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THE IMPACT OF PARITY AND AGE IN EXERCISE MEDIATED RESOLUTION OF DIASTASIS RECTI ABDOMINIS AMONG POSTPARTUM WOMEN: A SURVEY OF WOMEN IN ABAKALIKI, EASTERN NIGERIA

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Abstract: Weakness of the abdominal segment has been of great concern to women during the child-bearing year. Separation of the bellies of the recti muscles of the abdomen at the linea alba gives rise to a condition known as diastasis recti abdominis (DRA). The condition is common among postpartum women wherein it creates weakness and impaired functions of the muscles of the abdomen. This study was undertaken to assess whether or not number of pregnancies and maternal age influence DRA resolution. In a cross-sectional survey, thirty multiparous women who had two to five safe deliveries, with age range 29 – 44 years and mean age of 36.7 ± 2.76 years, participated in the study and were randomly assigned into two groups, A (isometric, N = 23) and B (control, N = 7). The 23 participants who undertook four weeks routine isometric abdominal exercises served as their own control while 8 of them compared with the control group. Using analysis of variance, results revealed a statistically significant DRA resolution difference between multiparity of two and four, as well as two and five, at varying degrees ($p < 0.05$).Younger subjects also fared significantly better ($p< 0.05$) in DRA reduction than older counterparts. Findings from this study showed that number of births and maternal age are both inversely related to inter-recti distance closure. This knowledge base is of critical importance to caregivers as it may potentiate reliable clinical guide and decision, when planning therapeutic intervention for women with DRA.

Keywords: Age, Diastasis recti abdominis, Multiparous, Postpartum,

Background of the Study

Weak abdominal muscle status and the resultant compromised functions of the trunk has been of great concern to women during the child-bearing year. Most women hope to engage into procreation soon after marriage which they normally desire to occur early in life. The thinking among African women include bearing not just one child in a family setting. They hope that their fitness will enable healthy successive pregnancies and child bearing. Abdominal and pelvic pathologies are

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common factor that impede the actualization of these laudable desires. One of these pathological factors is a condition known as diastasis recti abdominis (DRA), which affects negatively abdominal muscle strength and functionality. A diastasis rectus abdominis can compromise mechanical trunk function in both genders.[1] DRA is defined as an increase in the inter-recti distance (IRD), or width of the linea alba. This condition is variously viewed by different authors as separation of the recti bellies at the linea alba when the inter recti distance is greater than 1.5 cm, Gilleard [2]; greater than 2 cm, Lo [3]; greater than 2.5 cm, Candido[4]; greater than 2 finger widths during a partial sit-up.[5, 6] Inter recti distance in some cases is believed to resolve spontaneously, but the extent to which this resolution occurs is uncertain.[7]

It is widely believed that DRA is prevalent among multiparous women, while its rate and pattern of recovery have unspecified relationship with age and parity. Little information exists on the short- and long-term recovery of IRD and the relationship between changes in IRD and the functional performance of the abdominal muscles.[7] Candido [4] recorded 35% immediate occurrence on postpartum women. In another work, Boissonnault and Blaschak [8] noted the existence of IRD in as much as 66% of third trimester women in a cross-sectional study. The locations of IRD are mainly above and below the umbilicus. Rett, [9] noted that the prevalence of DRA and mean DRA were greater above the umbilicus both among multiparae and primiparae. Below the umbilicus, the mean DRA was greater among multiparae, as noted by Boissonnault and Blaschak, [8] in which work they also recorded the greatest incidence of the condition around the umbilicus.

Recti diastasis can vary between a small vertical gap 2 – 3cm wide and 12 – 15cm long, to a space measuring 12 – 20cm in width and extending nearly the whole length of the recti muscle (Mantle *et al*, 2004). As a result, the entire abdominal 'corset' will be weakened with very little apparent mechanical control. Those whose pregnancies necessitated prolonged inactivity, or those who habitually take very little exercise, are mostly at risk of having very weak abdominal muscles. The combination of reduced mechanical control and increased elasticity of ligaments will render the back much more susceptible to injury. Those most at risk of developing a gross divarification are women with narrow pelvis, those who carried large babies, who had multiple birth, and multiparous women.[10]

Most physiological changes that occur during pregnancy gradually resolve during the 6 weeks to 8 weeks following delivery.[11] This suggests that at the end of puerperium the mother should be back to her pre-pregnancy state. However the stretched abdominal muscles may become weak. The length of the abdominal muscles may increase by approximately two thirds in a primigravida while in multigravida this length may even double by term.[11, 12]

Evidence for the Benefit of Exercise during and after pregnancy

Studies suggest that women who began various forms of non-weight-bearing (free) exercises (cycling or swimming) in early pregnancy were able to maintain a high-intensity, moderate-duration regimen of exercise training throughout the third trimester.[12, 13] Thus, the maternal adaptation to both physiologic and morphologic changes appears to favour non-weight bearing exercise over weight-bearing exercise during pregnancy.

Most of the guidelines for designing a general fitness programme in women outlined previously by the American College of Obstetricians and Gynecologists also apply to pregnant women.[14] An exercise prescription in pregnancy should be individualized and should include a health assessment. However, the physiologic changes occurring during pregnancy described here should lead obstetricians and pregnant women to consider several modifications of these general guidelines. It must be emphasized that none of these recommendations has a firm basis in prospective, randomized, clinical trials. These guidelines follow from a

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critical analysis of the available physiologic data regarding exercise and pregnancy and represent reasonable extrapolations from such knowledge.

Recommendations for Exercise in Pregnancy and Postpartum

There are no data in humans to indicate that pregnant women should limit exercise intensity and lower target heart rates because of potential adverse effects.[15] For women who do not have any additional risk factors for adverse maternal or perinatal outcome, some recommendations on essential exercise protocols may suffice.

During pregnancy, women can continue to exercise and derive health benefits even from mild-to-moderate exercise routines. Regular exercise (at least three times per week) is preferable to intermittent activity. Women should avoid exercise in the supine position after the first trimester. Such a position is associated with decreased cardiac output in most pregnant women; because the remaining cardiac output will be preferentially distributed away from splanchnic beds (including the uterus) during vigorous exercise; such regimens are best avoided during pregnancy.

Prolonged periods of motionless standing should also be avoided. Women should be aware of the decreased oxygen available for aerobic exercise during pregnancy. They should be encouraged to modify the intensity of their exercise according to maternal symptoms. Pregnant women should stop exercising when fatigued and not exercise to exhaustion. Weight bearing exercises may under some circumstances be continued at intensities similar to those prior to pregnancy throughout pregnancy. Non-weight-bearing exercises such as cycling or swimming will minimize the risk of injury and facilitate the continuation of exercise during pregnancy. Morphologic changes in pregnancy should serve as a relative contraindication to types of exercise in which loss of balance could be detrimental to maternal or fetal well-being, especially in the third trimester.

Further, any type of exercise involving the potential for even mild abdominal trauma should be avoided. Pregnancy requires an additional 300 kca in order to maintain metabolic homeostasis. Thus, women who exercise during pregnancy should be particularly careful to ensure an adequate diet. Pregnant women who exercise in the first trimester should augment heat dissipation by ensuring adequate hydration, appropriate clothing, and optimal environmental surroundings during exercise. Many of the physiologic and morphologic changes of pregnancy persist 4-6 weeks postpartum. Thus, pregnancy exercise routines should be resumed gradually based on a woman's physical capability.

Significance of the Study

Abdominal muscles weakness and impaired trunk functional status have been of great concern to women during the child-bearing year. Most women hope that their fitness will enable healthy successive pregnancies and child-birth. The thinking of an average African woman is to engage in procreation soon after marriage, which onset she desires early in life. The major rationale for this research stems from the fact that there is dearth of clinical information on the relativity of number of births and maternal age to recovery from diastasis recti abdominis. Even where some scanty information exist, they hardly address the circumstances of women in Eastern Nigeria. It is intended that the outcome of this study will help to bridge the gap in clinical differential diagnosis, as well as serve to augment useful indicators while planning for total healthcare delivery in the case of DRA. The research outcome is also expected to provide required clinical guide for women's health professionals, as well as enhance holistic assessment of postpartum women.

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Brief Review of Functional Anatomy of the Abdominal Wall.

The anterolateral wall of the human abdomen is fortified by four large muscles. These muscles are external oblique, internal oblique, tranversus abdominis, and rectus abdominis. Two small muscles, the cremaster and pyramidalis are also present. The external oblique, internal oblique and transversus abdominis are larger flat muscles placed in the anteolateral aspect of the abdominal wall, each ending in an extensive aponeurosis that reaches the mid-line.[16] At the mid-line the aponeurosis of the right and left sides decussate to form a median band known as linea alba. The rectus abdominis runs vertically on each side of the linea alba and enclosed in a sheath formed by the aponeuroses of the external and internal oblique, and transversus abdominis.

Rectus abdominis muscle originate through two tendinous heads. The lateral head arises from the lateral part of the pubic crest while the medial head from the anterior pubic ligament. It inserts on the front of the wall of the thorax, along a horizontal line passing laterally from the xiphoid process cutting the 7^{th}, 6^{th} and 5^{th} costal cartilages in that order. Its nerve supply is through the sixth and seventh thoracic nerves. It is enclosed in a sheaf formed mainly by the aponeurosis of the three flat muscles of the abdominal wall. Rectus abdominis is three times as wide cranially, where it is fleshy, as it is caudally where it is tendinous. Its lateral border crosses the gall-bladder at the costal margin.[17]

Some authors, [10, 16] described the abdominal muscular actions in the light of both their individual and collective dispositions. The four main muscles of the anterior abdominal wall form four-way firm elastic support for the abdominal content. This action is mainly carried out by the oblique muscles especially the internal oblique by muscle tone. Combined action of oblique and transversus abdominis muscles ensures expulsive acts like micturition, defecation and vomiting through compression of the abdominal viscera. External oblique muscles contraction brings about forceful expiratory action like coughing, sneezing, blowing by compressing the lower part of the thorax, Trunk movements are made possible by the synergic actions of these four muscles. While rectus abdominis is mainly responsible for the flexion of the trunk and lumbar spine, lateral rotation of the trunk is brought about by one sided contraction of the oblique muscles**.** Combined action of the internal and external oblique muscles produce trunk rotation.

The abdominal muscles (external oblique, internal oblique, transversus abdominis and rectus abdominis,) are arranged like an extensive four-way corset which span the front of the trunk from the breastbone and ribs to the public bones, and around the side of the pelvic ridge that can be felt at each hip. Their arrangement and attachments are quite complex, but can be compared to an elaborate corset.[18] The extensive diagonal fabric around the sides of a corset or girdle is similar to the two oblique abdominal muscles that overlap in such a way that each layer pulls in the opposite direction. The vertical panel down the corset's center represents the straight abdominal muscles (which are actually two recti muscles joining in the midline, at the linea alba). An extensive horizontal waistband is formed by the transverse abdominal muscles.

Although each segment of the abdominal corset makes a key contribution, during exercises and activities the different parts are combined rather than isolated. For example, the top half of the corset is emphasized during movement with the upper trunk; the lower abdominals work to stabilize the pelvis when the legs are moved.[18]

The habitual use of the standing and sitting positions during exercise provide little stimulus for the abdominal muscles, nor are these muscles exercised when we walk at a normal pace on level ground. Therefore, the abdominal muscles are usually the weakest group of muscles among the general population and their weakness is one of the most common causes of backache.[10, 18] Their maximal

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exertion occurs only when they must perform against resistance, factors such as leverage and body weight, during trunk or leg-raising from the horizontal, and while running, lifting, and so on.

Abdominal Muscles Postpartum

The abdominal muscles are very loose and stretched after delivery and provide inadequate support for the pelvis and lower back. At this time these joints are particularly at risk because of the hormonal changes in pregnancy, which softened their protective ligaments. It is essential now to avoid any strain on the backbone or any stretching of the abdominal muscles. Exercises, then, are performed in stable positions where support is maximal and unnecessary effort avoided. The ligaments will gradually tighten back to their former stage as the uterus returns to normal, due to the fact that physiological adjustments of the body during the former shape, size, and efficiency, on the contrary, require active input. Best results are achieved when exercises are commenced within twenty-four hours after delivery, especially if necessary.[10, 18, 19]

Initially, it is normal to engage in tensing, retracting, and pulling in the muscles to coax them back to their former length and tone. Since the abdominal muscles have been subjected to prolonged tension stress, it is important not to overwork them at first but to repeat the exercises a few at a time and often. The exercises are simple and completely safe; they are easy to do and can be performed on the bed. Strong exercises must not be attempted until there has been good recovery of the abdominal wall and pelvic floor. This will vary with each woman and relates to her physical condition before pregnancy, her labour and delivery, and the management in the immediate postpartum phase.

However, it is advisable that postpartum women should not perform strong abdominal muscles exercises until the correction of any lingering sphincter weakness is effected, or the state of the abdominal wall is checked.[15]

Methods

Study Design

The study was a single blinded randomized control trial of the influence of maternal age and number of pregnancies experienced, on the resolution of recti diastasis in postpartum women

Participants

The women who participated in the research had healthy pregnancies and uncomplicated vaginal deliveries. Both the experimental and control participants were recruited from within the Abakaliki metropolis, some of whom had history of safe deliveries at the Obstetrics and Gynecology clinic of Federal Teaching Hospital Abakaliki, Ebonyi State, Nigeria. Only women who were able to perform the abdominal crunch exercise among other criteria, were eligible for inclusion in the study. Before participation, the researchers gave the subjects all relevant research information (e.g. risks and benefits), orally and in written form, allowing them to make informed decision about participation.

Procedure for data collection

The procedure was consistent with the authors' previous work on closure of DRA using therapeutic exercise protocols.[20] Thirty multiparous postpartum women with age range 29 – 44 years, and mean age 36.7 ± 2.76 years who participated in the study were randomly assigned into two groups, group A (isometric) 23 in number, and group B (control) 7 in number. The 23 women in the experimental (isometric) group A also served as their own control while 8 of them compared with the control group. Initial IRD were measured for all participants using 7.5-MHz Linear diagnostic ultrasound transducer, model: NeuSonic Pi by NewTech Medical. Group A subjects were then placed on isometric abdominal muscle contraction, two sessions daily (morning and evening) at 30 minutes per session in three batches of 10 minutes each, with 2 minutes resting period between each batch for a period of four weeks. Weekly IRD for each subject in the group were measured and noted. The group B subjects were not given any abdominal exercises but were placed on routine 30

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minutes morning jog for the same period of four weeks, with weekly IRD measurements. The avoidance of abdominal exercise in group B subjects was necessary so as to check for any possible spontaneous IRD resolution.

For all participants, data were also obtained through primary source. Individual initial and weekly ultrasonography measurement values of the abdominal inter-recti distance obtained in relaxed crook lying from the subjects were recorded. All measurements were done 2.5cm above and below the umbilical ring. Also noted were the ages of each subject, and number of pregnancies prior to study.

Data Analysis

A 2-way mixed ANOVA was utilized to draw comparison of the mean value differences both within and between groups. All analyses and imputation procedures were done using SPSS software version 15. Statistical significance was set at $p < 0.05$ at 95% confidence interval.

Results

Demographic Characteristics of Subjects in the Study

A total of 30 women of 4 to 6 weeks postpartum participated in this study. They were all multigravids who had two to five pregnancies, and were distributed as follows: eight experimental group A, seven control group B, and twenty three experimental group C (15 + 8 in group A) who also served as their own control. The participants were within the age range of 27 – 44 years, with a mean age of 39.33 ± 2.71 years.

Number of Pregnancy differences in inter-recti distance closure during isometric exercise

Results from this study showed that women with increasing parity had poorer resolution of inter-recti distance for the measurement 2.5cm above and below the umbilicus (table 1). These differences were between those with two births and four births, two births and five births, three births and four births and between three births and five births as seen in the post hoc analysis in table 2. Post hoc comparison of number of pregnancy difference and mean recti diastasis resolution reveals variable relationship between different numbers of multiparity. While the resolution value between multiparity of two and three was not statistically significant ($p > 0.05$), two compared to four and five show significant resolution difference ($P < 0.05$) of varying degrees, at 2.5cm above the umbilical ring. Multiparty of four compared to five showed no statistical significance ($p > 0.05$).

On the other hand at 2.5cm below the umbilical ring multiparity of two compared with three was also not statically significant ($P > 0.05$) whereas two in relation to four and five were significant with the values of F= -1.805, P=0.00 and F= -1.476, P=0.00 respectively. Multigravid of three compared to four and five showed statistical significance ($P < 0.05$). Comparatively multiparity of four to five had no mean resolution significance ($P > 0.05$).

Table 1: Number of Pregnancy differences in inter-recti distance closure during isometric exercise N=23

	Mean±SD	95% CI		df	F	p-value
		Lower bound	upper bound			
Measurement 2cm above umbilicus						
2	2.55±0.61	2.96	2.83			

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3	3.09±1.06	2.79	3.40	3	19.285	0.000*
4	4.57±1.86	3.88	5.26			
5	3.63±1.52	4.42	5.50			
Measurement 2cm above umbilicus						
2	2.75±0.51	2.50	2.99			
3	3.06±1.10	2.74	3.37	3	13.203	0.000*
4	4.56±1.96	3.82	5.28			
5	4.40±0.79	3.29	4.84			

*Statistically significant value, CI = Confidence interval

Table 2: Bonferroni post hoc test of number of pregnancy differences in relation to recti diastasis resolution

	Number of pregnancy	Mean difference (p-values)		
Measurement 2.5cm above umbilicus	2	3	4	5
2	-	-0.549(0.611)	2.005 (0.00*)	2.422 (0.000*)
3			-1.476(0.000*)	-1.873(0.000*)
4				-0.397(1.000)
5				-
Measurement 2.5cm below umbilicus	-	-0.311(1.00)		1.655 (0.002*)
2		-	-1.805 (0.000*)	-1.344(0.004*)
3			-1.476(0.000*)	0.150(1.000)
4			-	
5				-

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*Statistically significant value

Consideration of Age of subjects and Inter-recti distance resolution

The subjects mean ages were considered in relation to recti diastasis mean resolution at two points 2.5cm above and below the umbilical ring. The result indicated significant improvement in inter-recti distance resolution ($p < 0.05$) at both 2.5cm above and below the umbilicus, with time. Analysis of variance (ANOVA) test revealed that younger subjects fared significantly better ($p< 0.05$) in terms of reduction in their recti diastases than older counterparts. This finding is true for both points 2.5cm above and below the umbilical ring, (Table 3).

This result shows that age was negatively related with the inter-recti distance resolution. Bonferroni post hoc analysis also revealed that postpartum women in their twenties had better closure compared with those in their thirties and forties. However, there was no difference in the pattern and rate of resolution between women at thirties compared to those in their forties as seen in table 4.

Table 3: Age mediated differences in resolution of separation in 4 weeks of Isometric exercises, using analysis of variance (ANOVA)

	Mean ± SD	df	F	p-value
2cm above umbilicus				
2	2.67± 0.78	2	9.542	0.000*
3	4.07± 1.77			
4	3.78± 1.20			
2cm below the umbilicus				
2	2.65± 0.81			
3	3.89± 1.75			
4	3.88± 1.05	2	8.746	0.000*
5	3.56± 1.48			

*Statistically significant value

Table 4: Bonferroni **(**post hoc) test of the difference in age in terms of the diastasis resolution

means difference (p-value)

Measurement			
2cm above umbilicus	2	3	4
2	-	-1.397(0.000)	-1.110(0.010*)
3		-	0.287(1.00*)
4			-

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Measurement 2cm below umbilicus	2	3	4
2	-	-1. 241(0.000)	-1.227(0.000*)
3		-	0.015(1.00)
4			

*Statistically significant value

Discussion

Comparison of number of pregnancy and mean inter-recti gap resolution reveals variable relationship between different numbers of multiparity. While the resolution value between multiparity of two and three was not statistically significant (p> 0.05), two compared to four and five show significant resolution difference (P < 0.05) of varying degrees, at 2.5cm above the umbilical ring. Multiparty of four compared to five showed no statistical significance (p> 0.05).

On the other hand the inter-recti gap closure at 2.5cm below the umbilical ring of multiparity of two previous pregnancies compared with those of three was also not statically significant (P> 0.05) whereas those of two in relation to four and five were significant with the values of F= -1.805, P=0.00 and F= -1.476, P=0.00 respectively. Multigravid of three compared to those of four and five showed statistical significance (P< 0.05). Comparatively multiparity of four to five had no mean resolution significance (P>0.05).

These findings have shown indication that multiparous women with recti diastases achieve various degrees of recovery which may depend on individual multiparous status. Therefore, women with fewer number of previous pregnancies were found to have higher closure of inter-recti gaps than their counterparts with records of numerous pregnancies. It was also not clear if there were relative differences in the degree of recti diastasis closure between the two spots of study (i.e. 2.5cm above and below the umbilical ring) when considering the number of previous pregnancies experienced by the subjects. Clinical investigation is therefore necessary in this regard so as to have a comparative knowledge of performance of various locations along the linea alba as caused by recti- diastasis and related to different levels of multiparity.

The subjects mean age was compared with the recti diastasis mean resolution at the two points 2.5cm above and below the umbilical ring. The result indicated significant closure at both 2.5cm above and below the umbilicus for younger women over their older counterparts.

This result shows that age was negatively related with the recti diastasis resolution. Postpartum women in their twenties had better closure compared with those in their thirties and forties. However there was no difference in the pattern and rate of resolution between women at thirties compared to those in their forties.

It is pertinent to observe here that the younger the subject the faster the IRD resolution. This assertion is true for both locations of study along the linea alba. It is therefore possible to conclude that muscular prompt response to stimuli is favourable in younger women than the order ones. It could also be inferred that aging myofibres may not respond readily to toning forces of exercise sufficient to activate younger ones. Although no previous work was available with which to compare the IRD resolution with maternal age, Lo, [3] listed age above 34 years among the risk factors for the occurrence of recti diastasis. This means that child-bearing women within this age bracket are at risk of sustaining the ailment. The clinical implication of these

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findings is that clinicians handling cases of recti diastasis should be cautious when prognosticating treatment success and pay attention to age of clients. This action is necessary so as to enable individualized management protocol, as opposed to group intervention.

In considering the pattern of IRD resolution from baseline to the fourth week it was found that significant closure of inter-recti gap occurred at the fourth week for both upper and lower aspects of the umbilical ring. The result also revealed that though marginal resolution occurred between the baseline and week1 all through to week3, these differences were not statistically significant. Between week1 and week2, week2 and week3 and week4 marginal resolution pattern varied disproportionally but were progressive and quite visible. These results could point to the fact that isometric muscle work played remarkable role in the contractile quality of skeletal muscles, including abdominal muscles. It means that if this exercise quality is sustained for a longer period, it could solve the problem of recti separation as well as strengthen other weak muscles of the abdomen. This finding could be compared with the results obtained by Liaw, [7] in which IRD resolution of thirty postpartum women were studied against time. They found out mean resolution difference between 7 weeks and 6 weeks postpartum to be 0.17± 0.35cm and 0.14± 0.40 respectively for 2.5cm above and below the umbilical ring. The difference at the 2.5cm above the umbilical ring was found to be statistically significant at P< 0.05.

Conclusion

Twenty three subjects who went through abdominal isometric exercises were considered in respect to their recti diastasis resolution scores from baseline through to fourth week of exercises. The result showed that significant resolution (p< 0.05) occurred when baseline was compared with the fourth week of exercise. However, only marginal differences occurred between baseline and first week, first week and second week, and second week and third week. There was no significant mean resolution difference (p> 0.05) between the baseline and any of the first to third week.

Gravid status was also found to have influence on recti diastasis closure using isometric abdominal exercises as method of intervention. While inter-recti distance resolution value between multiparity of women with two previous pregnancies and those of three was not statistically significant (p> 0.05), two compared to four and five show significant resolution difference (P < 0.05) of varying degrees, at 2.5cm above the umbilical ring. Multiparty of four compared to five showed no statistical significance (p> 0.05). At 2.5cm below the umbilical ring multiparity of two compared with three was also not statistically significant (P> 0.05) whereas the resolution in multigravida of two in relation to four and five were significant (p< 0.05) In other words women with fewer number of previous pregnancies had higher inter-recti gap resolution than their counterparts who recorded numerous pregnancies.

Comparison of mean age of subjects in the exercise group with recti diastasis resolution also revealed significant inverse relationship. At the two points 2.5cm above and below the umbilical ring the outcome indicated significant relationship with age. This result shows that age was negatively related with inter-recti distance resolution. Postpartum women in their twenties had better closure compared with those in their thirties and forties. However there was no difference in the pattern and rate of resolution between women at thirties compared to those in their forties using post hoc analysis.

Based on the outcome of this study, it could be concluded that age and number of previous pregnancies are important factors to consider when expecting timely recovery from diastasis recti abdominis in postpartum women. Deliberate efforts towards achieving early DRA resolution should be made, bearing in mind that multiparous women who are older in age are vulnerable group with the risk of poor recovery rate. It is necessary for care givers to consider the

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age and number of pregnancies of clients when planning therapeutic exercise programme as method of intervention for recti diastasis in postpartum women. This will ensure accurate application of modalities and resultant maximum may also be pertinent to explore individualized exercise therapy programme for postpartum women since their abdominal muscle response to therapeutic exercises in time, may differ from person to person. Investigation of other risk factors of DRA is necessary so as to be well equipped with clinical know-how when planning for its effective intervention.

Limitations

Though efficacious in strengthening of abdominal muscles and treatment of recti diastasis, exercise protocol as sole intervention has its own limitations. Patients who are subjected to this method are usually reluctant and unable to conform to the set exercise programmes. Others though willing, may carry out these exercises incorrectly or see it as recreational and should be done at their own discretion. It is also factual that high percentage of clients naturally perceive exercise as mere volitional activity rather than treatment strategy for ailment. It was also possible that some subjects in this study handled successive therapeutic exercise protocols with levity and so did not acquire sufficient benefit inherent in this method of intervention. The factors so enumerated may have adversely affected the outcome of this study.

Inability to include primiparous subjects in this study also created a level of limitation to critical outcome and quality of the work. Inclusion of an appreciable number of primigravids would have created an additional insight into the pattern of closure of IRD in response to therapeutic exercise.

Conflict of interest

The authors have no conflict of interest to declare in this study.

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