingen av dine personopplysninger i prosjektet:
Karine Justad, 97536704, karine.justad@nih.no

Kjære deltaker,

Velkommen til denne spørreundersøkelsen.

Spørreundersøkelsen er del av et doktorgradsprosjekt ved Norges idrettshøgskole, Institutt for idrettsmedisinske fag. Forskningsprosjektet er fullfinansiert av Norske Kvinners Sanitetsforening.

Med dette spørreskjemaet ønsker vi å samle informasjon om hvordan **førstegangsfødende kvinner, 6-8 mnd etter fødsel** opplever helse, utseende, funksjon av kroppen og magen etter en fødsel. I tillegg skal vi undersøke sammenhengen mellom seperasjon av de rette magemusklene (rectus diastase) og korsrygg-/bekkenleddssmerter og bekkenbunnsplager etter fødsel. Noen av spørsmålene er fra internasjonale standardiserte spørreskjemaer som benyttes innen forskning (EDE-Q, ODI, PGQ og PFDI-20).

Ta deg god tid til å lese igjennom spørsmålene, det er viktig at du gir ærlige svar. Noen av spørsmålene kan virke personlige, men vi understreker at dine svar blir behandlet konfidensielt.

Det tar 15-30 minutter å gjennomføre spørreundersøkelsen.

NB: Dersom spørreskjemaet skulle stoppe å fungere eller henge underveis, logger du deg inn igjen og fortsetter der du falt ut.

På forhånd takk for hjelpen!

Jeg har mottatt informasjonsskriv tilsendt via mail, forstått informasjon om prosjektet og fått anledning til å stille spørsmål. Jeg samtykker til:

(1) ❑ å delta i elektroniske spørreskjema

(2) ❑ at mine personopplysninger lagres etter prosjektslutt, til ca. 30.09.2021

De følgende spørsmålene omhandler bakgrunnsinformasjon om deg **i dag**

Alder (oppgi antall år)

_____

Sivilstatus

(1) ❍ Gift/samboende

(2) ❍ Bor alene (singel/skilt/separert)

Utdanningsnivå

(1) ❍ Universitet/høgskole

(2) ❍ Videregående

(3) ❍ Grunnskole

(4) ❍ Annet, oppgi _____

Genetisk opprinnelse. Hvilket opphav har dine foreldre? (Flere kryss hvis din mor og far har ulikt opphav)

(1) ❍ Europeisk (hvit/amerikaner med opphav fra Europa)

(2) ❍ Amerikansk urbefolkning (indianere/inuitter)

(3) ❍ Afrikansk, nord for Sahara eller Midt-Østen

(4) ❍ Afrikansk, sør for Sahara

(5) ❍ Asiatisk (inkl Pakistan og India)

(6) ❍ Øygruppene i Stillehavet inkl ubefolkning i Australia

(7) ❍ Usikker

Høyde (cm)

_____

Nåværende vekt (kg)

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Vekt før graviditet?

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Vektoppgang i svangerskapet?

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Røyker du?

(1) ❍ Ja, hver dag

(2) ❍ Ja, av og til

(3) ❍ Nei

Ammer du?

(1) ❍ Ja, 3 ganger eller mer daglig

(2) ❍ Ja, 1-2 ganger daglig

(3) ❍ Ja, 4-6 ganger pr uke

(4) ❍ Ja, 1-3 ganger pr uke

(5) ❍ Sjelden/aldri

Har du fått tilbake menstruasjonen etter fødselen?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Bruker du noen form for hormoner?

(1) ❍ Nei

(2) ❍ Ja (p-piller, p-ring, p-plaster)

(3) ❍ Ja (hormonspiral, p-sprøyte, implanon, minipille)

(4) ❍ Ja (østrogenstikkpiller i skjeden)

(5) ❍ Ja, annen hormonell behandling, hvilken? _____

Er du tilbake i arbeid etter fødselen?

(1) ❍ Ja

(2) ❍ Nei

Hvor ofte opplever du belastende løft på din arbeidsplass?

(1) ❍ Sjelden/aldri

(2) ❍ Mindre enn 20 ganger ukentlig

(3) ❍ Mer enn 20 ganger ukentlig

(4) ❍ 10-20 ganger daglig

(5) ❍ Mer enn 20 ganger daglig

Oppgi antall % lønnet arbeid

_____

De følgende spørsmål omhandler informasjon barnet/tvillingene/trillingene du fødte

Hvor mange måneder er det siden du fødte?

_____

Antall fødte barn

(1) ❍ 1 barn

(2) ❍ Tvillinger

(3) ❍ Trillinger eller flere barn

I hvilken svangerskapsuke ble barnet/tvillingene/trillingene født

(1) ❍ Svangerskapsuke 25 eller tidligere

(2) ❍ Mellom svangerskapsuke 26 og 30

(3) ❍ Mellom svangerskapsuke 31 og 36

(4) ❍ 37.svangerskapsuke eller senere

Barnets/tvillingenes/trillingenes fødselsvekt (g)
(Ved tvillinger/trillinger legger du sammen deres vekt)

(1) ❍ Over 4500 g

(2) ❍ 4000 - 4500 g

(3) ❍ Mellom 3000 og 3999 g

(4) ❍ 2500 - 2999 g

(5) ❍ Under 2500 g

(6) ❍ Under 1500 g

(7) ❍ Under 1000 g

Barnets/tvillingenes/trillingenes fødselslengde (cm)
(Ved tvillinger/trillinger, svar for det lengste barnet)

_____

Hvordan ble barnet/tvillingene/trillingene født?
(Flere kryss hvis du fødte tvillingene/trillingene på forskjellig måter)

(1) ❑ Vaginal fødsel

(2) ❑ Keisersnitt

De følgende spørsmål omhandler helsen din **før, under** og **etter** svangerskapet

Hvordan vil du beskrive helsen din før svangerskapet?

(1) ❍ Svært god

(2) ❍ God

(3) ❍ Verken god eller dårlig

(4) ❍ Dårlig

(5) ❍ Svært dårlig

Hvordan vil du beskrive helsen din under svangerskapet?

(1) ❍ Svært god

(2) ❍ God

(3) ❍ Verken god eller dårlig

(4) ❍ Dårlig

(5) ❍ Svært dårlig

Hadde du noen av følgende sykdommer/plager under svangerskapet? (Flere kryss ved flere sykdommer)

(1) ❑ Svangerskapsforgiftning (preeklampsi)

(2) ❑ Diabetes

(3) ❑ Høyt blodtrykk

(4) ❑ Astma

(5) ❑ Revmatisk sykdom

(6) ❑ Psykiske vansker

(7) ❑ Nevrologisk sykdom

(8) ❑ Hevelse i kroppen (ødem)

(9) ❑ Treg mage/forstoppelse

(10) ❑ Andre sykdommer

(11) ❑ Nei, ingen sykdommer

Hvordan vil du beskrive helsen din i dag?

(1) ❍ Svært god

(2) ❍ God

(3) ❍ Verken god eller dårlig

(4) ❍ Dårlig

(5) ❍ Svært dårlig

Har du noen av følgende sykdommer/plager i dag? (Flere kryss ved flere sykdommer)

(1) ❑ Diabetes

(2) ❑ Høyt blodtrykk

(3) ❑ Astma

(4) ❑ Revmatisk sykdom

(5) ❑ Psykiatrisk sykdom/lidelse

(6) ❑ Nevrologisk sykdom

(7) ❑ Hevelse i kroppen (ødem)

(8) ❑ Treg mage/forstoppelse

(9) ❑ Nei, ingen sykdommer

(10) ❑ Andre sykdommer

Har du navlebrokk i dag?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Har du hatt navlebrokk før?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Har du blitt operert for navlebrokk?

(1) ❍ Ja

(2) ❍ Nei

Har du blitt operert i magen for andre grunner?

(1) ❍ Ja, oppgi _____

(2) ❍ Nei

De følgende spørsmål omhandler fysisk aktivitet før, under og etter graviditeten.

Hvor ofte var du så fysisk aktiv (fritid eller arbeid) de siste 6 månedene før svangerskapet at du ble andpusten eller svett?

(1) ❍ Aldri

(2) ❍ Mindre enn en gang pr. uke

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3-4 ganger pr. uke

(6) ❍ 5 ganger pr. uke eller mer

Angi gjennomsnittlig hvor mange minutter pr. uke du var så fysisk aktiv (fritid eller arbeid) at du blir andpusten eller svett (1 time = 60 min)

_____

Kryss av for hva som best beskriver type fysisk aktivitet du bedrev i tiden like før svangerskapet (Flere kryss ved flere aktiviteter)

(1) ❑ Rolig gange/spasertur

(2) ❑ Rask gange/turgåing

(3) ❑ Løping/jogging/orientering

(4) ❑ Sykling

(5) ❑ Treningssenter/styrketrening

(6) ❑ Spesiell gymnastikk/aerobic (bootcamp m.f)

(7) ❑ Aerobics/gymnastikk/dans uten løp og hopp

(8) ❑ Aerobics/gymnastikk/dans med løp og hopp

(9) ❑ Yoga/ pilates

(10) ❑ Dansing (ballett, jazzdans, swing, rock, folkedans m.f)

(11) ❑ Skigåing

(12) ❑ Svømming

(13) ❑ Ridning

(14) ❑ Annet

Hvor ofte var du så fysisk aktiv (fritid eller arbeid) under svangerskapet at du ble andpusten eller svett?

(1) ❍ Aldri

(2) ❍ Mindre enn en gang pr. uke

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3-4 ganger pr. uke

(6) ❍ 5 ganger pr. uke eller mer

Angi gjennomsnittlig hvor mange minutter pr. uke du var så fysisk aktiv (fritid eller arbeid) at du blir andpusten eller svett (1 time = 60 min)

_____

Kryss av for hva som best beskriver type fysisk aktivitet du bedrev under svangerskapet (Flere kryss ved flere aktiviteter)

(1) ❑ Rolig gange/spasertur

(2) ❑ Rask gange/turgåing

(3) ❑ Løping/jogging/orientering

(4) ❑ Sykling

(5) ❑ Treningssenter/styrketrening

(6) ❑ Spesiell gymnastikk/aerobic for gravide

(7) ❑ Aerobics/gymnastikk/dans uten løp og hopp

(8) ❑ Aerobics/gymnastikk/dans med løp og hopp

(9) ❑ Yoga/pilates

(10) ❑ Dansing (ballett, jazzdans, swing, rock, folkedans m.f)

(11) ❑ Skigåing

(12) ❑ Svømming

(13) ❑ Ridning

(14) ❑ Annet

Hvor ofte er du så fysisk aktiv (fritid eller arbeid) nå for tiden at du blir andpusten eller svett?

(1) ❍ Aldri

(2) ❍ Mindre enn en gang pr. uke

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3-4 ganger pr. uke

(6) ❍ 5 ganger pr. uke eller mer

Angi gjennomsnittlig hvor mange minutter pr. uke du er så fysisk aktiv (fritid eller arbeid) at du blir andpusten eller svett (1 time = 60 min)

_____

Kryss av for hva som best beskriver type fysisk aktivitet du bedriver nå for tiden (Flere kryss ved flere aktiviteter)

(1) ❑ Rolig gange/spasertur

(2) ❑ Rask gange/turgåing

(3) ❑ Løping/jogging/orientering

(4) ❑ Sykling

(5) ❑ Treningssenter/styrketrening

(6) ❑ Spesiell gymnastikk/aerobic for kvinner etter fødsel (bootcamp, strong mama m.f)

(7) ❑ Aerobics/gymnastikk/dans uten løp og hopp

(8) ❑ Aerobics/gymnastikk/dans med løp og hopp

(9) ❑ Yoga/ pilates

(10) ❑ Dansing (ballett, jazzdans, swing, rock, folkedans m.f)

(11) ❑ Skigåing

(12) ❑ Svømming

(13) ❑ Ridning

(14) ❑ Annet

Hvor ofte gjorde du øvelser for magemusklene hjemme eller på trening før denne graviditeten?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Hvor ofte gjorde du øvelser for magemusklene hjemme eller på trening under denne graviditeten?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Hvor ofte gjør du øvelser for magemusklene hjemme eller på trening nå for tiden?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Hvilke øvelser gjør du når du trener magemusklene? (Flere kryss ved flere svar)

(1) ❑ Ulike variasjoner av sit-ups/crunch

(2) ❑ Ulike variasjoner av planken

(3) ❑ Inndragning av navlen i ulike utgangsstillinger

(4) ❑ Bekkenvipp

(5) ❑ Andre magemuskeløvelser

(6) ❑ Gjør ikke magemuskeløvelser

I hvilke/hvilken av disse øvelsene mener du at bekkenbunnsmusklene trenes spesifikt? (Flere kryss ved flere svar)

(1) ❑ Sit-ups

(2) ❑ Planken

(3) ❑ Inndragning (trekke inn navlen)

(4) ❑ Seteløft

(5) ❑ Knebøy

(6) ❑ Vet ikke

(7) ❑ Ingen av alternativene ovenfor trener bekkenbunnsmusklene spesifikt

Spesifikk trening av bekkenbunnsmusklene innebærer å trekke sammen muskler rundt skjede, urinrør, endetarm.

Hvor ofte gjorde du spesifikk trening for bekkenbunnsmusklene hjemme eller på trening før denne graviditeten?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Hvor ofte gjorde du spesifikk trening for bekkenbunnsmusklene hjemme eller på trening under denne graviditeten?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Hvor ofte gjør du spesifikk trening for bekkenbunnsmusklene hjemme eller på trening nå for tiden?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Har du hørt om separasjon av de rette magemusklene/rectus diastase, i forbindelse med graviditeten eller i tiden etter fødselen? (se bilder ovenfor)

(1) ❍ Ja

(2) ❍ Nei

Hvor har du hørt om dette? (Flere kryss)

(1) ❑ Vitenskapelig litteratur

(2) ❑ Helsevesenet (lege, jordmor, helsesøster, fysioterapeut)

(3) ❑ Venner/bekjente

(4) ❑ Sosiale medier

(5) ❑ TV/media

(6) ❑ Kvinnemagasiner

(7) ❑ Annet

Har du forsøkt et eller flere tiltak/behandling med hensikt å få magemusklene til å gå sammen etter fødselen?

(1) ❍ Ja

(2) ❍ Nei

Hva slags type tiltak/behandling har du forsøkt for delte magemuskler? (Flere kryss)

(1) ❑ Kirurgi

(2) ❑ Påføring av spesifikke kremer på magen

(3) ❑ Ekstern støtte/korsett

(4) ❑ Tape (f.eks. kinesio tape)

(5) ❑ Elektrisk stimulering

(6) ❑ Øvelser for bekkenbunnsmusklene

(7) ❑ Øvelser for magemusklene

(8) ❑ Annet

Fra hvem/hvor har du mottatt/funnet øvelser/behandling for delte magemuskler? (Flere kryss)

(1) ❑ Øvelser/behandlingstiltak jeg har funnet via internettsider/sosiale medier

(2) ❑ Øvelser/behandlingstiltak fra fysioterapeut

(3) ❑ Øvelser/behandlingstiltak fra naprapat/kiropraktor/osteopat

(4) ❑ Øvelser/behandlingstiltak fra treningssenter/personlig trener

(5) ❑ Øvelser/behandlingstiltak fra andre (familie/venner)

Hvordan vil du beskrive magen din nå sammenliknet med før behandlingen/tiltaket?
-5 = veldig mye verre
0 = Uforandret
5 = fullstendig tillhelet

(1) ❍ -5

(2) ❍ -4

(3) ❍ -3

(4) ❍ -2

(5) ❍ -1

(6) ❍ 0

(7) ❍ 1

(8) ❍ 2

(9) ❍ 3

(10) ❍ 4

(11) ❍ 5

De følgende spørsmålene omhandler hvordan du opplever magen din etter fødselen.

Svar for hvordan du opplever magen din i dag.

Svar for hvordan du opplever magen din i dag

Opplever du at magen din har gått tilbake igjen etter svangerskapet?

(1) ❍ Ja, magen ser lik at som før jeg ble gravid

(2) ❍ Ja, nesten som den var før graviditeten

(3) ❍ Vet ikke

(4) ❍ Nei, den har ikke gått tilbake

Føler du at noe buler ut langs midtlinjen på magen din?

(1) ❍ Nei, aldri

(2) ❍ Ja, av og til

(3) ❍ Ja, hele tiden

(4) ❍ Vet ikke

Hvordan vil du beskrive styrken i magemusklene dine?

(1) ❍ Sterkere enn jeg var før jeg ble gravid

(2) ❍ Lik som den var før jeg ble gravid

(3) ❍ Litt svakere enn før svangerskapet

(4) ❍ Veldig mye svakere enn før svangerskapet

(5) ❍ Usikker

Opplever du at huden på magen din er slapp/løs etter graviditeten?

(1) ❍ Nei

(2) ❍ Ja, i noen grad

(3) ❍ Ja, i stor grad

I hvor stor grad plager den slappe/løse huden på magen deg?
0 = ikke i det hele tatt
10 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

(8) ❍ 7

(9) ❍ 8

(10) ❍ 9

(11) ❍ 10

Har du strekkmerker på magen din etter graviditeten?

(1) ❍ Nei

(2) ❍ Ja, noen få

(3) ❍ Ja, en del

(4) ❍ Ja, veldig mange

I hvor stor grad plager strekkmerkene på magen deg?
0 = ikke i det hele tatt
10 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

(8) ❍ 7

(9) ❍ 8

(10) ❍ 9

(11) ❍ 10

Opplever du at andre (f.eks. venner og familie) er opptatt av hvordan din mage ser ut etter fødsel?

(1) ❍ Nei

(2) ❍ Ja, i noen grad

(3) ❍ Ja, i stor grad

Synes du det er mye fokus fra media, TV, internett, ukeblader, om å få flat mage etter fødselen?

(1) ❍ Veldig uenig

(2) ❍ Ganske uenig

(3) ❍ Verken/eller

(4) ❍ Ganske enig

(5) ❍ Veldig enig

Var du bekymret for hvordan magen din ville se ut etter svangerskapet mens du var gravid?

(1) ❍ Nei

(2) ❍ Ja, i noen grad

(3) ❍ Ja, i stor grad

I hvor stor grad er du opptatt av utseende på magen din i dag?
0 = ikke i det hele tatt
10 = svært opptatt

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

(8) ❍ 7

(9) ❍ 8

(10) ❍ 9

(11) ❍ 10

Totalt sett, hvor fornøyd er du med magen din etter fødselen?
0 = svært misfornøyd
10 = svært fornøyd

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

(8) ❍ 7

(9) ❍ 8

(10) ❍ 9

(11) ❍ 10

Følgende spørsmål omhandler utseende, kroppspress og forstyrret spiseatferd (EDE-Q)

Svar for de siste 4 ukene.

Svar for ca. hvor mange dager i løpet av de siste 4 ukene

Har du hatt et klart ønske om å ha en helt flat mage?

(1) ❍ Ingen dager

(2) ❍ 1-5 dager

(3) ❍ 6-12 dager

(4) ❍ 13-15 dager

(5) ❍ 16-22 dager

(6) ❍ 23-27 dager

(7) ❍ Alle dager

Har du opplevd at tanker om figur eller vekt har gjort det vanskelig å konsentrere deg om andre ting du er interessert i (f.eks. være tilstede med barnet ditt, følge en samtale, lese)?

(1) ❍ Ingen dager

(2) ❍ 1-5 dager

(3) ❍ 6-12 dager

(4) ❍ 13-15 dager

(5) ❍ 16-22 dager

(6) ❍ 23-27 dager

(7) ❍ Alle dager

Har du hatt en klar frykt om å gå opp i vekt?

(1) ❍ Ingen dager

(2) ❍ 1-5 dager

(3) ❍ 6-12 dager

(4) ❍ 13-15 dager

(5) ❍ 16-22 dager

(6) ❍ 23-27 dager

(7) ❍ Alle dager

Har du følt deg tykk?

(1) ❍ Ingen dager

(2) ❍ 1-5 dager

(3) ❍ 6-12 dager

(4) ❍ 13-15 dager

(5) ❍ 16-22 dager

(6) ❍ 23-27 dager

(7) ❍ Alle dager

Svar for de siste 4 ukene

I hvor stor grad har figuren din påvirket hvordan du tenker om (bedømmer) deg selv som person?
0 = ikke i det hele tatt
6 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

I hvor stor grad har du vært misfornøyd med figuren din?
0 = ikke i det hele tatt
6 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

Hvor mye ubehag har du følt ved å se kroppen din (f.eks. når du ser figuren din i speilet, reflektert i et butikkvindu, ved klesskift eller når du bader eller dusjer)?
0 = ikke i det hele tatt
6 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

Hvor mye ubehag har du følt ved at andre ser figuren din (f.eks. i offentlige omkledningsrom, når du svømmer, eller når du har på deg trange klær)?
0 = ikke i det hele tatt
6 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

De følgende spørsmålene omhandler muskel- og skjelettplager.

Svar for de siste 4 ukene.

Svar for de siste 4 ukene

Plages du med smerter i korsryggen?

(1) ❍ Ja

(2) ❍ Nei

Plages du med smerter i bekkenet?

(1) ❍ Ja

(2) ❍ Nei

Plages du med smerter i magen?

(1) ❍ Ja

(2) ❍ Nei

Stråler smertene fra ryggen ned i lår og/eller legg?

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmål omhandler hvordan ryggsmertene dine har påvirket din evne til å klare deg i dagliglivet (ODI).

Vennligst svar hva som best beskriver ditt **nåværende** problem.

Vennligst svar hva som best beskriver ditt **nåværende** problem.

Smerteintensitet

(1) ❍ Jeg har ingen smerter for øyeblikket

(2) ❍ Smertene er veldig svake for øyeblikket

(3) ❍ Smertene er moderate for øyeblikket

(4) ❍ Smertene er temmelig sterke for øyeblikket

(5) ❍ Smertene er veldig sterke for øyeblikket

(6) ❍ Smertene er de verste jeg kan tenke meg for øyeblikket

Løfte

(1) ❍ Jeg kan løfte tunge ting uten å få mer smerter

(2) ❍ Jeg kan løfte tunge ting, men får mer smerter

(3) ❍ Smertene hindrer meg i å løfte tunge ting opp fra gulvet, men jeg greier det hvis det som skal løftes er gunstig plassert, f.eks. på et bord

(4) ❍ Smertene hindrer meg i å løfte tunge ting, men jeg kan klare lette eller middels tunge ting, hvis det er gunstig plassert

(5) ❍ Jeg kan bare løfte noe som er veldig lett

(6) ❍ Jeg kan ikke løfte eller bære noe i det hele tatt

Personlig stell (vaske seg, kle på seg, osv.)

(1) ❍ Jeg kan stelle meg selv på vanlig måte uten at det forårsaker ekstra smerter

(2) ❍ Jeg kan stelle meg selv på vanlig måte, men det er veldig smertefullt

(3) ❍ Det er smertefullt å stelle meg selv, og jeg gjør det langsomt og forsiktig

(4) ❍ Jeg trenger noe hjelp, men klarer det meste av mitt personlige stell

(5) ❍ Jeg trenger hjelp hver dag til det meste av eget stell

(6) ❍ Jeg kler ikke på meg, har vanskeligheter med å vaske meg, og holder sengen

Gå

(1) ❍ Smerter hindrer meg ikke i å gå i det hele tatt

(2) ❍ Smerter hindrer meg i å gå mer enn 1 ½ km

(3) ❍ Smerter hindrer meg i å gå mer enn ¾ km

(4) ❍ Smerter hindrer meg i å gå mer enn 100 m

(5) ❍ Jeg kan bare gå med stokk eller krykker

(6) ❍ Jeg ligger for det meste i sengen og jeg må krabbe til toalettet

Sitte

(1) ❍ Jeg kan sitte så lenge jeg vil i en hvilken som helst stol

(2) ❍ Jeg kan sitte så lenge jeg vil i min favorittstol

(3) ❍ Smerter hindrer meg i å sitte i mer enn en time

(4) ❍ Smerter hindrer meg i å sitte i mer enn en halv time

(5) ❍ Smerter hindrer meg i å sitte i mer enn ti minutter

(6) ❍ Smerter hindrer meg i å sitte i det hele tatt

Stå

(1) ❍ Jeg kan stå så lenge jeg vil uten å få mer smerter

(2) ❍ Jeg kan stå så lenge jeg vil, men får mer smerter

(3) ❍ Smerter hindrer meg i å stå i mer enn en time

(4) ❍ Smerter hindrer meg i å stå i mer enn en halv time

(5) ❍ Smerter hindrer meg i å stå i mer enn ti minutter

(6) ❍ Smerter hindrer meg i å stå i det hele tatt

Sove

(1) ❍ Søvnen min forstyrres aldri av smerter

(2) ❍ Søvnen min forstyrres av og til av smerter

(3) ❍ På grunn av smerter får jeg mindre enn seks timers søvn

(4) ❍ På grunn av smerter får jeg mindre enn fire timers søvn

(5) ❍ På grunn av smerter får jeg mindre enn to timers søvn

(6) ❍ Smerter hindrer all søvn

Seksualliv

(1) ❍ Seksuallivet mitt er normalt og forårsaker ikke mer smerter

(2) ❍ Seksuallivet mitt er normalt, men forårsaker noe mer smerter

(3) ❍ Seksuallivet mitt er normalt, men svært smertefullt

(4) ❍ Seksuallivet mitt er svært begrenset av smerter

(5) ❍ Seksuallivet mitt er nesten borte på grunn av smerter

(6) ❍ Smerter forhindrer alt seksualliv

Sosialt liv

(1) ❍ Det sosiale livet mitt er normalt og forårsaker ikke mer smerter

(2) ❍ Det sosiale livet mitt er normalt, men øker graden av smerter

(3) ❍ Smerter har ingen betydelig innvirkning på mitt sosiale liv, bortsett fra at de begrenser mine mer fysisk aktive sider, som sport osv.

(4) ❍ Smerter har begrenset mitt sosiale liv og jeg går ikke så ofte ut

(5) ❍ Smerter har begrenset mitt sosiale liv til hjemmet

(6) ❍ På grunn av smerter har jeg ikke noe sosialt liv

Reising

(1) ❍ Jeg kan reise hvor som helst uten smerter

(2) ❍ Jeg kan reise hvor som helst, men det gir mer smerter

(3) ❍ Smertene er ille, men jeg klarer reiser på to timer

(4) ❍ Smerter begrenser meg til korte reiser på under en time

(5) ❍ Smerter begrenser meg til korte, nødvendige reiser på under 30 minutter

(6) ❍ Smerter forhindrer meg fra å reise, unntatt for å få behandling

Hvor i bekkenet har du vondt? (Flere kryss dersom du har vondt flere steder)

(1) ❑ Bak i bekkenet på høyre side

(2) ❑ Bak i bekkenet på venstre side

(3) ❑ Bak i bekkenet på begge sider

(4) ❑ Foran i bekkenet (symfysen)

Følgende spørsmål omhandler i hvilken grad du finner det problematisk på grunn av plager fra bekkenet å utføre aktivitetene som er listet opp nedenfor. Velg alternativet som best beskriver hvordan du har det **nå for tiden** under hver aktivitet (PGQ).

Svar for hvordan du har det **nå for tiden.**

Hvor sterke smerter har du:

	Ingen	Noe	Moderate	Svært mye
Om morgenen	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Om kvelden	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Hvor problematisk på grunn av bekkenet å:

	Ikke i det hele tatt	I liten grad	I noen grad	I stor grad
Kle på deg selv	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Stå mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Stå mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Bøye deg	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Sitte mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Sitte mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå trapper	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Husarbeid	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Bære lett	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Løfte tungt	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Reise/sette seg	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Skyve en handlevogn	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Løpe	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Utføre sportslige aktiviteter	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Ligge	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Snu deg i sengen	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Ha et normalt seksualliv	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Skyve noe med den ene foten	(1) ❍	(2) ❍	(3) ❍	(4) ❍

I hvilken grad på grunn av plagene i bekkenet:

	Ikke i det hele tatt	I liten grad	I noen grad	I stor grad
Svikter beinet/beina under deg?	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gjør du ting langsommere?	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Forstyrres nattesøvnen din?	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Følgende spørsmål omhandler smerter i magen. Svar for hvordan du har det **nå for tiden.**

Svar for hvordan du har det **nå for tiden.**

Hvor i magen har du vondt? (Flere kryss dersom du har smerter flere steder)

(1) ❑ Inni magen

(2) ❑ Ved navlen

(3) ❑ Over navlen

(4) ❑ Under navlen

Hvor mye påvirker smertene ditt hverdagsliv?
0 = ikke i det hele tatt
10 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

(8) ❍ 7

(9) ❍ 8

(10) ❍ 9

(11) ❍ 10

De følgende spørsmål omhandler hvor bevegelige ledd du har (5PQ).

Kan du på nåværende tidspunkt (eller har tidligere kunnet) legge begge håndflatene flatt i gulvet uten å bøye i knærne?

(1) ❍ Ja

(2) ❍ Nei

Kan du på nåværende tidspunkt (eller har tidligere kunnet) ta tak rundt tommelen og føre den til underarmen?

(1) ❍ Ja

(2) ❍ Nei

Pleide du som barn å underholde andre med at du kunne vri kroppen din i merkelige posisjoner eller kunne gå ned i spagaten uten å ha trent på det?

(1) ❍ Ja

(2) ❍ Nei

Skjedde det gjentagende ganger at skulder eller kneskjell gikk ut av ledd da du var barn eller tenåring?

(1) ❍ Ja

(2) ❍ Nei

Kan det virke som om du har flere/løsere ledd enn andre personer?

(1) ❍ Ja

(2) ❍ Nei

Har du symptomer i tarmen, blæren eller bekkenregionen som plager deg? For eksempel urinlekkasje, avføringslekkasje eller at du føler noe buler/faller ut fra skjeden.

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmålene omhandler hvorvidt du har visse symptomer i blæren, tarmen eller bekkenregionen, og i så fall hvor mye de plager deg (PFDI-20).

Vær snill og svar på spørsmålene ut fra de symptomer du har hatt gjennom **de siste tre månedene.**

Kjenner du du ofte trykk i nedre del av magen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte tyngdefølelse i bekkenet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Kjenner eller ser du noe som faller eller buler ut fra sjeden?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Må du ofte presse med fingre i skjeden eller rundt endetarmsåpningen for å få ut avføring eller få tømt tarmen helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du ofte at du ikke får tømt blæren helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hender det at du må trykke inn med fingrene noe som buler i skjeden, for å få tisset eller tømt blæren helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du at du må presse hardt for å få ut avføringen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du at du ikke har tømt tarmen helt, når du har hatt avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte avføringslekkasje når avføringen er fast?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte avføringslekkasje når avføringen er løs eller flytende?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte ufrivillig lekkasje av luft fra tarmen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte smerter når du har avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Opplever du så sterk avføringstrang at du må løpe til toalettet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hender det at en del av tarmen følger med ut gjennom endetarmsåpningen under eller etter avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du vanligvis hyppig vannlating?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Opplever du så sterk vannlatingstrang at du ikke rekker til toalettet før du får lekkasje?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte urinlekkasje når du hoster, nyser, ler eller under fysisk aktivtet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte små urinlekkasjer (dvs. dråper?)

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte problemer med å tømme blæren?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte smerte eller ubehag i nedre del av magen eller underlivet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du eventuelle kommentarer?

_____
_____
_____
_____
_____
_____

Tusen takk for at du var med i denne spørreundersøkelsen!

Ved spørsmål ta kontakt med:

Sandra Lødeng Gluppe
s.l.gluppe@nih.no

Ved behov for råd/veiledning/behandling, kan du ta kontakt med aktuelle behandlere:https://fysio.no/Forbundsforsiden/Organisasjon/Faggrupper/Kvinnehelse/Spesialister-og-behandlere-i-kvinnehelse

Appendix 4

Paper II

Study information and consent form

Clinical assessment form

NIH NORGES IDRETTSHØGSKOLE Norske Kvinners Sanitetsforening

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

"MAMMAMAGE" – ET PROBLEM ETTER FØDSEL?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt for å undersøke seperasjon av de to magemusklene "rectus diastase" etter fødsel. Rectus diastase kan oppstå hos gravide kvinner og for en del vedvarer tilstanden etter fødsel. Det er for tiden stor oppmerksomhet rundt denne tilstanden, spesielt i sosiale medier, men det foreligger lite forskning om både forekomst, årsak, risikofaktorer, mulige følger og behandling. Forskningsprosjektet omfatter fire studier hvor formålene er å undersøke 1. helseplager og hvordan kvinner opplever kroppen og magen sin etter fødsel, 2. hvordan ulike magemuskeløvelser påvirker rectus diastase, 3. om det er forskjell mellom kvinner med og uten rectus diastase i funksjon og plager etter fødsel og 4. effekten av et styrketreningsprogram på rectus diastase. Kunnskap om disse forholdene er viktig for å kunne gi forskningsbaserte råd til kvinner etter fødsel. Du forespørres om å delta i studien hvor vi skal undersøke hvordan ulike magemuskeløvelser påvirker rectus diastase. Forskningsprosjektet er fysioterapeut Sandra Lødeng Gluppes doktorgradsprosjekt ved Norges idrettshøgskole (NIH), Seksjon for idrettsmedisinske fag, finansiert av Norske kvinners Sanitetsforening. Hovedveileder er professor, dr. scient, og fysioterapeut Kari Bø ved NIH, Seksjon for idrettsmedisinske fag. Biveileder er Marie Ellström Engh, professor og gynekolog, Kvinneklinikken, Akershus universitetssykehus. NIH er ansvarlig institusjon for forskningsprosjektet.

HVA INNEBÆRER PROSJEKTET?

Kvinner med rectus diastase (mer enn 2 fingerbredder eller ved synlig utbuling på magen) og som har født for minst 6 uker siden inviteres til å delta i studien. Deltakelse i studien innebærer å svare på et elektronisk spørreskjema og gjennomføre tester på NIH. Hele undersøkelsen vil ta ca. 1,5 time, og du skal bare møte en gang. Sandra Lødeng Gluppe vil avtale et tidspunkt med deg på telefon eller mail for undersøkelsen. Noen dager før undesøkelsen vil du få tilsendt et elektroniske spørreskjema på mail som skal besvares før du møter på NIH. Spørreskjemaet inneholder spørsmål om relevant bakgrunnsinformasjon, helseplager og spørsmål om mulige risikofaktorer for og konsekvenser av rectus diastase. Spørreskjema tar 15-30 min å besvare. For testingen vil Sandra Lødeng Gluppe møte deg i resepsjonen på NIH. Undersøkelsen starter med at du later vannet og så drikker 2,5 glass med vann. Deretter vil du få en muntlig opplæring i bekkenbunnsmusklenes funksjon og hvordan man gjør en riktig bekkenbunnskontraksjon. Undersøkelsen består av måling av vekt, høyde, bevegelighetstest og ultralydundersøkelse av evne til bekkenbunnskontraksjon. Ultralydundersøkelsen gjøres på nedre del av magen. Etter undersøkelsen vil du få mulighet til å gå på toalettet før testingen av de ulike øvelsenes innvirkning på rectus diastase starter. Ultralyd tas 2 cm over og 2 cm under navlen mens du gjør ulike mage- og bekkenbunnsøvelser i tilfeldig rekkefølge. Til slutt testes magemusklenes styrke. I disse testene vil din utholdende styrke testes ved å registrere antall crunch og din maksimale styrke vil bli testet ved at du skal bøye overkroppen fremover mens du står i et apparat. For å gjennomføre de ulike testene og målingene er det viktig at du har på shorts og t-trøye.

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Deltakelse i dette forskningsprosjektet medfører ikke noen umiddelbare fordeler for deg, men ved å delta får du en fysioterapeutisk undersøkelse av mage- og bekkenbunnsmuskulatur og får en test på om du gjør bekkenbunnsøvelser riktig. Undersøkelsen vil kunne bidra til mer kunnskap om mulige øvelser som kan brukes i behandling av rectus diastase. Økt kunnskap om dette vil kunne gi et bedre behandlingstilbud til kvinner etter fødsel.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke. Dette vil ikke få konsekvenser for din videre behandling. Dersom du trekker deg fra prosjektet, kan du kreve å få slettet innsamlede prøver og opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte prosjektleder eller annen varig kontaktperson, se telefonnummer og mailadresse til disse under kontaktopplysninger.

HVA SKJER MED OPPLYSNINGENE OM DEG?

Opplysningene som registreres om deg skal kun brukes slik som beskrevet i hensikten med prosjektet. Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert. I tillegg har du rett til få utlevert en kopi av dine personopplysninger og sende klage til Datatilsynet om behandlingen av dine personopplysninger. Du har også rett til å få innsyn i sikkerhetstiltakene ved behandling av opplysningene.

Svar fra det elektroniske spørreskjemaet overføres sikkert fra SurveyXact by Rambøll og vil lagres og analyseres elektronisk på en beskyttet server på NIH, det samme gjelder innsamlede data fra testingen. En kode knytter deg til dine opplysninger gjennom en navneliste. Det er kun Sandra Lødeng Gluppe som har tilgang til denne listen. Alle opplysningene vil bli behandlet uten navn, fødselsnummer eller andre direkte gjenkjennende opplysninger.

Prosjektet skal etter planen avsluttes 30.09.2021. Opplysningene om deg vil bli anonymisert eller slettet senest fem år etter prosjektslutt.

FORSIKRING

Det er ikke nødvendig med særegen forsikring for deltakelse i denne studien. Som deltaker i studien er du forsikret dersom det skulle oppstå skade eller komplikasjoner som følge av deltakelse i forskningsprosjektet. NIH er en statlig institusjon og ikke et forsikringsselskap, dette innebærer at NIH dekker en eventuell erstatning. For skade på mennesker som oppstår under medisinske forsøk, gjelder pasientskadeloven.

OPPFØLGINGSPROSJEKT

Det planlegges en studie hvor vi sammenlikner kvinner med og uten rectus diastase med tanke på funksjon og plager etter fødsel. Ved å samtykke til deltakelse i denne studien kan du bli spurt om du ønsker å bli med i studie nr. 3 på et senere tidspunkt. I dette tilfellet vil et nytt samtykke bli innhentet.

I tillegg kan et oppfølgingsprosjekt, for å undersøke treningseffekt av ulike type øvelser på rectus diastase, bli aktuelt. Ved å samtykke til deltakelse i denne studien kan du bli spurt på et senere tidspunkt om du ønsker å bli med i studie nr. 4. I dette tilfellet vil et nytt samtykke bli innhentet dersom det er aktuelt for deg.

GODKJENNING

Vi behandler opplysninger om deg basert på ditt samtykke. Regional komité for medisinsk og helsefaglig forskningsetikk har vurdert prosjektet, og har gitt forhåndsgodkjenning (2018/2312/REK sør-øst D). Etter ny personopplysningslov har behandlingsansvarlige NIH og Sandra Lødeng Gluppe et selvstendig ansvar for å sikre at behandlingen av dine opplysninger har et lovlig grunnlag. Norsk senter for forskningsdata (NSD) har, på vegne av NIH, vurdert at prosjektet er i overensstemmelse med personvernregelverket. Dette prosjektet har rettslig grunnlag i EUs personvernforordning artikkel (referansekode 440860).

Du har rett til å sende klage til personvernombudet eller Datatilsynet på behandlingen av dine personopplysninger.

KONTAKTOPPLYSNINGER

Dersom du har spørsmål til prosjektet kan du ta kontakt med:
Prosjektleder: Sandra Lødeng Gluppe, 97523133, sandra.l.gluppe@hotmail.com
Hovedveileder: professor, dr.scient Kari Bø, 99047363, kari.bo@nih.no

Du kan ta kontakt med institusjonens personvernombud dersom du har spørsmål om behandlingen av dine personopplysninger i prosjektet:
Karine Justad, 97536704, karine.justad@nih.no

JEG HAR MOTTATT OG FORSTÅTT INFORMASJON OM PROSJEKTET "MAMMAMAGE" – ET PROBLEM ETTER FØDSEL?, OG HAR FÅTT ANLEDNING TIL Å STILLE SPØRSMÅL. JEG SAMTYKKER TIL:

- ☐ å delta i *medisinske/fysiske tester*
- ☐ å delta i *elektroniske spørreskjema*
- ☐ *at mine personopplysninger lagres etter prosjektslutt, til* ca. 30.09.2021

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

Klinisk undersøkelse, studie 2

IDnr:

Dato:

☐ Deltaker har > **2 fingerbredder** eller **en synlig utbuling**

(2 cm over eller 2 cm under navlen)

- Har du forsøkt et eller flere tiltak/behandling med den hensikt om å få magemusklene til å gå sammen etter fødselen?
  - ❑ Ja
  - ❑ Nei

    - Hvis ja; Hva slags type tiltak/behandling har du forsøkt for delte magemuskler? (Flere kryss)
      - ❑ Kirurgi
      - ❑ Påføring av spesifikke kremer på magen
      - ❑ Ekstern støtte/korsett
      - ❑ Tape (f.eks. kinesio tape)
      - ❑ Elektrisk stimulering
      - ❑ Øvelser for bekkenbunnsmusklene
      - ❑ Øvelser for magemusklene
      - ❑ Annet

    - Hvis ja; Fra hvem/hvor har du mottatt/funnet øvelser/behandling for delte magemuskler? (Flere kryss)
      - ❑ Øvelser/behandling jeg har funnet via internettsider/sosiale medier
      - ❑ Øvelser/behandling fra fysioterapeut
      - ❑ Øvelser/behandling fra naprapat/kiropraktor/osteopat
      - ❑ Øvelser/behandling fra treningssenter/personlig trener
      - ❑ Øvelser/behandling fra andre (familie/venner)

Høyde:_____(m) Vekt:_____(kg) Midjemål:_____(cm)

Leddbevegelighet

Hypermobilitet (Beighton)

- Ekstensjon 5. MCP **hø**. Hånd, over 90 grader? nei ja ugyldig test

  Eksakt (grader):_____

- Ekstensjon 5. MCP **ve**. Hånd, over 90 grader? nei ja ugyldig test

  Eksakt (grader):_____

- Kontakt **hø.** tommel mot underarm? nei ja ugyldig test
- Kontakt **ve**. tommel mot underarm? nei ja ugyldig test
- >10 grader hyperekstensjon **hø.** albue? nei ja ugyldig test
- >10 grader hyperekstensjon **ve.** albue? nei ja ugyldig test
- >10 grader hyperekstensjon **hø**. kne? nei ja ugyldig test
- >10 grader hyperekstensjon **ve.** kne? nei ja ugyldig test
- Håndflater lett i gulvet? nei ja ugyldig test

Kommentar:

Total score:_____

Observerbare strekkmerker (stria: mage/sete/hofte/lår/bryst)

Strekkmerker fra tenårene nei ja usikker Hvor:_____

Strekkmerker under graviditet nei ja usikker Hvor:_____

Strekkmerker etter graviditet nei ja usikker Hvor:_____

Funksjon bekkenbunn

Vurdering av bekkenbunnskontraksjon m/ultralyd (ryggliggende på benk med bøyde ben)

Kommando: *"Pust rolig inn og ut." "Du er klar." "Trekk sammen rundt alle åpningene, løft opp og inn i bekkenet – trekk sammen så hardt du kan." "Slipp og pust rolig ut".*

Ja, tydelig løft ☐

Ja, noe løft ☐

Nei, ikke uten hjelpemuskler ☐

Nei ☐

Trykker nedover ☐

Usikker ☐

Deltaker skal gå å tisse

Rectus diastase

Observerbar rectus diastase (v/crunch – ryggliggende på benk med bøyde ben)

Nei Ja, u/utbuling Ja, m/utbuling Usikker

Måling av rectus diastase (ultralyd, 2 cm over og 2 cm under navlen)

Hvile (ryggliggende på benk med bøyde ben)

Kommando: *"Pust rolig inn og ut".*

2 cm under navlen ☐ 2 cm over navlen ☐

Deretter øvelser i random order (eget ark pr. deltaker)

Øvelsene vises en gang, deretter får deltaker to forsøk og UL bilde tas på 3. forsøk.

- Hodeløft (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Pust rolig inn og ut." "Løft hodet opp fra underlaget." "Senk ned".*

2 cm under navlen ☐ 2 cm over navlen ☐

- Bekkentilt (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Pust rolig inn og ut." "Tilt bekkenet bakover slik at korsryggen presses ned mot benken" "Senk ned".*

2 cm under navlen ☐ 2 cm over navlen ☐

- Crunch (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Pust rolig inn og ut." "Hold armene i kryss på brystet." "Løft hodet og bøy øvre del av ryggen opp fra underlaget helt til skulderbladene er fri." "Senk ned".*

2 cm under navlen ☐ 2 cm over navlen ☐

- Bekkenbunnskontraksjon (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Pust rolig inn og ut." "Du er klar." "Trekk sammen rundt alle åpningene, løft opp og inn i bekkenet – trekk sammen så hardt du kan." "Slipp og pust rolig ut".*

2 cm under navlen ☐ 2 cm over navlen ☐

- Bekkenbunnskontraksjon + crunch (ryggliggende på benk med bøyde ben)

Kommando: *"Pust rolig inn og ut." "Du er klar." "Trekk sammen rundt alle åpningene, løft opp og inn i bekkenet – trekk sammen så hardt du kan." "Hold armene i kryss på brystet." "Løft hodet og øvre del av ryggen opp fra underlaget helt til skulderbladene er fri." "Slipp, senk ned og pust rolig ut".*

2 cm under navlen ☐ 2 cm over navlen ☐

- Maksimal inndragning (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Plasser hendene dine på magen." "Pust dypt inn gjennom nesen slik at magen løftes ut." "Slipp pusten rolig ut samtidig som du trekker nedre del av magen inn mot ryggsøylen så dypt du klarer." "Slipp og pust rolig ut."*

2 cm under navlen ☐ 2 cm over navlen ☐

"Pust dypt inn slik at magen går ut.

- Bekkenbunnskontraksjon + maksimal inndragning (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Plasser hendene dine på magen." "Pust rolig inn og ut." "Trekk sammen rundt skjede, urinrør og endetarm, løft opp og inn i bekkenet." "Hold sammentrekkningen og deretter trekker du navlen dypt inn mot ryggsøylen." "Slipp og pust rolig ut."*

2 cm under navlen ☐ 2 cm over navlen ☐

- Skrå crunch (ryggliggende på benk med bøyde ben)

Kommando: *"Pust rolig inn og ut." "Den ene armen hviler strak på benken, den andre hånden bak nakken." "Løft hodet og bøy skrått øvre del av ryggen opp fra underlaget helt til det ene skulderbladet er fri." "Senk ned".*

Sit-up mot HØ 2 cm under navlen ☐ 2 cm over navlen ☐

Sit-up mot VE 2 cm under navlen ☐ 2 cm over navlen ☐

Muskelstyrketesting

ACSM Curl-up test

Utholdende dynamisk styrketest av trunkusfleksorer

Kommando: *"Pust rolig inn og ut." "Du er klar." "Løft opp slik at du når teipen." "Følg takten til metronomen."*

Antall:_____(stk)

Kommentar:_____

Maks muskelstyrke (Humac)

Maksimal isometrisk trunkus fleksjon

Instruksjon:*"Er du klar?" "Pust inn." "Pust ut." "Bøy ryggen fremover og ta gradvis i alt du kan." "Kom igjen, ta i maks."* (Etter 5 sek.) *"Slapp av og pust vanlig."*

30 grader, Peak torque:_____ Nm

10 grader, Peak torque:_____ Nm

Kommentar:_____

Appendix 5

Paper III

Study information and consent form

Questionnaire

Clinical assessment form

NORGES IDRETTSHØGSKOLE

Norske Kvinners Sanitetsforening

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Deltakelse i dette forskningsprosjektet medfører ikke noen umiddelbare fordeler for deg, men ved å delta får du en fysioterapeutisk undersøkelse av magemusklene. Undersøkelsen vil kunne bidra til mer kunnskap om mulige øvelser som kan brukes i behandling av rectus diastase. Økt kunnskap om dette vil kunne gi et bedre behandlingstilbud til kvinner etter fødsel.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke. Dette vil ikke få konsekvenser for din videre behandling. Dersom du trekker deg fra prosjektet, kan du kreve å få slettet innsamlede prøver og opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte prosjektleder eller annen varig kontaktperson, se telefonnummer og mailadresse til disse under kontaktopplysninger.

HVA SKJER MED OPPLYSNINGENE OM DEG?

Opplysningene som registreres om deg skal kun brukes slik som beskrevet i hensikten med prosjektet. Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert. I tillegg har du rett til få utlevert en kopi av dine personopplysninger og sende klage til Datatilsynet om behandlingen av dine personopplysninger. Du har også rett til å få innsyn i sikkerhetstiltakene ved behandling av opplysningene.

Svar fra det elektroniske spørreskjemaet overføres sikkert fra SurveyXact by Rambøll og vil lagres og analyseres elektronisk på en beskyttet server på NIH, det samme gjelder innsamlede data fra testingen. En kode knytter deg til dine opplysninger gjennom en navneliste. Det er kun Sandra Lødeng Gluppe som har tilgang til denne listen. Alle opplysningene vil bli behandlet uten navn, fødselsnummer eller andre direkte gjenkjennende opplysninger.

Prosjektet skal etter planen avsluttes 30.09.2021. Opplysningene om deg vil bli anonymisert eller slettet senest fem år etter prosjektslutt.

FORSIKRING

Det er ikke nødvendig med særegen forsikring for deltakelse i denne studien. Som deltaker i studien er du forsikret dersom det skulle oppstå skade eller komplikasjoner som følge av deltakelse i forskningsprosjektet. NIH er en statlig institusjon og ikke et forsikringsselskap, dette innebærer at NIH dekker en eventuell erstatning. For skade på mennesker som oppstår under medisinske forsøk, gjelder pasientskadeloven.

OPPFØLGINGSPROSJEKT

For kvinner med rectus diastase kan et oppfølgingsprosjekt, for å undersøke treningseffekt av ulike type øvelser på rectus diastase, bli aktuelt. Ved å samtykke til deltakelse i denne studien kan du bli spurt på et senere tidspunkt om du ønsker å bli med i studie nr. 4. I dette tilfellet vil et nytt samtykke bli innhentet dersom det er aktuelt for deg.

GODKJENNING

Vi behandler opplysninger om deg basert på ditt samtykke. Regional komité for medisinsk og helsefaglig forskningsetikk har vurdert prosjektet, og har gitt forhåndsgodkjenning (2018/2312/REK sør-øst D). Etter ny personopplysningslov har behandlingsansvarlige NIH og Sandra Lødeng Gluppe et selvstendig ansvar for å sikre at behandlingen av dine opplysninger har et lovlig grunnlag. Norsk senter for forskningsdata (NSD) har, på vegne av NIH, vurdert at prosjektet er i overensstemmelse med personvernregelverket. Dette prosjektet har rettslig grunnlag i EUs personvernforordning artikkel (referansekode 440860).

Du har rett til å sende klage til personvernombudet eller Datatilsynet på behandlingen av dine personopplysninger.

KONTAKTOPPLYSNINGER

Dersom du har spørsmål til prosjektet kan du ta kontakt med:
Prosjektleder: Sandra Lødeng Gluppe, 97523133, sandra.l.gluppe@hotmail.com
Hovedveileder: professor, dr.scient Kari Bø, 99047363, kari.bo@nih.no

Du kan ta kontakt med institusjonens personvernombud dersom du har spørsmål om behandlingen av dine personopplysninger i prosjektet:
Karine Justad, 97536704, karine.justad@nih.no

JEG HAR MOTTATT OG FORSTÅTT INFORMASJON OM PROSJEKTET "MAMMAMAGE" – ET PROBLEM ETTER FØDSEL?, OG HAR FÅTT ANLEDNING TIL Å STILLE SPØRSMÅL. JEG SAMTYKKER TIL:

- ☐ å delta i *medisinske/fysiske tester*
- ☐ å delta i *elektroniske spørreskjema*
- ☐ *at mine personopplysninger lagres etter prosjektslutt, til* ca. 30.09.2021

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

Kjære deltaker,

Velkommen til denne spørreundersøkelsen.

Spørreundersøkelsen er del av et doktorgradsprosjekt ved Norges idrettshøgskole, Seksjon for idrettsmedisinske fag. Forskningsprosjektet er fullfinansiert av Norske Kvinners Sanitetsforening.

Med dette spørreskjemaet ønsker vi å samle informasjon om sammenhengen mellom seperasjon av de rette magemusklene (rectus diastase) og muskelstyrke, korsrygg-/bekkenleddssmerter og bekkenbunnsplager etter fødsel. Noen av spørsmålene er fra internasjonale standardiserte spørreskjemaer som benyttes innen forskning (ODI, PGQ og PFDI-20).

Ta deg god tid til å lese igjennom spørsmålene, det er viktig at du gir ærlige svar. Noen av spørsmålene kan virke personlige, men vi understreker at dine svar blir behandlet konfidensielt.

Det tar 15-30 minutter å gjennomføre spørreundersøkelsen.

NB: Dersom spørreskjemaet skulle stoppe å fungere eller henge underveis, logger du deg inn igjen og fortsetter der du falt ut.

På forhånd takk for hjelpen!

Jeg har mottatt informasjonsskriv tilsendt via mail, forstått informasjon om prosjektet og fått anledning til å stille spørsmål. Jeg samtykker til:

(1) ❑ å delta i elektroniske spørreskjema

(2) ❑ å delta i medisinske/fysiske tester

(3) ❑ at mine personopplysninger lagres etter prosjektslutt, til ca. 30.09.2021

De følgende spørsmålene omhandler bakgrunnsinformasjon om deg **i dag**

Alder (oppgi antall år)

_____

Sivilstatus

(1) ❍ Gift/samboende

(2) ❍ Bor alene (singel/skilt/separert)

Utdanningsnivå

(1) ❍ Universitet/høgskole

(2) ❍ Videregående

(3) ❍ Grunnskole

(4) ❍ Annet, oppgi _____

Genetisk opprinnelse. Hvilket opphav har dine foreldre? (Flere kryss hvis din mor og far har ulikt opphav)

(1) ❍ Europeisk (hvit/amerikaner med opphav fra Europa)

(2) ❍ Amerikansk urbefolkning (indianere/inuitter)

(3) ❍ Afrikansk, nord for Sahara eller Midt-Østen

(4) ❍ Afrikansk, sør for Sahara

(5) ❍ Asiatisk (inkl Pakistan og India)

(6) ❍ Øygruppene i Stillehavet inkl ubefolkning i Australia

(7) ❍ Usikker

Høyde (cm)

_____

Nåværende vekt (kg)

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Vekt før graviditet?

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Vektoppgang i ditt siste svangerskap?

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Røyker du?

(1) ❍ Ja, hver dag

(2) ❍ Ja, av og til

(3) ❍ Nei

Bruker du noen form for hormoner?

(1) ❍ Nei

(2) ❍ Ja (p-piller, p-ring, p-plaster)

(3) ❍ Ja (hormonspiral, p-sprøyte, implanon, minipille)

(4) ❍ Ja (østrogenstikkpiller i skjeden)

(5) ❍ Ja, annen hormonell behandling, hvilken? _____

Er du i arbeid nå for tiden?

(1) ❍ Ja

(2) ❍ Nei

Hvor ofte opplever du belastende løft på din arbeidsplass?

(1) ❍ Sjelden/aldri

(2) ❍ Mindre enn 20 ganger ukentlig

(3) ❍ Mer enn 20 ganger ukentlig

(4) ❍ 10-20 ganger daglig

(5) ❍ Mer enn 20 ganger daglig

Oppgi antall % lønnet arbeid

_____

De følgende spørsmål omhandler informasjon om barnet/barna dine.

Hvor mange barn har du født?

(1) ❍ 1 barn

(2) ❍ 2 barn

(3) ❍ 3 barn

(4) ❍ 4 barn

(5) ❍ 5 eller fler barn

Har du født tvillinger/trillinger?

(1) ❍ Ja

(2) ❍ Nei

Hvor lenge er det siden din siste fødsel?

(1) ❑ Under 6 måneder siden

(2) ❑ 6 - 11 måneder siden

(3) ❑ 1 - 3 år siden siden

(4) ❑ Over 3 år siden

Ammer du?

(1) ❍ Ja, 3 ganger eller mer daglig

(2) ❍ Ja, 1-2 ganger daglig

(3) ❍ Ja, 4-6 ganger pr uke

(4) ❍ Ja, 1-3 ganger pr uke

(5) ❍ Sjelden/aldri

Har du fått tilbake menstruasjonen etter fødselen?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Hvor mange år det er mellom barna du har født (oppgi i hele år). Ved flere barn, vennligst angi antall år med komma mellom.

_____
_____
_____
_____
_____
_____

Angi fødselsvekt for ditt/dine barn. Flere kryss ved flere barn av ulik fødselsvekt (dersom du har født tvillinger/trillinger oppgir du deres vekt i neste spørsmål)

(1) ❑ Over 4500 g

(2) ❑ 4000 - 4500 g

(3) ❑ Mellom 3000 og 3999 g

(4) ❑ 2500 - 2999 g

(5) ❑ Under 2500 g

(6) ❑ Under 1500 g

(7) ❑ Under 1000 g

Angi fødselsvekt for tvillingene/trillingene

	Over 4500 g	4000 - 4500 g	Mellom 3000 og 3999 g	2500 - 2999 g	Under 2500 g	Under 1500 g	Under 1000 g
Tvilling/Trilling 1	(1) ❍	(2) ❍	(3) ❍	(4) ❍	(5) ❍	(6) ❍	(7) ❍
Tvilling/Trilling 2	(1) ❍	(2) ❍	(3) ❍	(4) ❍	(5) ❍	(6) ❍	(7) ❍
Trilling 3	(1) ❍	(2) ❍	(3) ❍	(4) ❍	(5) ❍	(6) ❍	(7) ❍

Hvordan ble barnet/ barna dine født?

(1) ❍ Vaginal fødsel

(2) ❍ Keisersnitt

(3) ❍ Jeg har født både vaginalt og med keisersnitt (ved flere barn)

Hvordan ble tvillingene/trillingene født?

(1) ❍ Vaginal fødsel

(2) ❍ Keisersnitt

(3) ❍ Vaginal fødsel og keisersnitt

De følgende spørsmål omhandler helsen din **i dag**.

Hvordan vil du beskrive helsen din i dag?

(1) ❍ Svært god

(2) ❍ God

(3) ❍ Verken god eller dårlig

(4) ❍ Dårlig

(5) ❍ Svært dårlig

Har du noen av følgende sykdommer/plager i dag? (Flere kryss ved flere sykdommer)

(1) ❑ Diabetes

(2) ❑ Høyt blodtrykk

(3) ❑ Astma

(4) ❑ Revmatisk sykdom

(5) ❑ Psykiatrisk sykdom/lidelse

(6) ❑ Nevrologisk sykdom

(7) ❑ Hevelse i kroppen (ødem)

(8) ❑ Treg mage/forstoppelse

(9) ❑ Nei, ingen sykdommer

(10) ❑ Andre sykdommer

Har du navlebrokk i dag?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Har du hatt navlebrokk før?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Har du blitt operert for navlebrokk?

(1) ❍ Ja

(2) ❍ Nei

Har du blitt operert i magen for andre grunner?

(1) ❍ Ja, oppgi _____

(2) ❍ Nei

De følgende spørsmål omhandler fysisk aktivitet og trening **i dag**.

Hvor ofte er du så fysisk aktiv (fritid eller arbeid) nå for tiden at du blir andpusten eller svett?

(1) ❍ Aldri

(2) ❍ Mindre enn en gang pr. uke

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3-4 ganger pr. uke

(6) ❍ 5 ganger pr. uke eller mer

Angi gjennomsnittlig hvor mange minutter pr. uke du er så fysisk aktiv (fritid eller arbeid) at du blir andpusten eller svett (1 time = 60 min)

_____

Kryss av for hva som best beskriver type fysisk aktivitet du bedriver nå for tiden (Flere kryss ved flere aktiviteter)

(1) ❑ Rolig gange/spasertur

(2) ❑ Rask gange/turgåing

(3) ❑ Løping/jogging/orientering

(4) ❑ Sykling

(5) ❑ Treningssenter/styrketrening

(6) ❑ Spesiell gymnastikk/aerobic for kvinner etter fødsel (bootcamp, strong mama m.f)

(7) ❑ Aerobics/gymnastikk/dans uten løp og hopp

(8) ❑ Aerobics/gymnastikk/dans med løp og hopp

(9) ❑ Yoga/ pilates

(10) ❑ Dansing (ballett, jazzdans, swing, rock, folkedans m.f)

(11) ❑ Skigåing

(12) ❑ Svømming

(13) ❑ Ridning

(14) ❑ Annet

Hvor ofte gjør du øvelser for magemusklene hjemme eller på trening nå for tiden?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Hvilke øvelser gjør du når du trener magemusklene? (Flere kryss ved flere svar)

(1) ❑ Ulike variasjoner av sit-ups/crunch

(2) ❑ Ulike variasjoner av planken

(3) ❑ Inndragning av navlen i ulike utgangsstillinger

(4) ❑ Bekkenvipp

(5) ❑ Andre magemuskeløvelser

(6) ❑ Gjør ikke magemuskeløvelser

I hvilke/hvilken av disse øvelsene mener du at bekkenbunnsmusklene trenes spesifikt? (Flere kryss ved flere svar)

(1) ❑ Sit-ups

(2) ❑ Planken

(3) ❑ Inndragning (trekke inn navlen)

(4) ❑ Seteløft

(5) ❑ Knebøy

(6) ❑ Vet ikke

(7) ❑ Ingen av alternativene ovenfor trener bekkenbunnsmusklene spesifikt

Spesifikk trening av bekkenbunnsmusklene innebærer å trekke sammen muskler rundt skjede, urinrør, endetarm.

Hvor ofte gjør du spesifikk trening for bekkenbunnsmusklene hjemme eller på trening nå for tiden?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Har du tidligere gjort spesifikk bekkenbunnstrening hjemme eller på trening?

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmålene omhandler muskel- og skjelettplager.

Svar for de siste 4 ukene.

Svar for de siste 4 ukene

Plages du med smerter i korsryggen?

(1) ❍ Ja

(2) ❍ Nei

Plages du med smerter i bekkenet?

(1) ❍ Ja

(2) ❍ Nei

Plages du med smerter i magen?

(1) ❍ Ja

(2) ❍ Nei

Stråler smertene fra ryggen ned i lår og/eller legg?

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmål omhandler hvordan ryggsmertene dine har påvirket din evne til å klare deg i dagliglivet (ODI).

Vennligst svar hva som best beskriver ditt **nåværende** problem.

Vennligst svar hva som best beskriver ditt **nåværende** problem.

Smerteintensitet

(1) ❍ Jeg har ingen smerter for øyeblikket

(2) ❍ Smertene er veldig svake for øyeblikket

(3) ❍ Smertene er moderate for øyeblikket

(4) ❍ Smertene er temmelig sterke for øyeblikket

(5) ❍ Smertene er veldig sterke for øyeblikket

(6) ❍ Smertene er de verste jeg kan tenke meg for øyeblikket

Personlig stell (vaske seg, kle på seg, osv.)

(1) ❍ Jeg kan stelle meg selv på vanlig måte uten at det forårsaker ekstra smerter

(2) ❍ Jeg kan stelle meg selv på vanlig måte, men det er veldig smertefullt

(3) ❍ Det er smertefullt å stelle meg selv, og jeg gjør det langsomt og forsiktig

(4) ❍ Jeg trenger noe hjelp, men klarer det meste av mitt personlige stell

(5) ❍ Jeg trenger hjelp hver dag til det meste av eget stell

(6) ❍ Jeg kler ikke på meg, har vanskeligheter med å vaske meg, og holder sengen

Løfte

(1) ❍ Jeg kan løfte tunge ting uten å få mer smerter

(2) ❍ Jeg kan løfte tunge ting, men får mer smerter

(3) ❍ Smertene hindrer meg i å løfte tunge ting opp fra gulvet, men jeg greier det hvis det som skal løftes er gunstig plassert, f.eks. på et bord

(4) ❍ Smertene hindrer meg i å løfte tunge ting, men jeg kan klare lette eller middels tunge ting, hvis det er gunstig plassert

(5) ❍ Jeg kan bare løfte noe som er veldig lett

(6) ❍ Jeg kan ikke løfte eller bære noe i det hele tatt

Gå

(1) ❍ Smerter hindrer meg ikke i å gå i det hele tatt

(2) ❍ Smerter hindrer meg i å gå mer enn 1 ½ km

(3) ❍ Smerter hindrer meg i å gå mer enn ¾ km

(4) ❍ Smerter hindrer meg i å gå mer enn 100 m

(5) ❍ Jeg kan bare gå med stokk eller krykker

(6) ❍ Jeg ligger for det meste i sengen og jeg må krabbe til toalettet

Sitte

(1) ❍ Jeg kan sitte så lenge jeg vil i en hvilken som helst stol

(2) ❍ Jeg kan sitte så lenge jeg vil i min favorittstol

(3) ❍ Smerter hindrer meg i å sitte i mer enn en time

(4) ❍ Smerter hindrer meg i å sitte i mer enn en halv time

(5) ❍ Smerter hindrer meg i å sitte i mer enn ti minutter

(6) ❍ Smerter hindrer meg i å sitte i det hele tatt

Stå

(1) ❍ Jeg kan stå så lenge jeg vil uten å få mer smerter

(2) ❍ Jeg kan stå så lenge jeg vil, men får mer smerter

(3) ❍ Smerter hindrer meg i å stå i mer enn en time

(4) ❍ Smerter hindrer meg i å stå i mer enn en halv time

(5) ❍ Smerter hindrer meg i å stå i mer enn ti minutter

(6) ❍ Smerter hindrer meg i å stå i det hele tatt

Sove

(1) ❍ Søvnen min forstyrres aldri av smerter

(2) ❍ Søvnen min forstyrres av og til av smerter

(3) ❍ På grunn av smerter får jeg mindre enn seks timers søvn

(4) ❍ På grunn av smerter får jeg mindre enn fire timers søvn

(5) ❍ På grunn av smerter får jeg mindre enn to timers søvn

(6) ❍ Smerter hindrer all søvn

Seksualliv

(1) ❍ Seksuallivet mitt er normalt og forårsaker ikke mer smerter

(2) ❍ Seksuallivet mitt er normalt, men forårsaker noe mer smerter

(3) ❍ Seksuallivet mitt er normalt, men svært smertefullt

(4) ❍ Seksuallivet mitt er svært begrenset av smerter

(5) ❍ Seksuallivet mitt er nesten borte på grunn av smerter

(6) ❍ Smerter forhindrer alt seksualliv

Sosialt liv

(1) ❍ Det sosiale livet mitt er normalt og forårsaker ikke mer smerter

(2) ❍ Det sosiale livet mitt er normalt, men øker graden av smerter

(3) ❍ Smerter har ingen betydelig innvirkning på mitt sosiale liv, bortsett fra at de begrenser mine mer fysisk aktive sider, som sport osv.

(4) ❍ Smerter har begrenset mitt sosiale liv og jeg går ikke så ofte ut

(5) ❍ Smerter har begrenset mitt sosiale liv til hjemmet

(6) ❍ På grunn av smerter har jeg ikke noe sosialt liv

Reising

(1) ❍ Jeg kan reise hvor som helst uten smerter

(2) ❍ Jeg kan reise hvor som helst, men det gir mer smerter

(3) ❍ Smertene er ille, men jeg klarer reiser på to timer

(4) ❍ Smerter begrenser meg til korte reiser på under en time

(5) ❍ Smerter begrenser meg til korte, nødvendige reiser på under 30 minutter

(6) ❍ Smerter forhindrer meg fra å reise, unntatt for å få behandling

Hvor i bekkenet har du vondt? (Flere kryss dersom du har vondt flere steder)

(1) ❑ Bak i bekkenet på høyre side

(2) ❑ Bak i bekkenet på venstre side

(3) ❑ Bak i bekkenet på begge sider

(4) ❑ Foran i bekkenet (symfysen)

Følgende spørsmål omhandler i hvilken grad du finner det problematisk pga plager fra bekkenet å utføre aktivitetene som er listet opp nedenfor. Velg alternativet som best beskriver hvordan du har det **nå for tiden** under hver aktivitet (PGQ).

Svar for hvordan du har det **nå for tiden.**

Hvor sterke smerter har du i bekkenet:

	Ingen	Noe	Moderate	Svært mye
Om morgenen	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Om kvelden	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Hvor problematisk på grunn av bekkenet å:

	Ikke i det hele tatt	I liten grad	I noen grad	I stor grad
Kle på deg selv	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Stå mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Stå mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Bøye deg	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Sitte mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Sitte mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Gå mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå trapper	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Husarbeid	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Bære lett	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Løfte tungt	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Reise/sette seg	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Skyve en handlevogn	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Løpe	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Utføre sportslige aktiviteter	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Ligge	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Snu deg i sengen	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Ha et normalt seksualliv	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Skyve noe med den ene foten	(1) ❍	(2) ❍	(3) ❍	(4) ❍

I hvilken grad på grunn av plagene i bekkenet:

	Ikke i det hele tatt	I liten grad	I noen grad	I stor grad
Svikter beinet/beina under deg?	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gjør du ting langsommere?	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Forstyrres nattesøvnen din?	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Følgende spørsmål omhandler smerter i magen. Svar for hvordan du har det **nå for tiden.**

Svar for hvordan du har det **nå for tiden.**

Hvor i magen har du vondt? (Flere kryss dersom du har smerter flere steder)

(1) ❑ Inni magen

(2) ❑ Ved navlen

(3) ❑ Over navlen

(4) ❑ Under navlen

Hvor mye påvirker smertene ditt hverdagsliv?
0 = ikke i det hele tatt
10 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

(8) ❍ 7

(9) ❍ 8

(10) ❍ 9

(11) ❍ 10

Har du symptomer i tarmen, blæren eller bekkenregionen som plager deg? For eksempel urinlekkasje, avføringslekkasje eller at du føler noe buler/faller ut fra skjeden.

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmålene omhandler hvorvidt du har visse symptomer i blæren, tarmen eller bekkenregionen, og i så fall hvor mye de plager deg (PFDI-20).

Vær snill og svar på spørsmålene ut fra de symptomer du har hatt gjennom **de siste tre månedene.**

Kjenner du du ofte trykk i nedre del av magen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte tyngdefølelse i bekkenet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Kjenner eller ser du noe som faller eller buler ut fra sjeden?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Må du ofte presse med fingre i skjeden eller rundt endetarmsåpningen for å få ut avføring eller få tømt tarmen helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du ofte at du ikke får tømt blæren helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hender det at du må trykke inn med fingrene noe som buler i skjeden, for å få tisset eller tømt blæren helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du at du må presse hardt for å få ut avføringen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du at du ikke har tømt tarmen helt, når du har hatt avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte avføringslekkasje når avføringen er fast?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte avføringslekkasje når avføringen er løs eller flytende?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte ufrivillig lekkasje av luft fra tarmen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte smerter når du har avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Opplever du så sterk avføringstrang at du må løpe til toalettet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hender det at en del av tarmen følger med ut gjennom endetarmsåpningen under eller etter avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du vanligvis hyppig vannlating?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Opplever du så sterk vannlatingstrang at du ikke rekker til toalettet før du får lekkasje?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte urinlekkasje når du hoster, nyser, ler eller under fysisk aktivtet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte små urinlekkasjer (dvs. dråper?)

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte problemer med å tømme blæren?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte smerte eller ubehag i nedre del av magen eller underlivet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du eventuelle kommentarer?

_____
_____
_____
_____
_____
_____

Tusen takk for at du var med i denne spørreundersøkelsen!

Klinisk undersøkelse, studie 3

ID:

Dato:

☐ Deltaker har **< 2 fingerbredder** og **ikke en synlig utbuling**

(2 cm over eller 2 cm under navlen)

- Har du forsøkt et eller flere tiltak/behandling med den hensikt om å få magemusklene til å gå sammen etter fødselen?
  - ❑ Ja
  - ❑ Nei

    - Hvis ja; Hva slags type tiltak/behandling har du forsøkt for delte magemuskler? (Flere kryss)
      - ❑ Kirurgi
      - ❑ Påføring av spesifikke kremer på magen
      - ❑ Ekstern støtte/korsett
      - ❑ Tape (f.eks. kinesio tape)
      - ❑ Elektrisk stimulering
      - ❑ Øvelser for bekkenbunnsmusklene
      - ❑ Øvelser for magemusklene
      - ❑ Annet

    - Hvis ja; Fra hvem/hvor har du mottatt/funnet øvelser/behandling for delte magemuskler? (Flere kryss)
      - ❑ Øvelser/behandling jeg har funnet via internettsider/sosiale medier
      - ❑ Øvelser/behandling fra fysioterapeut
      - ❑ Øvelser/behandling fra naprapat/kiropraktor/osteopat
      - ❑ Øvelser/behandling fra treningssenter/personlig trener
      - ❑ Øvelser/behandling fra andre (familie/venner)

Høyde:_____(m) Vekt:_____(kg) Midjemål:_____(cm)

Leddbevegelighet

Hypermobilitet (Beighton)

- Ekstensjon 5. MCP **hø**. Hånd, over 90 grader? nei ja ugyldig test

  Eksakt (grader):_____

- Ekstensjon 5. MCP **ve**. Hånd, over 90 grader? nei ja ugyldig test

  Eksakt (grader):_____

- Kontakt **hø.** tommel mot underarm? nei ja ugyldig test
- Kontakt **ve**. tommel mot underarm? nei ja ugyldig test
- >10 grader hyperekstensjon **hø.** albue? nei ja ugyldig test
- >10 grader hyperekstensjon **ve.** albue? nei ja ugyldig test
- >10 grader hyperekstensjon **hø**. kne? nei ja ugyldig test
- >10 grader hyperekstensjon **ve.** kne? nei ja ugyldig test
- Håndflater lett i gulvet? nei ja ugyldig test

Total score:_____

Observerbare strekkmerker (stria: mage/sete/hofte/lår/bryst)

Strekkmerker fra tenårene nei ja usikker Hvor:_____

Strekkmerker under graviditet nei ja usikker Hvor:_____

Strekkmerker etter graviditet nei ja usikker Hvor:_____

Rectus diastase

Måling av rectus diastase (ultralyd, 2 cm over og 2 cm under navlen)

Hvile (ryggliggende på benk med bøyde ben, liten pute under hodet)

Kommando: *"Pust rolig inn og ut".*

2 cm under navlen ☐ 2 cm over navlen ☐

Crunch (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Pust rolig inn og ut." "Hold armene i kryss på brystet." "Løft hodet og bøy øvre del av ryggen opp fra underlaget helt til skulderbladene er fri." "Senk ned".*

2 cm under navlen ☐ 2 cm over navlen ☐

Muskelstyrketesting

ACSM Curl-up test

Utholdende dynamisk styrketest av trunkusfleksorer

Kommando: *"Pust rolig inn og ut." "Du er klar." "Løft opp slik at du når teipen." "Følg takten til metronomen."*

Antall:_____(stk)

Kommentar:_____

Maks muskelstyrke (Humac)

Maksimal isometrisk trunkus fleksjon

Instruksjon:*"Er du klar?" "Pust inn." "Pust ut." "Bøy ryggen fremover og ta gradvis i alt du kan." "Kom igjen, ta i maks."* (Etter 5 sek.) *"Slapp av og pust vanlig."*

30 grader, Peak torque:_____ Nm

10 grader, Peak torque:_____ Nm

Kommentar:_____

Appendix 6

Paper IV

Study information and consent form

Consent form screening

Questionnaire pretest

Questionnaire posttest

Clinical assessment form pretest

Clinical assessment form posttest

NORGES IDRETTSHØGSKOLE

Norske Kvinners Sanitetsforening

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKTET

"MAMMAMAGE" – ET PROBLEM ETTER FØDSEL?

Dette er et spørsmål til deg om å delta i et forskningsprosjekt for å undersøke seperasjon av de to magemusklene "rectus diastase" etter fødsel. Rectus diastase kan oppstå hos gravide kvinner og for en del vedvarer tilstanden etter fødsel. Det er for tiden stor oppmerksomhet rundt denne tilstanden, spesielt i sosiale medier, men det foreligger lite forskning om både forekomst, årsak, risikofaktorer, mulige følger og behandling. Forskningsprosjektet omfatter fire studier hvor formålene er å undersøke 1. helseplager og hvordan kvinner opplever kroppen og magen sin etter fødsel, 2. hvordan ulike magemuskeløvelser påvirker rectus diastase, 3. om det er forskjell mellom kvinner med og uten rectus diastase i funksjon og plager etter fødsel og 4. effekten av et styrketreningsprogram på rectus diastase. Kunnskap om disse forholdene er viktig for å kunne gi forskningsbaserte råd til kvinner etter fødsel. Du forespørres om å delta i studien hvor vi skal undersøke effekten av et styrketreningsprogram på rectus diastase etter fødsel. Forskningsprosjektet er fysioterapeut Sandra Bjordal Gluppes doktorgradsprosjekt ved Norges idrettshøgskole (NIH), Seksjon for idrettsmedisinske fag, finansiert av Norske kvinners Sanitetsforening. Hovedveileder er professor, dr. scient, og fysioterapeut Kari Bø ved NIH, Seksjon for idrettsmedisinske fag. Biveileder er Marie Ellström Engh, professor og gynekolog, Kvinneklinikken, Akershus universitetssykehus. NIH er ansvarlig institusjon for forskningsprosjektet.

HVA INNEBÆRER PROSJEKTET?

Kvinner med rectus diastase (mer enn 2 fingerbredder eller ved synlig utbulig på magen) og som har født for 6-12 måneder siden inviteres til å delta i denne studien. Du blir ved en loddtrekkning trukket ut til å være med i en treningsgruppe eller en kontrollgruppe. Blir du trukket ut til treningsgruppen vil du få individuell oppfølging via en treningsapp en gang i uken og ellers gjennomføre et hjemmetreningsprogram for magemusklene fem dager i uken. Hjemmetreningen tar ca. 10 min. Treningen starter 6-12 måneder etter fødsel og varer i 3 måneder. Registrering av treningen loggføres i en app (Athlete Monitoring) som lastes ned på din mobil. I denne appen vil du i tillegg få en påminnelse om treningen. Dersom du kommer i kontrollgruppen vil du få skriftlig informasjon om resultatene og treningsprogrammet om det viser seg å ha effekt. I tillegg vil ber vi deg om å ikke gjøre spesielle tiltak for rectus diastase i intervensjonsperioden. Fysioterapeut Sandra Bjordal Gluppe ved NIH skal ikke vite om du er i trenings- eller kontrollgruppen.

Deltakelse i studien innebærer å møte to ganger på NIH for klinisk undersøkelse. Sandra Bjordal Gluppe vil avtale tidspunkt med deg på telefon eller mail for undersøkelsene. Noen dager før den kliniske undesøkelse vil du få tilsendt et elektroniske spørreskjema på mail som skal besvares før du møter på NIH. Spørreskjemaet inneholder spørsmål om relevant bakgrunnsinformasjon og spørsmål om mulige risikofaktorer for og konsekvenser av rectus diastase. Spørreskjema tar 5-15 min å besvare. Fysioterapeut Sandra Bjordal Gluppe møter deg i resepsjonen på NIH og gjennomfører undersøkelsen. Undersøkelsen består av måling av vekt, høyde, bevegelighetstest og ultralydundersøkelse av rectus diastase 2 cm over og 2 cm under navlen. Ultralydundersøkelsen gjøres på nedre del av magen. Deretter testes magemusklenes styrke. I disse testene vil

din styrke testes ved å registrere antall crunch og din maksimale styrke vil bli testet ved at du skal stå i et apparat og bøye overkroppen fremover. Undersøkelsen vil ta ca 1,5 time. For å gjennomføre de ulike testene og målingene er det viktig at du har på shorts og t-trøye.

For deltakere som ikke ønsker å reise til Oslo som følge av økt smittetrykk under covid-19 pandemien er det mulighet for å gjennomføre testingen på aktuelle klinikker utenfor Oslo. Testingen gjennomføres som tidligere beskrevet, bortsett fra testen hvor maksimal muskelstyrke testes ved at overkroppen bøyes fremover stående i et apparat.

MULIGE FORDELER OG ULEMPER

En ulempe med deltakelse i dette forskningsprosjektet kan være at det vil ta ca. 1 time å gjennomføre testene, i tillegg til å besvare et elektronisk spørreskjema.

Deltakelse i dette forskningsprosjektet medfører ikke noen umiddelbare fordeler for deg, men ved å delta får du en fysioterapeutisk undersøkelse av magemusklene. Undersøkelsen vil kunne bidra til mer kunnskap om mulige øvelser som kan brukes i behandling av rectus diastase. Økt kunnskap om dette vil kunne gi bedre behandlingstilbud til kvinner etter fødsel.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE SITT SAMTYKKE

Det er frivillig å delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke. Dette vil ikke få konsekvenser for din videre behandling. Dersom du trekker deg fra prosjektet, kan du kreve å få slettet innsamlede prøver og opplysninger, med mindre opplysningene allerede er inngått i analyser eller brukt i vitenskapelige publikasjoner. Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte prosjektleder eller annen varig kontaktperson, se telefonnummer og mailadresse til disse under kontaktopplysninger.

HVA SKJER MED OPPLYSNINGENE OM DEG?

Opplysningene som registreres om deg skal kun brukes slik som beskrevet i hensikten med prosjektet. Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert. I tillegg har du rett til få utlevert en kopi av dine personopplysninger og sende klage til Datatilsynet om behandlingen av dine personopplysninger. Du har også rett til å få innsyn i sikkerhetstiltakene ved behandling av opplysningene.

Svar fra det elektroniske spørreskjemaet overføres sikkert fra SurveyXact by Rambøll og vil lagres og analyseres elektronisk på en beskyttet server på NIH, det samme gjelder innsamlede data fra testingen. En kode knytter deg til dine opplysninger gjennom en navneliste. Det er kun Sandra Bjordal Gluppe som har tilgang til denne listen. Alle opplysningene vil bli behandlet uten navn, fødselsnummer eller andre direkte gjenkjennende opplysninger.

Prosjektet skal etter planen avsluttes 30.09.2021. Opplysningene om deg vil bli anonymisert eller slettet senest fem år etter prosjektslutt.

FORSIKRING

Det er ikke nødvendig med særegen forsikring for deltakelse i denne studien. Som deltaker i studien er du forsikret dersom det skulle oppstå skade eller komplikasjoner som følge av deltakelse i forskningsprosjektet. NIH er en statlig institusjon og ikke et forsikringsselskap, dette innebærer at NIH dekker en eventuell erstatning. For skade på mennesker som oppstår under medisinske forsøk, gjelder pasientskadeloven.

GODKJENNING

Vi behandler opplysninger om deg basert på ditt samtykke. Regional komité for medisinsk og helsefaglig forskningsetikk har vurdert prosjektet, og har gitt forhåndsgodkjenning (2018/2312/REK sør-øst D). Etter ny personopplysningslov har behandlingsansvarlige NIH og Sandra Bjordal Gluppe et selvstendig ansvar for å sikre at behandlingen av dine opplysninger har et lovlig grunnlag. Dette prosjektet har rettslig grunnlag i EUs personvernforordning artikkel (referansekode 440860).

Du har rett til å sende klage til personvernombudet eller Datatilsynet på behandlingen av dine personopplysninger.

KONTAKTOPPLYSNINGER

Dersom du har spørsmål til prosjektet kan du ta kontakt med:
Prosjektleder: Sandra Bjordal Gluppe, 97523133, sandra.l.gluppe@hotmail.com
Hovedveileder: Kari Bø, 99047363, kari.bo@nih.no

Du kan ta kontakt med institusjonens personvernombud dersom du har spørsmål om behandlingen av dine personopplysninger i prosjektet:
Karine Justad, 97536704, karine.justad@nih.no

JEG HAR MOTTATT OG FORSTÅTT INFORMASJON OM PROSJEKTET «MAMMAMAGE» - ET PROBLEM ETTER FØDSEL?, OG HAR FÅTT ANLEDNING TIL Å STILLE SPØRSMÅL. JEG SAMTYKKER TIL:

☐ Å delta i medisinske/fysiske tester

☐ Å delta i elektroniske spørreskjema

☐ At mine personopplysninger lagres etter prosjektslutt, til ca. 30.09.2021

Sted og dato

Deltakers signatur

Deltakers navn med trykte bokstaver

NORGES IDRETTSHØGSKOLE

Norske Kvinners Sanitetsforening

VIL DU DELTA I FORUNDERSØKELSE I PROSJEKTET;

«MAMMAMAGE» - ET PROBLEM ETTER FØDSEL?

FORMÅLET MED PROSJEKTET OG HVORFOR DU BLIR SPURT

Delte magemuskler kan oppstå hos gravide kvinner og for en del vedvarer tilstanden etter fødsel. Dette er et spørsmål til deg om å delta i en forundersøkelse for å undersøke seperasjon av de to rette magemusklene "rectus diastase" etter fødsel. Hensikten med forundersøkelsen er å måle avstanden mellom de to rette magemusklene for å avklare om du oppfyller våre inklusjonskriterier, for å senere evt. kunne delta i forskningsprosjektet om rectus diastase etter fødsel. Hensikten med studien å undersøke effekten av et styrketreningsprogram på rectus diastase etter fødsel. Forskningsprosjektet er fysioterapeut Sandra Bjordal Gluppes doktorgradsprosjekt ved Norges idrettshøgskole (NIH), Institutt for idrettsmedisinske fag, finansiert av Norske kvinners Sanitetsforening. Hovedveileder er professor, dr. scient, og fysioterapeut Kari Bø ved NIH, Seksjon for idrettsmedisinske fag. Biveileder er Marie Ellström Engh, professor og gynekolog, Kvinneklinikken, Akershus universitetssykehus. NIH er ansvarlig institusjon for forskningsprosjektet.

HVA INNEBÆRER PROSJEKTET FOR DEG?

Kvinner som tror de har rectus diastase, og som har født for 6-12 måneder siden, melder seg frivillig til en forundersøkelse for måling av mulig rectus diastase. Timebestilling gjøres via en bookingside. Undersøkelsen består av en ultralydundersøkelse som gjøres på nedre del av magen. Forundersøkelsen tar ca. 15 min.

Dersom du oppfyller våre inklusjonskriterier, vil du få muligheten til å delta i hovedstudien hvor vi undersøker effekt av styrketreningsprogram for magemusklene på rectus diastase. Dersom du ønsker å delta i hovedprosjektet vil Sandra Bjordal Gluppe avtale et tidspunkt med deg, og samtykke i selve forskningsprosjektet underskrives når du møter opp til testing i studien på NIH. Deltakelse i studien innebærer å møte 2 ganger på NIH for klinisk undersøkelse, og trene magemusklene ca. 10 min, 5 dager i uken i 12 uker, dersom du kommer i treningsgruppen.

MULIGE FORDELER OG ULEMPER

En ulempe med deltakelse i denne forundersøkelsen kan være at det vil ta ca. 15 min å gjennomføre undersøkelsen. Hvis du ikke oppfyller våre inklusjonskriterier, vil du ikke få mulighet til å delta i hovedstudien.

Deltakelse i denne forundersøkelsen medfører ikke noen umiddelbare fordeler for deg, men ved å delta får du en fysioterapeutisk undersøkelse av magemusklene og du vil få avkreftet/bekreftet om du har rectus diastase. I tillegg får du muligheten til å delta i selve forskningsprosjektet som igjen vil kunne bidra til mer kunnskap om øvelser kan eller ikke kan behandle rectus diastase. Økt kunnskap om dette vil kunne gi bedre behandlingstilbud til kvinner etter fødsel.

FRIVILLIG DELTAKELSE OG MULIGHET FOR Å TREKKE DITT SAMTYKKE

Det er frivillig å stille opp til forundersøkelsen og evt. delta i prosjektet. Dersom du ønsker å delta, undertegner du samtykkeerklæringen på siste side når du møter til forundersøkelsen. Du kan når som helst og uten å oppgi grunn trekke ditt samtykke. Det vil ikke ha noen negative konsekvenser for deg eller din videre behandling om du ikke vil delta eller senere velger å trekke deg. Dersom du trekker tilbake samtykket, vil det ikke forskes videre på dine helseopplysninger. Du kan også kreve at dine helseopplysninger i prosjektet slettes eller

utleveres innen 30 dager. Adgangen til å kreve destruksjon, sletting eller utlevering gjelder ikke dersom materialet eller opplysningene er anonymisert. Denne adgangen kan også begrenses dersom opplysningene er inngått i utførte analyser.

Dersom du senere ønsker å trekke deg eller har spørsmål til prosjektet, kan du kontakte prosjektleder (se kontaktinformasjon på siste side).

HVA SKJER MED OPPLYSNINGENE OM DEG?

Dersom du ikke oppfyller våre inklusjonskriterier, lagres ingen opplysninger om deg.

Dersom du oppfyller våre inklusjonskriterier, men ikke ønsker å delta lagres ingen opplysninger om deg.

Dersom du oppfyller våre inklusjonskriterier og ønsker å delta i prosjektet vil opplysningene som registreres om deg kun brukes slik som beskrevet under formålet med hovedstudien. Du har rett til innsyn i hvilke opplysninger som er registrert om deg og rett til å få korrigert eventuelle feil i de opplysningene som er registrert. Du har også rett til å få innsyn i sikkerhetstiltakene ved behandling av opplysningene. Du kan klage på behandlingen av dine opplysninger til Datatilsynet og institusjonen sitt personvernombud. Alle opplysningene vil bli behandlet uten navn og fødselsnummer eller andre direkte gjenkjennende opplysninger (=kodede opplysninger). En kode knytter deg til dine opplysninger gjennom en navneliste. Det er kun Sandra Bjordal Gluppe som har tilgang til denne listen.

Prosjektet skal etter planen avsluttes 28.02.2023. Opplysningene om deg vil bli anonymisert eller slettet senest fem år etter prosjektslutt.

FORSIKRING

Det er ikke nødvendig med særegen forsikring for deltakelse i denne forundersøkelsen. Som deltaker i forundersøkelsen er du forsikret dersom det skulle oppstå skade eller komplikasjoner som følge av deltakelse i forskningsprosjektet. NIH er en statlig institusjon og ikke et forsikringsselskap, dette innebærer at NIH dekker en eventuell erstatning. For skade på mennesker som oppstår under medisinske forsøk, gjelder pasientskadeloven.

GODKJENNINGER

Regional komité for medisinsk og helsefaglig forskningsetikk har gjort en forskningsetisk vurdering og godkjent hovedstudien og forundersøkelsen (2018/2312/REK sør-øst D).

Etter ny personopplysningslov har behandlingsansvarlige NIH og Sandra Bjordal Gluppe et selvstendig ansvar for å sikre at behandlingen av dine opplysninger har et lovlig grunnlag. Norsk senter for forskningsdata (NSD) har, på vegne av NIH, vurdert at prosjektet er i overensstemmelse med personvernregelverket. Dette prosjektet har rettslig grunnlag i EUs personvernforordning artikkel (referansekode 440860). Du har rett til å sende klage til personvernombudet eller Datatilsynet på behandlingen av dine personopplysninger

KONTAKTOPPLYSNINGER

Dersom du har spørsmål til prosjektet, kan du ta kontakt med:

Prosjektleder: Sandra Bjordal Gluppe, 97523133, sandra.l.gluppe@hotmail.com

Hovedveileder: professor, dr.scient Kari Bø, 99047363, kari.bo@nih.no

Du kan ta kontakt med institusjonens personvernombud dersom du har spørsmål om behandlingen av dine personopplysninger i prosjektet: Karine Justad, 97536704, karine.justad@nih.no

JEG SAMTYKKER TIL Å DELTA I FORUNDERSØKELSEN OG TIL AT MINE PERSONOPPLYSNINGER BRUKES SLIK DET ER BESKREVET

Sted og dato	Deltakers signatur
	Deltakers navn med trykte bokstaver

Kjære deltaker,

Velkommen til denne spørreundersøkelsen.

Spørreundersøkelsen er del av et doktorgradsprosjekt ved Norges idrettshøgskole, Institutt for idrettsmedisinske fag. Forskningsprosjektet er fullfinansiert av Norske Kvinners Sanitetsforening.

Med dette spørreskjemaet ønsker vi å undersøke sammenheng mellom rectus diastase og funksjon/plager etter fødsel. Noen av spørsmålene er fra internasjonale standardiserte spørreskjemaer som benyttes innen forskning (ODI, PGQ og PFDI-20).

Ta deg god tid til å lese igjennom spørsmålene, det er viktig at du gir ærlige svar. Noen av spørsmålene kan virke personlige, men vi understreker at dine svar blir behandlet konfidensielt.

Det tar 15-30 minutter å gjennomføre spørreundersøkelsen.

NB: Dersom spørreskjemaet skulle stoppe å fungere eller henge underveis, logger du deg inn igjen og fortsetter der du falt ut.

På forhånd takk for hjelpen!

Jeg har mottatt informasjonsskriv tilsendt via mail, forstått informasjon om prosjektet og fått anledning til å stille spørsmål. Jeg samtykker til:

(1) ❑ å delta i elektroniske spørreskjema

(2) ❑ å delta i medisinske/fysiske tester

(3) ❑ at mine personopplysninger lagres etter prosjektslutt, til ca. 30.06.2023

De følgende spørsmålene omhandler bakgrunnsinformasjon om deg **i dag**

Alder (oppgi antall år)

_____

Sivilstatus

(1) ❍ Gift/samboende

(2) ❍ Bor alene (singel/skilt/separert)

Utdanningsnivå

(1) ❍ Universitet/høgskole

(2) ❍ Videregående

(3) ❍ Grunnskole

(4) ❍ Annet, oppgi _____

Genetisk opprinnelse. Hvilket opphav har dine foreldre? (Flere kryss hvis din mor og far har ulikt opphav)

(1) ❍ Europeisk (hvit/amerikaner med opphav fra Europa)

(2) ❍ Amerikansk urbefolkning (indianere/inuitter)

(3) ❍ Afrikansk, nord for Sahara eller Midt-Østen

(4) ❍ Afrikansk, sør for Sahara

(5) ❍ Asiatisk (inkl Pakistan og India)

(6) ❍ Øygruppene i Stillehavet inkl ubefolkning i Australia

(7) ❍ Usikker

Høyde (cm)

_____

Nåværende vekt (kg)

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Vekt før graviditet?

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Vektoppgang i ditt siste svangerskap?

(1) ❍ Ønsker ikke å oppgi

(2) ❍ Ant kg, oppgi _____

Røyker du?

(1) ❍ Ja, hver dag

(2) ❍ Ja, av og til

(3) ❍ Nei

Ammer du?

(1) ❍ Ja, 3 ganger eller mer daglig

(2) ❍ Ja, 1-2 ganger daglig

(3) ❍ Ja, 4-6 ganger pr uke

(4) ❍ Ja, 1-3 ganger pr uke

(5) ❍ Sjelden/aldri

Har du fått tilbake menstruasjonen etter fødselen?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Bruker du noen form for hormoner?

(1) ❍ Nei

(2) ❍ Ja (p-piller, p-ring, p-plaster)

(3) ❍ Ja (hormonspiral, p-sprøyte, implanon, minipille)

(4) ❍ Ja (østrogenstikkpiller i skjeden)

(5) ❍ Ja, annen hormonell behandling, hvilken? _____

Er du i arbeid nå for tiden?

(1) ❍ Ja

(2) ❍ Nei

Hvor lenge er det siden din siste fødsel?

(1) ❑ Mellom 6-7 måneder siden

(2) ❑ Mellom 7-8 måneder siden

(3) ❑ Mellom 8-10 måneder siden

(4) ❑ Mellom 10-12 måneder siden

Hvor ofte opplever du belastende løft på din arbeidsplass?

(1) ❍ Sjelden/aldri

(2) ❍ Mindre enn 20 ganger ukentlig

(3) ❍ Mer enn 20 ganger ukentlig

(4) ❍ 10-20 ganger daglig

(5) ❍ Mer enn 20 ganger daglig

Oppgi antall % lønnet arbeid

_____

De følgende spørsmål omhandler informasjon om barnet/barna dine.

Har du født tvillinger/trillinger?

(1) ❍ Ja

(2) ❍ Nei

Hvordan ble tvillingene/trillingene født?

(1) ❍ Vaginal fødsel

(2) ❍ Keisersnitt

(3) ❍ Vaginal fødsel og keisersnitt

Angi fødselsvekt for tvillingene/trillingene

Tvilling1/Trilling 1 _____

Tvilling2/Trilling 2	_____
Trilling 3	_____

Hvor mange barn du har født utenom tvillingene/trillingene?

(6) ❍ 0

(7) ❍ 1

(8) ❍ 2

(3) ❍ 3

(4) ❍ 4

(5) ❍ 5 eller flere

Angi fødselsvekt for ditt/dine barn (utenom tvillingene/trillingene)

Barn 1	_____
Barn 2	_____
Barn 3	_____
Barn 4	_____
Barn 5	_____

Hvor mange barn har du født?

(1) ❍ 1 barn

(2) ❍ 2 barn

(3) ❍ 3 barn

(4) ❍ 4 barn

(5) ❍ 5 eller fler barn

Angi fødselsvekt (g) på ditt/dine barn

Barn 1	_____
Barn 2	_____
Barn 3	_____
Barn 4	_____
Barn 5	_____

Hvordan ble barnet/ barna dine født?

(1) ❍ Vaginal fødsel

(2) ❍ Keisersnitt

(3) ❍ Jeg har født både vaginalt og med keisersnitt (ved flere barn)

Ved flere barn, hvor mange år det er mellom barna du har født (oppgi i hele år). Ved flere barn, vennligst angi antall år med komma mellom.

_____
_____
_____
_____

_____
_____

De følgende spørsmål omhandler helsen din **i dag**.

Hvordan vil du beskrive helsen din i dag?

(1) ❍ Svært god

(2) ❍ God

(3) ❍ Verken god eller dårlig

(4) ❍ Dårlig

(5) ❍ Svært dårlig

Har du noen av følgende sykdommer/plager i dag? (Flere kryss ved flere sykdommer)

(1) ❑ Diabetes

(2) ❑ Høyt blodtrykk

(3) ❑ Astma

(4) ❑ Revmatisk sykdom

(5) ❑ Psykiatrisk sykdom/lidelse

(6) ❑ Nevrologisk sykdom

(7) ❑ Hevelse i kroppen (ødem)

(8) ❑ Treg mage/forstoppelse

(9) ❑ Nei, ingen sykdommer

(10) ❑ Andre sykdommer

Har du navlebrokk i dag?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Har du hatt navlebrokk før?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

Har du blitt operert for navlebrokk?

(1) ❍ Ja

(2) ❍ Nei

Har du blitt operert i magen for andre grunner?

(1) ❍ Ja, oppgi _____

(2) ❍ Nei

De følgende spørsmål omhandler fysisk aktivitet og trening **i dag**.

Hvor ofte er du så fysisk aktiv (fritid eller arbeid) nå for tiden at du blir andpusten eller svett?

(1) ❍ Aldri

(2) ❍ Mindre enn en gang pr. uke

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3-4 ganger pr. uke

(6) ❍ 5 ganger pr. uke eller mer

Angi gjennomsnittlig hvor mange minutter pr. uke du er så fysisk aktiv (fritid eller arbeid) at du blir andpusten eller svett (1 time = 60 min)

_____

Kryss av for hva som best beskriver type fysisk aktivitet du bedriver nå for tiden (Flere kryss ved flere aktiviteter)

(1) ❑ Rolig gange/spasertur

(2) ❑ Rask gange/turgåing

(3) ❑ Løping/jogging/orientering

(4) ❑ Sykling

(5) ❑ Treningssenter/styrketrening

(6) ❑ Spesiell gymnastikk/aerobic for kvinner etter fødsel (bootcamp, strong mama m.f)

(7) ❑ Aerobics/gymnastikk/dans uten løp og hopp

(8) ❑ Aerobics/gymnastikk/dans med løp og hopp

(9) ❑ Yoga/ pilates

(10) ❑ Dansing (ballett, jazzdans, swing, rock, folkedans m.f)

(11) ❑ Skigåing

(12) ❑ Svømming

(13) ❑ Ridning

(14) ❑ Annet

Hvor ofte gjør du øvelser for magemusklene hjemme eller på trening nå for tiden?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Hvilke øvelser gjør du når du trener magemusklene? (Flere kryss ved flere svar)

(1) ❑ Ulike variasjoner av sit-ups/crunch

(2) ❑ Ulike variasjoner av planken

(3) ❑ Inndragning av navlen i ulike utgangsstillinger

(4) ❑ Bekkenvipp

(5) ❑ Andre magemuskeløvelser

(6) ❑ Gjør ikke magemuskeløvelser

I hvilke/hvilken av disse øvelsene mener du at bekkenbunnsmusklene trenes spesifikt? (Flere kryss ved flere svar)

(1) ❑ Sit-ups

(2) ❑ Planken

(3) ❑ Inndragning (trekke inn navlen)

(4) ❑ Seteløft

(5) ❑ Knebøy

(6) ❑ Vet ikke

(7) ❑ Ingen av alternativene ovenfor trener bekkenbunnsmusklene spesifikt

Spesifikk trening av bekkenbunnsmusklene innebærer å trekke sammen muskler rundt skjede, urinrør, endetarm.

Hvor ofte gjør du spesifikk trening for bekkenbunnsmusklene hjemme eller på trening nå for tiden?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Har du tidligere gjort spesifikk bekkenbunnstrening hjemme eller på trening?

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmålene omhandler muskel- og skjelettplager.

Svar for de siste 4 ukene.

Svar for de siste 4 ukene

Plages du med smerter i korsryggen?

(1) ❍ Ja

(2) ❍ Nei

Plages du med smerter i bekkenet?

(1) ❍ Ja

(2) ❍ Nei

Plages du med smerter i magen?

(1) ❍ Ja

(2) ❍ Nei

Stråler smertene fra ryggen ned i lår og/eller legg?

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmål omhandler hvordan ryggsmertene dine har påvirket din evne til å klare deg i dagliglivet (ODI).

Vennligst svar hva som best beskriver ditt **nåværende** problem.

Vennligst svar hva som best beskriver ditt **nåværende** problem.

Smerteintensitet

(1) ❍ Jeg har ingen smerter for øyeblikket

(2) ❍ Smertene er veldig svake for øyeblikket

(3) ❍ Smertene er moderate for øyeblikket

(4) ❍ Smertene er temmelig sterke for øyeblikket

(5) ❍ Smertene er veldig sterke for øyeblikket

(6) ❍ Smertene er de verste jeg kan tenke meg for øyeblikket

Personlig stell (vaske seg, kle på seg, osv.)

(1) ❍ Jeg kan stelle meg selv på vanlig måte uten at det forårsaker ekstra smerter

(2) ❍ Jeg kan stelle meg selv på vanlig måte, men det er veldig smertefullt

(3) ❍ Det er smertefullt å stelle meg selv, og jeg gjør det langsomt og forsiktig

(4) ❍ Jeg trenger noe hjelp, men klarer det meste av mitt personlige stell

(5) ❍ Jeg trenger hjelp hver dag til det meste av eget stell

(6) ❍ Jeg kler ikke på meg, har vanskeligheter med å vaske meg, og holder sengen

Løfte

(1) ❍ Jeg kan løfte tunge ting uten å få mer smerter

(2) ❍ Jeg kan løfte tunge ting, men får mer smerter

(3) ❍ Smertene hindrer meg i å løfte tunge ting opp fra gulvet, men jeg greier det hvis det som skal løftes er gunstig plassert, f.eks. på et bord

(4) ❍ Smertene hindrer meg i å løfte tunge ting, men jeg kan klare lette eller middels tunge ting, hvis det er gunstig plassert

(5) ❍ Jeg kan bare løfte noe som er veldig lett

(6) ❍ Jeg kan ikke løfte eller bære noe i det hele tatt

Gå

(1) ❍ Smerter hindrer meg ikke i å gå i det hele tatt

(2) ❍ Smerter hindrer meg i å gå mer enn 1 ½ km

(3) ❍ Smerter hindrer meg i å gå mer enn ¾ km

(4) ❍ Smerter hindrer meg i å gå mer enn 100 m

(5) ❍ Jeg kan bare gå med stokk eller krykker

(6) ❍ Jeg ligger for det meste i sengen og jeg må krabbe til toalettet

Sitte

(1) ❍ Jeg kan sitte så lenge jeg vil i en hvilken som helst stol

(2) ❍ Jeg kan sitte så lenge jeg vil i min favorittstol

(3) ❍ Smerter hindrer meg i å sitte i mer enn en time

(4) ❍ Smerter hindrer meg i å sitte i mer enn en halv time

(5) ❍ Smerter hindrer meg i å sitte i mer enn ti minutter

(6) ❍ Smerter hindrer meg i å sitte i det hele tatt

Stå

(1) ❍ Jeg kan stå så lenge jeg vil uten å få mer smerter

(2) ❍ Jeg kan stå så lenge jeg vil, men får mer smerter

(3) ❍ Smerter hindrer meg i å stå i mer enn en time

(4) ❍ Smerter hindrer meg i å stå i mer enn en halv time

(5) ❍ Smerter hindrer meg i å stå i mer enn ti minutter

(6) ❍ Smerter hindrer meg i å stå i det hele tatt

Sove

(1) ❍ Søvnen min forstyrres aldri av smerter

(2) ❍ Søvnen min forstyrres av og til av smerter

(3) ❍ På grunn av smerter får jeg mindre enn seks timers søvn

(4) ❍ På grunn av smerter får jeg mindre enn fire timers søvn

(5) ❍ På grunn av smerter får jeg mindre enn to timers søvn

(6) ❍ Smerter hindrer all søvn

Seksualliv

(1) ❍ Seksuallivet mitt er normalt og forårsaker ikke mer smerter

(2) ❍ Seksuallivet mitt er normalt, men forårsaker noe mer smerter

(3) ❍ Seksuallivet mitt er normalt, men svært smertefullt

(4) ❍ Seksuallivet mitt er svært begrenset av smerter

(5) ❍ Seksuallivet mitt er nesten borte på grunn av smerter

(6) ❍ Smerter forhindrer alt seksualliv

Sosialt liv

(1) ❍ Det sosiale livet mitt er normalt og forårsaker ikke mer smerter

(2) ❍ Det sosiale livet mitt er normalt, men øker graden av smerter

(3) ❍ Smerter har ingen betydelig innvirkning på mitt sosiale liv, bortsett fra at de begrenser mine mer fysisk aktive sider, som sport osv.

(4) ❍ Smerter har begrenset mitt sosiale liv og jeg går ikke så ofte ut

(5) ❍ Smerter har begrenset mitt sosiale liv til hjemmet

(6) ❍ På grunn av smerter har jeg ikke noe sosialt liv

Reising

(1) ❍ Jeg kan reise hvor som helst uten smerter

(2) ❍ Jeg kan reise hvor som helst, men det gir mer smerter

(3) ❍ Smertene er ille, men jeg klarer reiser på to timer

(4) ❍ Smerter begrenser meg til korte reiser på under en time

(5) ❍ Smerter begrenser meg til korte, nødvendige reiser på under 30 minutter

(6) ❍ Smerter forhindrer meg fra å reise, unntatt for å få behandling

Hvor i bekkenet har du vondt? (Flere kryss dersom du har vondt flere steder)

(1) ❑ Bak i bekkenet på høyre side

(2) ❑ Bak i bekkenet på venstre side

(3) ❑ Bak i bekkenet på begge sider

(4) ❑ Foran i bekkenet (symfysen)

Følgende spørsmål omhandler i hvilken grad du finner det problematisk pga plager fra bekkenet å utføre aktivitetene som er listet opp nedenfor. Velg alternativet som best beskriver hvordan du har det **nå for tiden** under hver aktivitet (PGQ).

Svar for hvordan du har det **nå for tiden.**

Hvor sterke smerter har du i bekkenet:

	Ingen	Noe	Moderate	Svært mye
Om morgenen	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Om kvelden	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Hvor problematisk på grunn av bekkenet å:

	Ikke i det hele tatt	I liten grad	I noen grad	I stor grad
Kle på deg selv	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Stå mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Stå mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Bøye deg	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Sitte mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Sitte mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå trapper	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Husarbeid	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Bære lett	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Løfte tungt	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Reise/sette seg	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Skyve en handlevogn	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Løpe	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Utføre sportslige aktiviteter	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Ligge	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Snu deg i sengen	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Ha et normalt seksualliv	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Skyve noe med den ene foten	(1) ❍	(2) ❍	(3) ❍	(4) ❍

I hvilken grad på grunn av plagene i bekkenet:

	Ikke i det hele tatt	I liten grad	I noen grad	I stor grad
Svikter beinet/beina under deg?	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Gjør du ting langsommere?	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Forstyrres nattesøvnen din?	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Følgende spørsmål omhandler smerter i magen. Svar for hvordan du har det **nå for tiden.**

Svar for hvordan du har det **nå for tiden.**

Hvor i magen har du vondt? (Flere kryss dersom du har smerter flere steder)

(1) ❑ Inni magen

(2) ❑ Ved navlen

(3) ❑ Over navlen

(4) ❑ Under navlen

Hvor mye påvirker smertene ditt hverdagsliv?
0 = ikke i det hele tatt
10 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

(8) ❍ 7

(9) ❍ 8

(10) ❍ 9

(11) ❍ 10

Har du symptomer i tarmen, blæren eller bekkenregionen som plager deg? For eksempel urinlekkasje, avføringslekkasje eller at du føler noe buler/faller ut fra skjeden.

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmålene omhandler hvorvidt du har visse symptomer i blæren, tarmen eller bekkenregionen, og i så fall hvor mye de plager deg (PFDI-20).

Vær snill og svar på spørsmålene ut fra de symptomer du har hatt gjennom **de siste tre månedene.**

Kjenner du du ofte trykk i nedre del av magen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte tyngdefølelse i bekkenet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Kjenner eller ser du noe som faller eller buler ut fra sjeden?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Må du ofte presse med fingre i skjeden eller rundt endetarmsåpningen for å få ut avføring eller få tømt tarmen helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du ofte at du ikke får tømt blæren helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hender det at du må trykke inn med fingrene noe som buler i skjeden, for å få tisset eller tømt blæren helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du at du må presse hardt for å få ut avføringen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du at du ikke har tømt tarmen helt, når du har hatt avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte avføringslekkasje når avføringen er fast?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte avføringslekkasje når avføringen er løs eller flytende?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte ufrivillig lekkasje av luft fra tarmen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte smerter når du har avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Opplever du så sterk avføringstrang at du må løpe til toalettet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hender det at en del av tarmen følger med ut gjennom endetarmsåpningen under eller etter avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du vanligvis hyppig vannlating?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Opplever du så sterk vannlatingstrang at du ikke rekker til toalettet før du får lekkasje?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte urinlekkasje når du hoster, nyser, ler eller under fysisk aktivtet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte små urinlekkasjer (dvs. dråper?)

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte problemer med å tømme blæren?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte smerte eller ubehag i nedre del av magen eller underlivet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du eventuelle kommentarer?

_____
_____
_____
_____
_____
_____

Tusen takk for at du var med i denne spørreundersøkelsen!

Kjære deltaker,

Velkommen til denne spørreundersøkelsen.

Spørreundersøkelsen er del av et doktorgradsprosjekt ved Norges idrettshøgskole, Institutt for idrettsmedisinske fag. Forskningsprosjektet er fullfinansiert av Norske Kvinners Sanitetsforening.

Med dette spørreskjemaet ønsker vi å undersøke sammenheng mellom rectus diastase og funksjon/plager etter fødsel. Noen av spørsmålene er fra internasjonale standardiserte spørreskjemaer som benyttes innen forskning (ODI, PGQ og PFDI-20).

Ta deg god tid til å lese igjennom spørsmålene, det er viktig at du gir ærlige svar. Noen av spørsmålene kan virke personlige, men vi understreker at dine svar blir behandlet konfidensielt.

Det tar 15-30 minutter å gjennomføre spørreundersøkelsen.

NB: Dersom spørreskjemaet skulle stoppe å fungere eller henge underveis, logger du deg inn igjen og fortsetter der du falt ut.

På forhånd takk for hjelpen!

De følgende spørsmålene omhandler bakgrunnsinformasjon om deg **i dag**

Bruker du noen form for hormoner?

(1) ❍ Nei

(2) ❍ Ja (p-piller, p-ring, p-plaster)

(3) ❍ Ja (hormonspiral, p-sprøyte, implanon, minipille)

(4) ❍ Ja (østrogenstikkpiller i skjeden)

(5) ❍ Ja, annen hormonell behandling, hvilken? _____

Er du i arbeid nå for tiden?

(1) ❍ Ja

(2) ❍ Nei

Hvor ofte opplever du belastende løft på din arbeidsplass?

(1) ❍ Sjelden/aldri

(2) ❍ Mindre enn 20 ganger ukentlig

(3) ❍ Mer enn 20 ganger ukentlig

(4) ❍ 10-20 ganger daglig

(5) ❍ Mer enn 20 ganger daglig

Oppgi antall % lønnet arbeid

_____

Ammer du?

(1) ❍ Ja, 3 ganger eller mer daglig

(2) ❍ Ja, 1-2 ganger daglig

(3) ❍ Ja, 4-6 ganger pr uke

(4) ❍ Ja, 1-3 ganger pr uke

(5) ❍ Sjelden/aldri

Har du fått tilbake menstruasjonen etter fødselen?

(1) ❍ Ja

(2) ❍ Nei

(3) ❍ Usikker

De følgende spørsmål omhandler helsen din **i dag**.

Hvordan vil du beskrive helsen din i dag?

(1) ❍ Svært god

(2) ❍ God

(3) ❍ Verken god eller dårlig

(4) ❍ Dårlig

(5) ❍ Svært dårlig

De følgende spørsmål omhandler fysisk aktivitet og trening **i dag**.

Hvor ofte er du så fysisk aktiv (fritid eller arbeid) nå for tiden at du blir andpusten eller svett?

(1) ❍ Aldri

(2) ❍ Mindre enn en gang pr. uke

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3-4 ganger pr. uke

(6) ❍ 5 ganger pr. uke eller mer

Angi gjennomsnittlig hvor mange minutter pr. uke du er så fysisk aktiv (fritid eller arbeid) at du blir andpusten eller svett (1 time = 60 min)

_____

Kryss av for hva som best beskriver type fysisk aktivitet du bedriver nå for tiden (Flere kryss ved flere aktiviteter)

(1) ❑ Rolig gange/spasertur

(2) ❑ Rask gange/turgåing

(3) ❑ Løping/jogging/orientering

(4) ❑ Sykling

(5) ❑ Treningssenter/styrketrening

(6) ❑ Spesiell gymnastikk/aerobic for kvinner etter fødsel (bootcamp, strong mama m.f)

(7) ❑ Aerobics/gymnastikk/dans uten løp og hopp

(8) ❑ Aerobics/gymnastikk/dans med løp og hopp

(9) ❑ Yoga/ pilates

(10) ❑ Dansing (ballett, jazzdans, swing, rock, folkedans m.f)

(11) ❑ Skigåing

(12) ❑ Svømming

(13) ❑ Ridning

(14) ❑ Annet

Hvor ofte gjør du øvelser for magemusklene hjemme eller på trening nå for tiden?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

Hvilke øvelser gjør du når du trener magemusklene? (Flere kryss ved flere svar)

(1) ❑ Ulike variasjoner av sit-ups/crunch

(2) ❑ Ulike variasjoner av planken

(3) ❑ Inndragning av navlen i ulike utgangsstillinger

(4) ❑ Bekkenvipp

(5) ❑ Andre magemuskeløvelser

(6) ❑ Gjør ikke magemuskeløvelser

Spesifikk trening av bekkenbunnsmusklene innebærer å trekke sammen muskler rundt skjede, urinrør, endetarm.

Hvor ofte gjør du spesifikk trening for bekkenbunnsmusklene hjemme eller på trening nå for tiden?

(1) ❍ Aldri

(2) ❍ 1-3 ganger pr. måned

(3) ❍ 1 gang pr. uke

(4) ❍ 2 ganger pr. uke

(5) ❍ 3 ganger eller mer pr. uke

De følgende spørsmålene omhandler muskel- og skjelettplager.

Svar for de siste 4 ukene.

Svar for de siste 4 ukene

Plages du med smerter i korsryggen?

(1) ❍ Ja

(2) ❍ Nei

Plages du med smerter i bekkenet?

(1) ❍ Ja

(2) ❍ Nei

Plages du med smerter i magen?

(1) ❍ Ja

(2) ❍ Nei

Stråler smertene fra ryggen ned i lår og/eller legg?

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmål omhandler hvordan ryggsmertene dine har påvirket din evne til å klare deg i dagliglivet (ODI).

Vennligst svar hva som best beskriver ditt **nåværende** problem.

Vennligst svar hva som best beskriver ditt **nåværende** problem.

Smerteintensitet

(1) ❍ Jeg har ingen smerter for øyeblikket

(2) ❍ Smertene er veldig svake for øyeblikket

(3) ❍ Smertene er moderate for øyeblikket

(4) ❍ Smertene er temmelig sterke for øyeblikket

(5) ❍ Smertene er veldig sterke for øyeblikket

(6) ❍ Smertene er de verste jeg kan tenke meg for øyeblikket

Personlig stell (vaske seg, kle på seg, osv.)

(1) ❍ Jeg kan stelle meg selv på vanlig måte uten at det forårsaker ekstra smerter

(2) ❍ Jeg kan stelle meg selv på vanlig måte, men det er veldig smertefullt

(3) ❍ Det er smertefullt å stelle meg selv, og jeg gjør det langsomt og forsiktig

(4) ❍ Jeg trenger noe hjelp, men klarer det meste av mitt personlige stell

(5) ❍ Jeg trenger hjelp hver dag til det meste av eget stell

(6) ❍ Jeg kler ikke på meg, har vanskeligheter med å vaske meg, og holder sengen

Løfte

(1) ❍ Jeg kan løfte tunge ting uten å få mer smerter

(2) ❍ Jeg kan løfte tunge ting, men får mer smerter

(3) ❍ Smertene hindrer meg i å løfte tunge ting opp fra gulvet, men jeg greier det hvis det som skal løftes er gunstig plassert, f.eks. på et bord

(4) ❍ Smertene hindrer meg i å løfte tunge ting, men jeg kan klare lette eller middels tunge ting, hvis det er gunstig plassert

(5) ❍ Jeg kan bare løfte noe som er veldig lett

(6) ❍ Jeg kan ikke løfte eller bære noe i det hele tatt

Gå

(1) ❍ Smerter hindrer meg ikke i å gå i det hele tatt

(2) ❍ Smerter hindrer meg i å gå mer enn 1 ½ km

(3) ❍ Smerter hindrer meg i å gå mer enn ¾ km

(4) ❍ Smerter hindrer meg i å gå mer enn 100 m

(5) ❍ Jeg kan bare gå med stokk eller krykker

(6) ❍ Jeg ligger for det meste i sengen og jeg må krabbe til toalettet

Sitte

(1) ❍ Jeg kan sitte så lenge jeg vil i en hvilken som helst stol

(2) ❍ Jeg kan sitte så lenge jeg vil i min favorittstol

(3) ❍ Smerter hindrer meg i å sitte i mer enn en time

(4) ❍ Smerter hindrer meg i å sitte i mer enn en halv time

(5) ❍ Smerter hindrer meg i å sitte i mer enn ti minutter

(6) ❍ Smerter hindrer meg i å sitte i det hele tatt

Stå

(1) ❍ Jeg kan stå så lenge jeg vil uten å få mer smerter

(2) ❍ Jeg kan stå så lenge jeg vil, men får mer smerter

(3) ❍ Smerter hindrer meg i å stå i mer enn en time

(4) ❍ Smerter hindrer meg i å stå i mer enn en halv time

(5) ❍ Smerter hindrer meg i å stå i mer enn ti minutter

(6) ❍ Smerter hindrer meg i å stå i det hele tatt

Sove

(1) ❍ Søvnen min forstyrres aldri av smerter

(2) ❍ Søvnen min forstyrres av og til av smerter

(3) ❍ På grunn av smerter får jeg mindre enn seks timers søvn

(4) ❍ På grunn av smerter får jeg mindre enn fire timers søvn

(5) ❍ På grunn av smerter får jeg mindre enn to timers søvn

(6) ❍ Smerter hindrer all søvn

Seksualliv

(1) ❍ Seksuallivet mitt er normalt og forårsaker ikke mer smerter

(2) ❍ Seksuallivet mitt er normalt, men forårsaker noe mer smerter

(3) ❍ Seksuallivet mitt er normalt, men svært smertefullt

(4) ❍ Seksuallivet mitt er svært begrenset av smerter

(5) ❍ Seksuallivet mitt er nesten borte på grunn av smerter

(6) ❍ Smerter forhindrer alt seksualliv

Sosialt liv

(1) ❍ Det sosiale livet mitt er normalt og forårsaker ikke mer smerter

(2) ❍ Det sosiale livet mitt er normalt, men øker graden av smerter

(3) ❍ Smerter har ingen betydelig innvirkning på mitt sosiale liv, bortsett fra at de begrenser mine mer fysisk aktive sider, som sport osv.

(4) ❍ Smerter har begrenset mitt sosiale liv og jeg går ikke så ofte ut

(5) ❍ Smerter har begrenset mitt sosiale liv til hjemmet

(6) ❍ På grunn av smerter har jeg ikke noe sosialt liv

Reising

(1) ❍ Jeg kan reise hvor som helst uten smerter

(2) ❍ Jeg kan reise hvor som helst, men det gir mer smerter

(3) ❍ Smertene er ille, men jeg klarer reiser på to timer

(4) ❍ Smerter begrenser meg til korte reiser på under en time

(5) ❍ Smerter begrenser meg til korte, nødvendige reiser på under 30 minutter

(6) ❍ Smerter forhindrer meg fra å reise, unntatt for å få behandling

Hvor i bekkenet har du vondt? (Flere kryss dersom du har vondt flere steder)

(1) ❑ Bak i bekkenet på høyre side

(2) ❑ Bak i bekkenet på venstre side

(3) ❑ Bak i bekkenet på begge sider

(4) ❑ Foran i bekkenet (symfysen)

Følgende spørsmål omhandler i hvilken grad du finner det problematisk pga plager fra bekkenet å utføre aktivitetene som er listet opp nedenfor. Velg alternativet som best beskriver hvordan du har det **nå for tiden** under hver aktivitet (PGQ).

Svar for hvordan du har det **nå for tiden.**

Hvor sterke smerter har du i bekkenet:

	Ingen	Noe	Moderate	Svært mye
Om morgenen	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Om kvelden	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Hvor problematisk på grunn av bekkenet å:

	Ikke i det hele tatt	I liten grad	I noen grad	I stor grad
Kle på deg selv	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Stå mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Stå mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Bøye deg	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Sitte mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Sitte mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå mindre enn 10 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gå mer enn 60 min	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Gå trapper	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Husarbeid	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Bære lett	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Løfte tungt	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Reise/sette seg	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Skyve en handlevogn	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Løpe	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Utføre sportslige aktiviteter	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Ligge	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Snu deg i sengen	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Ha et normalt seksualliv	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Skyve noe med den ene foten	(1) ❍	(2) ❍	(3) ❍	(4) ❍

I hvilken grad på grunn av plagene i bekkenet:

	Ikke i det hele tatt	I liten grad	I noen grad	I stor grad
Svikter beinet/beina under deg?	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Gjør du ting langsommere?	(1) ❍	(2) ❍	(3) ❍	(4) ❍
Forstyrres nattesøvnen din?	(1) ❍	(2) ❍	(3) ❍	(4) ❍

Følgende spørsmål omhandler smerter i magen. Svar for hvordan du har det **nå for tiden.**

Svar for hvordan du har det **nå for tiden.**

Hvor i magen har du vondt? (Flere kryss dersom du har smerter flere steder)

(1) ❑ Inni magen

(2) ❑ Ved navlen

(3) ❑ Over navlen

(4) ❑ Under navlen

Hvor mye påvirker smertene ditt hverdagsliv?
0 = ikke i det hele tatt
10 = i veldig stor grad

(1) ❍ 0

(2) ❍ 1

(3) ❍ 2

(4) ❍ 3

(5) ❍ 4

(6) ❍ 5

(7) ❍ 6

(8) ❍ 7

(9) ❍ 8

(10) ❍ 9

(11) ❍ 10

Har du symptomer i tarmen, blæren eller bekkenregionen som plager deg? For eksempel urinlekkasje, avføringslekkasje eller at du føler noe buler/faller ut fra skjeden.

(1) ❍ Ja

(2) ❍ Nei

De følgende spørsmålene omhandler hvorvidt du har visse symptomer i blæren, tarmen eller bekkenregionen, og i så fall hvor mye de plager deg (PFDI-20).

Vær snill og svar på spørsmålene ut fra de symptomer du har hatt gjennom **de siste tre månedene.**

Kjenner du du ofte trykk i nedre del av magen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte tyngdefølelse i bekkenet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Kjenner eller ser du noe som faller eller buler ut fra sjeden?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Må du ofte presse med fingre i skjeden eller rundt endetarmsåpningen for å få ut avføring eller få tømt tarmen helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du ofte at du ikke får tømt blæren helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hender det at du må trykke inn med fingrene noe som buler i skjeden, for å få tisset eller tømt blæren helt?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du at du må presse hardt for å få ut avføringen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Føler du at du ikke har tømt tarmen helt, når du har hatt avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte avføringslekkasje når avføringen er fast?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte avføringslekkasje når avføringen er løs eller flytende?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte ufrivillig lekkasje av luft fra tarmen?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte smerter når du har avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Opplever du så sterk avføringstrang at du må løpe til toalettet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hender det at en del av tarmen følger med ut gjennom endetarmsåpningen under eller etter avføring?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du vanligvis hyppig vannlating?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Opplever du så sterk vannlatingstrang at du ikke rekker til toalettet før du får lekkasje?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte urinlekkasje når du hoster, nyser, ler eller under fysisk aktivtet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte små urinlekkasjer (dvs. dråper?)

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte problemer med å tømme blæren?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Har du ofte smerte eller ubehag i nedre del av magen eller underlivet?

(1) ❍ Ja

(2) ❍ Nei

Hvor mye plager det deg?

(1) ❍ Ikke i det hele tatt

(2) ❍ Litt

(3) ❍ I noen grad

(4) ❍ Ganske mye

Hvordan vil du beskrive dine delte magemuskler i dag, sammenliknet med da du ble målt første gangen i denne studien?

(1) ❍ -5 veldig mye verre

(2) ❍ -4

(3) ❍ -3

(4) ❍ -2

(5) ❍ -1

(6) ❍ 0 uforandret

(7) ❍ 1

(8) ❍ 2

(9) ❍ 3

(10) ❍ 4

(11) ❍ 5 fullstendig tilhelet

Har du eventuelle kommentarer?

_____
_____
_____
_____
_____
_____

Tusen takk for at du var med i denne spørreundersøkelsen!

Klinisk undersøkelse, pre RCT

ID:

Dato:

Rectus diastase

Observerbar rectus diastase (v/crunch – ryggliggende på benk med bøyde ben)

Nei Ja, u/utbuling Ja, m/utbuling Går innover Usikker

Måling av rectus diastase (ultralyd, 2 cm over og 2 cm under navlen)

Hvile (ryggliggende på benk med bøyde ben, liten pute under hodet)

Kommando: *"Pust rolig inn og ut".*

2 cm under navlen ☐ 2 cm over navlen ☐

Crunch (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Pust rolig inn og ut." "Hold armene i kryss på brystet." "Løft hodet og bøy øvre del av ryggen opp fra underlaget helt til skulderbladene er fri." "Senk ned".*

2 cm under navlen ☐ 2 cm over navlen ☐

Muskeltykkelse (Pirri et al 2019)

Hvile (ryggliggende på benk med utstrakte ben, liten pute under hodet-3 MÅLINGER)

Kommando: *"Pust rolig inn og ut".*

2 cm over navlen ☐ ☐ ☐

HØYRE SIDE

- Har du forsøkt et eller flere tiltak/behandling med den hensikt om å få magemusklene til å gå sammen etter fødselen?
  - ❑ Ja
  - ❑ Nei

    - Hvis ja; Hva slags type tiltak/behandling har du forsøkt for delte magemuskler? (Flere kryss)
      - ❑ Kirurgi
      - ❑ Påføring av spesifikke kremer på magen
      - ❑ Ekstern støtte/korsett
      - ❑ Tape (f.eks. kinesio tape)
      - ❑ Elektrisk stimulering
      - ❑ Øvelser for bekkenbunnsmusklene
      - ❑ Øvelser for magemusklene
      - ❑ Annet:_____

    - Hvis ja; Fra hvem/hvor har du mottatt/funnet øvelser/behandling for delte magemuskler? (Flere kryss)
      - ❑ Øvelser/behandling jeg har funnet via internettsider/sosiale medier
      - ❑ Øvelser/behandling fra fysioterapeut
      - ❑ Øvelser/behandling fra naprapat/kiropraktor/osteopat
      - ❑ Øvelser/behandling fra treningssenter/personlig trener
      - ❑ Øvelser/behandling fra andre (familie/venner)

Høyde:_____(m) Vekt:_____(kg) Midjemål:_____(cm)

Leddbevegelighet

Hypermobilitet (Beighton)

- Ekstensjon 5. MCP **hø**. Hånd, over 90 grader? nei ja ugyldig test

  Eksakt (grader):_____

- Ekstensjon 5. MCP **ve**. Hånd, over 90 grader? nei ja ugyldig test

  Eksakt (grader):_____

- Kontakt **hø.** tommel mot underarm? nei ja ugyldig test
- Kontakt **ve**. tommel mot underarm? nei ja ugyldig test
- >10 grader hyperekstensjon **hø.** albue? nei ja ugyldig test
- >10 grader hyperekstensjon **ve.** albue? nei ja ugyldig test
- >10 grader hyperekstensjon **hø**. kne? nei ja ugyldig test
- >10 grader hyperekstensjon **ve.** kne? nei ja ugyldig test
- Håndflater lett i gulvet? nei ja ugyldig test

Total score:_____

Observerbare strekkmerker (stria: mage/sete/hofte/lår/bryst)

Strekkmerker fra tenårene nei ja usikker Hvor:_____

Strekkmerker under graviditet nei ja usikker Hvor:_____

Strekkmerker etter graviditet nei ja usikker Hvor:_____

Muskelstyrketesting

ACSM Curl-up test

Utholdende dynamisk styrketest av trunkusfleksorer

Kommando: *"Pust rolig inn og ut." "Du er klar." "Løft opp slik at du når teipen." "Følg takten til metronomen."*

Antall:_____(stk)

Kommentar:_____

Maks muskelstyrke (Humac)

Maksimal isometrisk trunkus fleksjon

Instruksjon:*"Er du klar?" "Pust inn." "Pust ut." "Bøy ryggen fremover og ta gradvis i alt du kan." "Kom igjen, ta i maks."* (Etter 5 sek.) *"Slapp av og pust vanlig."*

30 grader, Peak torque:_____ Nm

10 grader, Peak torque:_____ Nm

Kommentar:_____

Klinisk undersøkelse, post RCT

ID:

Dato:

Vekt:_____(kg) Midjemål:_____(cm)

Rectus diastase

Observerbar rectus diastase (v/crunch – ryggliggende på benk med bøyde ben)

Nei Ja, u/utbuling Ja, m/utbuling Usikker

Måling av rectus diastase (ultralyd, 2 cm over og 2 cm under navlen)

Hvile (ryggliggende på benk med bøyde ben, liten pute under hodet)

Kommando: *"Pust rolig inn og ut".*

2 cm under navlen ☐ 2 cm over navlen ☐

Crunch (ryggliggende på benk med bøyde ben, armene ned langs siden)

Kommando: *"Pust rolig inn og ut." "Hold armene i kryss på brystet." "Løft hodet og bøy øvre del av ryggen opp fra underlaget helt til skulderbladene er fri." "Senk ned".*

2 cm under navlen ☐ 2 cm over navlen ☐

Muskeltykkelse (Pirri et al 2019)

Hvile (ryggliggende på benk med utstrakte ben, liten pute under hodet-3 MÅLINGER)

Kommando: *"Pust rolig inn og ut".*

2 cm over navlen ☐ ☐ ☐

HØYRE SIDE

Muskelstyrketesting

ACSM Curl-up test

Utholdende dynamisk styrketest av trunkusfleksorer

Kommando: *"Pust rolig inn og ut." "Du er klar." "Løft opp slik at du når teipen." "Følg takten til metronomen."*

Antall:_____(stk)

Kommentar:_____

Maks muskelstyrke (Humac)

Maksimal isometrisk trunkus fleksjon

Instruksjon:*"Er du klar?" "Pust inn." "Pust ut." "Bøy ryggen fremover og ta gradvis i alt du kan." "Kom igjen, ta i maks."* (Etter 5 sek.) *"Slapp av og pust vanlig."*

30 grader, Peak torque:_____ Nm

10 grader, Peak torque:_____ Nm

Kommentar:_____