

Sonographic Comparison of Fetal Biophysical Profile in Diabetic & Non-Diabetic during Third Trimester

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Abstract

Background:

The pregnant females with diabetes are found at enhanced risk of inborn deformities, stillbirth, perinatal mortality, macrosomia, prematurity, operative delivery or increased rates of caesarean section. Early identification of high-risk pregnancies is important to reduce mortality and morbidity of the mother and fetus as well as improve perinatal outcomes.

Objective:

To compare fetal biophysical profile assessed by ultrasound in diabetic and non-diabetic during third trimester.

Methods:

It was comparative, cross sectional study in which 200 (100 diabetic & 100 non-diabetic) pregnant females in their third trimester of pregnancy were included. Data was collected through proforma, which was entered and statistically analyzed using SPSS 25.0.

Results:

Among diabetic women, mean age was 29.14 ± 4.461 years while in non-diabetic women was 30.72 ± 5.558 years. Women in diabetic group had gestational age 32.447 ± 2.1932 weeks and in non-diabetic group had 32.581 ± 1.9784 weeks. 86.0% diabetic and 87.0% non-diabetic women had normal fetal BPP.

Conclusion:

The majority of the diabetic and non-diabetic pregnant women had normal fetal breathing, fetal tone, fetal movements, amniotic fluid index, placental grading, fetal heart rate and BPP score.

Key words:

Sonography, fetal biophysical profile, diabetic,

non-diabetic, third trimester

Introduction:

During pregnancy, diabetes mellitus (DM) is believed to be the most frequent complication and it represents almost 90 percent of cases and among all pregnancies 2-5% are affected by diabetes mellitus.¹ Current data demonstrate that incidence of DM in pregnancy has enhanced by about 10 to 100 percent in numerous ethnicity groups during last two decades.² An inexpensive and fast diagnostic technique for fetal wellbeing evaluation is essential regarding prenatal care. Early identification of high-risk pregnancies is important to reduce mortality and morbidity of the mother and fetus as well as improve perinatal outcomes. Conditions that are considered a risk to pregnancy are often eclampsia, anemia and oligohydramnios.³ During 3rd trimester of gestation, the hormonal alterations put pregnant females at risk of gestational diabetes mellitus and it can lead to miscarriages, large babies (macrosomia), polyhydramnios and toxemia.⁴ In biophysical profile (BPP), there are six biophysical variables that are assessed by ultrasound and scoring system allocates 2 points to all variable. These variables include the non-stress test, fetal breathing & movements, amniotic fluid volume (AFV), placental grading and fetal tone.⁵ The biophysical profile is not more than thirty minute long ultrasound evaluation for the assessment of fetal well-being together with heart rate tracing of fetus. The components are fluid index assessment, non-stress test, movements of fetal breathing, movements of entire body and the limb tone shown by limb extension and flexion.⁶ Until 30

minutes are completed, the examination is continued to give permission regarding sleep cycle completion. The biophysical profile testing can take place at earlier gestational ages (GAs) when the patient has multiple co-morbidities however it is normally started after thirty two weeks for the patients who are at stillbirth risk. Furthermore, observational studies have demonstrated at cut-off value ≤ 4 , specificity is 99.23% and sensitivity is 12.5%. However, at score of ≤ 8 , specificity is 91.53% and sensitivity is 70.83%.⁷ For every parameter BPP allows two points which is present; providing maximum 12 score. Ultrasound assessment is planned to last for thirty minutes to keep out fetal sleep wake up cycle. Profile could be accomplished when total variables have been examined; though a complete thirty minutes must pass prior to profile is found abnormal.⁸ The BPP coding criteria as normal/abnormal is encoded in components of thirty minute BPP Score for example: 1) Fetal movements 3 or above body/limb movements, 2) Fetal tone 1 episode of the active expansion and limbs flexion; hand closing and opening, 3) Breathing movements of fetus one or more episode of above 30 seconds during thirty minutes, 4) AFV single 2cm x 2cm pocket is believed satisfactory, 5) Non-stress test two accelerations above 15 beats/minute of minimum 15 seconds time duration.⁸ The BPP is a method initially described in 1980 to standardize antepartum fetal evaluation. Large studies have confirmed that BPP allows the most comprehensive evaluation of fetal well-being since patients that underwent antepartum testing had a significantly lower fetal death rate than the untested population. Of 44,828 BPPs, probability of stillbirth taking place during one week with normal medical test result was 0.8 in 1000 and had negative predictive value (NPV) $>99.9\%$.⁵ With the scoring system, maximum 12 score can be obtained and when examination is complete entire variables have been examined. In case when the variables are normal, cardiotocogram can be excluded, although, if

ultrasound is found with ≥ 1 abnormal variables, then antenatal cardiotocogram must be carried out.⁹ Therefore, present research is carried out to compare the fetal BPP assessed by ultrasound in diabetic and non-diabetic during third trimester at Department of Radiology, Singapore Medical Center, Allama Iqbal Town Lahore.

Methods:

It was comparative, cross sectional study in which 200 (100 diabetic & 100 non-diabetic) pregnant females in their third trimester of pregnancy were included. The consecutive non-probability sampling technique was used. The data collection was divided into two parts. The first part consisted of demographic and clinical symptoms of patients and second part consisted of sonographic findings of fetal biophysical profile in both groups. The fetal BPP combines data from two sources, i.e., ultrasound imaging and fetal heart rate monitoring. Dynamic real-time B-mode ultrasound was used to measure the amniotic fluid volume and to observe several types of fetal movements. Data was collected through proforma, which was entered and statistically analyzed using SPSS 25.0. Qualitative variables were described as frequencies and percentages. Charts were used for graphical presentation.

Results:

Table-1 depicts that among 100 diabetic pregnant women, 20 (20.0%) were upto 25 years old and majority 71 (71.0%) was 26-30 years old while only 9 (9.0%) diabetic pregnant women were above 35 years old. The mean age of the women was 29.14 ± 4.461 years. Likewise among 100 non-diabetic pregnant women, 17 (17.0%) were upto 25 years old and mainstream 57 (57.0%) was 26-30 years old while 26 (26.0%) women were above 35 years old. The mean age of the non-diabetic pregnant women was 30.72 ± 5.558 years. Figure-1 demonstrates that among 100 pregnant women, 21 (21.0%) had pre-gestational diabetes while majority 79 (79.0%) had gestational diabetes. Table-2 indicates that among 100 diabetic pregnant women, mean

gestational age was 32.447 ± 2.1932 weeks while among 100 non-diabetic pregnant women, mean gestational age was 32.581 ± 1.9784 weeks. Table-3 exhibits that among 100 diabetic pregnant women, 14 (14.0%) had abnormal fetal breathing while majority 86 (86.0%) had normal fetal breathing. Similarly among 100 non-diabetic pregnant women, 13 (13.0%) had abnormal fetal breathing and majority 87 (87.0%) had normal fetal breathing. Among 100 diabetic pregnant women, only 1 (1.0%) had abnormal fetal tone and significant majority 99 (99.0%) had normal fetal tone. Likewise, among 100 non-diabetic pregnant women also only 1 (1.0%) had abnormal fetal tone and 99 (99.0%) had normal fetal tone. Out of 100 diabetic pregnant women, 16 (16.0%) had abnormal fetal movement and 84 (84.0%) had normal fetal movement. Among 100 non-diabetic pregnant women, 15 (15.0%) had abnormal fetal movement and 85 (85.0%) had normal fetal movement. Result shows that among 100 diabetic pregnant women, 15 (15.0%) had abnormal amniotic fluid index and 85 (85.0%) had normal amniotic fluid index. Among 100 non-diabetic pregnant women, 25 (25.0%) had abnormal amniotic fluid index and 75 (75.0%) had normal amniotic fluid index. Out of 100 diabetic pregnant women, 5 (5.0%) had abnormal placental grading and 95 (95.0%) had normal placental grading. Similarly, out of 100 non-diabetic pregnant women, only 2 (2.0%) had abnormal placental grading and 98 (98.0%) had normal placental grading. Among 100 diabetic pregnant women, only 4 (4.0%) had abnormal fetal heart rate and 96 (96.0%) had normal fetal heart rate. Likewise among 100 non-diabetic pregnant women, only 4 (4.0%) had abnormal fetal heart rate and 96 (96.0%) had normal fetal heart rate. Result highlights that among 100 diabetic pregnant women, 14 (14.0%) had abnormal BPP score and majority 86 (86.0%) had normal BPP score. Among 100 non-diabetic pregnant women, 13 (13.0%) had abnormal BPP score and majority 87 (87.0%) had normal BPP score.

Age	Diabetic		Non-Diabetic	
	N	%	N	%
≤25 years	20	20.0	17	17.0
26-35 years	71	71.0	57	57.0
>35 years	9	9.0	26	26.0
Total	100	100.0	100	100.0
Mean±SD	29.14 ± 4.461		30.72 ± 5.558	

Table-1: Frequency distribution of age among diabetic and non-diabetic pregnant women

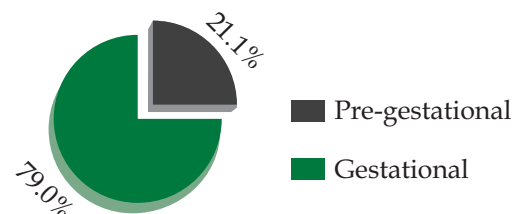


Figure-1: Frequency distribution of diabetes among pregnant women

Variables	Diabetic		Non-Diabetic	
	N	%	N	%
27 weeks	1	1.0	0	0.0
28 weeks	3	3.0	2	2.0
29 weeks	6	6.0	5	5.0
30 weeks	13	13.0	10	10.0
31 weeks	17	17.0	22	22.0
32 weeks	15	15.0	19	19.0
33 weeks	17	17.0	12	12.0
34 weeks	12	12.0	20	20.0
35 weeks	11	11.0	3	3.0
36 weeks	4	4.0	4	4.0
37 weeks	1	1.0	2	2.0
38 weeks	0	0.0	1	1.0
Total	100	100.0	100	100.0
Mean ± SD	32.447 ± 2.1932		32.581 ± 1.9784	

Table-2: Frequency distribution of gestational age among diabetic and non-diabetic pregnant women

BPP	Diabetic		Non-Diabetic	
	N	%	N	%
Fetal breathing (FB)				
Abnormal	14	14.0	13	13.0
Normal	86	86.0	87	87.0
Total	100	100.0	100	100.0
Fetal tone (FT)				
Abnormal	1	1.0	1	1.0
Normal	99	99.0	99	99.0
Total	100	100.0	100	100.0

BPP	Diabetic		Non-Diabetic	
	N	%	N	%
Fetal movement (FM)				
Abnormal	16	16.0	15	15.0
Normal	84	84.0	85	85.0
Total	100	100.0	100	100.0
Amniotic fluid index (AFI)				
Abnormal	15	15.0	25	25.0
Normal	85	85.0	75	75.0
Total	100	100.0	100	100.0
Placental grading (PG)				
Abnormal	5	5.0	2	2.0
Normal	95	95.0	98	98.0
Total	100	100.0	100	100.0
Fetal heart rate (FHR)				
Abnormal	4	4.0	4	4.0
Normal	96	96.0	96	96.0
Total	100	100.0	100	100.0
Fetal biophysical profile (BPP)				
Abnormal	14	14.0	13	13.0
Normal	86	86.0	87	87.0
Total	100	100.0	100	100.0
Mean $\pm$ SD	10.88 $\pm$ 2.483		10.70 $\pm$ 2.452	

Table-3: Frequency distribution of fetal biophysical profile among diabetic and non-diabetic pregnant women

Discussion:

Current study is carried out to compare the fetal BPP assessed by ultrasound in diabetic and non-diabetic during third trimester at Department of Radiology, Singapore Medical Center, Allama Iqbal Town Lahore. To acquire appropriate outcomes total 200 pregnant women were including in the study and divided into two groups (100 diabetics and 100 non-diabetics). Study revealed that in both groups most of the pregnant women were in their best reproductive age group (26 to 35 years). In diabetic group, the mean age of the pregnant women was 29.14 $\pm$ 4.461 while in non-diabetic group the mean age was 30.72 $\pm$ 5.558 years. Almost the findings of our study are comparable with a study conducted by Westerneng and coworkers (2019) who reported that mean age of the pregnant females was 32.9 years.¹⁰ But a similar study performed by Nalamaru and Reddy (2020)

demonstrated that manage age of the pregnant women was 23.3 $\pm$ 5.1 years.¹¹ Study revealed that in both groups massive portion of pregnant women had gestational diabetes. Among diabetic women, mean gestational age was 32.447 $\pm$ 2.1932 weeks while 32.581 $\pm$ 1.9784 weeks among non-diabetic women and majority in both groups had gestational age between 30-35 weeks. But the findings of a study conducted in Bangalore (India) by Beena (2013) confirmed that mean gestational age among pregnant women was between 18-40 weeks.¹² Study showed very encouraging results that major proportion of pregnant women in both groups had normal fetal breathing. Likewise significant majority (99.0% in each group) of pregnant women in both groups had normal fetal tone. The findings of our study are comparable but exhibited better scenario than a study undertaken by Beena (2013) who also confirmed that significant majority (96.0%) of pregnant women had normal fetal tone.¹² Study further disclosed there was no big difference in both groups regarding fetal movements. Majority (84.0%) of diabetic women and mainstream (85.0%) of non-diabetic women had normal fetal movement. But the study carried out by Nomura and associates (2007) highlighted that fetal movement was found better among diabetic women than non-diabetic women.¹³ A study carried out by Beena (2013) reported that significant majority (97.0%) had normal fetal movement.¹² It is believed that amniotic fluid index is found elevated among diabetic pregnant women. The finding of our study confirmed that 85.0% diabetic pregnant women and 75.0% non-diabetic pregnant women had normal amniotic fluid index. The findings of a most recent study performed by Bakhsh and collaborators (2021) highlighted that 85.5% pregnant women had normal fluid index.¹⁴ Nomura and associates (2007) reported in their study that amniotic fluid index was observed elevated among diabetic women than non-diabetic women.¹³ A study carried out by Kofinas and Kofinas (2006) indicated that

diabetic pregnant females had high amniotic fluid index than non-diabetic pregnant females.¹⁵ The findings of our study also highlighted that majority of women (95.0% diabetic and 98.0% non-diabetic) in both groups had normal placental grading. Similarly most of the pregnant women (96.0% in each group) had normal fetal heart rate. The biophysical profile is carried out to assess the babies who are at risk of pregnancy poor outcome.¹⁶ It is worth-mentioning here that 86.0% diabetic women and 87.0% non-diabetic pregnant women had normal biophysical profile. The findings of our study are better than a study performed by Ullah and teammates (2010) who asserted that 79.0% women had normal biophysical profile.⁸ A recent study conducted by Jha and Dangal (2020) indicated that only 56.4% women had normal biophysical profile while remaining proportion had abnormal biophysical profile.¹⁷ A study carried out by Surtea and teammates (2019) showed much better scenario that 92.2% women had normal biophysical profile.¹⁸ However, a study undertaken by Nalamaru and Reddy (2020) reported that only 51.0% women had normal biophysical profile.¹¹ Another study done by Makanjuola and fellows confirmed that 86.5% women had normal fetal biophysical profile.¹⁹ The results of a study performed Beena (2013) showed that 81.0% women had normal biophysical profile.¹² But a study conducted by Singh and comrades (2017) showed much better situation who confirm that only 3.5% had abnormal while significant majority (96.5%) had normal biophysical profile.²⁰

Conclusion:

Study concluded that majority of the diabetic and non-diabetic pregnant women had normal fetal breathing, fetal tone, fetal movements, amniotic fluid index, placental grading, fetal heart rate and BPP score. However, FB, FM, PG, BPP score were found more better in non-diabetic group and only AFI was found more better in diabetic group while FT and FHR were found equal in both groups.

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