

## Exercises for pregnant and postpartum women with diastasis recti abdominis – literature review

## Ćwiczenia u kobiet w ciąży i po porodzie z rozstępem mięśnia prostego brzucha – przegląd piśmiennictwa

A – preparing concepts  
B – formulating methods  
C – conducting research  
D – processing results  
E – interpretation and conclusions  
F – editing the final version

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### Abstract

*Introduction:* Diastasis recti abdominis is a pathological condition at the linea alba in which rectus abdominis muscles separate. It occurs mainly in pregnant and postpartum women. Changes in the linea alba area are caused by stress to the tissue and pregnancy induced hormonal changes which lead to the loosening of abdominal connective tissue. This pathological condition is not manifested with any pain symptoms but the effects which may develop as a result of diastasis recti abdominis may cause pain.

This literature review study discusses the non-surgical methods of treating diastasis recti abdominis by reducing the distance between the two parts of the rectus abdominis muscle.

*Material and methods:* Scientific literature on physiotherapy, surgical treatment and diagnostics of diastasis recti abdominis in pregnant and postpartum women from the last 15 years was analysed. Such databases as Google Scholar, PubMed, ScienceDirect, Ebsco and MedLine were used in the analysis and 11 publications were considered.

*Results:* Having analysed the available literature, it was concluded that abdominal exercises can prevent or reduce diastasis recti abdominis. However, the analysis did not reveal which method of treatment was the most effective.

*Conclusions:* This review of the literature revealed that there is not currently a gold standard method of treating diastasis recti abdominis. However, abdominal exercises during pregnancy reduce the risk of this condition postpartum. Diastasis recti abdominis may be reduced even a few years after childbirth by implementing appropriate treatment including a special training programme focusing on strengthening anterior abdominal wall and learning to maintain a proper body posture during activities of daily living.

### Key words:

physiotherapy, pregnancy, Rectus Abdominis, postpartum, diastasis recti

### Streszczenie

*Wstęp:* Rozstęp mięśnia prostego brzucha to patologiczna zmiana w obrębie kresy białej polegająca na powstaniu szczeliny pomiędzy brzuścami mięśnia prostego brzucha. Pojawia się szczególnie u kobiet w czasie ciąży oraz po porodzie. Do zmian w obrębie kresy białej przyczyniają się hormony, które wpływają na rozluźnienie tkanki łącznej. Ta patologiczna zmiana nie objawia się żadnymi dolegliwościami bólowymi ale następstwa, które mogą rozwinąć się w wyniku rozstępu mogą powodować ból.

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The research was financed from the authors' own resources  
Badania sfinansowane ze środków własnych autorów

Celem niniejszej pracy było omówienie niechirurgicznych sposobów zmniejszenia rozejścia mięśnia prostego brzucha, które wpływają na zwięźlenie dystansu pomiędzy dwoma częściami mięśnia prostego brzucha na podstawie przeglądu piśmiennictwa.

*Materiały i metody:* Przeanalizowano piśmiennictwo naukowe z ostatnich 15 lat z zakresu postępowania fizjoterapeutycznego i operacyjnego, diagnostyki w przypadku rozejścia mięśni prostych brzucha u kobiet w ciąży i po porodzie. Wykorzystano bazy naukowe takie jak Google Scholar, PubMed, ScienceDirect, Ebsco, MedLine włączając 11 prac.

*Wyniki:* Po dokonaniu analizy przeglądu piśmiennictwa stwierdzono, że ćwiczenia mięśni brzucha zapobiegają lub zmniejszają rozstęp mięśni prostych brzucha. Analiza nie wykazała jednak najskuteczniejszej metody leczenia.

*Wnioski:* Na podstawie przeglądu piśmiennictwa stwierdzono, że nie ma jednoznacznej metody zwalczającej rozstęp mięśnia prostego brzucha. Natomiast ćwiczenia mięśni brzucha przed porodem zmniejszają ryzyko wystąpienia rozstępu po porodzie. Zwięźlenie rozstępu można uzyskać nawet po kilku latach od porodu po wprowadzeniu odpowiedniego leczenia, które obejmuje specjalny program treningowy skupiający się na wzmocnieniu przedniej ściany tułowia oraz odpowiedniej edukacji postawy podczas codziennych aktywności.

**Słowa kluczowe:** fizjoterapia, ciąża, prosty brzucha, po porodzie, rozstęp mięśni prostych

## Introduction

Diastasis recti abdominis (DRA) is defined as the separation of rectus abdominis muscle at the linea alba which connects the two parts of this muscle. This condition occurs primarily in pregnant women (usually in the third trimester) but it may also be noted in men, obese middle-aged individuals, newborns and infants [1]. This condition is experienced by 100% of women 35 weeks pregnant [2]. It may continue for 6 weeks postpartum in 50%-60% of women or even for 6 months postpartum in 39%-45% of women [3]. DRA does not produce any pain symptoms. Pain may occur only when the effects of this condition appear. Abdomen, perineum and pelvic floor tissues are stretched during pregnancy. They do not always return to the initial state after childbirth. The consequences of the abdominal contents shifting anteriorly due to DRA can result in changes in body statics with the centre of gravity moving 2 centimetres forward. Properly contracted muscles keep the viscera in an appropriate position, which prevents them from exerting excessive pressure on the lumbar spine. It is also connected with maintaining a proper body posture and preventing excessive pelvis anteversion and lumbar lordosis. Therefore, functional disorders of abdominal muscles may lead to spinal pain and dysfunction and other complications such as abdominal hernia [4]. A bulge in the area of anterior median line of the abdomen which can be observed in individuals with

DRA is also an aesthetic problem. The potential consequences of DRA justify the importance of treating DRA [5].

This literature review study discusses the non-surgical methods of treating DRA by reducing the distance between the two parts of the rectus abdominis muscle.

## Material and methods

Peer reviewed articles on DRA diagnostics and physiotherapy in pregnant and postpartum women from the last 15 years were analysed in our study. In addition, one article from 1996 was also considered as it included information significant for this review. Excluding this article would reduce the value of our paper. Sheppard (1996) described a detailed DRA treatment procedure which she implemented in the case of a female patient 2 years postpartum.

Such scientific databases as Google Scholar, PubMed, ScienceDirect, Ebsco and MedLine were used. The following keywords were selected while searching for articles:

- diastasis recti + physiotherapy + exercises + treatment
- diastasis recti abdominis muscle (DRAM)
- abdominis recti (AR)
- inter-recti distance (IRD).

Articles which did not deal with non-surgical treatment of diastasis recti abdominis or presented a low content-related value were excluded from the study.

## Results

In total, 40 articles were found. Of the articles identified, 11 were analysed and DRA treatment methods were presented. The articles that were taken into consideration for this review are listed in table 1.

The issue of DRA prevention and treatment was analysed by Benjamin et al. (2014), who concluded that exercises engaging the transversus abdominis muscle may potentially protect the linea alba, prevent and reduce DRA and accelerate women's return to physical activity [6].

Sancho et al. (2015) compared DRA at rest between females who had vaginal delivery and those who underwent caesarean section. No significant differences regarding DRA evaluated at rest were found between these two groups. The distance increased during drawing-in exercises and decreased during abdominal crunch exercises. The research revealed that drawing-in exercises are less effective than abdominal crunch exercises [7].

Mota et al. (2015) assessed the effects of the exercises described by Sancho et al. (drawing-in and abdominal crunch exercises) on the width of the linea alba. The measurements were made with the use of ultrasound imaging in 3 locations on the linea alba (2 cm below as well as 2 cm and 5 cm above the umbilicus) at rest and during exercise. They were performed at 4 time points (35-41 weeks of gestation as well as 6-8, 12-14 and 24-26 weeks postpartum). A considerable decrease in DRA 2 cm below the umbilicus was noted at 35-41 weeks of gestation compared to an increase in DRA in all the 3 postpartum time points. During the abdominal crunch exercise, DRA decreased in all the locations at the linea alba in all time points, except for the location 2 cm below the umbilicus at 24-26 weeks postpartum. Drawing-in exercises led to a considerable increase in DRA 2 cm below the umbilicus. IN summary, the authors highlighted the fact that performing the abdominal crunch exercise program led to a considerable decrease in DRA, while drawing-in exercise program resulted a slight increase in DRA [8].

The aim of the study by Pascoal et al. (2014) was to determine the effects of using isometric exercises of the abdominal muscles on the magnitude of DRA. It was concluded that postpartum women had considerably bigger DRA than the control group of nulliparous women. DRA was found to be

significantly smaller during an isometric contraction than at rest in both groups; however, in postpartum women, DRA was significantly bigger at rest than during isometric contraction. The need for including isometric exercises for the prevention and treatment of DRA in postpartum women was supported [9].

Benerjee et al. (2013) carried out research aimed at assessing the effects of routine antenatal exercises only and antenatal combined with abdominal strengthening exercises on postpartum woman with DRA. Group A, (n=15), received the antenatal exercise program complete with abdominal strengthening exercises, while group B(n=15), received a program involving antenatal exercises only. The exercise programs were performed three times per week for 16 weeks. DRA was measured with a dial caliper. In group A, the DRA in 7 woman was resolved, whereas in group B, it only resolved in 1. Implementing abdominal exercises may reduce the risk of DRA but it will not eliminate the risk completely. A weakness of this paper was that the study participants were not supervised and the exercise protocols were not precisely defined [10].

This study looked at the effects of an antenatal exercise program, developed by Chiarello et al. (2005), on pregnant women with DRA. The research included two groups of women at 16-35 weeks of gestation. The study group included 8 women participating in an antenatal abdominal exercise programme, while the control group consisted of 10 women who did not perform the exercise prior to delivery. DRA was measured via caliper at three points, (4.5 cm above the umbilicus, at the umbilicus and 4.5 cm below the umbilicus). The exercises involved the strengthening of abdominal muscles and pelvic floor muscles. The training was divided into 5 parts: 1. pelvic movements: pelvic ante- and retroflexion in a supine position, while standing and on all fours, 2. pelvic ante- and retroflexion in a sitting position and in a supine position with lifted head, 3. contracting the transversus abdominis muscle with a simultaneous movement of lifting one's head and activating pelvic floor muscles, 4. contracting the transversus abdominis muscle with simultaneous strengthening of upper limbs with the use of a tape while lying on one's side and back. The exercise programme included 6 sessions, each lasting 90 minutes. At the conclusion of the study the non-exercising women demonstrated DRAs that were greater than 2 cm, while in the group of

exercising participants, only one out of the eight women presented with clinical DRA [11].

A case study by Hsia and Jones (2000) included two women; a 33-year-old physiotherapist (A), who was 36 weeks pregnant and a 28-year-old shop assistant (B), who was 38 weeks pregnant; both participated in an antenatal exercise program. The measurements were made via a caliper at the umbilicus, 45 mm below and 45 mm above the umbilicus. The measurements were performed 3 times a week for a maximum of 16 weeks at the same time of day at the participants' homes. The first postpartum measurements were made 24 hours after delivery in the case of participant A and 48 hours after delivery in participant B. The results revealed that in both women, DRA increased considerably during pregnancy at the whole linea alba, while the largest distance was noted at the umbilicus. In participant A, DRA increased after the delivery, which may have been affected by increased pushing during the delivery. The delivery by participant B was less demanding and the postpartum measurements revealed a decrease in DRA [12].

Gilleard and Brown (1996) assessed the structural adaptation and functional capabilities of abdominal muscles during pregnancy and immediate postpartum period in primigravid women. The authors concluded that as the DRA increased during the course of pregnancy the length and angle of insertion of the rectus abdominis muscle also changed. Normalization of these values typical occurred in the 4<sup>th</sup> week postpartum, when the width of DRA as well as rectus abdominis length and angle of insertion decreased. The functional ability to stabilise the pelvis against resistance decreased during pregnancy and did not change until 8 weeks postpartum [13].

Emanuelsson (2014) analysed the effectiveness of various surgical and physiotherapeutic methods on the resulting DRA. In the first group, including 29 participants, abdominal hernia was repaired with a retromuscular mesh. In the other group, 27 patients underwent operations with the use of a knotless suture technique. Emanuelsson created a post-operative training program for these patients to follow. This training program was followed by 30 non-surgical patients and 56 patients who underwent surgeries. All the patients were females with pregnancy-related DRA (type A). The quality of life, pain and abdominal muscle strength were assessed one year after the surgery.

Physiotherapy procedures lasted three months and involved the strengthening of the rectus abdominis muscle, abdominal oblique muscle and transversus abdominis muscle. [4].

Apart from type A diastasis, there are also types B, C and D. This typology was created by Nahas in order to classify patients for abdominoplasty. Type A develops in patients who have pregnancy-related DRA and in this case, plication of both sides of rectus abdominis is recommended. Type B is found in patients who have a laxity of the lateral and inferior areas of the abdominal wall which is visible after the approximation of anterior sheaths of the rectus abdominis muscle. Type C refers to patients whose rectus abdominis muscle is inserted laterally on the costal margins. In this case, the insertion is released from posterior sheath and is attached to the anterior sheath. Type D includes patients with poor waistline definition and they undergo a procedure involving external oblique muscle rotation connected with the plication of the anterior sheath of rectus abdominis [14]. Patients received individual written instructions from a physiotherapist regarding particular exercises. Two versions of training were described in the study. During the training programme, several patients complained about difficulties performing the exercises and/or pain during the training. Therefore, exercises were modified and an alternative training program was developed. The patients who were not satisfied with the effects of the training were offered a surgery. The exercises included: inter alia, contracting abdominal muscles in a supine position with upper limbs crossed over one's chest combined with lifting one's head and shoulders from the floor, bending one leg against the abdomen while lifting the other straight leg off the floor in a stabilised sitting position, contracting abdominal muscles and turning one elbow towards the opposite knee, shifting bent knees to the right and left side in a stabilised sitting position, contracting pelvic floor muscles while lying on one's back or on one side, contracting abdominal muscles in a supine position while lifting one leg and pushing the knee against the opposite hand, lifting one's pelvis off the floor while lying on one's back with knees bent and feet held together on the floor, lifting the upper knee by rotating the hip while lying on one side, lifting one arm and the opposite leg to the horizontal position while standing on all fours and holding the position for 5-10 seconds, lifting one knee up by 10 degrees

without bending the spine or pelvis in a sitting position and maintaining the position for 10 seconds, lifting the knee to 90 degrees without bending the spine or pelvis while standing straight on one leg. The results revealed that 26 patients were not satisfied with the effects of training and underwent a surgery. The lack of satisfaction resulted from the fact that the bulge in the median line of the body and pain did not disappear. An improvement in the strength of the anterior abdominal wall assessed by the study participants was considerably smaller than in the groups of patients who underwent a surgery. Pain was not relieved after 3 months of exercising. Patients after surgical treatment experienced a decrease in pain and disability during activities of daily living. From the 1-year follow-up observations, Emanuelsson concluded that both surgical techniques produced identical results in treating DRA. However, the training program did not meet the expectations of the study participants because, although their muscle strength improved, they would have to continue the training in order to maintain this strength [4].

Litos (2014) presented a case study in which they reported a detailed program developed for a 32-year-old African-American woman during her second pregnancy who was referred to a physiotherapist by her obstetrician 7 weeks postpartum due to a wide DRA and weak abdominal muscles. This woman continued to jog for most of her pregnancy, but gave it up in the third trimester due to back pain and general discomfort. She felt pain while lifting objects, bending down, standing or walking. The patient stopped breastfeeding as she was not able to hold her baby for more than 10 minutes. An active range of flexion in the lumbar spine, lateral flexion and rotation in a standing position were within the norm. Muscle strength in lower limbs was assessed at the level of 5/5, except for hip flexion (limited because of pain) which was evaluated at the level of 2/5. Trunk muscle strength was assessed as weak during functional activities (moving from sitting to standing, from sitting to lying on one's side, from sitting to lying on one's back). Moreover, the patient could not maintain isometric contraction of the rectus abdominis muscle. DRA was evaluated by palpation with fingers held horizontally. At umbilicus, DRA was 11.5 cm wide, 4.5 cm below the umbilicus it was 3 cm wide and 4.5 cm above the umbilicus it was 8 cm wide. The results of SLR test, Gillet test, Trendelenburg test and deep squat

test were positive. The therapeutic program which was prepared for the patient involved 2-3 visits a week for 18 weeks in the period of 4 months. The patient wore a corset to ensure stability during functional activities and to protect the aorta as there was a risk of damaging it. The patient also exercised at home focusing on activating the abdomen, trunk and pelvic floor muscles. The patient was advised to avoid activities which may have increased her DRA. It was recommended that she should not take a position on all fours due to gravity forces, perform hyperextension in the lumbar spine or perform Valsalva maneuver. She was advised to place loads symmetrically on her pelvis when in a sitting and standing position and she was taught how to maintain a proper position during activities requiring a sitting or standing position in order to ensure optimal muscle activity. The patient was also taught abdominal muscles and pelvic floor muscles activation and diaphragmatic breathing while changing the position (turning from one side to the other, sitting up, sitting down) and during activities requiring lifting. She was advised to control and support abdominal muscles with her hands or with a pillow to bring both parts of the rectus abdominis muscle together and reduce the pressure inside the abdominal cavity while coughing, laughing and sneezing. As a result of this intervention her reported pain was eliminated and the DRA at the umbilicus was reduced from the initial 11.5 cm to 2 cm 7 weeks postpartum. The patient returned to physical activity from before childbirth and did not have any problems with activities of daily living [15].

Acharry and Kutty (2015) studied 30 women within 1 month after delivery who were diagnosed with DRA on the basis of palpation examination at the umbilicus, 5 cm above and 5 cm below the umbilicus. The women were instructed how to perform exercises aimed at bringing both sides of the rectus abdominis muscle together. The training included static abdominal exercises performed in a supine position. For example, the patient crossed her arms above the separation for stability and pushed the external sheaths to the middle line in order to achieve isometric contraction of abdominal muscles. Another exercise involved lifting one's head while exhaling with simultaneous contraction of the rectus abdominis muscle and with arms crossed above the separation for stability until a bulge appeared at the median line of the body. Then, the patient pushed both sides of rectus abdominis together, slowly

lowered the head and loosened the muscles. In order to stabilise the abdomen and bring the parts of rectus abdominis together, a towel wrapped around the trunk could also be used instead of hands. An exercise with the use of visualisation was one of the most interesting exercises. A patient was supposed to imagine a clock face placed on a lower part of the abdomen (12 o'clock was placed under the xiphoid process) and began slight pelvis movements from 12 to 6 o'clock, then from 3 to 9 o'clock, from 12 to 3 o'clock, from 6 to 9 o'clock and from 9 to 12 o'clock. The patients were instructed to perform 5-7 repetitions of the above exercises twice a day for 2 weeks. At the onset of the study the mean DRA among the study participants was 3.5 fingers wide, while after two weeks of exercising it decreased to 2.5 fingers. The authors concluded that non-surgical DRA treatment methods may prevent or reduce DRA in the postpartum period [16].

Sheppard (1996) implemented a 4-month re-education of the transversus abdominis muscle with 60 mm diastasis recti in a patient 2 months postpartum. The physiotherapeutic procedure included re-education of the transversus abdominis muscle which began from activating this muscle in a supine position and progressing to the position on all fours. At the beginning, the patient was able to maintain the contraction for 2 seconds. The contraction was repeated 10 times in a supine

position. After 16 weeks, DRA decreased to 7 mm. In the final phase of the therapy, the contraction of the transversus abdominis muscle was maintained for 10 seconds and the patient was able to repeat it 10 times. According to Sheppard (1996), within the first days and weeks of the postpartum period it is not recommended to exercise in the position on all fours since DRA may increase as a result of gravity forces. A supine position, half-sitting position with arms as a support and lying on one side were more appropriate at early stages of the postpartum period. After learning to activate the transversus abdominis muscle in these positions, it was possible to move to the position on all fours [17].

Sharma (2014) compared the results on DRA in women who started their exercise program while pregnant versus those who started postpartum. All the women were under the supervision of the same trainer. The program included isometric contractions of the transversus abdominis muscle, resistance training and cardiovascular exercises. In both groups, DRA was decreased considerably, but there were no statistically significant differences between the groups regarding the width of DRA. Women who started the training program aimed at reducing DRA after delivery achieved the same results as women who started exercising already during pregnancy [18].

**Tab. 1.** The results of the analysis of the studies by other authors

Author	Material and method	Results and summary
Sancho et al., (2015) [7]	- Abdominal crunch - Drawing-in - Combination of 1 and 2	Abdominal crunch reduced DRA, drawing-in exercises did not reduce DRA
Mota et al., (2015) [8]	- Abdominal crunch - Drawing-in	Considerable decrease in DRA during abdominal crunch, a slight reduction in DRA during drawing-in exercises
Pascoal et al., (2014) [9]	Isometric contraction of abdominal muscles	Reduction in DRA during contraction
Benerjee et al. (2013) [10]	Two groups: group A – antenatal exercises + abdominal strengthening exercises group B – antenatal exercises only	Abdominal strengthening exercises reduced the risk of DRA in group A. Group A included 53% of the participants who had DRA, while group B included 93% of the women with DRA.
Chiarello et al., (2005) [11]	Two groups: 1. Exercising before delivery: pelvic ante- and retroflexion, contracting the transversus abdominis muscle and pelvic floor muscles, + strengthening upper and lower limbs, 2. Non-exercising before delivery.	Exercising during pregnancy reduced the risk of DRA. In the group of exercising participants, 12.5% of the women exhibited DRA, while in the non-exercising group, 90% had DRA. In the exercising group, DRA was much narrower than in the non-exercising group.
Hsia, Jones, (2000) [12]	Comparison of two pregnant women: A – non-exercising, increased pushing during delivery, B – participant of antenatal exercise programme, less demanding delivery	DRA increased considerably during pregnancy in woman A and B. After delivery, DRA in woman A increased, while in woman B it decreased.
Emanuelsson, (2014) [4]	Assessment of the effects of the training programme of exercises engaging abdominal muscles.	The lack of satisfaction of the study participants caused by the long-lasting pain and bulge in the median line of the body. An improvement in trunk muscle strength.

Litos, (2014) [15]	Progressive exercises programme focusing on the activation of the transversus abdominis muscle and pelvic floor muscles, patient education, using braces.	The therapy eliminated pain, DRA was reduced completely, the patient returned to physical activity from before delivery, no problems with ADL.
Acharry, Kutty, (2015) [16]	The programme of isometric exercises in a supine position: - pushing the two parts of the rectus abdominis muscle together towards the median line of the body with one's hands, - stabilising DRA with one's hands combined with pelvis retroflexion, - pelvis movements.	DRA reduced by 71% after two weeks of training.
Sheppard, (1996) [17]	Re-education of the transversus abdominis muscle two years after delivery. Contractions of transversus abdominis progressing with the therapy from the supine position to the position on all fours.	Reduction in DRA by 88% after 4-month treatment. Eliminating low back pain. Strengthening abdominal muscles.
Sharma, (2014) [18]	Comparison of two groups of women exercising: 1. during pregnancy, 2. during postpartum period. Exercises of the transversus abdominis muscle, resistance training, cardiovascular exercises.	In both groups, DRA decreased considerably, there were no significant differences between the groups.

DRA – diastasis recti abdominis

ADL – activities of daily living

## Discussion

Sancho et al. (2015), Mota et al. (2015) and Pascoal et al. (2014) concluded that in postpartum women, contracting all abdominal muscles reduced DRA, while contracting the transversus abdominis muscle did not reduce DRA or reduced it to a small extent.

According to Benerjee et al. (2013), Chiarello et al. (2005) as well as Hsia and Jones (2000), exercises strengthening abdominal muscles performed during pregnancy reduced the risk of DRA postpartum.

The majority of the authors noted the participants' satisfaction with physiotherapy and the reduction in complaints (Litos (2014), Acharry, Kutty (2015), Sheppard (1994), Sharma (2014)). In turn, the lack of satisfaction of the participants caused by long-lasting pain and bulge in the median line of the body despite an improvement in trunk muscle strength was reported in the research by Emanuelsson (2014).

While present the issue of DRA is not widespread in Poland. The results of research by Rajkowska and Szumilewicz (2014) revealed that the majority of the examined women did not know what DRA is and whether they experienced this problem [19]. It leads to the fact that they rarely seek therapists' help. In the research by Keeler et al., the majority of the physiotherapists (90.3%) participating in the survey regarding the techniques which they apply in DRA treatment had 1% to 30% of patients with DRA, while only 5 therapists responded that patients with DRA constituted 61% to 75% of all their patients. DRA is frequently not noticed by patients and not diagnosed properly by therapists. Usually, prior to detecting the problem with the rectus abdominis

muscle, such issues as low back pain (80.7%), pelvic floor muscles dysfunction (67.0%), pelvic area pain (59.5%) or urinary incontinence (59.4%) are initially diagnosed. Less than a half of the surveyed physiotherapists diagnosed DRA in the first place. Other diagnoses mentioned in the comments section by the physiotherapists under examination included abdominal pain, faecal incontinence, hip pain, considerable muscle weakness, painful bladder syndrome, vulvar vestibulitis syndrome, interstitial cystitis or disc herniation. Symptoms which were perceived by patients as the most important included pain (75.9%) and/or weaker muscles (69.7%), urinary incontinence (56.9%), anaesthetic abdomen. Other symptoms included pelvic organ prolapse, general fatigue and weakness, faecal incontinence, abdominal swelling, inability or difficulty performing exercises, bad posture, muscular imbalance, pain in the area of pelvis, lower limbs and sacroiliac joints as well as pain during intercourse. While assessing DRA, physiotherapists most often applied palpation method, i.e. "finger widths". In turn, 17% of the therapists used measuring tape, approximately 4% used ultrasonography, while only 1.7% of the physiotherapists measured DRA with a caliper. The questionnaire included a question regarding therapeutic exercise techniques used in the treatment of DRA. A vast majority of the respondents (89%) applied a general training of the transversus abdominis muscle in their treatment programmes, 87% of the therapists used pelvic floor muscles training, while 82.8% of the physiotherapists included transversus abdominis muscle exercises in the functional training. Elizabeth Noble technique was applied by 62.5% of the respondents. It involves

pushing both sides of the rectus abdominis muscle together while performing an incomplete bend in a sitting position. A smaller number of therapists selected a general training of abdominal muscles combined with Julie Kupler technique which includes progressive contractions of the transversus abdominis muscle with or without contracting other abdominal muscles. A small percentage of physiotherapists indicated Pilates with the use of specialist equipment as a method that they employ. Other exercise techniques mentioned in the comments section used by the respondents included diaphragmatic breathing, multifidus muscle training, PNF, Shirley Sahrmann abdominal exercises, mat Pilates, isolated rectus abdominis muscle exercises, strengthening pelvic girdle, whole body vibration techniques. The majority of the physiotherapists (60%) applied manual therapy in their work. They also used, *inter alia*, myofascial release, trigger point release, muscle energy techniques, visceral manipulations, manual unloading during abdominal muscle contractions, mobilisation of soft tissues, pelvis, lumbar spine, coccyx and pubic symphysis. Moreover, the therapists supported abdominal muscles with the use of bandages or corsets, kinesiotaping, biofeedback, thermotherapy or ultrasound therapy. In addition, Russian electrostimulation and laser therapy were applied to relieve pain. The application of elastic abdominal binders was perceived as a common treatment technique among the examined physiotherapists. In the group of therapists, 56% of the respondents instructed their patients to wear a binder during tiring activities requiring a lot of effort, 39.7% advised their patients to wear a binder during exercises, 38.5% recommended putting on an abdominal binder during activities of daily living, while 32.0% did not recommend it. In turn, 36% of the physiotherapists instructed their patients to exercise twice a day, 28.6% – once a day, 19.5% – five times a week, 10% - six times a week and 5.7% – less than 5 times a week [20].

Women often experience from low back pain during pregnancy. Mota et al. and Sperstad et al. examined the correlation between DRA and low back pain and pelvic pain. In their research, Mota et al. revealed that the prevalence of pain among women 6 months postpartum diagnosed with DRA was the same as among women without DRA. The same result was revealed by Sperstad et al., who carried out research among women 12 months

postpartum. The results of the research indicated that DRA did not exert any influence on low back pain and pelvic pain [2,3].

Bø (2015) examined the correlation between DRA and the function of pelvic floor muscles. The study involved comparing vaginal muscle tone, pelvic floor muscles strength and pelvic floor muscles endurance in women with and without diagnosed DRA in the 21<sup>st</sup> week of gestation as well as 6 weeks, 6 months and 12 months postpartum. All the examined elements had higher values in women in the 21<sup>st</sup> week of gestation with diagnosed DRA than in females without DRA. No differences were noted between both groups of women in any of the periods and in any of the variables under investigation [21].

It is significant for physiotherapists to make women aware of DRA so that they can prevent it before pregnancy and know what consequences it may have if it is not treated. Treatment should be selected individually. It is necessary to carry out further research on a representative group of women to examine this issue more thoroughly and prepare detailed procedure algorithms.

## Summary

This literature review has demonstrated that abdominal exercises before delivery can reduced the risk of DRA postpartum. There is no consensus for the recommendations regarding physiotherapeutic methods of DRA treatment. Exercising all of the abdominal muscles was the most common theme. DRA is not a fixed condition and may be reduced even a few years postpartum by implementing appropriate treatment that includes a training program focusing on strengthening the anterior abdominal wall and teaching patients to maintain a proper posture during activities of daily living.



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