CARD International Journal of Science and Advanced Innovative Research (IJSAIR)
ISSN: 2536-7315 (Print) 2536-7323 (Online)
Volume 2, Number 2, June 2017
http://www.casirmediapublishing.com

Relationship between Abdominal Conditioning and Prevalence of Diastasis Rectus Abdominis during Pregnancy among Primigravids

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ABSTRACT

This study aimed to determine the relationship between abdominal conditioning and the prevalence of Diastasis Rectus Abdominis during pregnancy among primigravids. A total of 310 primigravids were recruited from Antenatal clinic, Aminu Kano Teaching Hospital, Kano. Eight of the participants were diagnosed to have diastasis recti abdominis (DRA) and more than half of the participants of this study were found to be abdominally not conditioned. DRA status was classified as present and absent according to Noble's criteria whereas abdominal conditioning status of the participants was categorized as conditioned and not conditioned with respect to McArdle, Katch and Katch criteria. Data was analyzed using descriptive statistics of mean, standard deviation and simple percentage to describe the participants' physical characteristics. Inferential statistics of spearman's correlation described the relationship between abdominal conditioning and prevalence of DRA; Chi-square was computed to determine difference in prevalence of DRA across the trimesters. The result of the study indicates that most of the subjects were in their second trimester. Also, abdominal conditioning is related to prevalence of DRA in primigravids such that pregnant women with weakened abdominals can easily develop DRA. DRA is more prevalent in third trimester. Based on the results obtained from this study, it was recommended that all pregnant women should be examined for the presence of DRA and physiotherapists should design both prenatal and postnatal exercises.

Keywords: Diastasis rectus abdominis, prevalence, trimester, pregnancy.

INTRODUCTION

Diastasis rectus abdominis (DRA), a lesion of musculoskeletal tissue with separation of the rectus abdmonis muscles [1,2,3], has potential repercussions for function, movement and alignment of the human

form [4]. Diastasis rectus abdominis is the most obvious visible change during pregnancy and postpartum period [5]; the fact that DRA is common in pregnant women does not make it exclusive to the child bearing years. Noble [6] believes that during pregnancy or post-partum, women are predisposed to develop DRA because of hormonal and biomechanical changes they undergo. The connective tissue throughout the body, therefore, is at risk of injury or predisposing the structures it supports to injury. The linea alba is under the influence of these hormones. Hormonal softening of the linea alba and the continually increasing stretch placed on the abdominal wall by the growing fetus on an already weakened structure produces a predisposition to separation [7].

The diastasis may be slight or severe, sometimes resulting in herniation of the abdominal viscera [3,6,8]. When the condition is severe, the abdominal wall is composed only of a layer of skin, attenuated fascia and periosteum. Since abdominal musculature plays a crucial role in trunk control and function, compromise of the abdominal musculature due to DRA can diminish the mechanical control of the abdomen and its functions; these include: posture, trunk stability, respiration, delivery of a fetus, trunk flexion, rotation and side bending and support of the abdominal viscera. Diastasis rectus abdominis commonly occur around the umbilicus, but can occur anywhere between the xiphoid process and pubic bone [9].

Fast *et al;* [9] in their study found out that pregnant women had significantly weaker abdominal musculature compared to non-pregnant women and attributed this weakness to their overstretched abdominal muscles. Multiparity, especially without recovery of abdominal tone between successive pregnancies, places a woman at risk for developing DRA due to repeated and prolonged stretch on the abdominal wall [11,12]. Boissonault and Blaschak[4] suggest that advancing pregnancy influences the integrity of the linea alba in many cases resulting in DRA and the third trimester demonstrates a greater incidence of the condition because the uterus has exerted a

great deal of continuous stress on the soft tissues of the abdominal wall by this point in pregnancy.

Bursch[13] discovered in his study on pregnant women that the majority of the subjects had DRA and it was concluded that many women that are not evaluated for DRA before an exercise prescription may be receiving instructions which may be contraindicated with DRA. It was further recommended that there is need determine the correlation between the abdominal conditioning during pregnancy and DRA. Diastasis rectus abdominis appears to be common in non-exercising pregnant women as almost all exhibited a separation of rectus abdominis in the study conducted by Chiarello et al [14]; because of the integral role the abdominal muscles play in functional activities, it was recommended that pregnant women should be examined for the presence of DRA. The purpose of this study therefore was to determine the relationship between the prevalence of DRA and abdominal conditioning during pregnancy and also to determine the difference in the prevalence of DRA and abdominal conditioning status across the trimesters of pregnancy.

Objective of the study

1. To determine the relationship between abdominal conditioning status and DRA during pregnancy.
2. To determine the difference in the prevalence of DRA between the abdominally conditioned and not conditioned primigravids.
3. To determine the difference in the prevalence of DRA across the 3 trimesters in primigravids.

METHODOLOGY

Research Design

The research design used for this study was a cross-sectional correlational research design.

Population

All primigravida in the antenatal clinic, Aminu Kano Teaching Hospital (AKTH), Kano, constituted population of the study.

Sample Size/Technique

300 subjects were recruited for the purpose of this study using convenient sampling technique using the following inclusion and exclusion criteria:

1. Inclusion Criteria

Primigravida.

2. Exclusion Criteria

History of any connective tissue diseases; Midline abdominal surgery; Hernias; Lumbar fusions; Multigravida; Postpartum women.

Data Collection Instrument

The data was collected using the following:

1. Stadiometer (SECA gmbh/Germany): This was used to assess height and body mass of participants.
2. Finger width method [6]: This was used to determine the presence of DRA.

Data Collection Procedure

Approval to conduct the study was sought from the ethical committee of AKTH, Kano. Subjects were recruited from ante-natal clinic, AKTH. They were provided with information concerning the study and a consent form to sign. The following were recorded:

1) **Age:** This was recorded in years.
2) **Stature:** Participants' height was measured barefoot or wearing thin socks. The participants were instructed to stand with their back against the stadiometer with their heels together. The horizontal bar was placed down firmly onto the top of the head and the measurement was recorded [15].
3) **Body Mass:** Participants' weight was measured using a standard weighing scale with provision for calibration. Subjects were asked to present themselves in light clothing and to remove all heavy objects prior to measurement. They were then instructed to step on the weighing scale barefooted and stand erect, with the face

looking straight forward and their hands by the side. The reading was then taken and recorded to the nearest 0.5kg [16].

4) **Body Mass Index (BMI):** BMI was computed by dividing the participants' weight in kilogram to the square of their height in meter [17].

   BMI = Body mass (kg)/[Stature (m)] ^{2}

5) **Trimester:** This was recorded as: 1 = first trimester; 2 = second trimester; 3 = third trimester.

6) **Diagnosis of DRA:** Diagnosis of DRA was made using the Noble's[6] protocol for assessing for the presence of DRA. Participants were instructed to lie supine with the hip and knee flexed at 90 degrees, feet supported and arms extended over the body. The participants were then asked to perform a forward trunk flexion until the inferior angle of the scapula is off the bed. The reference points of DRA measurement was three finger breadths (4.5cm) above and below the umbilicus and when the trunk is flexed forward, the evaluator places the finger perpendicularly between the medial edges of the rectus abdominis muscles. The diastasis is graded by the number of finger breadths between the medial edges of the rectus abdominis muscles at the reference points. Each finger breadth represents 1.5cm. Any separation above, below, or at the umbilicus of two finger widths or less is considered normal; greater than two finger widths is considered as DRA[6]. DRA was coded as 0 = Absent; 1= Present

7) **Abdominal conditioning status:** This was classified as conditioned and not conditioned according to McArdle, Katch and Katch[18] criteria. Any woman that performed at least 3 sets of 10 to 15 repetitions of an accepted rectus abdominis muscles strengthening exercise, two or more times a week; is considered as involved in abdominal conditioning during pregnancy. Data were coded as 0= not conditioned; 1 = conditioned.

Data Analysis Procedure

The data was analyzed using the descriptive and inferential statistics. Descriptive statistics of means, standard deviation and simple percentage described participant characteristics. Inferential

statistics of Spearman's correlation coefficient was used to determine the relationship between abdominal conditioning and prevalence of DRA during pregnancy. Chi-square was computed to determine the difference in prevalence of DRA across the 3 trimesters of pregnancy. Statistical Package for Social Sciences (SPSS) (version 16.0) was used to analyze the data. Probability level of 0.05 was used to determine significance.

RESULTS

A total number of 310 participants participated in this study. The physical/descriptive characteristics are presented in Table 1:

Table 1: Participants' Physical/Descriptive Characteristics (N=310)

Variables	M±SD	Range
Age (years)	21.85 ± 3.409	17-37
Stature (m)	1.59 ± 0.972	1.45-1.85
BM (Kg)	56.56 ± 9.238	45-96
BMI (Kg/m^2)	22.37 ± 3.777	14.53-34.13
Trimester	**n**	**(%)**
First trimester	13	4.2
Second trimester	287	92.6
Third trimester	10	3.2
Abdominal Conditioning		
Conditioned	149	48
Not-conditioned	161	52
DRA status		
Present	8	2.6
Absent	302	97.4

Subjects fell within the teenage and middle age group and on average, participants of the study were within the normal BMI category. Majority of the participants in this study were in their 2nd trimester with very few of them in 3rd trimester. A greater proportion of participants had their abdominal muscles not conditioned. Also, minority of the participants were diagnosed with DRA. Table 2 details prevalence of DRA across categories of abdominal conditioning.

Table 2: Prevalence of DRA across Abdominal Conditioning categories (N=310)

DRA status	Not conditioned	Conditioned	Total N (%)
Absent	155 (96.9)	147 (98.0)	302 (97.4)
Present	5 (3.1)	3 (2.0)	8 (2.6)
Total	160 (100)	150 (100)	310 (100)

There is a lower prevalence of DRA among abdominally conditioned participants. Table 3 shows the distribution of DRA across the 3 trimesters of pregnancy among the primigravids.

Table 3: Distribution of DRA across the trimesters (N=310)

DRA status	First trimester n (%)	Second trimester n (%)	Third trimester n (%)	Total n (%)
Absent	13 (100)	282 (98.26)	7 (70)	302 (97.42)
Present	0 (0)	5 (1.74)	3 (30)	8 (2.58)

Most of the subjects that participated in this study were in second trimester of pregnancy. No subject had DRA in first trimester. However, a very small proportion of subjects were diagnosed to have DRA in the second and third trimesters. Spearman's correlation was used to determine the relationship between the abdominal conditioning status and prevalence of DRA during pregnancy among primigravids (Table 4).

Table 4: Spearman correlation summary showing relationship between abdominal conditioning status and prevalence of DRA

Variable	r
Abdominal conditioning status Prevalence of DRA	0.175*

$r_{critical} = 0.195$; $P<0.05$

There was a significant positive relationship between abdominal conditioning status and prevalence of DRA.

Chi-square was computed to determine the difference in prevalence of DRA between the conditioned and not conditioned groups (Table 5).

Table 5: Summary of chi-square analysis comparing the prevalence of DRA across abdominal conditioning groups

Abdominal Conditioning Status		Absent	Present	Total	X^2
Not Conditioned	FO	153	6	159	1.848
	FE	154.9	4.1	159	
Conditioned	FO	149	2	151	
	FE	147.1	3.9	151	
Total	FO	302	8	310	
	FE	302	8	310	

$X^2_{(1)\ critical}$ = 3.84; P<0.05; FO=observed frequency; FE=expected frequency

Result of the chi-square analysis show that there is no significant difference in prevalence of DRA between the 2 groups.

Chi-squared was computed to determine the difference in the prevalence of DRA across the trimesters (Table 6).

Table 6: Summary of chi-square analysis comparing the prevalence of DRA across the trimesters

DRA		First Trimester	Second Trimester	Third Trimester	Total	X^2
Absent	FO	13	282	7	302	31.052*
	FE	12.2	279.6	9.7	302	
Present	FO	0	5	3	8	
	FE	0.3	7.4	0.3	8	
Total	FO	13	287	10	310	
	FE	13.0	287.0	10.0	310.0	

$X^2_{(2)critical}$ = 5.99 ; P<0.05; FO=observed frequency; FE=expected frequency

Prevalence of DRA varies across the trimesters. Results of this study (Table 6) reveal that DRA is not prevalent in the first trimester, with very few having DRA in second trimester despite the fact that the number of participants in second trimester was quite high. Out of the total number of participants in the third trimester, 1/3rd of them had DRA.

DISCUSSION

This study was conducted to determine the relationship between the prevalence of DRA and abdominal conditioning during pregnancy and also to determine the difference in the prevalence of DRA and

abdominal conditioning status across the trimesters of pregnancy. There was a low prevalence of DRA among primigravids in this study. This is expected due to minimal pressure on the abdominal wall of primigravids being pregnant for the first time and not yet undergoing the process of labour which would have created the DRA or worsened the gap. This result is in line with the outcome of a study conducted by Candido *et al;* [19]. Most pregnant women were in their second trimester during the course of this study and majority of the primigravids of this study did not have their abdominal muscles conditioned during or before pregnancy.

Results of this study further showed that prevalence of DRA was quite low among primigravids who had their abdominal muscles conditioned before and during pregnancy. This is consistent with the results of Chiarello[14]. As expected, no woman was diagnosed to have DRA in the first trimester and a very small proportion of primigravids had DRA in their second trimester with a large proportion of primigravids in the third trimester. Almost half of the primigravids in the third trimester had DRA and this could be related to the fact that increased pressure on the abdominal wall together with increased size of the fetus may increase the possibility of DRA existence; this is in line with the findings of the study conducted by Fransman-Van Santan[7]. This study showed that prevalence of DRA in primigravids is related to abdominal conditioning status of the participants. However, the relationship was found to be a weak and positive relationship; this may be attributed to the fact that weak abdominal muscles predispose pregnant women to DRA in accordance with a study conducted by Chiarello[14].

Result of this study showed that there was no difference in the prevalence of DRA between the conditioned and non-conditioned primigravids. Even though DRA was shown to be more prevalent in the primigravids who had their abdominal muscles not conditioned, yet few of the participants with conditioned abdomen were diagnosed with DRA. This contradicts the findings of the study conducted by Meredy[20] in Chicago, result of their work showed that significant

DRA was present in more than 90% of the participants who have their abdominal muscles not conditioned.
Prevalence of DRA varied across the trimesters. The result indicated that DRA is not prevalent at all in the first trimester. Despite the fact that more than half of the subjects participated in this study were in the second trimester of their pregnancy, very small proportion of the subjects were diagnosed to have DRA in second trimester. One-third of the participants in the third trimester had DRA, this may be related with the fact that during pregnancy women are predisposed to develop DRA because of hormonal and biomechanical changes they undergo which is very obvious in the third trimester, this is consistent with Noble's[6] finding.

CONCLUSION

Generally, there was a low prevalence of DRA among the primigravids of this study. Prevalence of DRA depends on the abdominal conditioning status, that is, with conditioned abdominal muscles prevalence of DRA is low. As pregnancy progresses from first to third trimester DRA prevalence possibility increases with women having poor abdominal wall muscles.

RECOMMENDATION

Based on the results obtained in this study, the study recommends the following:

1. All pregnant women should be examined for the presence of DRA.
2. Women should partake in exercise especially of the abdominal muscles before and throughout the period of pregnancy.
3. Therapists should design exercise programs for pregnant women.

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