Effect of Head Lift Exercise versus Abdominal Supporting Belt on Inter-rectus Distance among Postnatal Women

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Abstract

Diastasis of Rectus Abdominis (DRA) muscle is a concerning health issue that commonly affects female within pregnancy and postpartum time. However, regular exercise reduces the risk of developing this complication. This study ***aimed*** to compare the effect of head lift exercise versus abdominal supporting belt on inter-rectus distance among postnatal women. **Method:** A quasi-experimental research design was adopted. This study was conducted at the Fertility Care Center (FCC) at Mansoura University Hospitals, Mansoura City, Egypt. A Purposive sample of 80 postpartum women were assigned to the head lift exercise and abdominal belt supporting groups equally, where 40 women for each one. Data were collected using three tools; a structured interviewing schedule, distance recti abdomenis assessment tool which include finger palpation and dial caliper measurement and assessment of maternal concerns and satisfaction of abdominal appearance tool**. Results:** There was significant decrease in the inter-rectus distance ($p<0.001$) and its associated symptoms (low back pain, pain in the pelvic region, pain in the lower abdomen, pressure or fullness in the pelvic region) among the head lift exercise group than abdominal supporting belt group after 8 and 12 weeks of intervention. Additionally, there was a highly statistically significant difference regarding concerns and satisfaction of abdominal appearance among the head lift exercise group than abdominal supporting belt group after 12 weeks of intervention ($p<0.001$). **Conclusion**: Head lift exercise was very effective in reducing DRA and its associated symptoms among postnatal women compared to the abdominal supporting belt. Additionally, perceived level of satisfaction regarding abdominal appearance was high among the exercise group than abdominal belt group **Recommendation:** Integrate Head lift exercise in the routine care for postnatal women.

Keywords: Abdominal Supporting Belt, Head Lift Exercise, Inter-rectus Distance, Postnatal Women.

Introduction

Diastasis recti abdominis (DRA) is a connective tissue condition characterized by the two rectus abdominis (RA) muscles along the linea alba (LA) separate as a result of straining and weakening. During an abdominal contraction, separation is evident and can be seen as a protrusion or as an invagination through the anterior abdominal wall's midline **(Chabra, Anderson, Javid, 2024)**. This disorder may also be referred to as divarication of rectus abdominal muscles (DRAM) or rectus abdominis diastasis (RAD) in various literature sources, **(Gluppe et al., 2022).**

Diastasis recti abdominis is a prevalent health issue that can cause a range of health problems and a reduction in quality of life during the prenatal and postpartum phases. The presence of DRA may affect the stability of the trunk and pelvis, resulting in hip and lumbo-pelvic discomfort, poor posture, and difficulties during physical exercise. Additionally, DRA may result in pelvic organ prolapse, anal incontinence, and urine incontinence **(Laframboise, Schlaff, & Baruth, 2022).**

The causes of diastasis of the rectus abdominis muscle (DRAM) during pregnancy include changes in connective tissue elasticity brought on by hormones, where high levels of relaxin and estrogen hormones cause the linea alba to relax, which separates the two recti muscle that are mainly located at the umbilical level. As a result, the abdomen usually feels weak and slack right after giving birth **(Gluppe, Ellström Engh, & Kari, 2021).**

Additionally, other several factors, such as obesity, delivering a large baby or twins, and successive pregnancies without adequate recovery of abdominal tone, Moreover, elevated intra-abdominal pressure includes poor breathing techniques, constipation, coughing, sneezing,

lifting heavy objects, and sitting forward against gravity **(Crommert, Fieril, & Gustavsson, 2020).**

Rectus diastasis is diagnosed based on the physical examination and history. The degree of separation between the medial borders of the two rectus abdominis muscles at the linea alba is measured by the inter-rectus distance (IRD) **(Thabet and Alshehri, 2019).** The use of computed tomography (CT), magnetic resonance imaging, or ultrasound can be used to confirm rectus diastasis. These techniques are essential for determining the inter-rectus distance before surgery, but they are also used to assess the effectiveness of the repair after surgery **(Cardaillac et al., 2020).**

The majority of sources advise conservative care that includes weight loss, lifestyle changes, and various exercise regimens designed to avoid diastasis recti and alleviate its postpartum effects **(Carlstedt et al., 2021)**.

Therapeutic abdominal exercises are essential for postpartum women with DRA to regain function and a positive body image. Abdominal exercises, including a head lift, a semi curl-up (SCU), and an abdominal draw-in maneuver (ADIM) **(Gluppe et al., 2022).** Head lift exercises are repeated, postural, and rhythmic therapeutic exercises that help the woman restore control over the neck, chest, and abdominal muscles. It can successfully treat and prevent DRA **(Theodorsen, Strand, & Bo, 2019).**When engaging in abdominal strengthening exercises, one assumes that contracting all of the abdominal muscles will result in a decrease in the abdominal horizontal diameter and a horizontal force that will resemble both of the rectus abdominis muscles, particularly at the umbilical level**(Liang et al., 2022**).

In addition, women's abdomens have been supported for many generations with belly binding and postnatal support belts. By supporting the stretched skin during pregnancy, it may make the abdomen appear smaller. The belt helps women restore their pre-pregnancy body shape by speeding up uterine involution and flattening the stomach. When a postpartum support belt is worn regularly, the weight of the abdomen is transferred to the spine, where it may be supported naturally, reducing back pain and pressure on muscles and ligaments **(Yalfani, Bigdeli, & Ahmadi, 2019).**

Abdominal diastasis recti and the treatment options for management are relevant topics for obstetricians, gynecologists, nurse midwives, general surgeons, family practitioners, physical therapists, and many other healthcare team members. Nurses can fulfill a distinct role in the management of abdominal diastasis recti. They can empower women by educating them on non-pharmacological interventions, such as practicing several exercise programs, making lifestyle modifications, and losing weight to cope with their conditions. **(Laframboise, Schlaff, & Baruth, 2022)**.

Significance of the study

The prevalence of diastasis above the navel was observed (63.3%), below the navel – (36.7%) **(Levytskyy et al.,2024)**. DRA occurs most frequently during pregnancy and regresses spontaneously after childbirth in most women. However, Prevalence of DRA was 33.1%, 60.0%, 45.4%, and 32.6% at gestation week 21, 6 weeks, 6 months and 12 months postpartum, respectively **(Sperstad et al., (2016).**

Few studies have been conducted on the prevention and management of DRA, despite the fact that it is a serious and significant clinical concern. However, regular exercise lowers the chance of getting this issue. There is currently insufficient high-quality evidence in the literature to direct therapeutic practice with regard to the conservative management of DRA among postpartum women **(Yalfani, Bigdeli, & Gandomi, 2020; Tuominen et al., 2022).**

Conversely, DRA is frequently linked to negative body image and musculoskeletal pain **(Laframboise, Schlaff, & Baruth, 2022).** While DRA is a condition that should be addressed during antenatal and postnatal follow-up, it is not a common practice in most maternity hospitals, primarily due to limited awareness among clinicians and mothers regarding this condition**.** With an effective strengthening exercise, the women can safely restore these core muscles to resemble her pre-pregnancy self and fulfill the demands of carrying and lifting her child **(Gluppe, Engh, & Bø 2020).** To the best of our knowledge, there was little research that discussed the management strategies for

alleviating inter-rectus distance among postnatal women. **So, this study was conducted to compare** the effect of head lift exercise versus abdominal supporting belt on inter rectus distance among postnatal women.

Aim of the study

The study aimed to compare the effect of head lift exercise versus abdominal supporting belt on inter-rectus distance among postpartum women.

Research hypotheses:

H1: Postpartum women who practiced head lift exercise exhibit decreased inter-rectus distance than those who used abdominal support belts.

H2: Postpartum women who practiced head lift exercise exhibit fewer inter-rectus distance-associated symptoms than those who used abdominal support belts.

H3: Postpartum women who practiced head lift exercise exhibit a higher level of satisfaction with abdominal appearance than those who used abdominal support belts.

Operational definition

- Diastasis Rectus Abdominis (DRA) in this study refers to any gap in between the rectus abdominis (RA) muscle along the xiphoid process to the symphysis pubis. DRA was diagnosed when the gap is more than two-finger width measured with finger palpation at the umbilicus. Also, if DRA is more than 9 mm, 27mm & 10mm below, at and above the umbilical respectively when measured by dial caliper.

Subjects and Method

Design

A quasi-experimental design (pretest\posttest non-equivalent control group design) was adopted in this study, where the effect of independent variables (head lift exercise and abdominal supporting belt) on dependent variable (inter-rectus distance) was assessed, where the IRD was measured before and after the intervention.

Setting

This study was carried out at a family planning clinic at the Fertility Care Center (FCC) at Mansoura University Hospitals, Mansoura City, Egypt. The center comprises distinct areas such as an admission section, examination room, family planning insertion room, inpatient ward, waiting area, and staff office. The provision of care is overseen by a team of six obstetricians and twelve nurses. This setting was selected as it is the major maternity health agency in El-Mansoura and postpartum women turnover is high.

Subjects:

A purposive sample of 80 postpartum women who met the following inclusion criteria was recruited: women after 4weeks postpartum with mild and moderate IRD 2-4 finger width; a BMI ≤ 29 kg/m^2; primiparous and multiparous women and had vaginal delivery with or without episiotomy; on the other hand, women with third and fourth degree perineal injuries after vaginal delivery; afflicted with any cardiac or respiratory problem; involving persistent coughing or sneezing; have previous abdominal, spinal, or pelvic surgery; who exercise regularly and have allergies to the material of the supporting belts were excluded from the study.

Sample size calculation

To determine the sample size, theEpi-Info program version 10 was used to calculate the following parameters: Population size: 95 postpartum women

- Expected frequency: 50%
- Acceptable error: 10%
- Confidence coefficient: 95%
- Minimumsample size: 80

The postpartum women selected were evenly divided between the head lift exercise group and the abdominal supporting belt group. Each group consisted of 40 postpartum women with DRA.

Tools:

Three tools were used to collect the necessary data.

Tool 1: A structured interviewing schedule.

The researchers developed this tool based on pertinent literature to collect the basic data of the study subjects. It consisted of three parts as follows:

Part I: Demographic data such as age, level of education, occupation, and residence.

Part II: Obstetric history such as gravidity, parity, single/multiple births, fetal birth weight, and weeks of gestation at delivery.

Part III: Health profile such as weight, height and BMI during the postpartum period and symptoms/ complaints associated with IDR such as low back pain, pelvic girdle pain and pressure, lower abdominal pain, urinary incontinence, and difficulty in controlling flatulence.

Tool 2: Distance Recti Abdominis Assessment Tool.

This tool was developed by the researchers after an extensive review of pertinent literature **(Roehling, 2020; Shohaimi et al., 2023)** and was used to assess the DRA. It included two parts:

Part 1: Distance Recti Abdominis Measurements by Finger Width Palpation

It is one of the easiest and subjective method used in a clinical setting. Finger palpation was used initially to screen for the presence of DRA and its size, where more than two fingers width is considered diastasis recti.

Part II: Distance Recti Abdominis Measurements by Dial Caliper Method:

A dial caliperis a plastic tool with a range of 0 to 150 mm. It was employed to evaluate the size of the inter-recti distance by mm, where the measurement number indicates the distance between Inter-rectus abdominis.

Tool 3: Assessment of maternal concerns &satisfaction of abdominal appearance tool

This tool was adopted from **Gluppe et al. (2022)** to assess women's concerns and satisfaction regarding perceived abdominal appearance and strength. This tool consisted of eight items; the women responded to the first seven items (a protrusion of the abdomen, strength of the abdominal muscles, flappy and lax skin of the abdomen, presence of striae graviderum, etc.) using three point Likert scales, where agree = 1, natural = 2, and disagree = 3.The range of total scores is 1 to 3 as follows: disagree=1-1.66, somewhat agree=1.67 – 2.33 and strongly agree =2.34 – 3.0.

The eight question (women perceived satisfaction with abdominal appearance) was also rated on a numerical scale ranging from 1 to 10, with 1 representing 'very dissatisfied' and 10 representing very satisfied'. The range of responses is as follows: from1-3 unsatisfied, from 4-7 satisfied to some extent and from8-10 satisfied.

Ethical considerations:

The researchers ascertained to the postpartum women that participation in the study is completely voluntary. It was also stressed that women had the refusal right to participate or withdraw from the study at any time without any change in the quality of care provided to them. Confidentiality of the collected data, anonymity of postpartum women, and privacy were guaranteed. After the participants' agreement, they signed written informed consent.

Data collection process

Data collection was carried out for eleven months, starting in September 2023 and concluding in September 2024. The study was accomplished through four phases: preparatory,

Phase I: Preparatory Phase

An approval from the Research Ethics Committee, Faculty of Nursing, Mansoura University was obtained on August 27, 2023, with Ref. No. P.0519. Additionally, an official letter was submitted from the nursing faculty to the responsible authorities to get their permission for data collection after explaining the purpose of the study. Then, tools (I, II& III) were developed by the researchers after an extensive review of literature.

The study tools' content validity was verified by a panel of five professors in obstetrics and gynecological nursing. After that, a pilot study was carried out involving 10% (8 postpartum women) diagnosed with DRA to assess clarity, visibility, applicability, and the required time to fulfill the tools. The pilot study was excluded from the main study subjects. The tools reliability (II, III) was tested by using the Alpha Cronbach test, and the results were statistically acceptable, where the values were 0.81 and 0.88, respectively.

Phase II: Interviewing and initial assessment Phase

In this phase, the researcher interviewed with postpartum women who had been recruited for the study at the Mansoura University Hospital's outpatient family planning clinic. Written consent for participation in the study was obtained from each woman. The researchers interviewed each woman individually, introducing themselves, explaining the purpose of the study, and building therapeutic communication with women to get their cooperation.

Then the researcher collected the basic data from all women using tool I; tool II, part I (finger palpation), was used to assess the presence of DRA, and with woman was positioned in a crook-lying posture on a bed. The woman's head was supported by a pillow, and their knees were flexed at a 90-degree angle. Then the researcher places fingers on the linea alba at the umbilical. If the DRA is present, the fingers will drop in the middle of the two rectus muscles, and sometimes a noticeable lump rises up. The horizontal distance between the two muscles of the rectus abdominis is measured by counting all the finger widths that can be placed between them. Testing was done along the linea alba at and above the umbilical level; the gap of more than two fingers width is considered DRA., as mentioned in Figure 1.

Figure 1: Finger width palpation
Source: Available at: https://www.semanticscholar.org/paper/Diastasis-recti-abdominis-a-review-of-treatment-Michalska-Rokita/394ddb78d9443b2c3c8ad55327bef5c44b838ec8

- After the completion of finger palpation, tool II (part 2) was utilized to assess IRD, where the dial caliper's jaws were positioned perpendicularly at the borders of the rectus muscle to quantify the DRA size. To prevent the infection, the researcher disinfects it with alcohol before and after each assessment. Measurements were conducted by the researchers and confirmed by the obstetrician. The readings were recorded systematically. Measurements were performed during each testing session
- The measurements were obtained at three specific levels, as follows: at the umbilicus level; 2.5 cm above the umbilicus; and 2.5 cm below the level of the umbilicus., as mentioned in Figure 2.
- The data collected during this phase served as the baseline for subsequent comparisons to assess the impact of head lift exercise versus abdominal support belt on IRD. The average time required to complete the interview questionnaire is 20 to 25 minutes.

Figure (2): Dial caliper technique
Source: Available at: https://www.jospt.org/doi/full/10.2519/jospt.2013.4449

Phase III: Implementation phase:

After baseline assessment, women were assigned into two equal groups: the head lift exercise group (40 women) and the abdominal supporting belt group (40 women).

The head lift exercise group (abdominal exercise)

- Through the study the researcher interviewed each woman individually and demonstrated each step of the exercise to the women using different visual materials, such as videos and visual images for more clarification. The exercise included the following steps: Instruct the woman to lie on the back with the hips and knees flexed and the foot flat on the floor. Ask her to cross the palm and finger behind the head. While in this posture, inhale deeply, then slowly lift the head and shoulders off the bed or floor and simultaneously exhale. Hold this position for five seconds, and then relax ten seconds, and one-minute pause between each set as in **figure 3**. Women were instructed to comply with proper breathing technique to avoid excessive increase in intra-abdominal pressure when holding breath. At the end of the session, postpartum women were asked to apply this exercise daily and gradually as follows:
  - In the first and second weeks, do 2 sets of 8 repetitions.
  - In the third and fourth weeks, do 2sets of 10 repetitions.
  - In the fifth and sixth weeks, do 2 sets of 15 repetitions.
  - From seventh till twelve weeks, do 3 sets of 15 repetitions.

For the abdominal supporting belt group:

- The belt group was instructed to wear it on the skin or over a thin shirt, not to wear the belt too tight or too loose, and to adjust the straps to fit their waist size, as it may irritate the skin and make breathing difficult, creating discomfort, and to check their skin for any redness or inflammation. Additionally, wear the supporting belt all day and take it off for sleeping and showering for 12 weeks. The researchers instructed every woman about the importance of compliance with the intervention and refraining from engaging in any other exercise regimen throughout the study time.
- Postpartum women were instructed to wear the abdominal supporting belt based on the provided instructions: The side of the belt that lacked fasteners was held in place with one hand, while the other hand lifted the participant's abdomen to secure it effectively. Pull the other end of the belt tightly across the surface. Adjust the participant's stomach and pull it over the top to ensure a proper fit that is comfortable but not overly constricting. It was then easy to adjust the straps according to the participant's waist size, as shown in **Figure 4.**

- The interventions were individually demonstrated to each woman in both groups, asking women to re-demonstrate until they master it. also, they were given the opportunity to inquire about the intervention. The researchers contacted the postpartum women of the two groups daily through WhatsApp and weekly through a telephone call to ascertain their compliance and credibility with the intervention. Also, videos and images were shared with postpartum women to remind them of the steps.
- Data collection was conducted by two researches to guarantee accurancy, while phone communication was used to maintain contact with women, and ensure follow-up visits in outpatient clinics, and respond to any questions regarding the intervention application.

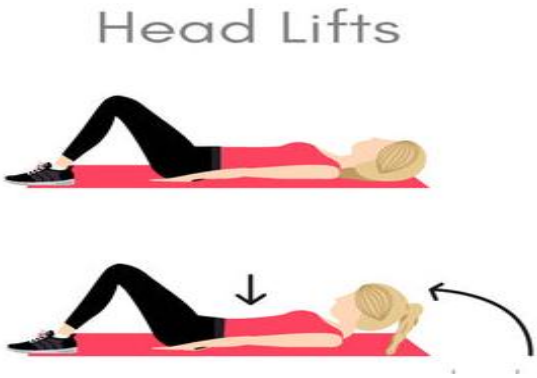

Figure (3): Head lift exercise
Reference:Available at: https://www.pinterest.com/pin/418131146645005741/.

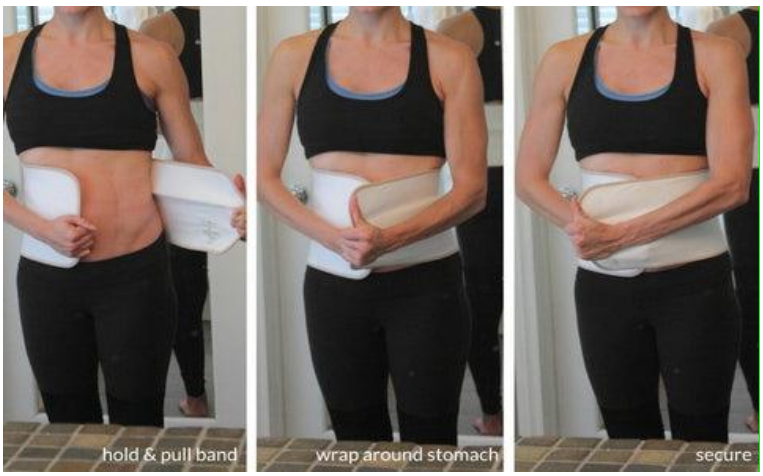

Figure (4): Abdominal supporting belt support
Reference: Available at:https://bellybandit.com/blogs/bandita-blog/diastasis-recti-mind-the-gap.

Phase IV: Follow-up and evaluation phase.

Postpartum women were instructed to attend to the Fertility Care Center (FCC) after four, eight, and twelve weeks for follow-up, where the IDR, its associated symptoms and postpartum women's concerns and satisfaction with abdominal appearance were reassessed using the same tools.

Statistical data analysis:

After completion of data collection, IBM SPSS software package version 23 data was used to analyze the data. The chi-square test was used to evaluate group comparisons for categorical variables. For normally distributed quantitative variables, the two groups were compared using a student t-test. A paired t test was employed to assess the significance between before and after

in each group for normally distributed quantitative variables. The significance of the results obtained was assessed at a significance level of 0.05.

Results

Table 1 shows that 50.0% of the exercise group was 25 < 30 years old compared to 42.5% of the abdominal supporting belt group was 30 ≤ 35 years old. Moreover, 52.5% and 55%, respectively, of the headlift exercise group and abdominal supporting belt group had secondary and equivalent education. Concerning occupation, 67.5% and 70%, respectively, of the headlift exercise group and abdominal supporting belt group were working. 82.5% and 85%, respectively, of the head lift exercise group and abdominal supporting belt group rarely or never performed heavy lifting. Also, 75.0% and 82.5%, respectively, of the headlift exercise group and abdominal supporting belt group lived in rural areas.

Table 2 displays that 42.5% of the head lift exercise group had 3 pregnancies and deliveries compared to 37.5% of the abdominal supporting belt group. In addition, 42.5% of the headlift exercise group had 3 deliveries compared to 47.5% of the abdominal supporting belt group. Fetal birth weight/kg was 3000–3500 in 42.5% and 62.5% of the head lift exercise group and abdominal supporting belt group groups, respectively. Lastly, no statistically significant differences were found between the two groups except for fetal birth weight (p = 0.015).

Table 3 reports that the mean of BMI during postpartum was 26.69±2.15 for the head lift exercise group compared to 27.1±2.47 for the abdominal supporting belt group. No statistically significant differences were found between the two groups.

Figure 5 demonstrates that 82.5% and 75%, respectively, of the headlift exercise group and the abdominal supporting belt group had low back pain. Also, 65% and 62.5% of the exercise group and belt group had pain in the pelvic region, respectively. Furthermore, about two-thirds of both groups had pain in the lower abdomen and pressure or fullness in the pelvic region. 57.5% and 52.5% of the two groups hadn't urinary incontinence.

As can be seen in **Figures 6 and 7,** there was a decrease in the associated symptoms with IRD after 8 and 12 weeks of intervention compared with pre-intervention in the headlift exercise group. Also, there were statistically significant differences in the associated symptoms with IRD in the head lift exercise group after 12 weeks of intervention compared with 8 weeks in (low back pain p = 0.013, pain in the pelvic region & pain in the lower abdomen p = 0.025, pressure or fullness in the pelvic region p = 0.070).

Table 4 clarifies that there was a highly statistically significant difference between pre- and post-intervention in both groups, especially after 12 weeks: 0.074 & (<0.001*) respectively when IRD 2.5 was above umbilicus and (0.212) & (<0.001*) respectively when IRD was at umbilicus. η^2= Partial Eta Squire was higher in the head lift exercise group than abdominal supporting belt when IRD 2.5 was above umbilicus and at umbilicus 0.787 and 0.934, respectively.

Table 5 illustrates that there was a highly statistically significant difference between pre- and post-intervention in both groups, especially after 12 weeks, when IRD 2.5 was above umbilicus (p = 0.586 and <0.001*), respectively, when IRD was at umbilicus (p = 0.883 and <0.001*), respectively, and when IRD was below umbilicus (p = 1.007 and <0.001*), respectively. η^2= Partial Eta Squire was higher in the head lift exercise group than abdominal supporting belt when IRD 2.5 was above umbilicus, at umbilicus, and below umbilicus (0.919, 0.934, and 0.794, respectively).

Table 6 presents the distribution of postpartum women among both groups according to their concerns with abdominal appearance. There was a highly statistically significant difference regarding to what extent both groups were concerned about their abdominal appearance after 12 weeks of intervention (p<0.001). The table also displays that the effect size was 0.736 in the head lift exercise group compared to η2 = 0.729 in the abdominal support belt group related to their concerns with abdominal appearance, respectively.

As shown in **Figure 8,** 67.5% of the headlift exercise group was satisfied after 12 weeks of intervention compared to 20% of the abdominal supporting beltgroup. On the other hand, there were statistically significant differences in the head lift exercise group **(p = 0.001)** compared to the abdominal supporting belt group (p = <0.001).

Table (1): Distribution of post-partum women among both groups according to their demographic data. (N=80)

Demographic data	Head lift exercise group (n=40)		Abdominal supporting belt group (n=40)		Test of sig. χ^2	P
	No.	%	No.	%		
Age (years)						
20 < 25	10	25.0	7	17.5		
25 < 30	20	50.0	16	40.0	2.798	0.248
30 ≤ 35	10	25.0	17	42.5		
Mean ± SD	28.63±3.78		29.33±3.49		t = 0.861	0.392
Level of education						
Secondary and its equivalent	21	52.5	22	55.0	0.050	0.823
University &more	19	47.5	18	45.0		
Occupation						
Housewife	13	32.5	12	30.0	0.058	0.809
Working	27	67.5	28	70.0		
Heavy lifting at work						
Perform heavy lifting	7	17.5	6	15.0	0.092	0.762
Rarely /never perform heavy lifting	33	82.5	34	85.0		
Residence						
Urban	10	25.0	7	17.5	0.672	0.412
Rural	30	75.0	33	82.5		

χ^2: Chi square test t: Student t-test

Table (2): Distribution of post-partum women among both groups according to their obstetric history (N=80)

Obstetric history	Head lift exercise group (n=40)		Abdominal supporting belt group (n=40)		Test of sig. χ^2	P
Gravidity						
2	11	27.5	8	20.0	1.461	0.482
3	17	42.5	15	37.5		
4+	12	30.0	17	42.5		
Parity						
1	3	7.5	4	10.0		
2	16	40.0	8	20.0	4.797	^{MC}p = 0.190
3	17	42.5	19	47.5		
4+	4	10.0	9	22.5		
Abortion						
0	24	60.0	24	60.0	0.0	1.000
1+	16	40.0	16	40.0		
Number of fetus of the last pregnancies						
Single	22	55.0	25	62.5		
Twins	15	37.5	12	30.0	0.615	^{MC}p = 0.880
Triple	3	7.5	3	7.5		
Time after last delivery (weeks)						
<8	5	12.5	7	17.5	0.392	0.531
≥8	35	87.5	33	82.5		
Fetal birth weight by kg						
2500 – 3000	15	37.5	4	10.0		
3000 – 3500	17	42.5	25	62.5	8.366*	0.015*
3500 – 4000	8	20.0	11	27.5		

χ^2: Chi square test MC: Monte Carlo t: Student t-test
P_0: p value for Paired t test for comparing between prenatal and during postpartum in each group
* Statistically significant p-value at ≤0.05

Table (3): Distribution of post-partum women among both groups according to their current health profile (N=80)

Current health profile	Head lift exercise group (n=40)		Abdominal supporting belt group (n=40)		Test of sig.	P
Height	161.35±3.43		161.35±3.83		t = 0.00	1.000
Weight	73.60±4.79		73.05±4.54		t =0.527	0.600
BMI	**No.**	**%**	**No.**	**%**		
Normal	12	30.0	14	35.0	χ^2=0.228	0.633
Overweight	28	70.0	26	65.0		
Mean ± SD	26.69±2.15		27.1±2.47		t =0.352	0.725

χ^2: Chi square test MC: Monte Carlo t: Student t-test

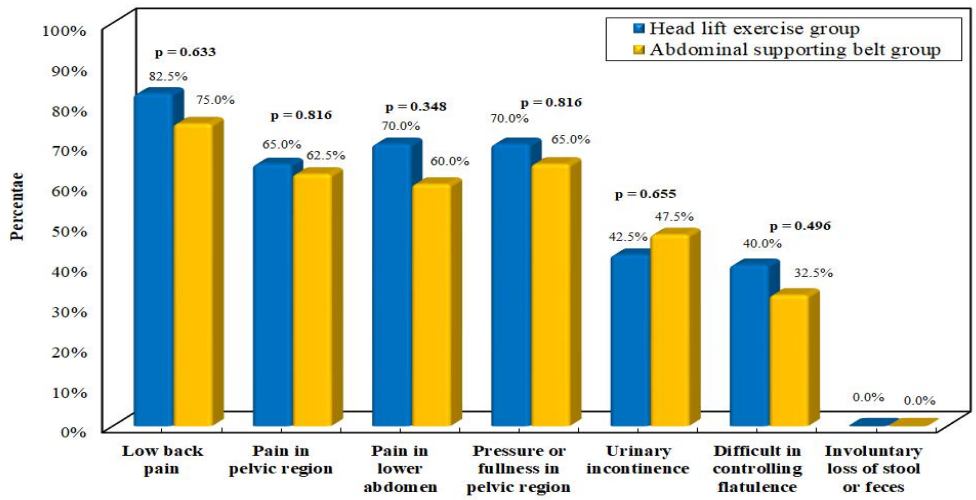

Figure (5): Distribution of post-partum women among both groups according to their Associated Symptoms with IRD Pre- Intervention

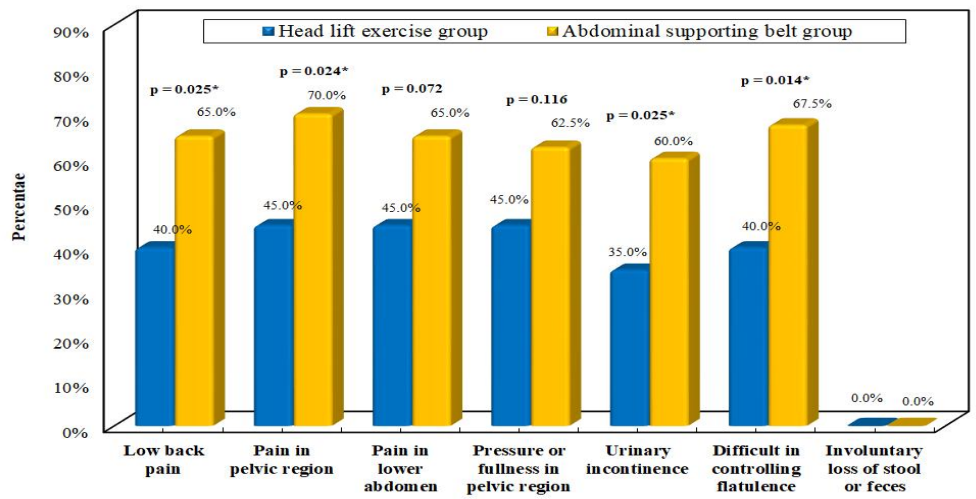

Figure (6): Distribution of post-partum women among both groups according to their Associated Symptoms with IRD after 8 Weeks of Intervention

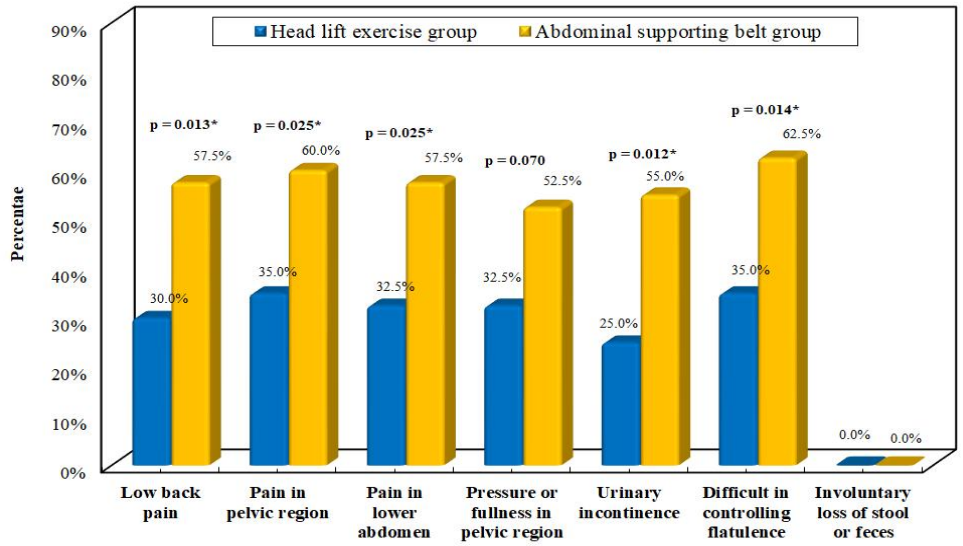

Figure (7): Distribution of post-partum women among both groups according to their Associated Symptoms with IRD after 12 Weeks of Intervention.

Table (4): Distribution of post-partum women among both groups according to their inter rectus distance measurements (IRD) by finger palpation (N=80)

Inter-rectus measurements by (finger palpation)	Pre	Post			F	p	η^2
		4 weeks	8 weeks	12 weeks			
IRD measurements2.5cm above umbilical							
Head lift exercise group (n=40)	3.15±0.75	3.00±0.61	2.51±0.43	1.90±0.30	**94.928***	**<0.001***	**0.787**
Abdominal supporting belt group (n=40)	3.14±0.76	3.03±0.66	2.95±0.64	2.84±0.58	**13.349***	**<0.001***	**0.314**
t(p)	**0.074 (0.941)**	**0.176 (0.861)**	**3.592* (0.001*)**	**9.03* (<0.001*)**			
IRD measurements at umbilical							
Head lift exercise group (n=40)	3.53±0.42	3.29±0.32	2.78±0.28	2.14±0.23	**213.925***	**<0.001***	**0.934**
Abdominal supporting belt group (n=40)	3.64±0.38	3.51±0.33	3.51±0.37	3.39±0.42	**8.864***	**<0.001***	**0.301**
t(p)	**1.258 (0.212)**	**3.106* (0.003*)**	**10.16* (<0.001*)**	**16.72* (<0.001*)**			

F: F test (ANOVA) with repeated measures for comparing between different periods in each group
t: Student t-test for comparing the two groups
* Statistically significant p-value at ≤0.05
η^2= Partial Eta Squire

Table (5): Distribution of post-partum women among both groups according to their inter rectus distance measurements (IRD) by dial caliper (mm). (N=80)

Inter-rectus measurements by (dial caliper) by mm	Pre	Post			F	P	η^2
		4 weeks	8 weeks	12 weeks			
Inter-rectus distance measurements by(mm) 2.5 cm above umbilical							
Head lift exercise group (n=40)	17.33±2.02	16.75±1.53	14.23±0.92	10.45±1.28	**258.546***	**<0.001***	**0.919**
Abdominal supporting belt group (n=40)	17.10±1.35	16.85±1.21	15.95±1.34	14.98±1.49	**43.166***	**<0.001***	**0.607**
t(p)	**0.586 (0.560)**	**0.324 (0.747)**	**6.717* (<0.001*)**	**14.55* (<0.001*)**			
Inter-rectus distance measurements by mm at umbilical							
Head lift exercise group (n=40)	28.40±0.79	27.91±1.15	25.38±1.44	23.55±1.58	**213.327***	**<0.001***	**0.934**
Abdominal supporting belt group (n=40)	28.55±0.73	28.18±0.89	27.93±0.83	27.45±0.97	**30.356***	**<0.001***	**0.609**
t(p)	**0.883 (0.380)**	**1.140 (0.258)**	**9.685* (<0.001*)**	**13.29* (<0.001*)**			
Inter-rectus distance measurements by mm 2.5 cm below umbilical							
Head lift exercise group (n=40)	14.30±2.26	12.90±1.61	10.70±1.44	9.30±1.20	**90.671***	**<0.001***	**0.794**
Abdominal supporting belt group (n=40)	13.80±2.19	13.05±1.96	12.20±1.51	11.38±1.73	**32.178***	**<0.001***	**0.573**
t(p)	**1.007 (0.317)**	**0.374 (0.710)**	**4.560* (<0.001*)**	**6.217* (<0.001*)**			

F: F test (ANOVA) with repeated measuresfor comparing between different periods in each group

t: Student t-test for comparing the two groups

* Statistically significant p-value at ≤0.05

η^2= Partial Eta Squire

Table (6): Distribution of post-partum women among both groups according to their Concerns with Abdominal Appearance (N=80)

Maternal Concerns with Abdominal Appearance	Pre		Post (12 weeks)		P0/ effect size Pre vs Post (12 weeks)	
	Head lift exercise group (n=40)	Abdominal supporting belt group (n=40)	Head lift exercise group (n=40)	Abdominal supporting belt group (n=40)	Head lift exercise group (n=40)	Abdominal supporting belt group (n=40)
Experience of a protrusion along the midline of the abdomen					**η^2= 0.053**	**η^2=0.325**
Mean ± SD	1.40±0.59	1.48±0.64	1.08±0.35	1.30±0.52	**<0.001***	**0.147**
t(p)	**0.545(0.588)**		**2.281*(0.026*)**			
Describe the strength of the abdominal muscles					**η^2= 0.100**	**η^2=0.873**
Mean ± SD	2.68±0.62	2.53±0.82	1.05±0.22	2.83±0.50	**<0.001***	**0.044***
t(p)	**0.928(0.356)**		**20.518*(<0.001*)**			
The skin of the abdomen is flabby or lax					**η^2=0.175**	**η^2=0.957**
Mean ± SD	1.08±0.35	1.10±0.30	2.95±0.22	1.28±0.64	**<0.001***	**0.006***
t(p)	**0.341(0.734)**		**15.648*(<0.001*)**			
A striae was developed on the abdomen during pregnancy/postpartum					**η^2=0.125**	**η^2=0.994**
Mean ± SD	1.0±0.0	1.0±0.0	2.98±0.16	1.13±0.33	**<0.001***	**0.023***
t(p)	**0.582(0.760)**		**31.591*(<0.001*)**			
Friends or family were concerned about the abdominal appearance postpartum					**η^2=0.017**	**η^2=0.932**
Mean ± SD	1.05±0.22	1.03±0.16	2.88±0.46	1.08±0.35	**<0.001***	**0.421**
t(p)	**1.421 (0.162)**		**19.605*(<0.001*)**			
There was too much focus from the media, TV, internet, magazines, about having a flat abdomen postpartum? Mean ± SD	1.08±0.35	1.10±0.38	1.0±0.0	1.18±0.45	**η^2=0.032** **0.086**	**η^2=0.045** **0.262**
t(p)	**0.704(0.483)**		**2.479* (0.018*)**			
worry about how the abdomen would look postpartum					**η^2=0.272**	**η^2=0.692**
Mean ± SD	1.15±0.53	1.03±0.16	2.75±0.59	1.38±0.63	**<0.001***	**<0.001***
t(p)	**0.742(0.460)**		**10.107*(<0.001*)**			

t: Student t-test for comparing the two groups * Statistically significant p-value at ≤0.05

P_0: p value for Paired t test for comparing between pre and post in each group

η^2= Partial Eta Squire

Effect size reference:0.01 was very small, 0.20 was small, 0.50 medium, 0.80 large, 1.20 very large and 2.0 huge size effect

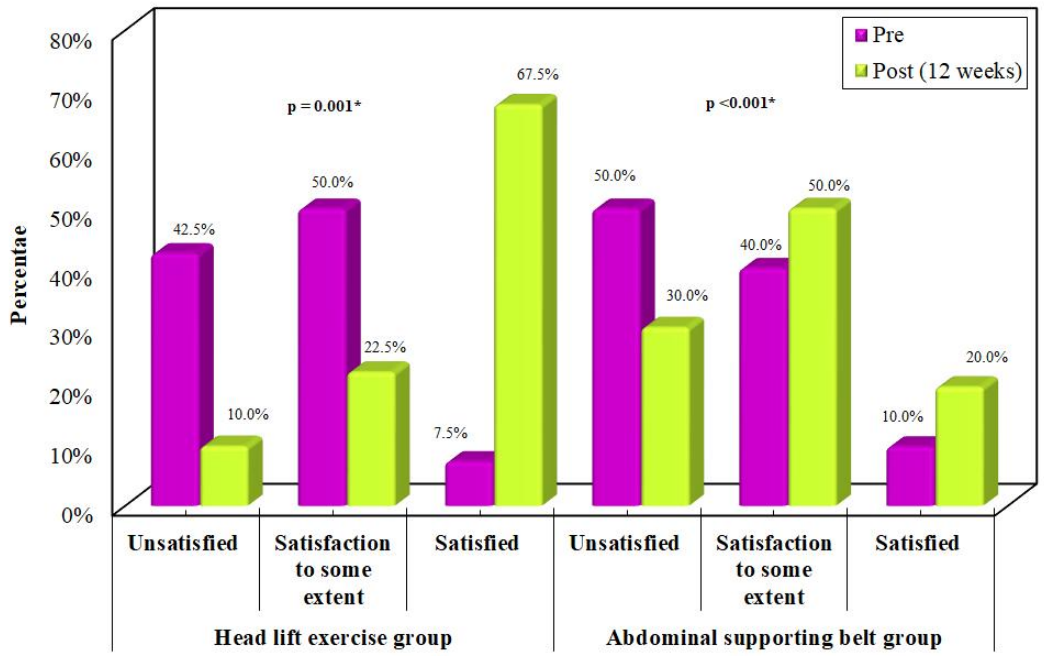

Figure (8): Distribution of post-partum women among both groups according to their Satisfaction with Abdominal Appearance after 12 Weeks of Intervention

Discussion

The results of the current study supported and accepted the research hypotheses: **H1:**Postpartum women who practiced head lift exercise exhibit decreased inter-rectus distance than those who used abdominal support belts. **H2**: Postpartum women who practiced head lift exercise exhibit fewer inter-rectus distance- associated symptoms than those who used abdominal support belts. **H3:** Postpartum women who practiced head lift exercise exhibit a higher level of satisfaction with abdominal appearance than those who used abdominal support belts.

H1: Postpartum women who practiced head lift exercise exhibit decreased inter-rectus distance than those who used abdominal support belts, the current study findings revealed that the mean of the IRD at umbilicus level, 2.5cm above umbilicus, and2.5cm below umbilicus either by finger palpation or by dial caliper among the head lift exercise group significantly reduced after 8 and 12 weeks of intervention compared to the abdominal supporting belt group. Thus, the first study hypothesis was confirmed.

This result is consistent with an experimental study conducted by **Theodorsen, Moe-Nilssen, & Haukenes (2023) among** thirty-eight women to investigate the effect of abdominal exercises on the inter-rectus distance (IRD) compared to resting values and found that the head lift exercise reduced the IRD significantly. **Similarly, Safaee, Barati, & Naderifar, (2022) study entitled "**Comparison of the Effect of Eight Weeks of Core Stability Training and Kegel on Diastasis Rectus Abdominis in Multiparous Women" in Iran showed that an exercise program including head lift exercise is effective on reducing diastasis of the rectus abdominal muscle (DRAM) post-intervention.

Furthermore, a systematic review carried out by **Weingerl, Kozinc, & Šarabon, (2022)** on fourteen articles to investigate the effects of conservative interventions for treating diastasis recti abdominis among postpartum women and reported that abdominal exercise programs including head lift exercise are generally effective in treating DRA at various postpartum periods. Moreover, **Gluppe et al. (2020)** who conducted study to evaluate immediate effect of abdominal and pelvic floor muscle exercises on interrecti

distance among women with diastasis recti abdominis who were parous in Norwegian. The researchers clarified that head lift exercise decreased the IRD significantly both 2 cm above and 2 cm below the umbilicus post- intervention.

In the same line Thabet and Alshehri, (2019) study about efficacy of deep core stability exercise program in postpartum women with diastasis recti abdominis in Umm Al-Qura University, Mecca, Saudi Arabia, who reported that abdominal exercises including head lift exercise, is effective for treating DRA and useful in closuring the DRA.

These results may be attributed to the adaptive changes in the muscles determined by the exercise, since the metabolic capabilities of the muscles were continuously overloaded. The hypertrophy of the muscle fibers and the increase in the recruitment of its motor units causes the muscle, a contractile tissue, to strengthen. In addition, it profusely affects the metabolic demand associated with producing a given muscle force which leads to an increase in muscular endurance and power. Therapeutic exercises also activate both slow twitch (ST) and fast twitch (FT) fibers of the skeletal muscles, with increased fiber as the high content of FT fibers improves muscle strength and reduce IRD. These changes in IRD and increased abdominal muscle thickness can lead to increased muscle strength and endurance **(Keshwani, Mathur, &McLean , 2021**; **Kim, Yi, Yim, 2022).**

In the current study it was found that the use of post-natal belt decrease the inter-rectus distance. It is possible to explain the improvement in muscle strength and decrease in rectus separation by pointing out that the abdominal belt strengthens the abdomen, which raises intra-abdominal pressure and helps to stabilize the spine mechanically by co-activating the trunk flexor and extensor muscles. Thus, the abdominal belt plays a crucial role in stabilizing the lumbar region during lifting, producing a significant improvement in lifting ability with decreased muscular fatigue and strain, and improving the ability to perform ADL activities. When the abdominals contract, intra-abdominal pressure increases and turns the abdomen into a rigid cylinder that greatly increases the stability of the spine, improves abdominal strength, and decreases abdominal separation **(El-Mekawy et al., 2013).**

However, the current study revealed that the effect of head lift exercise is more observable than belt in reducing IRD. These results agreed with **Keshwani et al. (2021)** who compared wearing abdominal belt or abdominal binding with exercise-based interventions and the study strongly favored the exercise interventions in reducing IRD ($p < 0.001$).On the other hand **El-Mekawy et al. (2013)** study entitled "Effect of abdominal exercises versus abdominal supporting belt on post-partum abdominal efficiency and rectus separation" in Egypt and found that use of post-natal belt is effective as head lift exercise in reducing the IRD among postnatal women there were no statistically significant differences between both groups.

H2: Postpartum women who practiced head lift exercise exhibit fewer inter-rectus distance- associated symptoms than those who used abdominal support belts. The current study results revealed that there was significant decrease in the associated symptoms with IRD such as low back pain, pain in pelvic region, pain in lower abdomen and pressure or fullness in pelvic region after 8 &12 weeks of intervention compared with pre intervention among head lift exercise group. Thus, the second study hypothesis was supported.

These findings are agreed with a randomized controlled trial (RCT) conducted by **Keshwani et al. (2021)** to compare the effectiveness of exercise therapy and/or abdominal binding to no intervention among thirty-two primiparous women who presented with DRA in the early post-partum period, where the researchers reported that there was significant decrease in back and pelvic pain, and urogynecological symptoms after exercise intervention. Similarly **Thabet and Alshehri, (2019) who revealed that** head lift exercise could prove effective for treating DRA and useful in closuring the DRA while also potentially reducing back and pelvic pain caused by DRA.

These results may be attributed that strengthening the core control muscles of the lower abdominal region through exercise during the post-natal period is crucial as it helps create a muscular "corset". This supports the spine and the back, decreases abdominal separation, and

alleviates muscle tension deriving from repetitive physical movement which in turn reduced associated symptoms with IRD.

H3: Postpartum women who practiced head lift exercise exhibit a higher level of satisfaction with abdominal appearance than those who used abdominal support belts. The current study results found that there was a highly significant difference between both groups regarding women`s satisfaction with their abdominal appearance(p-value = < 0.001). The present study revealed that head lift exercise group had more satisfaction than abdominal supporting belt group. While in the head lift exercise group more than two-thirds of the studied women were satisfied regarding their abdominal appearance after 12 weeks of intervention. Thus, the third study hypothesis was supported

This result agreed with a randomized controlled trial done by **Laframboise, Schlaff, & Baruth (2021)** to investigate postpartum exercise intervention targeting diastasis recti abdominis and reported that decreasing the severity of DRA separation may produce improvements in abdominal strength and endurance. Such improvements can directly impact a woman's ability to perform recurrent functional movements related to activities of daily living. Targeting the abdominal corset directly may also deliver the means to ameliorate abdominal protrusion, which further improves the functionality of the core and may positively impact postpartum body satisfaction.

Conclusion

This study concluded that head lift exercise was very effective in reducing diastasis recti and its associated symptoms in postnatal women compared to the abdominal supporting belt. It also improved the level of satisfaction with abdominal appearance among postnatal women.

Recommendations

- Integrate Head lift exercise in the routine care for postnatal women.
- Raise awareness of postnatal women regarding importance of Head lift exercise in decreasing Inter-rectus distance.
- Apply this study on a larger sample at another setting to assure the generalizability of results.

Limitations

Limited nursing research that discussed the management options of diastasis recti. Also, decreased the flow rate of cases so the data collection takes longer time.

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