

A – preparing concepts
B – formulating methods
C – conducting research
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and conclusions
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version

Physiotherapy in women with diastasis of the rectus abdominis muscles

Postępowanie fizjoterapeutyczne u kobiet z rozstępem mięśni prostych brzucha

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Abstract

Introduction: Diastasis of the rectus abdominis muscles (DRAM) is the separation of the two rectus abdominis muscles more than 2 cm wide. It often arises as a result of android obesity, dysfunctional abdominal cramp and pregnancy. Untreated diastasis may lead to dangerous health consequences such as.: abdominal hernia, lower back pain or disorders in pelvis's area. The aim of this study was to determinate the effectiveness of novel physiotherapeutic program in women with diastasis of the rectus abdominis muscles.

Material and methods: The study was conducted on a group of 40 women between 20-45 years old (mean 32,32±5,9 year). They all were qualified in obstetric ward of Szpital Bielański in Warsaw. All of them were in the postpartum between 0-3 days after labor and have DRAM greater than 2 cm (measured by palpation on the umbilicus height, 4,5 cm above and below umbilicus). In research group (included 20 women) applied novel physiotherapeutic program aimed at reduction of DRAM. In controlled group (20 women) there was no therapy but only observation of spontaneous reduction of diastasis. The study took 6 weeks.

Results: Data analysis had shown 95% effectiveness of novel physiotherapeutic program. Chi-square test has confirmed the difference in DRAM size in both groups ($p < 0,0001$). A statistically significant correlation was demonstrated between width of diastasis and growth of the mother's weight gain in pregnancy, waist-to-hip ratio, BMI, number of delivery and mother's physical activity before and during pregnancy ($p < 0,05$). There wasn't clear correlation between width of diastasis and mother's age or infant's mass ($p > 0,05$).

Conclusions: It seems that spontaneous reduction of diastasis of the rectus abdominis muscles is very rare. New physiotherapeutic program is an effective method in DRAM's reduction. The research should be continued in larger group of women and after effectiveness confirmation, program should be introduced in obstetric wards.

Key words: diastasis rectus abdominis, puerperium, postpartum, physiotherapy, kinesiotaping

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Streszczenie

Wstęp: Rozstęp mięśni prostych brzucha (RMPB) jest separacją pomiędzy pasmami mięśni prostych brzucha powyżej 2 cm. Najczęściej powstaje na skutek otyłości typu androidalnego, afunkcjonalnej tłoczni brzusznej i ciąży. Nieleczony rozstęp prowadzi do groźnych konsekwencji tj.: przepuklina brzuszna, ból kręgosłupa, zaburzenia w obrębie dna miednicy. Celem badań była ocena skuteczności autorskiego programu fizjoterapeutycznego u kobiet z rozstępem mięśni prostych brzucha (RMPB).

Materiał i metody: W badaniu wzięło udział 40 kobiet w wieku od 20 do 45 lat (średnio 32,32 + 5,9 lat). Kwalifikacje do badań prowadzono w oddziale Położniczym Szpitala Bielańskiego w Warszawie. Wszystkie badane znajdowały się w okresie połogu od 0 do 3 doby po porodzie i posiadały RMPB większy niż 2 cm (mierzony palpacyjnie na wysokości 4,5cm powyżej i poniżej pępka). W grupie badanej (20 kobiet) zastosowano autorski program fizjoterapeutyczny mający na celu redukcję RMPB. W grupie kontrolnej (20 kobiet) nie zastosowano żadnego usprawniania, podając obserwacji samoistną redukcję rozstępu. Badanie trwało 6 tygodni.

Wyniki: Analiza danych wykazała 95% skuteczność autorskiego programu terapeutycznego. Test chi-kwadrat potwierdził różnicę w wielkości RMPB w obu grupach ($p < 0,0001$). Ponadto, wykazano istotną statystycznie korelację pomiędzy wielkością rozstępu, a przyrostem masy ciała w trakcie ciąży, wartościami wskaźników BMI i WHR, kolejnością porodu i aktywnością fizyczną przed i w trakcie ciąży ($p < 0,05$). Nie wykazano istotnej zależności pomiędzy wielkością rozstępu, a wiekiem matki i masą ciała noworodka ($p > 0,05$).

Wnioski: Samoistna redukcja rozstępu mięśni prostych brzucha występuje bardzo rzadko. Autorski program terapeutyczny jest skuteczną metodą w redukcji RMPB. Należy kontynuować badania na większej grupie osób i w razie potwierdzenia skuteczności programu wprowadzić go w oddziałach położniczych

Słowa kluczowe: rozstęp mięśni prostych brzucha, półóg, fizjoterapia, kinesiotaping

Introduction

Diastasis of the rectus abdominis muscles (DRAM) has been defined as a separation of the two bands of rectus abdominis muscles, which is wider than 2 cm [1, 2]. The main mechanism of DRAM is extension and thinning of the abdominal wall [3]. DRAM's predisposing factors are: abdominal obesity, pregnancy, significant weight loss in a short time, smoker's cough, diseases related with construction of collagen, degeneration of soft tissues, improperly performed exercises, i.e. dysfunctional abdominal cramp [4,5]. DRAM mainly observed in adult women, but it can also affect men and children [6,7]. A DRAM diagnoses is made in about 66% of women in the third trimester of pregnancy and 53% immediately after delivery [4,8]. In pregnant women, it arises as a result of physiological and hormonal changes. The hormone, Relaxin, changes the composition of collagen systemically thus making the abdominal wall, and all other connective rich structures, more susceptible to mechanical stretching [9]. Other factors that may result in

a DRAM include: multiple pregnancies, pregnancies in a short interval, high birth weight of the fetus, large volume of amniotic fluid, and being 35 years of age [10]. There is no relationship between the type of delivery natural or cesarean section and the occurrence of DRAM [11,12].

The diagnosis of DRAM includes both examination via palpation and imaging [13]. The palpation test is performed in supine lying. Lower extremities are bent in the hip and knee joints and the feet supported on the examination table. Usually the presence of DRAM is determined at three locations: at the height of the umbilicus, 4.5 cm above the umbilicus and 4.5 below the umbilicus. The person examining patient, should put their fingers in parallel and next perpendicular to the midline of the body. The subject actively lifts their head and shoulders up. The test is positive when at the level of the umbilicus there are 2-3 fingers in the interband space. In the other two places the gap must be equal to, or greater than the width of one finger [10]. For diagnostic imaging, computed tomography, magnetic resonance and diagnostic

ultrasound can all be used. Ultrasound is the fastest and the cheapest and is completely safe, which allows it to be performed in the third trimester of pregnancy. DRAM can also be diagnosed by a caliper [14,15].

Important in DRAM's reduction is activation of the abdominal transverse muscle (TrA), which improves tissue's integration with the linea alba and strength the fascia [6]. The focus should be on the isometric contraction of the rectus abdominis muscles [16,17]. In addition, appropriate prevention and minimalization of the risk of DRAM can also include kinesiotaping of the abdominal walls [12,18]. Untreated, DRAM may lead to abdominal and umbilical hernia, delays of the leading contraction mechanism (feedforward), lumbar and pelvic pain, lowering of reproductive organs and incontinence [9,19,20,21].

The aim of this study was to determine the effectiveness of a novel physiotherapeutic program in a group of women with DRAM.

Material and methods

Forty women between 20-45 years old took part in this study. Screening was conducted in the obstetrics ward of the Szpital Bielański in Warsaw. All subjects admitted into the study were 0 to 3 days postpartum and had a DRAM of greater than 2 cm. Participants of the study were randomly assigned to one of two groups: research or control. All of the subjects completed the 6 week intervention.. Detailed characteristics of the subjects are presented in the table No. 1.

Tab. 1. Characteristic of the participants divided into research and control groups

Group	Age [years]	Body mass [kg]	Body high [cm]	BMI*	WHR**	Width of DRAM [cm]
Research	28,90± 6,93	69,28± 11,30	166,5± 6,87	24,94± 3,60	0,953± 0,033	3,28± 0,39
Control	34,75± 5,95	73,37± 9,45	167,25± 5,99	26,183± 2,71	0,972± 0,038	3,54± 0,33

*Body mass index **Waist-to-hip ratio

The width of diastasis of the rectus abdominis muscles was diagnosed using palpation. The width of one physiotherapist's finger was 1.3 cm.

Physiotherapeutic program

Participants in the research group, completed the novel physiotherapeutic program daily for 6 weeks. The program was developed on the basis of scientific literature about DRAM and it consisted of three parts. The first part was a 20-minute posture position, which accelerated the involution of the uterus. For women after childbirth, was recommended laying in prone. Cushions were placed under their abdomen such that lumbar lordosis be was neutralized. Position was modified for women after cesarean section; they performed this same maneuver but in standing. The second part of the program consisted of three simple exercises which combined a long exhalation and the given movement. Each repetition lasted 10 seconds and was performed 10 times. The starting position was supine lying with lower limbs bent in the hip and knee joints. The first exercise consisted of the mechanical support of the two rectus abdominis muscles with crossed hands, lifting the head with the synchronous exhalation. The second

exercise consisted of exhaling, lifting the head with the simultaneous movement of the hands from the thighs towards the knees and lowering the head. The last exercise consisted of alternating bending and extending of the lower limbs in combination with a long calm exhalation. This exercise was repeated 10 times for each lower limb. The third part of the program was educational and focused on preventing further increasing of the DRAM. The education included: getting out of bed, sitting, breastfeeding and lifting the baby. Additionally, kinesiotaping was used in the research group once a week. Abdominal coatings were taped using the ligament method from sternum to the pubic symphysis.

Participants belonged to the control group did not perform any exercises, receive the education, and did not have the kinesiotaping applied. The control group was observed to and any spontaneous reduction of the DRAM was recorded. If after 6 weeks the DRAM was not spontaneously reduced, the participants were received their own physiotherapeutic program. which included exercise and taping.

Statistica 13nws used for the statistical analysis. The lack of a normal distribution was confirmed by the Shapiro-Wilk test. To assess the correlation between the factors the Spearman nonparametric test was used. The relationship between the factors was assessed

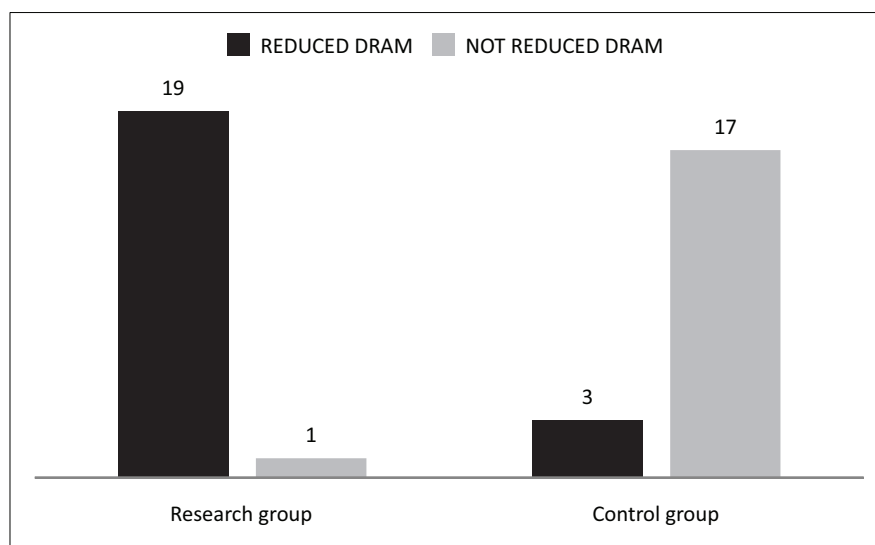
using the Chi-square test and the Student's T-test. The index changes were assessed using the U Mann-Whitney test. The level of significance was $p < 0.05$.

Results

After 6 weeks of using a new physiotherapeutic program, DRAM was reduced in 95% of women

(19 people). For comparison, DRAM was spontaneously reduced in 15% (3 people) in the control group (Tab. 2). On the basis of the Chi-square test, a statistically significant difference ($p < 0.001$) was found in the reduction of the diastasis between the research and control groups. Differences in DRAM size are shown in tables No. 3 and 4.

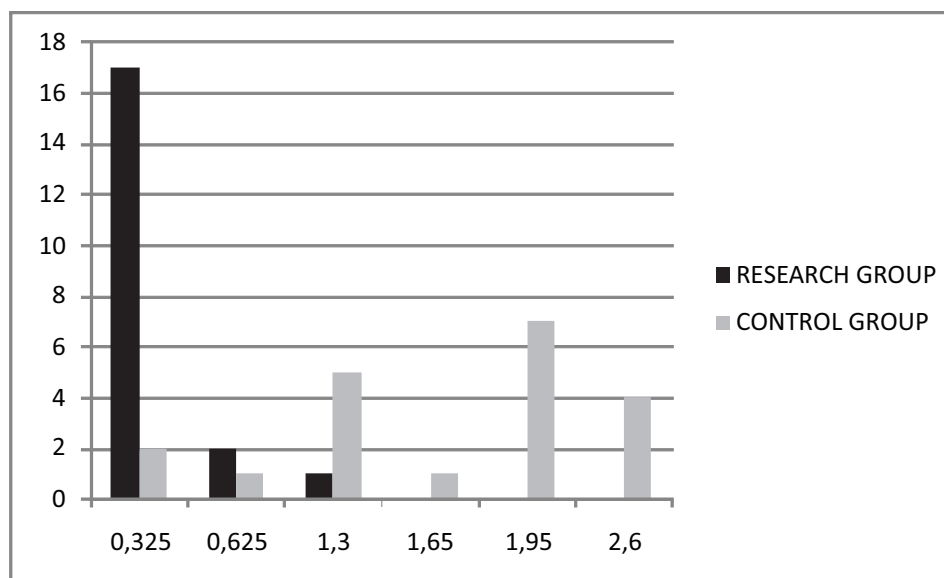
Tab. 2. Reduction of the diastasis rectus abdominis in the research and control groups



Tab. 3. The size of the DRAM before and after therapy

DRA size	Before therapy	After therapy
Control group	3,28± 0,39	0,404± 0,230
Research group	3,54± 0,33	1,675± 0,701

Tab. 4. The size of the DRAM in both groups after tests



There was a statistically significant difference in waist-to-hip ratio (WHR) at the beginning of the study and after 6 weeks of the study ($p < 0.05$). The decrease in WHR was significantly higher in the research group. In the research group, a significantly lower BMI ($p < 0.05$) was found after the 6 week program. There were statistically significant differences in waist circumference reduction. In the study group, the waist circumference measured at the height of the umbilicus significantly decreased ($p < 0.05$) compared to the control group (tab. 5)

Tab. 5. The results of difference in statistical significance of features before and after treatment in both groups

Cechy	p
Difference in BMI (1- 6 week)	0,001287**
Difference in WHR (1- 6 week)	0,000013**
Difference in waist circumference (1- 6 week)	0,000088**
Difference in hip circumference (1- 6 week)	0,440

* $p < 0.05$, ** $p < 0,001$

The data from the open questionnaire was analyzed. There was a statistically significant correlation ($p < 0.05$) between the size of the DRAM and predisposing factors. The bigger DRAM was correlated with mother’s weight gain in pregnancy, BMI and the number of deliveries. However, the higher level of physical activity before and during pregnancy predisposed to the smaller DRAM (Tab. 6).

Tab. 6. Relationship between predisposing factors and DRAM

Features	P
Weight gain in pregnancy [kg]	0,371*
BMI in 1 week after delivery	0,313*
Number of deliveries	0,319*
Physical activity before pregnancy [pkt]	-0,48*
Physical activity during pregnancy [pkt]	-0,44*
Mother’s age	0,090
Body weight of the child [g]	0,194

* $p < 0,05$, ** $p < 0,005$

The subjective assessment of the subjects regarding the type of their pre-pregnancy body type was also analyzed. Most of the participants presented with an aneroid body type (65%).

Discussion

The problem with a DRAM appears to not be common knowledge. This observation is confirmed by Rajkowska’s and Szumilewicz’s research, which demonstrated that most of their participants did not

know what the DRAM is and what the consequences are. A large proportion of women did not have any knowledge about the importance of physical activity during pregnancy and postpartum. In general, the respondents did not realize that some exercises may prevent band’s separation and result in DRAM [22].

One of the purposes of our study was to assess the correlation of an individual’s predisposing DRAM factors with the resulting DRAM size. Data analysis shows that there is a strong relationship between DRAM size with a level of mother’s physical activity before and during pregnancy. Participants which practiced sport, had significantly smaller DRAM in comparison to non-practitioners. This is confirmed by the study of Benjamin et al. They confirmed that proper physical activity before pregnancy affects the maintenance and improvement of tension, strength and control of the abdominal muscles. It reduces inter-bands distance and prevents the emergence of DRAM [2]. Chiarello et al. also studied the effects of physical activity in DRAM. Women in the research group intensively strengthened their abdominal muscles before pregnancy. The control group did not perform any exercises. The results showed that in the group of exercising women only one person presented with DRAM, while all of the women in the control group ended up with DRAM. In addition, the distance between two rectus abdominis muscles in the research group was significantly lower than in the control group [23].

Another predisposing factor of DRAM is the body size and shape Opala- Berdzik, Dąbrowski and Marshall suggest that obesity and the android type of body as DRAM risk factors [4,24]. Widely used weight-increase indices such as BMI or WHR do not only serve to assess current health status and the risk of chronic disease, but our own research supports the literature in that a larger DRAM was correlated with larger WHR and BMI values [25].

Although some authors [12,24,26] also include advanced maternal age and high body weight of the newborn as predisposing factors. This study does not support this finding. Perhaps this relationship should be re-examined on larger sample of women.

Numerous authors report [4,23] that spontaneous reduction of DRAM is extremely rare. Similar conclusions can be drawn from this study, where DRAM was reduced spontaneously only in 3 women from a 20-person control group.

The main goal of our research was to assess the effectiveness of the proposed novel physiotherapeutic

program consisting of exercises, education and kinesiotaping. The analysis of the data demonstrated that the program was effective in 95% of the women in the exercise group ($p < 0.0001$). These results support our conclusion that a program of appropriate exercises, education, and kinesiotaping in the postpartum period connected will contribute to reduction the existing DRAM. Similar studies were carried out by Achary and Kutta [1]. On the basis of the palpation examination, they recruited 30 women with the DRAM into their study. The participants were instructed and trained in a program to reduce DRAM. They were advised to do the exercises twice a day. After the intervention period, the palpated DRAM measurement reduced from 3.5 to 2.5 finger widths. This study demonstrates that exercises are effective in reducing DRAM in early postpartum period. At the same time, this leads to the conclusion that DRAM can be successfully be treated non-surgically [1].

Mota et al. studied exercise's impact for DRAM during and after pregnancy. They demonstrated that proper physical activity, not only in the postpartum period, but also during pregnancy, between 35-41 weeks of pregnancy can reduce DRAM [17].

Pascoal et al. evaluated the effectiveness of isometric exercises in reducing DRAM. The research group consisted of women after childbirth, and control nulliparous. The muscle's work in tension and rest was assessed using ultrasound. Imaging was performed immediately after exhalation under the control of the investigator's eyesight. In both groups, the distance between bands has narrowed. The study showed that isometric abdominal exercises contribute to the reduction of DRAM [11].

Sharma investigated the reduction of DRAM in pregnant and puerperal women. Both groups received the same set of exercises including strengthening TrA and endurance exercises. Diastasis was reduced

in both groups, with no statistically significant differences. This study shows that both, early and late introduction of a proper procedure to improve the reduction of DRAM is effective [27].

The influence of head elevation with the tension of the abdominal and pelvic floor muscles on the DRAM was examined by Shin et al. In the group of women who exercised with the head elevated, the diastasis was smaller by as much as 15%. This study shows that proper muscle tone of the pelvic floor and TrA reduces the size of the diastasis of the abdominal muscles [23].

In our research we assessed the effectiveness of a novel physiotherapeutic program in women with DRAM. None of the literature has previously examined the use of combining kinesiotaping with exercises. In order to clearly evaluate the effectiveness of the program, kinesiology taping should be assessed separately and the exercises should be assessed separately.

Conclusions

1. The size of the diastasis of the rectus abdominis muscles is related to: WHR, BMI, physical activity before pregnancy and during pregnancy.
2. The body weight of infant and mother's age do not affect the size of the diastasis of the rectus abdominis muscles.
3. Spontaneous reduction of diastasis of the rectus abdominis muscles in the postpartum is rare.
4. The novel physiotherapeutic program is an effective physiotherapeutic method that reduces the width of the diastasis of the rectus abdominis muscles in postpartum women.
5. Research should be continued on a larger group of women in postpartum and if an effectiveness of the program will be confirmed, it should be introduced in obstetric wards.

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