

# Epidemiology and related etiologies of diastasis recti among multiparous females

Raheela Kousar\*, Muneeba Kanwal\*\*, Farooq Islam\*, Asim Raza\*, Maleeha Rida\*

\*Department of Rehabilitation Sciences, University of Chenab, Gujrat, Punjab, Pakistan

\*\*University Institute of Physical Therapy, University of Lahore, Punjab, Pakistan

**Abstract:** Diastasis Recti indicated by the dissociation of the recti muscles is a common condition in pregnant and recently delivered females, typical in 2nd and 3rd trimester.

**Objective:** To find out the epidemiology and related etiologies of diastasis recti among multiparous females.

**Methodology:** Cross-sectional study was conducted with the sample size of 366. Data were collected from multiparous females of District Gujrat through non probability convenient sampling. Demographic data, data related to risk factors, urinary incontinence and hypermobility were collected through a Pro forma, ICIQ-UI SF questionnaire and Beighton Score Scale respectively. To measure the DRAM, finger width palpation test and Vernier Caliper was used. Data were analyzed through Statistical Package for Social Sciences (SPSS) version 24 and interpreted using chi-square test.

**Results:** The results of this study indicated that DRA was present in 22.7% multiparous females. 47% females with cesarean sections had diastasis. 6.3% females had DRA above, 22.1% females had at umbilicus and 3.5% females had below umbilicus level. Association of mode of delivery with DRA was found statistically significant ( $\chi^2 = 13.21$ ,  $p$ -value  $< 0.001$ ). Age, BMI, number of births, hypermobility and urinary incontinence was not associated with DRA significantly.

**Conclusion:** The study concluded quite significant prevalence of diastasis recti abdominis among multiparous females at six or more than six months postpartum period. Mode of delivery was found associated with DRA whereas no association was

found between DRA and age, BMI, number of births, hypermobility and urinary incontinence.

**Keywords:** Diastasis recti abdominis, postpartum, inter-rectus distance, finger width palpation

## I. INTRODUCTION

The rectus abdominis muscle, sometimes known as the "six-pack muscle," can partially or completely separate at the linea alba, which forms the centre line of the muscle.<sup>1</sup> It is measured by the inter-recti distance and can happen anywhere along the linea alba, from the xiphoid process to the pubic bone (IRD).<sup>2</sup> This can range from a tiny vertical gap that is 2-3 cm wide and 12-15 cm long to a larger area that is 12-20 cm wide and almost the whole length of the rectus muscle.<sup>3</sup> DRA is more common in pregnant women, postmenopausal women, and new mothers. Relaxin, a hormone that is generated during pregnancy, causes the bodies of pregnant women to adjust to physiological changes brought on by the expanding uterus, increasing pressure on the abdominal wall. The abdominal muscles stretch and move away from the linea alba as pregnancy progresses, which may cause DRA.<sup>1</sup> DRA can also affect men, women who are not pregnant, and kids.<sup>2</sup>

39% of the women who had DRA at 6 months after giving birth indicate that healing is still ongoing at this time.<sup>4</sup> DRA has a 100% frequency during pregnancy and is quite common at gestational week 35. It may last for six weeks in the postpartum period, with a prevalence of 50% to 60%.<sup>1</sup> According to studies, the prevalence was 33.1, 60.0, 45.4, and 32.6 percent at 21st week, six weeks, six months, and twelve months after birth of child, respectively.<sup>5</sup> According to a research, 82.6% of women had diastasis of the rectus abdominis during the first year after giving birth.<sup>6</sup> Within the first six months after giving birth, diastasis was 68% common in women.<sup>3</sup> In the second trimester, 27% of women showed a DRA, and in the third, 66% did.<sup>7</sup>

According to a study, a DRA was defined as being wider than two finger widths when it was palpated 4.5 centimeter above, 4.5 centimeter below umbilicus and at umbilicus.<sup>8</sup> A study used calipers to quantify the IRD at the same three places and defined DRA as being larger than 2 cm.<sup>9</sup> Although the cause of diastasis recti is unknown, but some risk factors have been proposed, including advanced age, multiple parities, caesarean sections, weight increase, high birth weight, multiple pregnancies, ethnicity, childcare, and benign joint hypermobility syndrome.<sup>8</sup> A risk factor for postpartum DRA is c-sections.<sup>10</sup> Additionally, 39% of older, parous women having abdominal hysterectomy had DRA.<sup>4</sup>

A study was carried in 2020 to determine the prevalence of separated recti muscles in adult females and to examine potential etiologies. 644 females were included. There were 28.4% cases of DRA. The following factors affected DRA: age, number of pregnancies, body mass index, and diabetes. After taking into account the effects of age, it was discovered that young women had risk factors of pregnancy and diabetes for separated rectus muscles, while obesity and diabetes were associated factors for DRA in elderly women.<sup>11</sup> Another study conducted in 2017 to look into the prevalence of DR in both pregnant and postpartum women. 250 women who were expecting or recently gave birth were enlisted. This study showed a high incidence of DR in both pregnant and postpartum women (84% and 64.7%, respectively); DR was most frequently seen at the umbilicus in both groups of women. DR was prevalently found in multigravida and age and parity were associated factors among pregnant and postpartum women.<sup>12</sup>

Plastic surgeons generally agree that DRA has cosmetic repercussions, typically manifesting as an abdominal bulge that is resistant to weight loss through diet and/or exercise. As a result females with diastasis may exhibit poorer body perception and body contentment rates than females without diastasis recti.<sup>13</sup> According to a study, physiotherapy with an emphasis on posture correction and abdominal muscle strengthening is the most popular conservative treatment option for DRA.<sup>14</sup>

Diastasis recti is a disorder that, if left untreated, can lead to a number of issues, including weak pelvic floor muscles, incorrect posture, low back discomfort, herniated abdominal viscera, and complications that could endanger the life of the fetus during a subsequent pregnancy. The significance of diastasis recti abdominis awareness and rehabilitation among health practitioners therefore becomes crucial

in this scenario. Additionally, there is relatively little information on DRA and the risk factors linked to it. Determining the prevalence of diastasis recti abdominis in multiparous females and its related etiologies is the purpose of this study.

## II. METHODOLOGY

This cross sectional study was conducted in District Gujrat on multiparous females. Sample size of 366 was calculated and collected through non probability convenient sampling. The participants fulfilling the eligibility criteria were included in this study. The inclusion criteria consisted of women of 23-43 years of age<sup>5</sup>, females with more than 6 months postpartum period and those were willing to participate. Exclusion criteria included pregnancy, smoking, chronic cough (for last 3 months)<sup>15</sup>, history of spinal surgery at T7-T11 level less than 6 months and abdominal surgery less than 6 months (involving chevron and midline incisions except C-section, appendectomy), any neuromuscular disease (Duchenne Muscular Dystrophy, GBS less than 6 months)<sup>5</sup> and neuropathy of rectus abdominis due to T7-T11 nerve root. Demographic data, data related to risk factors, urinary incontinence and hypermobility were collected through a Pro forma, ICIQ-UI SF questionnaire and Beighton Score Scale respectively. To measure the DRAM, finger width palpation test and Vernier Caliper was used. To measure hypermobility few movements were performed: flexion of trunk with palms resting flat on the floor, right and left elbow and knee's hyperextension passing 10°, passive thumb movement up to the forearm, left/right, and passive extension of the fifth metacarpophalangeal joint on the left and right passing 90 degree. Each test received a grade of 0 or 1. Maximum test score was 9, and the hypermobility cutoff was set at 5/9. To measure the DRAM, women were asked to position themselves in crook-lying. Women were asked to raise their heads and shoulders slowly off the floor, reaching their hands towards the knees, until the spine of the scapula left the floor. The evaluator placed the finger perpendicularly between the medial edges of the rectus abdominis muscles. The finger sank into the gap where a separation existed. The diastasis was graded by the number of finger breadths between the medial edges of the rectus abdominis muscles at the reference points. The reference points for DRAM measurement were three finger breadths (4.5cm) above and below the umbilicus and at the umbilicus. Diastasis of the rectus abdominis was considered present when the separation was greater than 2 finger breadths. Same positioning of the participants and same reference points were considered for caliper measurements and

DRA was considered if the separation between the recti muscles was greater than 2 cm. Data were analyzed through Statistical Package for Social Sciences (SPSS) version 24. For descriptive analysis, mean and standard deviation were calculated for quantitative variables whereas frequency and percentages were used for qualitative variables. For the inferential statistics to find significance chi-square test was applied. All results were calculated at 95% confidence interval and p-value  $\leq 0.05$  was considered as a significant value.

### III. RESULTS

Mean age of participants was 34.11( $\pm 5.37$ ). Mean body mass index (BMI) of participants was 27.40( $\pm 6.19$ ) (Table1). Diastasis recti abdominis was present in 22.7% (83 participants) multiparous females while 77.3% (283 participants) females did not have diastasis recti abdominis (Table2). Out of total 113 females with cesarean mode of delivery, 47% (39 females) had diastasis. 196 females had vaginal mode of delivery and 39.8% (33 females) of them had DRA. Whereas 57 females had both vaginal and cesarean method of delivery and 13.3% (11 participants) had separated recti muscles (Table3). Indicated that females with cesarean sections had more prevalence of DRA than females with vaginal and those with both modes of deliveries had. When measured with finger width palpation test and Vernier caliper 6.3% females had diastasis recti abdominis above umbilicus level, 22.1% multiparous females had diastasis of rectus abdominis muscle at umbilicus level and 3.5% females had diastasis below umbilicus level (Table2). So, it was found that DRA was more prevalent at umbilicus level. 29.5% females presented with 3 fingers width at 3 reference points and 2.4% females presented with  $>3$  fingers width at reference points (Table 2). Caliper measurement above umbilicus level in centimeter had mean value of 0.91( $\pm 0.98$ ), at umbilicus level had 1.45( $\pm 1.68$ ) mean value and below umbilicus level had 0.86( $\pm 0.85$ ) mean value (Table 1). Association of mode of delivery with split rectus abdominis was found statistically significant ( $\chi^2 = 13.21$ , p-value  $< 0.001$ ). Age of participants in years, body mass index Kg/m<sup>2</sup>, number of births, Beighton hypermobility score for hypermobility, urinary incontinence were not associated with split rectus abdominis significantly (Table3).

Tables:

Table 1: Mean and standard deviation of variables

Variables	Mean( $\pm$ S.D)
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Age of participants	34.117( $\pm 5.371$ )
Body mass index	27.403( $\pm 6.191$ )
Caliper measurement above umbilicus level in centimeter	0.918( $\pm 0.981$ )
Caliper measurement at umbilicus level in centimeter	1.457( $\pm 1.684$ )
Caliper measurement below umbilicus level in centimeter	0.861( $\pm 0.852$ )
Beighton hypermobility score (out of 9)	0.306( $\pm 1.090$ )
Urinary incontinence questionnaire	0.366( $\pm 1.985$ )

Table 2: Frequency distribution of participants according to different variables

Variables		n(%)
Number of Births	2-3	214(58.5)
	4-5	142(38.8)
	$> 5$	10(2.7)
Delivery Method	vaginal	196(53.5)
	cesarean	113(30.9)
	vaginal and cesarean	57(15.6)
Body Mass Index	under weight	15(4.1)
	normal	110(30.1)
	over weight	134(36.6)
	obese	107(29.2)
Finger width palpation above umbilicus level	$< 2$ fingers (Normal)	343(93.7)
	3 fingers	23(6.3)
Finger width palpation at umbilicus level	$< 2$ fingers (Normal)	285(77.9)
	3 fingers	74(20.2)
	$> 3$ fingers	7(1.9)
Finger width palpation below umbilicus level	$< 2$ fingers (Normal)	353(96.4)
	3 fingers	11(3.0)
	$> 3$ fingers	2(0.5)
Urinary incontinence questionnaire	absent	350(95.6)
	slight	6(1.6)
	moderate	6(1.6)
	severe	3(0.8)
	very severe	1(0.3)
Age Group	23-29	81(22.1)

	30-35	129(35.2)
	36-43	156(42.6)
<b>Beighton hypermobility score</b>	No Hypermobility	354(96.7)
	Hypermobility	12(3.3)
<b>Split Rectus Abdominis</b>	no	283(77.3)
	yes	83(22.7)
<b>Total</b>		366(100)

Table 3: Association of diastasis recti abdominis with associated risk factors

Variables		Split Rectus Abdominis n(%)			Chi-square	P value
		No	Yes	Total		
<b>Number of Births</b>	2-3	161 (56.9)	53 (63.9)	214 (58.5)	3.660	0.160
	4-5	112 (39.6)	30 (36.1)	142 (38.8)		
	> 5	10 (3.5)	0(0)	10 (2.7)		
<b>Delivery Method</b>	vaginal	163 (57.6)	33 (39.8)	196 (53.6)	13.212	<0.001*
	Cesarean	74 (26.1)	39 (47.0)	113 (30.9)		
	vaginal and cesarean	46 (16.3)	11 (13.3)	57 (15.6)		
<b>Body mass index</b>	under weight	14 (4.9)	1 (1.2)	15 (4.1)	3.079	0.380
	normal	84 (29.7)	26 (31.3)	110 (30.1)		
	over weight	100 (35.3)	34 (41.0)	134 (36.6)		
	obese	85 (30.0)	22 (26.5)	107 (29.2)		
<b>Beighton hypermob</b>	No Hypermobility	271 (95.8)	83 (100)	354 (96.7)	3.639	0.056

<b>ility score</b>	Hypemobility	12 (4.2)	0(0)	12 (3.3)		
<b>Urinary incontinence questionnaire</b>	absent	270 (95.4)	80 (96.4)	350 (95.6)	1.692	0.792
	slight	4 (1.4)	2 (2.4)	6 (1.6)		
	moderate	5 (1.8)	1 (1.2)	6 (1.6)		
	severe	3 (1.1)	0(0)	3 (0.8)		
	very severe	1 (0.4)	0(0)	1 (0.3)		
<b>Age Group</b>	23-29	61 (21.6)	20 (24.1)	81 (22.1)	1.888	0.389
	30-35	105 (37.1)	24 (28.9)	129 (35.2)		
	36-43	117 (41.3)	39 (47.0)	156 (42.6)		
<b>Total</b>		283 (100)	83 (100)	366 (100)		

IV. DISCUSSION

The results of this study showed quite significant prevalence diastasis among postpartum women with mode of delivery having association with DRA. There was no association found among diastasis recti abdominis and age, body mass index, number of births, hypermobility and urinary incontinence. A study finding concluded that from 100 percent at gestational week 35 to 39 percent at 6 months after delivery, the prevalence of DRA reduced. Any notable relation was not found among diastasis recti abdominis and age, BMI and hypermobility at 6 months postpartum.<sup>4</sup> Another study concluded that regardless of parity, the prevalence of supra umbilicus SRAM was greater in both primiparous and multiparous females as compared to prevalence of SRAM at infra umbilicus level.<sup>16</sup> This study was conducted after few weeks of delivery and our study included women of 6 months postpartum period that's why this study had more prevalence than our

study because prevalence of DRA is greater during pregnancy or immediately after delivery but decreases with time. So, the research's findings are in compliance with our results. Another study's findings showed a high incidence of DR in postpartum women and DR was most frequently seen at the umbilicus in women.<sup>12</sup> There is a difference of time point of postpartum period as this study included 2 months postpartum females and we worked on 6 months postpartum as it was our study gap. Accordingly we had less percentage of cases of DR in postpartum women and most of them had been seen at umbilicus level. The results of this study are corresponding to our study. A study results showed average mean values of 0.88 centimeters above, 1.23 centimeters at umbilical and 0.3 centimeters below umbilicus.<sup>17</sup> Whereas our study shows mean values (in centimeter) of  $0.91(\pm 0.98)$  above umbilicus level,  $1.45(\pm 1.68)$  at umbilicus level and  $0.86(\pm 0.85)$  below umbilicus level. Although our values vary a little from this study but this study was conducted in immediate postpartum women and our study was conducted in 6 or more than 6 months postpartum women. So, accordingly there should be a marked decrease in the average values of our study but instead they are little bit increased. In this way our study contradicts with the results of mentioned study. According to the findings of a study females with diastasis recti had higher BMI score and BMI is associated with diastasis recti.<sup>18</sup> Whereas in our study we did not find any significant interdependence between BMI and diastasis recti as in this study. So, this study contradicts with our results. A study found high occurrence of diastasis recti in women after deliveries. No association had been present between DRA and delivery method.<sup>1</sup> Whereas our study found significant association between DRA and delivery method. So, results of this study are not in accordance of our study's results. According to a study, women who had a caesarean delivery had greater levels of DRAM than those who gave birth vaginally and hence DRA had association with mode of delivery.<sup>19</sup> We found same results in our study in accordance with this study. Another study found a significant association between diastasis recti abdominis and number of deliveries.<sup>20</sup> In our study we did not found any association between diastasis recti and number of births. So, our study contradicts with this study.

Limitations: Ultrasound is a gold standard diagnostic tool for diastasis recti abdominis but we used finger width palpation test and Vernier caliper because ultrasound is very expensive. This study included sample selected through convenient sampling because we did not have sample pool. The test used in this study involved exposure of body, it caused hindrance in taking measurements somehow. There is a great impact of urban and rural lifestyle on diastasis but data of this study was collected from rural area only.

Recommendations: In this study diastasis was checked manually. Studies must be carried out using latest technology diagnostic tools such as ultrasound for obtaining more accurate information. Studies should be carried by selecting sample through probability sampling to get more enhanced results. Further studies are needed on the importance of preventive measures and rehabilitation programs for diastasis recti.

## V. CONCLUSION

The study concluded quite significant prevalence of diastasis recti abdominis among multiparous females at six or more than six months postpartum period. Mode of delivery was found associated with diastasis recti abdominis whereas no association was found among diastasis recti abdominis and age, body mass index, number of births, hypermobility and urinary incontinence.

### *Conflict of Interest*

There was no conflict of interest.

### *Financial Statement*

No fundings were given by any authorities; it was a project thesis of doctor of physical therapy.

### *Data availability*

Data will be provided on the demand by corresponding author.

## REFERENCES

1. Iqbal MH, Hussain T, Khalid F, Ali MM, Ashraf I, Nazir TJP. DIASTASIS RECTI ABDOMINIS AND ITS ASSOCIATED RISK FACTORS IN POSTPARTUM WOMEN. 2020;70(5):1535-38.
2. Harada BS, De Bortolli TT, Carnaz L, De Conti MHS, Hijaz A, Driusso P, et al. Diastasis recti abdominis and pelvic floor

dysfunction in peri-and postmenopausal women: a cross-sectional study. 2020;1-7.

3. Adkitte R, Yeole U, Gawali P, Gharote GJEJPMR. Prevalence of diastasis of rectus abdominis muscle in immediate post-partum women of urban and rural areas. 2016;3(5):460-2.

4. Da Mota PGF, Pascoal AGBA, Carita AIAD, Bø KJMt. Prevalence and risk factors of diastasis recti abdominis from late pregnancy to 6 months postpartum, and relationship with lumbopelvic pain. 2015;20(1):200-5.

5. Balasch-Bernat M, Pérez-Alenda S, Carrasco JJ, Valls-Donderis B, Dueñas L, Fuentes-Aparicio LJJoER, et al. Differences in Inter-Rectus Distance and Abdominopelvic Function between Nulliparous, Primiparous and Multiparous Women. 2021;18(23):12396.

6. Fei H, Liu Y, Li M, He J, Liu L, Li J, et al. The relationship of severity in diastasis recti abdominis and pelvic floor dysfunction: a retrospective cohort study. 2021;21(1):1-8.

7. Chiarello CM, McAuley JAJjoo, therapy sp. Concurrent validity of calipers and ultrasound imaging to measure interrecti distance. 2013;43(7):495-503.

8. Sperstad JB, Tennfjord MK, Hilde G, Ellström-Eng M, Bø KJBjoms. Diastasis recti abdominis during pregnancy and 12 months after childbirth: prevalence, risk factors and report of lumbopelvic pain. 2016;50(17):1092-6.

9. Chiarello CMJJoWSHPT. Pregnancy-related pelvic girdle pain and diastasis rectus abdominis. 2017;41(1):3-9.

10. Wang Q, Yu X, Chen G, Sun X, Wang JJIUJ. Does diastasis recti abdominis weaken pelvic floor function? A cross-sectional study. 2020;31(2):277-83.

11. Wu L, Gu Y, Gu Y, Wang Y, Lu X, Zhu C, et al. Diastasis Recti Abdominis in Adult Women Based on Abdominal CT Imaging: Prevalence, Risk Factors and Its Impact on Life. 2020.

12. Bichi F, Hanif SJPJoR. DIASTASIS RECTI AMONG PREGNANT AND POSTPARTUM WOMEN IN KANO, NIGERIA: A CROSS-SECTIONAL STUDY. 2017;6(1):15-20.

13. Keshwani N, Mathur S, McLean L. Relationship between interrectus distance and symptom severity in women with diastasis recti abdominis in the early postpartum period. Physical therapy. 2018;98(3):182-90.

14. Yaseen K, Anwar N, Ayesha S, Tauqeer S, Khalid K, Shaheen F. Prevalence of Diastasis Recti among Pregnant Women: A Cross Sectional Study. Pakistan Journal of Medical Research. 2022;61(1):40-2.

15. Turan V, Colluoglu C, Turkuilmaz E, Korucuoglu UJGp. Prevalence of diastasis recti abdominis in the population of young multiparous adults in Turkey. 2011;82(11).

16. Rett MT, Almeida TVd, Mendonça ACR, DeSantana JM, Ferreira APdL, Araújo KCGMdJRBdSML. Factors relating to mother and child associated with separation of the rectus abdominis muscle in immediate puerperium. 2014;14:73-80.

17. Demartini E, Deon KC, Fonseca EGdJ, Portela BSJFeM. Diastasis of the rectus abdominis muscle prevalence in postpartum. 2016;29:279-86.

18. Aabroo S, Riaz H, Saeed A, Ashraf FJRMJ. Frequency of diastasis recti and lumbopelvic pain during pregnancy and factors associated with diastasis recti. 2020;45(3):682-.

19. Luna DCBd, Cavalcanti ALAMH, Guendler JdA, Brito VC, Oliveira BDRd. Frequência da diástase abdominal em puérperas e fatores de risco associados. 2012.

20. Gitta S, Magyar Z, Tardi P, Füge I, Járomi M, Ács P, et al. Prevalence, potential risk factors and sequelae of diastasis recti abdominis. 2017;158(12):454-60.

## AUTHORS

**First Author: Raheela Kousar\***, MS, Lecturer, Department of Rehabilitation Sciences, Allied Health Sciences, University of Chenab, Gujrat, Punjab, Pakistan, [raheelasaleem10@yahoo.com](mailto:raheelasaleem10@yahoo.com) <http://orcid.org/0000-0002-1597-4786>

**Second Author: Muneeba Kanwal** Student, University Institute of Physical Therapy, University of Lahore, Lahore, Punjab, Pakistan, [Muneebakanwal608@gmail.com](mailto:Muneebakanwal608@gmail.com)

**Third Author: Farooq Islam**, PhD (Scholar), Assistant Professor, Department of Rehabilitation Sciences, University of Chenab, Gujrat, Punjab, Pakistan. [farooq.islam@uipt.uol.edu.pk](mailto:farooq.islam@uipt.uol.edu.pk)

**Fourth Author: Asim Raza**, PhD (Scholar), Assistant Professor, Allied Health Sciences, University of Chenab, Gujrat, Punjab, Pakistan. [asimrazathakur@gmail.com](mailto:asimrazathakur@gmail.com)

**Fifth Author: Maleeha Rida**, MBBS, Lecturer, Department of Rehabilitation Sciences, Allied Health Sciences, University of Chenab, Gujrat, Punjab, Pakistan [malihaalitex@gmail.com](mailto:malihaalitex@gmail.com)

### \*Corresponding Authors:

<sup>1</sup>Raheela Kousar  
[raheelasaleem10@yahoo.com](mailto:raheelasaleem10@yahoo.com)  
0092301-6494454

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