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RESEARCH ARTICLE

Incidence & Prevalence of Diastasis Recti, & its Association with Obesity in the Eastern region of the Kingdom of Saudi Arabia

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ABSTRACT
Globally there has been a surge in Physical fitness Centres and as we enter an era of obsession with "Six pack abdomen". Never before has the world witnessed such a fascination for Rectus Abdominis muscles as we see today.
Diastasis of the rectus (DR) abdomen or divarication of recti muscle abdomen is the midline bulge caused by attenuation of the Linea alba. This attenuation of Diastasis recti (DR), is gradual and is characterized by thinning and widening of the Linea alba [1].
Diastasis recti (DR) is devoid of a true fascial defect, which is what differentiates it from a ventral hernia. Traditionally it has been associated with pregnancy. With the global epidemic of Obesity and the rise of Bariatric Surgery worldwide there is a surge in the prevalence of **Diastasis Recti (DR).**
Keywords: Obesity, Prevalence, Diastasis Recti (DR), Rectus Abdominis repair; Pregnancy.EHS Clinical Hernia Classification.

Introduction:

Diastasis recti (DR) is an acquired adult condition characterised by an increase in width of the linea alba. Whether this is a part of ageing process or the result of acquired associated risk factors like pregnancy, multiparity, caesarean section, and Obesity and BMI is not known definitely. Further more there is no consensus on the relation of ventral hernias, like epigastric, umbilical or paraumblical and infraumblical hernia and their association to **Diastasis Recti (DR).** The Unified theory for hernia formation has elucidated Collagen defect as the primary event that sets the stage for eventual hernia formation. **Diastasis Recti (DR)** ought to be viewed as a network of collagen framework that has effaced along linea alba. **Diastasis Recti (DR) is** a common clinical presentation at the Surgical Clinics in Saudi Arabia. The other common hernias are paraumblical and infra umbilical hernias. The prevalence of **Diastasis Recti (DR)** in the eastern part of the world is not known and its association to Obesity is yet to be clearly defined. This study was therefore undertaken to report on the prevalence of Diastasis Recti (DR) & its association to Obesity.

Objectives:

To identify the incidence and prevalence of diastasis recti in the public population attending the health surgical clinic in Al Omran General Hospital, Omran City in the Eastern province of Al Hassa Saudi Arabia.

To report any associations between Age, Obesity, Smoking, Multiple Pregnancy and the number with mode of delivery to Diastasis Recti (DR).

Materials and Methods:

Cohort Study (Prospective Observation Study)- Sample Size 100

The patients with Clinical evidence of **Diastasis Recti (DR),** Male or Female were enrolled to this study. Anthropometric data such as height weight and BMI were Calculated following Clinical confirmation using the Head raising test. A Diastasis Recti (DR), was considered positive following visible confirmation of prominent ridge or shelf, extending anywhere from the xiphoid to the umbilicus or infra umbilical region. The location of this defect Epigastric, Supra umblical or infra umbilical was recorded by using the **EHS (German) Clinical Hernia Classification table 1.** The Diastasis Recti (DR) subjects were then sent to the Department of Radiology to confirm the presence of Diastasis Recti (DR), using a 2-D linear transducer (3–10 MHz) probe. The Supra umbilical reference was taken as a point 4.5 cm above the umbilicus, similarly the Infra umbilical reference point was a region 4.5cm or 2 finger breaths below the umbilicus. USG is a convenient efficient, handy and Cost effective tool (2). The confirmation was done by the same Radiologist for all enrolled in the study. The demographic data such as the subjects height, weight and BMI was recorded and in the case of female an additional history pertaining to the number and mode of delivery, normal vaginal or by Cesarian Section (CS) was noted by a dedicated Surgical Nursing staff. The subjects who fulfilled the inclusion criteria were then consented and subsequently underwent an open surgical Plication of Diastasis Recti with Mesh Placement done by a solitary General Surgeon team. In the Post OP follow up a Quality of life Euro Scale score was utilized for reporting the outcome of pain, Restriction of activity and Cosmetic Satisfaction of the procedure.

Results:

The study has concluded that the mean age at diagnosis of **Diastasis Recti (DR)** in the females was 39.8 years, with a mean BMI 35.4. In case of the Males the Mean age at diagnosis was 51yrs, the mean BMI for males 44.2. Obesity was evidently associated with **Diastasis Recti (DR),** 91% of the subjects with **Diastasis Recti (DR)** were Obese belonging to Grade II, III & IV obesity.

Umbilical hernia was the most common hernia associated with **Diastasis Recti (DR)** at 32%. This was followed by Supra Umbilical Hernia at 25%. In our study **Diastasis Recti (DR)** with Infra Umbilical Hernia had the lowest association at 6%. The subjects with pure **Diastasis Recti (DR)** without hernia were the highest at 37%. Among the Obese Category 27% were Morbid Obese, 23% had Grade II Obesity (BMI 35-40), 26 out of 100 had of Grade I Obesity (BMI 30-35) subjects had Umbilical Hernia a 37% DR prevalence. The average length for the hernia were 0.88 cm at supra umbilical, 1.23 cm at the umbilical and 0.3 cm at the infra umbilical region. The Incidence of **Diastasis Recti (DR)** was high in Multiparous Obese females and was prevalent among Obese Males as well. The prevalence of subjects who had Hernia associated with **Diastasis Recti (DR)** in our study was 63% across all BMI categories, the remaining 37% of subjects had **Diastasis Recti (DR)** solely. Obesity is associated with and contributes to **Diastasis Recti (DR)** development and its evolution. The association of Hernias with

Diastasis Recti (DR) is suggestive of the defective connective tissue framework that ought to be viewed as the primary event that set the stage for development of **Diastasis Recti (DR).**

Materials And Methods

Study Type: A Cohort Study (Prospective Observation Study).Sample Size: 100 Subjects

The study was approved by the Ethics Committee of Research of humans of the King Fahd Hospital & Al Omran General Hospital Research Committee, Al Omran City Al Hassa Eastern Province on June 2021.

Inclusion criteria

Males & Females aged 20 yrs
Males & Females with Clinical evident rectus divaricationPost partum, Primigravida,
Multigravida with Clinical abdominal Diastasis Recti or Rectus divarication

Exclusion criteria

Previous abdominal surgeryPatients on steroids
Covid Positive

Procedures and tools for assessment and data collection

These data were entered into an evaluation form, elaborated specifically for this research. The data sheet information included age, marital status, weight, level of education, obstetric history, number of pregnancies, Mode of delivery, BMI and the Comorbid s, The site and location of Diastasis Recti (DR) Supraumbilical, Umbilical or Infraumbilical. For anthropometric assessment the height was measured standing using the Frankfort horizontal plane methodology and for weight a digital weighing Chair Scale model (SECA 954) was utilized.

The **Diastasis Recti (DR)** measurement was performed using Rett protocol that was measured in the supine position, with the hips and knees flexed at 90_0, the feet supported and upper limbs extended along the body(3). In this position the patient was requested to flex the trunk and head until the back of upper chest was off ground at the level of inferior angle of the scapula. A Diastasis Recti (DR) test was considered positive if a visible ridge was seen and palpated anywhere or entirely from the xiphoid to the umbilicus using the dominant hand fingers of the examining Surgical Clinician. Once the **Diastasis Recti (DR)** site was visibly confirmed the examining Clinician then inserted one or two fingers of his dominant hand perpendicularly along the medial edges of therectus abdominis muscles to gauge the length & width of the defect. A single or two finger or three finger width, referred to 2cm ,4cm and 6cm that was then documented on the data sheet, All subjects then went to the Department of Radiology here the Radiologist confirmed and accurately documented the Clinicians finding of **Diastasis Recti (DR)** defect using an Ultrasound probe.

A semi curl up position, rather than a head lift maneuver was the utilized method to check for **Diastasis Recti (DR)**, as differences in stiffness and distortion are avoided by this method. The umbilicus was considered as the reference point during forward flexion motion of the trunk, as a distance 4.5 cm above the Umbilicus. Similarly, a point 4.5cm below the umbilicus was designated as infra umbilicus.

Table 1: Diastasis Recti (DR) length, & Width using EHS (German) Clinical Hernia Classification.

Midline	Site	Length (cm)	Width (cm) **W1** (<3cm), **W2** (3-5cm) **W3** (>5cm)
M1	SUBXIPHOID	One two finger length	One, two, three finger breath wide
M2	EPIGASTRIC		
M3	UMBLICAL		
M4	INFRAUMBLICAL		
M5	SUPRAUMBLICAL		

A Clinically Confirmation of Diastasis Recti (DR) was subjected to Ultrasound reconfirmation by the Radiologist at Al Omran Hospital.

Table 2.

EuraHS-QoL Postoperative

Pain at the site of the hernia repair												
	0 = no pain										10 = worst pain imaginable	
In rest (lying down)	0	1	2	3	4	5	6	7	8	9	10	
During activities (walking, biking, sports)	0	1	2	3	4	5	6	7	8	9	10	
Worst pain felt during the last week	0	1	2	3	4	5	6	7	8	9	10	
Restrictions of activities because of pain or discomfort at the site of the hernia repair												
	0 = no restriction										10 = completely restricted	
Daily activities (inside the house)	0	1	2	3	4	5	6	7	8	9	10	X
Outside the house (walking, biking,driving)	0	1	2	3	4	5	6	7	8	9	10	X
During sports	0	1	2	3	4	5	6	7	8	9	10	X
During heavy labour	0	1	2	3	4	5	6	7	8	9	10	X
	X = If you do not perform this activity											
Cosmetic discomfort												
	0 = very beautiful										10 = extremely ugly	
The shape of your abdomen	0	1	2	3	4	5	6	7	8	9	10	
The site of the hernia and the scars	0	1	2	3	4	5	6	7	8	9	10	

Eura HS-Quality of Life a validated Scoring System was utilized post operatively on follow up in the clinic.

Data analysis

The demographic variables included in this study were age at onset of Diastasis Recti (DR), the sex the body mass index (BMI), smoking status, the parity primigravida or multigravida, mode of delivery Normal or CS and the site and type with location of the hernia, Diastasis Recti (DR) with or without Supra Umbilical, Umbilical, Infra Umbilical.

SPSS Statistics version 25 (IBM, NY) was used for statistical analyses. Data was summarized as frequencies and percentages or mean and standard deviation. Pearson's and Chi-square were used for data evaluation. A two-tailed P value less than 0.05 was considered statistically significant for all tests.

Statistical analysis included percentage rate calculation for the Diastasis Recti (DR) prevalence rate. The descriptive analysis included measures of central tendency (average), dispersion (standard deviation), frequency and percentage.

The Pearson correlation was used to verify the correlation. Data were analyzed using SPSS 25 software, and was considered a significance level of $p < 0.05$.

Demographic Data

Fig 1.

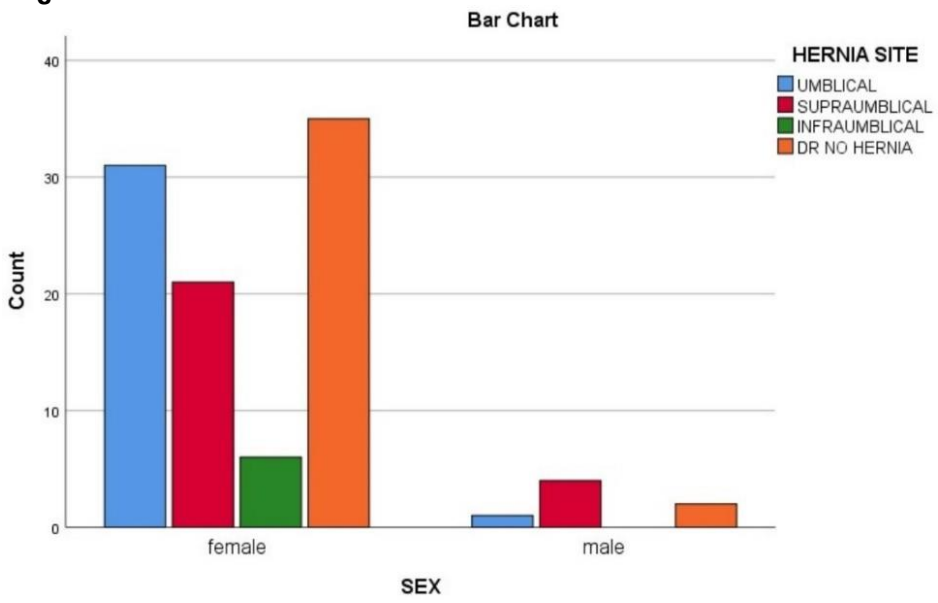

Table 3.

BMI	Hernia Site				Total	Precentage Prevalence
Wt(kg)/Ht m2	Umblical	Supraumbilical	Infraumbilical	Diastasis Recti (Only)		
Normal	1	4	2	2	9	78%
Obese I (25-30)	8	2	1	4	15	73%
Obese II (30-35)	7	8	1	10	26	62%
Obese III (35-40)	7	4	1	11	23	52%
Obese IV (40+)	9	7	1	10	27	63%
TOTAL	32	25	6	37	100	63%

Table 4.

DR & HERNIA SITE	Frequency (n)	Percent (%)	Cumulative Percent
UMBILICAL	32	32%	32%
SUPRAUMBLICAL	25	25%	57%
INFRAUMBLICAL	6	6%	63%
DR NO HERNIA	37	37%	37%
Total	100	100%	100%

Results:

In our study subjects with **Diastasis recti (DR)** without hernia were the highest at 37% followed by with **Diastasis Recti (DR)** associated with Umbilical hernia (32%). The **Diastasis Recti (DR)** with supra umbilical hernia were (25%). Those with **Diastasis Recti (DR)** in the infra umbilical region were the lowest at 6%. This is in contrast to other studies who had a higher prevalence of **Diastasis Recti (DR)** in supraumbilical (52%),

region followed by **Diastasis Recti (DR)** with infraumbilical hernia at 11% [4]. Greater **Diastasis Recti (DR)** was seen in the umbilical and infra umbilical levels. The supra umbilical hernias are associated with umbilical separation (50%) than those with **Diastasis Recti (DR)** & infra umbilical hernia [5], similar to what we noted in our study. The prevalence of Diastasis Recti (DR) is Significant Sixty three percent. **Diastasis Recti (DR)** is associated with all forms of Abdominal hernias. Obesity was predominant among the Male population as compared to the females. **Diastasis Recti (DR)** has an association with varying grades of Obesity, the greater the BMI the greater was the grade of **Diastasis Recti (DR).**

Table 5.

SEX	AGE	BMI
Female	Mean 39.85	35.40
N	93	93
Std. Deviation	8.981	8.180
Male	Mean 51.00	44.29
N	7	7
Std. Deviation	9.983	11.131
Total	Mean 40.63	36.03
N	100	100
Std. Deviation	9.443	8.653

Fig 2.

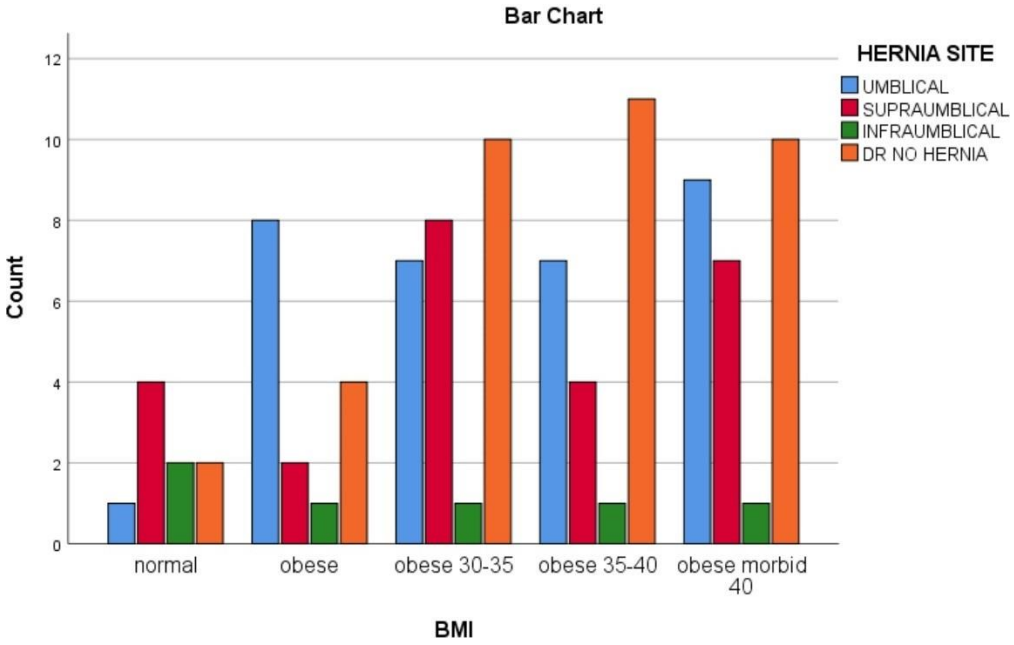

Table 6.

BMI	AGE	BMI
Normal Mean	29.89	23.40
N	9	9
Std. Deviation	8.923	1.480
Obese I Mean	33.93	27.53
N	15	15
Std. Deviation	11.560	1.457
Obese II (30-35) Mean	41.58	32.77
N	26	26
Std. Deviation	6.772	1.478
obese 35-40	42.91	37.83
N	23	23
Std. Deviation	7.908	1.586
Obese Morbid >40, Mean	45.07	46.56

N	27	27
Std. Deviation	7.364	7.324
TOTAL Mean	40.63	36.03
N	100	100
Std. Deviation	9.443	8.653

Table 7.
CHI SQUARE TESTS

Pearson Chi-Square	Value	Df	AsymptomaticSignificance (2 Sided)
Pearson Chi-Square	12.878a	12	.378
Likelihood Ratio	11.420	12	.493
N of Valid Cases	100		

10 cells (50.0%) have expected count less than 5.The minimum expected count is .54.

Postoperative care and follow-up — Lifting of weight more than five pounds was restricted for six weeks postoperatively. An abdominal binder was offered for those women with large Diastasis Recti (DR) for comfort and support.

Complications — The most common complication observed were seroma, surgical site infection (SSI) and post op scar. At our follow up the incidence of seroma and SSI were similar to those reported in literature worldwide at 10% [6], followed by scar hypertrophy [7]. A high score on cosmetic satisfaction scale was reported in many studies [8].

Post OP Satisfaction

The Euro Score is a effective post op scoring system for evaluation. Most of the patients scored a '5' in the first two to three weeks in the post Operative period. The score for Cosmetic satisfaction was more than '8'. A Similar grade of satisfaction was reported from studies on Diastasis Recti (DR) [6].

Discussion

The Anterior abdominal wall comprises of muscles and their ligament intersections. The muscles are external oblique, internal oblique, and transverse abdominal muscles constitute the lateral and ventral aspect abdominal muscles, while the rectus abdominis muscle forms the anterior muscular part anteriorly. The anterior abdominal wall its muscles and collective aponeuroses intersection in the midline provides a framework support and guards against a raised intra abdominal pressure. With the aid of confocal laser microscopy, the architectural pattern of the collagen fibers takes form along three zones. In Linea alba three different zones of orientation of fibers are seen.

1. The oblique layer,
2. The transverse fibril bundles
3. The lamina fibral Irregular pattern bundles [10].

Over the ventral aspect the dominant bundles are oblique pattern fibers. The dorsal rectus sheath consists mainly of transverse fibers. The arrangement of collagen fibers in Linea alba and rectus sheath forms an organized three-dimensional meshwork [10]. The normal thickness of the Linea alba ranges from 900 to 1200 micrometers from the xiphoid up to the umbilicus and infraumbilical from umbilicus to the pubic symphysis at 1700 to 2400 micrometers [10].

Diastasis Recti (DR) is defined according to the Beer classification as an inter-rectus distance (IRD) of 2.2 cm, three cm above the umbilicus measured in a relaxed state Another method of classification of Diastasis Recti (DR) is on the Width of the defect measured in cm, An Inter Rectal separation of <3 cm is called mild diastasis, A distance of 3–5 cm separation as moderate diastasis and more than 5 cm as severe diastasis recti (DR) [11]. A modern method of classification of midline hernias is the European Hernia Society classification of midline hernias [12], separating the distance between the xiphoid and pubic bone into the sub xiphoidal, epigastric, umbilical, infraumbilical, and suprapubic region, (**table 1**).

Linea alba implies a horizontal band of physiological fibers, between the two rectus muscles. Diastasis Recti (DR) is frequently encountered during pregnancy and regresses spontaneously after childbirth in most women. By the end of the first year however 33% postpartum of women still experience Diastasis Recti (DR), Although predominantly in females this condition is seen in males and the cause of Diastasis Recti (DR) in the males is not completely elucidated, therefore the most common reason for surgical repair in both males and females continues to be cosmetic appearance of the abdomen. In Diastasis Recti (DR) there is an absence of a true hernia sac which is what sets

Diastasis Recti (DR) apart from a ventral hernia. A clinical Ridge on examination without a sac therefore it poses no risk for strangulation [13], [14]. The 33% postpartum of women who still experience Diastasis Recti (DR) is a persistent DR state [15], The abdominal cavity is constantly exposed to fluctuations in intra-abdominal pressure, whether due to variation in intra-abdominal contents, contraction of the abdominal wall muscles, or movement of the thoracic cavity. During examination a semi curl up position is the preferred method, in contrast to a head lift maneuver as differences in stiffness and distortion are avoided [16].

TABLE 8. Diastasis Recti (DR) length using EHS (German) HERNIA CLASSIFICATION.

Midline	Site	Length (cm)	Width (cm) **W1** (<3cm), **W2** (3-5cm) **W3** (>5cm)
M1	SUBXIPHOID	One two finger length	One, two, three finger breath wide
M2	EPIGASTRIC		
M3	UMBLICAL		
M4	INFRAUMBLICAL		
M5	SUPRAUMBLICAL		

Diastasis of the rectus abdominis muscles (DR) is characterized by a protruding midline ridge following an increase in intra-abdominal pressure. The condition is characterized by a gradual thinning and widening of the Linea alba over a period of time combined with a general laxity of the ventral abdominal wall muscles [1]. The anterior abdominal wall its muscles and its aponeuroses intersection guards against a raised intra abdominal pressure In one anatomic review study on nulliparous females between 20 to 45 years of age with a body mass index (BMI) <30, the normal width of the Linea alba was 15 mm at the xiphoid, and 22 mm at a point 3 cm above the umbilicus, Infra umbilically 16 mm, at a point 2 cm below the umbilicus [1]. In thickness the Linea alba differs supra umbilically from the Xiphisternum up to umbilicus measuring 900 to 1200 micrometer and from Umbilicus to the Pubic Symphysis it is thicker measuring 1700 to 2400 micrometer [10]. The Linea alba is running from the xiphoid process of the sternum to the superior pubic ligament. The length of the Linea alba (LA) in an adult is 33 cm, while its width is at least 10 mm [1]. The anterior abdominal wall its muscles and its aponeuroses intersection guards against a raised intra abdominal pressure [2]. Thetension is regulated by the pyramidal muscles and the rectus abdominis muscles [17]. Structural Analysis reveal that the Linea alba, is composed of three different zones of fiber orientation: the Oblique lamina fibrae obliquae, the transverse named lamina fibrae transversae and the small irregular lamina fibrae irregularium fibres. The transverse fibers act as a counterpart to the intraabdominal pressure, whereas the oblique fiber are support framework for muscles during movements of the trunk [10].

Obesity & Diastasis Recti (DR): Anatomically the rectus muscles are normally fused at the midline with no more than 1 to 2 cm separating them [18]. **Diastasis recti (DR)** is an acquired condition in which the rectus muscles are separated by an abnormal distance along their length without a fascial defect [18]. A separation of >2 cm is considered to be a **Diastasis recti (DR)** [18]. It is most commonly found middle aged male and females and older men with central obesity, or in women who are pregnant and have conceived a large fetus or twins to term [18]. Gradual weight gain causes the rectus muscles to increasingly separate above the umbilicus [19]. The gradual increase in weight along with a rise of Intra abdominal Pressure with movements and coughing exerts a lateral stress along the intersections of Linea leading to the development of **Diastasis Recti (DR). Diastasis recti (DR)** is characterized by a protruding midline shelf following an increase in intra abdominal pressure. The condition characterized by a gradual thinning and widening of the Linea alba, combined with a general laxity of the ventral abdominal wall muscles. The musculofascial continuity of the midline and the subsequent absence of a true hernia sac is what sets **Diastasis Recti (DR)** apart from a ventral hernia [20].The prevalence of **Diastasis Recti (DR)** has traditionally been among the females. This does not explain its prevalence in males. Obesity induced gradual weight gain causes the rectus muscles to increasingly separate above the umbilicus [19]. In Obese individuals the normal transverse fibers and the oblique fiber orientation

that form framework for muscles are lost during movements of the trunk [21]. The **Diastasis Recti (DR)** seen at the umbilical and infra umbilical levels was greater than the supraumblical counterpart. Similar to the results in our study. It is interesting to note that weight loss does not improve the diastasis, once it sets in. The Obese people have a predisposition to incisional hernia development and the reason cited is an increased lateral stress. Obesity and comorbidities are associated with major alterations of white adipose tissue [1]. This is because fat is metabolically active. The adipose tissue gets is infiltrated with macrophages, that are a trigger to inflammatory cytokines like interlukin-6 (IL-6) and C- reactive protein (CRP) [22], [23]. The result is an increase in interstitial fibrosis with accumulation of extracellular matrix (ECM) [10]. Progressive ECM accumulation reducestissue plasticity and results in adipocyte dysfunction, ectopic fat storage, and metabolic syndrome disorders [24], along with laxity of the facial and ligament support. This increased acute phase reactants production, sets the stage for activation of inflammatory signaling pathways, that affect obese individual at the micro and macro cellular level. At the micro cellular level we see the basement Membrane undergoes modifications in both the adipocyte and extra Cellular matrix. Through a process called Pyroptosis. This pyroptosis is characterized by the formation of micropores along the basement membrane, that trigger and orchestrate a proinflammatory state characterized by an increased expression of TNF alpha, IL-1-β & IL6 with raised C-reactive protein [25]. With a global epidemic of Obesity, we are witnessing surge of fitness clinics & Musculoskeletal fitness Specialists worldwide. The effect of Obesity on the musculoskeletal system is the end result of inflammation that ends as degenerative changes of the ligaments joints and muscles in the body. The adipocyte hormones sited for these events are “adipokines” or “adipocytokines”. The effect of adipocytokines on ligaments and linea alba is yet to be elucidated. [26], [27], [28], [29].

Obesity & Role of Collagen: The term Collagen or Kolla in Greek refers to glue, & *gen*, denotes "producing". It is a component of connective tissue such as skin cartilage, tendons, ligaments, and bones. There are 28 types of human collagen and 90% of the collagen in the human body is type I collagen. Collagen is classified into Fibrillar (Type I, II, III, V, XI) & Non-fibrilla variety. Each is composed of the amino acid Hydroxyproline, proline and glycine. Hydroxyproline and proline provide stability & twisting of the triple helical structure of collagen. Hydroxyproline constitutes 80% of the rectus sheath and has been quantified to be 90 mcg/gm of collagen in normal tissues, 82 mcg in individualswith indirect inguinal hernia, and 75 mcg in those with direct inguinal hernias [30], Type I collagen is abundant form in the body & constitutes 90% by component of aponeuroses, Linea alba, tendons, even scar tissue, and is responsible for resistance to tensile stress. The collagen type I and type III collagen are important components of the extra interstitial matrix and are responsible for tissue framework support and stability [31].Collagen is a constituent of the abdominal fascia, aponeuroses like Linea alba, and ligaments. Individuals with lower collagen content in aponeurotic structures are more prone to develop hernias in general, including ventral hernia development [32], [33], [34], [35]. A decrease in the levels of collagen in ligaments specifically a decrease of Type I or an increase in Type III is linked to smoking, genetics and herniation [36], [37], [38] [39]. The fascia of Obese individuals have a reduced gene expression of collagen I and III [40]. The adipose tissue collagen VI, is dysfunctional and over time contributes to perivascular protein deposition as seen in metabolic syndrome [41]. The lower collagen in aponeurotic layout and obesity renders hernia development [42].

Diastasis Recti (DR) & Pregnancy During pregnancy, the body undergoes major physiological changes under the influence of hormones like, progesterone, estrogen and relaxin. The effect of this hormone is it renders the joints unstable [42], Pregnancy affects both muscles but ligaments in the body. Relaxin is a peptide hormone of the insulin superfamily [43]. First identified by Frederick Hisaw in 1926 as an ovarian corpus luteum cell derived hormone that induced relaxation of the pelvic ligament by increasing the length of the pubic ligament [44], The relaxation of ligaments is achieved by remodeling of the collagen [45], Females who are smokers the extracellular matrix turn over in skin is altered [46],This widening is persistent even after pregnancy [47], [48], This relaxin hormone acts is in an autocrine fashion. During pregnancy the rise in the level of relaxin is 1ng/mL gradually ebbing at delivery [49]. Its effects on ligaments and fascia of the pelvis start from six weeks reaching a peak at twelve weeks. Pregnancy is just one of the factors cited in that predispose women to Diastasis Recti (DR) development [50].The pubic symphysis and sacroiliac joints are also affected by the hormone relaxin, through activation of collagenases [51], [52].The net result is all the

ligaments in the body are affected. Relaxin is associated with both local and generalized laxity [39], It is Interesting to note that this hormone relaxin is even produced by the prostatic seminal fluid in males. During pregnancy the Diastasis Recti appears to be more prevalent in the third trimester [53], Normal spontaneous resolution of **Diastasis recti (DR)** with the lax abdominal muscles and ligaments take up to six months to revert back to their original state [54] This spontaneous resolution of **Diastasis recti (DR) is seen post partum in most pregnancies.** Pregnancy per se [55], solely cannot explain the reason for **persistence of Diastasis recti (DR)**. The combination of pregnancy & Obesity in addition to Obstetric factors like short stature and narrow pelvis under the influence of the hormone relaxin along with a bulky uteru [36], [56], aggravating the intra Abdominal pressure by exerting lateral stress with tension along Linea Alba is therefore a more plausible explanation for the development of Diastasis Recti (DR). In Obesity a low pro inflammatory state under the influence of hormone Relaxin, may be responsible for the persistence of Diastasis Recti post partum. A prevalence similar to our study of Diastasis Recti (DR) in the infraumbilical region was seen among multipara [12].

Diastasis Recti (DR) & Role of Smoking. Male and females Smokers produced less hydroxyproline than nonsmokers [9]. Less hydroxyproline amounts to destabilizing the triple helix structure of collagen that in turn weakens the fascia and ligaments. Smokers alters the balance of extracellular matrix turn over in skin. Smokers with a genetic predisposition or altered collagen 1:3 ratio's may have a more pronounced role in the development of Diastasis Recti. In our study the male subjects were either smokers or ex smokers, none of the female subjects smoked.

Diastasis Recti (DR) & Physiotherapy. The current evidence literature does not support the successful treatment of rectus diastasis by excercise. Physiotherapy only moderately reduces the **Diastasis Recti** (DR), the time taken for such a reduction of Inter diastasis recti (DR) varies from individual to individual and is described anywhere from months to years. Physiotherapy therefore does not contribute to satisfying functional outcome [13] The dynamics of the body changes with the development of **Diastasis Recti** (DR), normal body physiological functions like parturition and defecation even lumbar stabilization are secondarily affected [57], [58], [59].

Abdominoplasty — In general **Diastasis Recti** (DR) is treated by Conservative management with weight loss and exercise as first line treatment [38]. For our study **Diastasis Recti** (DR) abdominoplasty with rectus abdominis plication & mesh placement was performed [8]. Standard abdominoplasty involved elliptical excision of lower abdominal skin excess as a flap. The upper anterior abdominal wall flap was undermined up to the xiphoid to expose the fascia of the rectus muscles [8]. The umbilicus left in its native position a neo orifice is made in the upper flap and accommodated & sutured to the skin. The diastasis can be repaired by suture plication of widened Linea alba [6] followed by mesh placement [7].

Conclusion

The **Diastasis Recti (DR)** The diastasis recti (DR) is prevalent among the male population. The prevalence was considered high and relevant in this region of Saudi Arabia. Obesity in association with pregnancy & multiparity not only aggravates it accelerates the development of **Diastasis Recti (DR)**. The multiparous women had a higher correlation with the diastasis recti (DR) than their primiparous counter parts. Obesity ought to be perceived as a low grade metabolically active inflammatory state that erodes structural integrity of connective tissue. **The Hernia in the obese is the culmination of degradation of the collagen framework manifesting as Diastasis in its mild form and end stage hernia with organ prolapse at the extreme end of the spectrum.**

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