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Prevalence of Diastasis Recti Abdominis in Postmenopausal Women with Stress Urinary Incontinence: An Observational Study

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Abstract:

Purpose: To determine the prevalence of diastasis recti abdominis (DRA) in postmenopausal women with stress urinary incontinence (SUI).

Methods: 385 postmenopausal women complaining of SUI joined the study from Maghagha General Hospital/ El-Minia, Egypt. Their age ranged from 45- 60 years and their body mass index (BMI) ranged from 25- 35 kg/m^2. Only women with proven SUI, confirmed by cough stress test, were included in the study. Demographic data for each woman, including BMI, waist/hip ratio, (WHR), and the years since the last menstrual cycle were recorded. The magnitude and frequency of the urine loss were recorded through a set of questions. The measurements of inter-rectus distance were done by finger width test and abdominal ultrasonography. DRA identification was based on the presence of separation ≥ 20 mm at any level (supra umbilical / umbilical) in abdominal ultrasonography.

Results: Only 200 postmenopausal women were included out of 385 women. The prevalence of DRA among postmenopausal women with SUI was 79.5% (95% Confidence interval (CI) of 73.37- 84.51%) based on abdominal ultrasonography. There was a significant increase (p = 0.006)* in the prevalence of DRA in obese compared to overweight patients, and in patients with a WHR of 0.97-1.3, compared to patients with a WHR of 0.82-0.96 (p = 0.02)*. There was no significant association (p = 0.56) between DRA and the years since last menstrual cycle. Regarding SUI parameters, there was a statistically significant association (P<0.05) of DRA with both the amount of urine loss (p = 0.001)* and the times of involuntary loss of urine (p = 0.001)*.

Conclusion: DRA appears to be prevalent in Egyptian postmenopausal women with SUI. Also, DRA prevalence could be affected by the patient's BMI and WHR.

Keywords: Diastasis recti abdominis, Stress urinary incontinence, Menopause, Finger width test, Abdominal ultrasonography.

1. Introduction:

Female aging involves a transition from a reproductive to a non-reproductive state associated with hypoestrogenism. This process, which includes pre-menopause, menopause, and post-menopause, is marked by a number of vasomotor, psychological, sexual, and physical changes that may have a detrimental impact on some women's quality of life

(1). Menopause is defined as the reduction of ovarian follicular activity that results in a permanent cessation of menstruation, signifying the end of a woman's natural reproductive life. The menopausal transition, which often starts in one's mid-40s, precedes it (2).

When a woman has not had a period for one year or more, then she is postmenopausal. Though, changes and symptoms can start several years earlier. Among these are urogenital manifestations such as vaginal soreness (45.7%), sporadic stress incontinence (40%), weakened bladder control (24%), and urinary tract infection (3).

Following menopause, estrogen insufficiency is known to result in atrophic alterations and may be accompanied by urinary symptoms such as frequent urination, nocturia, urgency incontinence, and recurrent infections. According to epidemiological studies, lower urinary tract symptoms are associated with estrogen insufficiency in 70% of women attributing the onset of urinary incontinence (UI) to their final menstrual period (4). Hypoestrogenism was also associated with the loss of subcutaneous fat and the increase in abdominal fat. In fact, menopausal women are three times more likely to have central obesity, with increased abdominal fat, which leads to the development of diastasis recti abdominis (DRA) (5, 6).

DRA is defined as a condition where the two rectus abdominis muscles separate along the linea alba. Any separation of greater than 2 cm is deemed abnormal (7, 8). In many circumstances, the pelvic floor and abdominal muscles work in unison. Both muscle groups are responsible for regulating intra-abdominal pressure when performing actions like lifting, coughing, and quick arm motions since they both surround the abdominal cavity. Additionally, it has been shown that when women voluntarily contract their abdominal muscles, the pelvic floor muscles also contract concurrently and vice versa (9).

According to Hall and Sanjaghsaz, DRA has been shown to contribute to stress urinary incontinence (SUI) (10). Furthermore, Spitznagle et al. stated that about 50% of women seeking urogynecological examination were presented by DRA, with the majority of them being menopausal (5). Conversely, DRA was reported as a predictor of UI in women aged above 50 years in the study of Bo et al. (11).

Therefore, this study aimed to determine the prevalence of DRA in postmenopausal women with SUI.

2. Material and methods:

2.1. Study Design:

This study was designed as a cross-sectional study. Ethical approval was obtained from Ethical Research Committee at faculty of Physical Therapy, Cairo University before study commencement (P.T.REC/012/0033811).

All participants were given a full explanation and instructions about the assessment procedures to gain their confidence and co-operation. Also, an informed consent form was signed from each participant before joining this study. The study was conducted at Maghagha General Hospital, El-Minia Governorate between May 2021 and July 2022.

2.2. Participants:

Three hundred eighty-five postmenopausal women complaining of SUI were initially selected to participate in the study among women attending Maghagha General Hospital- El-Minia seeking a urogynecologist. Women with ages ranging from 45-60 years and body mass index (BMI) ranging from 25- 35 kg/m^2 were included in the study. All women were assessed by cough stress test (CST) to prove SUI presence.

Women with BMI > 35 kg/m^2 or <25 kg/m^2 were excluded. Also, information was taken to exclude from the study, those having history of previous abdominal or pelvic surgeries (except for caesarean section), history of multiparity, avulsion of the levator ani muscles causing severe pelvic organ to prolapse, tumors in lumber spine, pelvic or abdominal region, and those having local skin infection, receiving any hormonal therapy and women who were unable to perform the head-lift posture.

2.3. Assessment of outcome measures:

All demographic data for each woman participating in this study, including BMI, waist/hip ratio (WHR) and the years since last menstrual cycle were recorded. The magnitude and frequency of the urine loss were recorded using a set of questions. Moreover, the findings of CST together with the measurements of inter-rectus distance, done by ultrasound and finger width test, were involved.

2.3.1. *Body mass index*: BMI was calculated by using an automatic BMI calculator unit (12), it was measured for each woman and the value was recorded. Women were considered overweight if their BMI was ≥ 25 kg/m^2 and <30 kg/m^2, and obese when it was ≥ 30 kg/m^2.

2.3.2. *Waist/Hip ratio*: Central obesity was assessed by tape measurement through evaluating WHR. With the women standing erect and relaxed, arms at the sides, feet close together and her weight distributed across the feet, she was ordered to take several deep natural breaths before measurement. Women were asked to refrain from eating and drinking several hours before the measurement to reduce the effect of presence of water, food and gases in gastrointestinal

tract, which could affect the accuracy of waist circumference. Using the tape parallel to the floor, waist circumference was measured -at the end of normal expiration- with the tape at, roughly, the midpoint between the lower border of the last palpable rib and the top of the iliac crest. The broadest part of the buttocks was wrapped in tape to measure hip circumference (13), (**Figure** 1).

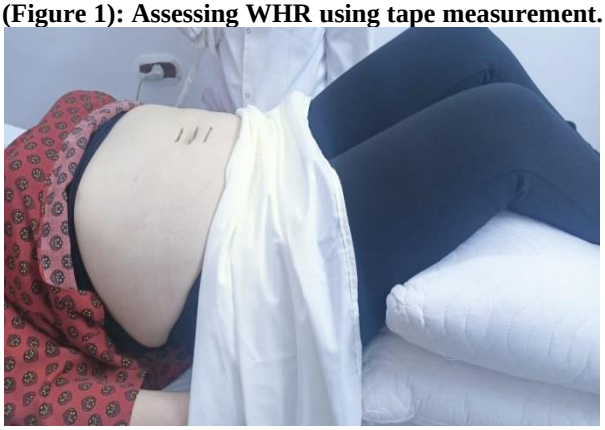
According to Donato et al., women's health hazards and the risk of central obesity start to rise noticeably over a WHR of 0.80. As well, WHRs of 0.80 or higher indicated a substantial, independent relationship with menopause status (14).

2.3.3. ***Measuring of SUI symptoms*****:** Women were asked to report the times of involuntary loss of urine and amount of the urinary loss, to assess SUI frequency and volume by a predesigned questionnaire, based on the validated questionnaires, "The Incontinence Severity Index (ISI)", "The International Consultation on Incontinence Questionnaire- Urinary Incontinence Short Form (ICIQ-UI SF)" and "The 3 incontinence questionnaire (3IQ)" (19, 20, 21, 22).

2.3.4. ***Finger width test:*** All of the women underwent DRA testing while lying supine with their knees bent at a 90-degree angle, their feet flat on the plinth and their arms by their sides. Each woman was advised to elevate her head and shoulders until her shoulder blades were clear of the table after receiving instructions on how to conduct an abdominal crunch. The number of fingerbreadths between the medial margins of the two sides of the rectus abdominis muscle was used to score DRA. Three sites across the abdominal wall were determined using a removable marker 2 cm above the umbilicus, at the level of umbilicus and 2 cm below the umbilicus (15), (**Figure 2**). Then, the test was done at those previously marked levels. Any separation more than 2 cm at any level along the linea alba was considered abnormal (7, 8), (**Figure 3**).

2.3.5. ***Abdominal ultrasonography***: An ultrasound device (Mindray DP-10, China) was used by an independent specialist, with a high-frequency, broad-band linear transducer. The transducer frequency was adapted according to the thickness of the subcutaneous layer to be 10 MHz (16), in the crook lying and knees flexed over two pillows. Measurements of inter-rectus distance were obtained at 2 cm supra umbilical and at the umbilical level (17, 18), at rest immediately after expiration, not pressing excessively on the abdominal surface with the transducer to avoid pressure-related contraction reflexes.

(Figure 1): Assessing WHR using tape measurement.



(Figure 2): Identifying the three sites of the measurements using a removable marker.

Each measurement was repeated 3 times and the average value was recorded for the analysis (16). DRA was reported if the subject had separation more than 20 mm at any level (supra umbilical / umbilical) in abdominal ultrasonography, (**Figure 4**).

2.4. Data and statistical analysis:

2.4.1. Sample size calculation:

The G*power program 3.1.9 (G power program version 3.1, Heinrich-Heine-University, Düsseldorf, Germany) for one tailed test was used to calculate the sample size for this study. Sample size calculation based on χ^2 tests - Variance: Difference from constant (one sample case), Type I error (α) = 0.05, power (1-β error probability) = 0.80, Ratio var1/var0 = 1.28 and DF= 199. Based on Spitznagle et al. (5), the appropriate sample size for this study was 200 patients.

2.4.2. Statistical analysis:

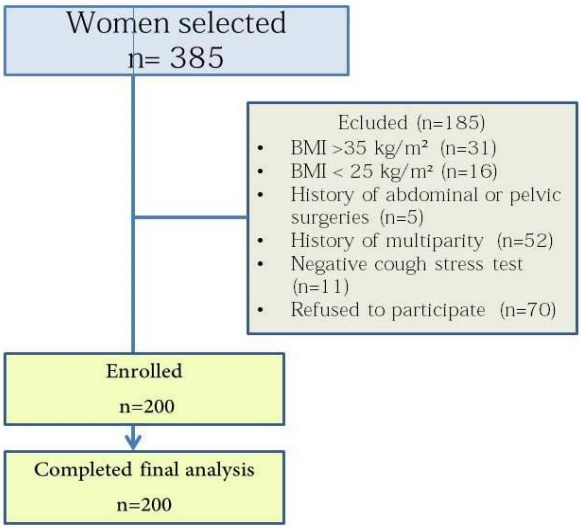
Descriptive statistics of mean, standard deviation (SD), frequencies, numbers, and minimum, maximum, percentage and range percentages were used to present the subjects' measurable and demographic data. While categorical variables were reported using frequencies and percentages, quantitative variables were summarized using mean and SD. Chi-square statistics were utilized to examine associations between DRA and risk factors. All statistical tests had a significance level of $p < 0.05$. The statistical package for social studies (SPSS) version 25 for windows was used to perform all statistical measures.

3. Results:

Out of 385 postmenopausal women initially selected to participate in the study, 115 women did not meet the inclusion criteria and 70 women did not agree to share in the study. Only 200 women were enrolled in the study based on their eligibility criteria, and 200 women agreed and completed the assessment procedures, (**Figure 5**).

(Figure 3): Assessing DRA by the finger width test.

(Figure 4): Assessing DRA using abdominal ultrasonography.



(Figure 5): Flow chart of the study participants.

3.1. Participants' characteristics

The mean ± SD for the age of the tested group was 51.91 ± 4.69 years, their BMI mean ± SD was 30.95 ± 2.47 kg/m², and the WHR mean ± SD was 0.95 ± 0.08. While the mean ± SD of the years since last menstrual cycle of the tested group was 4.93 ± 3.17 years.

Results have shown that 58 (29%) of the patients were overweight, while 142 (71%) were obese. For WHR, 105 patients (52.5%) had a WHR of 0.82-0.96, while 95 patients (47.5%) had a WHR of 0.97-1.3. Regarding the years since the last menstrual cycle, 109 patients (54.5%) were found to have their last menstrual cycle 1-4 years ago, and 91 patients (45.5%) had theirs 5-15 years ago**, Table (1).**

3.2. The SUI parameters

The amount of urine loss of the study group showed that 62 (31%) subjects had the amount of urine loss as "just a drop or less", 91 (45.5%) had "sometimes I lose a trickle", 35 (17.5%) had a loss of urine "so much that it noticeably wets clothes" and 12 (6%) had a loss of urine "so much that protection is soaked or leaks". Regarding the times of involuntary loss of urine in the tested group, 66 (33%) of subjects had the times of involuntary loss of urine once a week or less, 64 (32%) had an involuntary loss of urine more than once but less than three times a week, 51 (25.5%) had an involuntary urine loss of more than three times a week. but not every day and 19 (9.5%) had an involuntary urine loss every day**, Table (2).**

Table 1: Descriptive statistics of the tested group.

SUI parameters	*N*	%
Amount of urine loss		
Just a drop or less	62	31%
Sometimes I lose a trickle	91	45.5%
So much that it noticeably wets my clothes	35	17.5%
So much that my protection is soaked or leaks.	12	6%
Times of involuntary loss of urine		
Once a week or less	66	33%
More than once but less than three times a week	64	32%
More than three times a week. but not every day	51	25.5%
Every day	19	9.5%

SUI: stress urinary incontinence
N: Number **%: Percentage**

Table 2: The SUI parameters

Participant's characteristics	$\overline{X}$ ±SD	Min	Max	Range	N%
Age (years)	51.91 ± 4.69	45	60	15	
BMI (kg/m²)	30.95 ± 2.47	25.4	34.8	9.4	
Overweight (25 to 29.9 kg/m²)					58 (29%)
Obese (30 to 34.9 kg/m²)					142 (71%)
WHR	0.95 ± 0.08	0.82	1.3	0.48	
0.82-0.96					105 (52.5%)
0.97-1.3					95 (47.5 %)
Years since last menstrual cycle	4.93 ± 3.17	1	15	14	
1-4 years					109 (54.5%)
5-15 years					91 (45.5%)

SD: Standard deviation **BMI: Body mass index**
X̄: Mean **WHR: Waist/hip ratio**
Min: Minimum **Max: Maximum**
%: Percentage

3.3. Measurements of inter-rectus distance:

For the finger width test results, the mean ± SD value of the tested group at the supra umbilical level was 2.16 ± 0.58 fingers, at the umbilical level was 2.82 ± 0.73 fingers, and at sub umbilical level was 1.65 ± 0.57 fingers, **Table (3).** Regarding abdominal ultrasonography measurements, the mean ± SD at supra umbilical level was 21.03 ± 4.19 mm, while at umbilical level, it was 25.45 ± 4.41 mm, **Table (3).**

3.4. DRA prevalence and its association with women's characteristics:

DRA overall prevalence was 79.5% with 95% CI of 73.37- 84.51%. There was a significant increase in the prevalence of DRA in the subjects with obesity compared with overweight subjects (P = 0.006).

Moreover, there was a significant increase in the prevalence of DRA in the subjects with 0.97-1.3 WHR compared with subjects with 0.82-0.96 WHR (P = 0.02). However, there was no significant association between DRA and years since the last menstrual cycle (P= 0.56), **Table (4).**

Discussion:

In this study, two hundred post-menopausal women complaining of SUI participated and completed the procedures of the study. The results revealed that there was a significant increase in the prevalence of DRA in women with obesity compared with women who were overweight.

There was a significant increase in the prevalence of DRA in women with 0.97-1.3 WHR compared with women with 0.82-0.96 WHR. On contrary, there was no significant association between DRA and the years since last menstrual cycle. There was a significant association between DRA and the amount of urine loss, with a significant decrease in DRA in subjects with urine loss of "just a drop or less" compared with other categories. Also, there was a significant association between DRA and times of involuntary loss of urine**.**

However, unlike earlier research, the sample investigated in the current study included only women who had SUI symptoms and were seeking a urogynecological examination. As stated by Kocak et al., the prevalence of UI increases with age (23). Also, many studies conveyed the increasing prevalence of SUI during the menopause and postmenopausal period (24, 25, 26).

Table 3: Descriptive statistics of inter-rectus distance measurements of the tested group

Finger width test (fingers)	$\overline{X}$ ±SD	Min	Max	Range	>2 f > 2 fingers	% Of DRA
Supra-umbilical	2.16 ± 0.58	1	3.5	2.5	93	**46.5%**
Umbilical	2.82 ± 0.73	1.5	4	3	148	**74%**
Sub-umbilical	1.65 ± 0.57	0.5	3	2.5	30	**15%**
Abdominal ultrasonography (mm)	$\overline{X}$ ±SD	**Min**	**Max**	**Range**	**DRA (> 20 mm)**	**% Of DRA**
Supra-umbilical	21.03 ± 4.19	13	28	15	111	**55.5%**
Umbilical	25.45 ± 4.41	15	24	9	159	**79.5%**

$\bar{X}$: Mean SD: Standard deviation
Min: Minimum Max: Maximum
% of DRA: Percentage of diastasis recti abdominis

Table 4. ***Frequency distribution of DRA prevalence and its association with women's characteristics:***

Women's characteristics	Presence of DRA among women (n=200) N (%) Yes	No	χ^2 value	P –value
Women with SUI	159 (79.5%)	41 (20.5%)		
BMI (kg/m²)				
Overweight (25 to 29.9 kg/m²)	39 (67.2%)	19 (32.8%)	7.53	0.006*
Obese (30 to 34.9 kg/m²)	120 (84.5%)	22 (15.5%)		
WHR				
0.82-0.96	77 (73.3%)	28 (26.7%)	5.15	0.02*
0.97-1.3	82 (86.3%)	13 (13.7%)		
Years since last menstrual cycle				
1-4 years	85 (78%)	24 (22%)	0.33	0.56
5-15 years	74 (81.3%)	17 (18.7%)		
Amount of urine loss				
The amount of urine loss is just a drop or less	33 (53.2%)	29 (46.8%)	41.36	0.001*
Sometimes I lose a trickle	79 (86.8%)	12 (13.2%)		
The loss of urine is so much that it noticeably wets my clothes	35 (100%)	0 (0%)		
The loss of urine is so much that my protection is soaked or leaks.	12 (100%)	0 (0%)		
Times of involuntary loss of urine				

Once a week or less	39 (59.1%)	27 (40.9%)		
More than once but less than three times a week	55 (85.9%)	9 (14.1%)	32.04	0.001*
More than three times a week. but not every day	51 (100%)	0 (0%)		
Every day	14 (73.7%)	5 (26.3%)		

χ2: Chi squared value **P-value: Probability value** **DRA: Diastasis recti abdominis**
SUI: Stress urinary incontinence ***: Significant at P-value <0.05** **BMI: Body mass index** **WHR: Waist/hip ratio**

The current study population aged from 45 to 60 years. That agreed with the study conducted by Kim et al., who found that the mean age of the women with DRA was significantly higher than the age reported in previous studies (27). Most investigators disregarded women after more than one year following the delivery, middle-aged and menopausal women while concentrating on pregnant and postpartum women immediately following the delivery. Previous literature has shown that women during pregnancy suffer from DRA and a large percentage of them get better within the first year postpartum (28, 29).

Nevertheless, few studies have investigated the prevalence of DRA among menopausal women (5, 30).

The results shown by Spitznagle et al. coincided with the results of the current study regarding the presence of DRA in the menopausal women population (5). They stated that pregnancy hormonal changes make women susceptible to developing DRA. Sometimes, DRA persists beyond the childbearing period owing to the hormonal effects. If not treated surgically or with exercise, it may also persist into menopause (5). Changes in the connective tissue elasticity due to aging and stretching of the abdominal muscles because of hormonal changes due to menopause may help explain why DRA has developed (30). In this study, the tested sample was having SUI.

That specific condition was chosen based on the finding of Kirss et al., who stated that the most prevalent UI type was SUI (79%) (31). The same was reported by Oskay et al., who claimed that SUI was more prevalent in postmenopausal than other types (32).

Similarly, Çiftçi and Günay deducted that SUI possibility is about six times greater in women aged over 40 years. SUI prevalence in postmenopausal women could be explained by the diminishing of the contractility and capacity of the bladder with aging, as well as the ability to delay urination, which may lead to UI (33). Not only aging is the cause of the development of UI in postmenopausal women, but also the changes that occur in the urinary system related to aging increase the prevalence of UI in old age (32).

They reported that estrogen decreases during menopause leading to vaginal atrophy, reduction of supportive tissues that surround the urethra, and pelvic muscle weakness, hence, it may increase incontinence (32). Also, Dinç supported the idea that estrogen deficiency during menopause could increase the predisposition to SUI (34).

The population chosen for the current study included overweight and obese women with a BMI ranging from 25 to 35 kg/m2. The selection was based on what was mentioned in the study of Stachowiak et al. They indicated that the prevalence of overweight and obesity is high among middle-aged women and rapidly increases over the age of 40. Furthermore, about 65% were either overweight or obese and more than 30% were obese (35).

In the present study, the prevalence of DRA in obese postmenopausal women is higher compared to overweight. According to the studies conducted by Cheesborough and Dumanian, also Wu et al., BMI is a factor influencing the occurrence of DRA in elder women. A possible explanation is that obese individuals mostly have more fats in the abdominal cavity which cause extra pressure on the abdominal wall, which in turn leads to the separation of the rectus abdominis (36, 8). Another reason was stated by GROSSI et al., who claimed that the amount of collagen fibers in linea alba above the umbilicus in obese people is less compared to non-obese (37).

Moreover, similar results were reported by Doubkova et al. and Gruszczyńska et al. who reported a strong independent correlation between BMI and the occurrence of DRA (38, 39). Michalska et al. stated that prolonged stretch on the linea alba combined with hormonal changes led to the

separation of rectus abdominis causing DRA, mentioning that, obesity is a common cause of DRA (40). Whereas Sperstad et al. reported the opposite in their study; proposing that age and gaining weight were not found to be risk factors for DRA occurrence (41).

The results of the current study indicated that the women included in the study had variable degrees of SUI symptoms, in terms of the amount and frequency of urinary loss. That finding could be justified by the accumulative effect of the duration of being overweight or obese on the degree of SUI, as, there is evidence that women who were overweight or obese early in their life are more than twice as likely to have SUI.

That explanation was adopted by Fei et al., who concluded that a higher proportion of women who were chronically overweight or obese, first reported at the age of 48 years, already had symptoms of incontinence than underweight or normal-weight women. This difference widened at the age of 54, suggesting that symptoms may worsen over time (42).

Furthermore, Choi et al. observed that being overweight or obese at the age of 35 years may lead to UI in their midlife and that an increase in BMI from age 18 to 50 years is associated with a higher incidence of UI. They also reported that the longer the duration of being overweight or obese, the more frequent UI episodes and the higher amount of urine leakage (43).

In our study, abdominal obesity was measured by WHR, which agreed with the studies of Ferland et al., Owens et al., and Hara that suggested WHR as an effective indicator of intra-abdominal fat (44, 45, 46). On the contrary, Ponti et al. mentioned WHR among other anthropometric measurements as having a quite low accuracy though it is widely used to measure body composition for its ease to use, low cost, and avoidance of radiation exposure (47).

Our study showed that the prevalence of DRA among the two hundred postmenopausal women complaining of SUI was 79.5%. In a retrospective study, Spitznagle et al. indicated that more than 50% of women who were seeking a urogynecologist were DRA, most of them were menopausal and about 42% of them were suffering from SUI (5). They also stated that women with DRA were having weaker pelvic floor muscles than women without DRA. An earlier study by Sapsford et al. reported that people with DRA were most likely to have pelvic floor muscle weakness; consequently, they were more likely to have UI (48).

Similarly, Gruszczyńska et al. proposed in their study that there was a correlation between UI and the occurrence of DRA (39). Besides, according to Berhe et al., the prevalence of the DRA in women with SUI was more than that in women without SUI (49).

As suggested by Smith et al., there were coordination and synergism between the activity of the abdominals and pelvic floor muscles, as they both participate in the regulation of intra-abdominal pressure during lifting, coughing and, many other physical activities (9). Considering the activity of abdominal muscle, it could be a substantial step in the treatment of UI. When the abdominal muscles are voluntarily contracted, the pelvic floor muscles contract simultaneously, and vice versa. Consequently, in severe incontinence, the activity of pelvic floor muscles maybe not be enough to maintain continence with increased intra-abdominal pressure (9). Many other studies have recognized the collaboration between pelvic floor muscles and abdominals (50.51). Still, physiotherapists focus on strengthening the pelvic floor muscles, while giving less attention to the activity of the abdominals during UI management.

These results were opposite of those reported by Bø et al. that women with DRA have not weaker pelvic floor muscles or more pelvic floor dysfunctions than women without DRA (11). Likewise, Fei et al. stated that the occurrence of UI was more likely to happen in the presence of DRA; however, no statistically significant difference was indicated; since the percentage of UI in women with and without DRA was close (42). They also have shown that even with increased severity of DRA, there was no difference in the incidence e of UI among women with or without DRA. As well, Wang et al. and Braga et al. found that there was no correlation between DRA and the incidence of UI later (52, 53). These contrasting findings could be due to different criteria for the participants' ages and BMI included in each study.

In the current study, two methods were used for DRA assessment: finger width test and abdominal ultrasonography. The prevalence of DRA among the tested postmenopausal women using the finger width

test was 148 (74 %), while the prevalence using abdominal ultrasonography was 159 (79.5%). No studies have focused on comparing different results obtained using different measurement tools (8).

However, according to Cavalli et al., the prevalence of DRA varies depending on the measurement method (54). That was not true for our study as the prevalence did not significantly differ when using the two measurement tools. The difference could be due to using different measurement sites and/ or evaluation criteria. For instance, in the present study, DRA was reported if the subject had an inter-rectus distance greater than 20 mm at any level using abdominal ultrasonography, and above 2 fingers at any level in the finger width test. Turan et al. stated DRA presence if the subject had inter-rectus distance above 2 cm at 3-4 cm supra umbilical level in the finger width test (55), while, according to Mota et al., DRA was represented as an inter-rectus distance above 16 mm at 2 cm sub umbilical level in abdominal ultrasonography (56).

Wu et al. described DRA as a separation more than 10 mm above the umbilicus, 27 mm at the umbilical ring, and 9 mm below the umbilicus in individuals under the age of 45, however, above the age of 45 it was determined as a separation more than 15 mm above the umbilicus, 27 mm at the umbilical ring, and 14 mm below the umbilicus. (8). So, regardless of the method used to assess DRA, the actual prevalence will remain unknown. Nevertheless, there is no doubt that DRA is an extremely prevalent disorder. Also, DRA risk factors are still not well defined, and it is unclear whether DRA can be regarded as a pathological illness or a normal aspect of aging (54).

Regarding the finger width test used in the assessment, based on Keeler et al., the application of the finger width test to assess DRA was suggested as the most practically used and widely approved among patients. Also, it is inexpensive, easy to use, and its results can be recorded easily and quickly, however, its protocol must be standardized to increase reliability when assessing patients with multiple raters (57).

On the other hand, van de Water and Benjamin found that the finger width test is an easy method to measure inter-rectus distance, however, they considered ultrasound as a more accurate and consistent method (58). Additionally, Mendes et al. and Cavalli et al. concluded in their study that although the finger width test is commonly used, it is not quite accurate because of individual differences in finger width, and sometimes, the difficulty of application because of thick subcutaneous fat (17, 54).

The second method for measuring the inter-rectus distance was abdominal ultrasonography as a more accurate method to assess DRA (54, 56, 59, 60). It is used at the supra umbilical level and at the umbilical level, as we considered abdominal ultrasonography to be an accurate method of measuring DRA above the umbilicus and at the umbilical level, but not entirely accurate at sub umbilical level, based on Mendes et al. (17).

To the best of recent knowledge, this study is the first to explore the prevalence of DRA in a large sample of postmenopausal women with SUI. This study used objective assessment methods and the ultrasound examiner was blinded to the purpose of the study, which increased data accuracy and reduced the bias. Also, the study examined a homogenous tested group, which minimized the impact of possible confounding factors.

Conclusion:

Based on this study, it could be concluded that DRA is prevalent among Egyptian postmenopausal women with SUI. Therefore, examination of the DRA could play a vital role in addressing the complications faced by women post-menopause. Also, abdominal strengthening exercises –not only pelvic floor muscles- could be added to pelvic floor dysfunction management protocol. Moreover, a healthy diet program and physical therapy protocol for losing weight could be added to the management program of DRA, as DRA is affected by the patient's BMI and WHR.

Limitations:

Though, the study had some limitations. The results of this study may not be completely generalized because the sample was recruited only from Maghagha General Hospital, so it could not be representative of the whole population due to homogeneity. Another limitation of the present study is the lack of data on the normal width of the linea alba. Also, there is no standardized definition for

DRA, which could influence the prevalence of DRA among different populations.

Moreover, elder women consider SUI as a normal process of aging, so they avoid seeking medical advice and try to manage the problem on their own, which was a hindrance to exploring the actual prevalence of DRA in this age category of women with SUI.

Though the true prevalence of DRA is still not well known, there is no doubt that it is a widespread condition that affects women of various age groups. Postmenopausal women particularly must admit that there is a problem, as early diagnosis of DRA may help in assessing many complications they are facing.

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