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Relationship of Fetal Biophysical Profile in Second and Third Trimester with Maternal and Fetal Age in Sudan

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Abstract: ***Objective: This retrospective study is aimed to find the correlation between the fetal biophysical profile(BPP) test and maternal and fetal age in the second and third trimester among pregnant women in Sudan. Method: This study was conducted in Blue Nile state –Sudan in the Radiology department Aldamazin Hospital, Aldamazin specialized Center– Aldamazin and Aldamazin specialized Ultrasound Clinic during the period from October 2015 to December 2020. An abdominal U/S was performed for all pregnant women for 401 participants (168 males fetuses represent 41.9% and 233 females fetuses represent 58.1%) with gestational age ranged from 22 and 40 weeks. Result: the study results showed that the mean of gestational age was 33.03±3.40 weeks, the mean maternal age, weight, height, and BMI were 29.72±8.79 years, 69.47±14.84 Kg, 161.39±18.81 cm, 27.26±6.61 kg \cm2 respectively. There were no differences in fetal body movement, fetal breathing movement, liquor volume, and placental grading in different gestational age groups (P. value > 0.05), but there was a significant difference in fetal tone in different gestational age groups (P. value = 0.04)). Conclusion: There was a moderately significant correlation between the Gestational Age and fetal body movement, fetal tone, liquor volume, and score respectively and there was a weak significant correlation between the Gestational Age and placental grading, but no significant correlation between Gestational age and fetal breathing movement.***

Keywords: Fetal Biophysical Profile, pregnancy, U/S, fetus, Maternal, and Fetal Age

1. Introduction

A fetal biophysical profile is a prenatal test used to check on a baby's well-being. The test combines fetal heart rate monitoring (nonstress test) and fetal ultrasound to evaluate a baby's heart rate, breathing, movements, muscle tone, and amniotic fluid level. The nonstress test and ultrasound measurements are then each given a score based on whether certain criteria are met. [1]

Typically, a biophysical profile is recommended for women at increased risk of problems that could lead to complications or pregnancy loss. The test is usually done after week 32 of pregnancy, but can be done when your pregnancy is far enough along for delivery to be considered — usually after week 24. A low score on a biophysical profile might indicate that you and your baby need further testing. In some cases, early or immediate delivery might be recommended. [2]

A biophysical profile is a noninvasive test that doesn't pose any physical risks to you or your baby. However, it's not always clear that the test improves pregnancy outcomes. Find out what a biophysical profile involves and whether this prenatal test might benefit your baby. A biophysical profile is used to evaluate and monitor a baby's health. The goal of a biophysical profile is to prevent pregnancy loss and detect a low oxygen supply in the baby (fetal hypoxia) early enough so that the baby can be delivered and not sustain permanent damage. [1,2]

Routine prenatal ultrasound (US) scanning is an integral part of the follow-up of pregnancy in many countries. However, expert views on its use remain controversial with the main aspects of contention being benefits, cost, and ethical considerations. Over the years US scans have become more and more available in developing countries with increasing accessibility, enhancing its routine use in the follow-up of pregnancies by healthcare providers. The pregnant woman is an important stakeholder regarding prenatal ultrasonography. Her acceptance of the procedure and willingness to pay for it as is often the case in some developing countries where health insurance policies are quasi-inexistent for the majority of the population are factors that can contribute to its success as a tool in pregnancy assessment. [3]

Achieving this will very likely depend on her knowledge and understanding of the potential benefits and limitations of this utility over inconveniences and risks if any. In some studies, participants declared having received background information on the purposes of US scan while in others this

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was not the case This trend of awareness of information regarding the prenatal US warrants further investigations across different populations to confront local realities. [3]
Some published materials on the expectations of pregnant women who report for prenatal US scans have been similar across some different populations with significant variations in the reasons behind the expectations based on socio-economic and cultural differences Also, although the ultrasound U/S appears safe for clinical practice, as no study has yet proven the contrary, it is worthwhile investigating what the pregnant women think about its safety. This will help dispel some "myths" and erroneous perceptions regarding U/S during pre-scan preparation. Mainly we preferred to do BPP test when the pregnant women come with these indications for Sonographic examination in the second trimester of pregnancy such as evaluation of the situation, presentation and cardiac activity of the fetus; placental localization assessment of the amniotic fluid; fetal biometrics; and assessment of fetal anatomical structures and movements. Sonography in the second trimester is also recommended in cases of vaginal bleeding, risks for fetal malformations, and requests for invasive antenatal diagnosis.[4]

The main purpose of this study is found the relationship between BPP test parameters and demographic information of pregnant women which include fetal body movement, breathing movement, tone, liquor volume, placental grading, Score and patient age, weight, Height & Body Mass Index.

2. Materials and Method

A retrospective Scientific study was carried out in Blue Nile state, in the ultrasound departments of Radiology department of Aldamazin Hospital, Aldamazin specialized Center, and Aldamazin specialized Ultrasound Clinic. The study was obtained during the period From October 2015 to December 2020. Each pregnant woman was scanned; list the findings in detail according to the study variables recorded in the data collecting sheets.

The study was conducted on 401 pregnant women in the second and third trimester sent for Anti-Natal Care ultrasonography in the area of the study, selection of pregnant women through simple random sampling, and then the data was collected from the women.

By using A 3.5 to 5 MHz curved linear array, an electronically focused transducer was the best available for Obstetrical ultrasonography. The original fetal Biophysical profile Scoring (BPS) consisted of five ultrasound-based variables Test (maximum BPS 10/10), and the Non-Stress protocol Replaced by Cardiotocography (CTG) which was done by Gynecologist. All parameters were observed maximum at 4 minutes.

Each area that's evaluated during a biophysical profile (Figures (1-6) is given a score of 0 or 2 points, depending on whether specific criteria were met. A score can be given immediately. A biophysical profile (BPP) test measures the health of your baby (fetus) during pregnancy. The results are scores on five measurements in a 30-minute observation period. Each measurement has a score of 2 points if normal and 0 points if not normal. Some BPPs do not include all the measurements. When all five measurements are taken, a score of 8 or 10 points means that your baby is healthy. A score of 6 or 8 points means that you may need to be retested in 12 to 24 hours. A score of 4 or less may mean the baby is having problems. Further testing will be recommended. [5]

3. Result

All collected data analyzed and tabulated in tables and graphs as follows:

Table 1: Shows Frequency distribution of Age group

Age group	*Frequency*	*Percent*	*Valid Percent*
15-23 years	115	28.7	28.7
24-32 years	126	31.4	31.4
33- 41 years	109	27.2	27.2
42- 50 years	51	12.7	12.7
Total	401	100.0	100.0

Table 2: Shows Frequency distribution of Fetal Gender

Fetal Gender	*Frequency*	*Percent*	*Valid Percent*
male	168	41.9	41.9
female	233	58.1	58.1
Total	401	100.0	100.0

Table 3: Shows Frequency distribution of BPP Scores **(**fetal body movement, breathing movement, tone, liquor volume, placental grading)

Scores	*Frequency*	*Percent*	*Valid Percent*
0	2	0.5	0.5
2	49	12.2	12.2
4	85	21.2	21.2
6	88	21.9	21.9
8	177	44.1	44.1
Total	401	100.0	100.0

Figure 1: U/S Image of 25 years lady. 37Ws fetus show grade III placenta

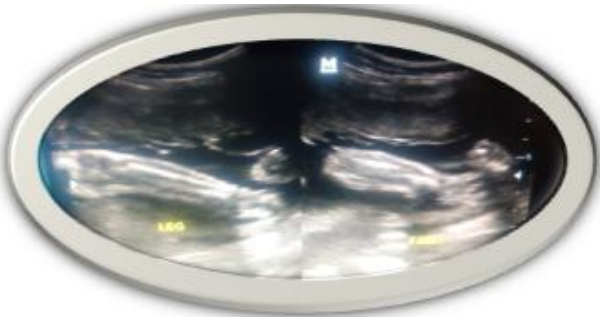

Figure 2: U/S Image of 35 years lady. 27Ws fetus shows fetal tone at level of lower limb

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Figure 3: U/S Image of 28 years lady. 32Ws fetus shows fetal tone at level of upper limb

Figure 4: U/S Image of 40 years lady. 25Ws fetus shows single vertical pocket liquor (Chamberlain Method) and grad II placenta

Figure 5: U/S Image of 33 years lady. 32Ws fetus shows fetal breathing movement and cardiac activity

Figure 6: U/S Image of 23 years lady. 25Ws fetus shows fetal breathing movement at level of diaphragm

Table 4: Shows the Minimum, Maximum, Mean, and Stander Deviation of Patient age, weight, height, BMI, and Gestational Age

Characteristic	*N*	*Minimum*	*Maximum*	*Mean*	*Std. Deviation*
Patient age	401	15.00	50.00	29.72	8.79
Patient weight	401	8.00	110.00	69.47	14.84
Patient height	401	100.00	210.00	161.39	18.81
Patient BMI	401	2.47	57.85	27.20	6.73
Gestational Age	401	22.00	40.00	33.03	3.40

Table 5: Cross tabulation fetal body movement, breathing movement, tone, liquor volume, and placental grading in different age group

Characteristic	Score	Age group				Total	P-value
		15-23 years	24-32 years	33- 41 years	42- 50 years		
Fetal body movement	score 2	81	80	70	38	269	0.392
	score 0	34	46	39	13	132	
Total		115	126	109	51	401	
Fetal breathing movement	score 2	108	109	95	46	358	0.246
	score 0	7	17	14	5	43	
Total		115	126	109	51	401	
Fetal tone	score 2	89	73	76	38	276	0.008
	score 0	26	53	33	13	125	
Total		115	126	109	51	401	
Liquor volume	score 2	90	90	80	30	290	0.079
	score 0	25	36	29	21	111	
Total		115	126	109	51	401	
Placental grading	score 2	49	75	61	28	213	0.055
	score 0	66	51	48	23	188	
Total		115	126	109	51	401	

Table 6: Shows the correlation between the fetal body movement, breathing movement, tone, liquor volume, placental grading, Score and fetal sex & gestational age

		fetal body movement	*fetal breathing movement*	*fetal tone*	*liquor volume*	*placental grading*	*Score*
fetal sex	Pearson Correlation	-.115*	-.032	-.127*	-.096	-.134**	.159**
	Sig. (2-tailed)	.021	.517	.011	.055	.007	.001
Gestational age	Pearson Correlation	.338**	.058	.324**	.371**	.239**	-.442**
	Sig. (2-tailed)	.000	.246	.000	.000	.000	.000
	N	401	401	401	401	401	401

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Table 7: Cross tabulation fetal body movement, breathing movement, tone, liquor volume, and placental grading in different Gestational age group:

Characteristic	*Score*	*Gestational Age group*		*Total*	*P-value*
		22-26 weeks	*27-40 weeks*		
Fetal Body Movement	score 2	12	257	269	0.13
	score 0	2	130	132	
Total		14	387	401	
Fetal Breathing Movement	score 2	13	345	358	0.65
	score 0	1	42	43	
Total		14	387	401	

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Fetal Tone	score 2	13	263	276	0.04
	score 0	1	124	125	
Total		14	387	401	
Liquor Volume	score 2	13	277	290	0.08
	score 0	1	110	111	
Total		14	387	401	
Placental Grading	score 2	8	205	213	0.75
	score 0	6	182	188	
Total		14	387	401	

4. Discussion

The sample of this research consisted of 401 pregnant women, the study carried out in Blue Nile State in the Radiology department of Aldamazin Hospital, Aldamazin specialized Center– Aldamazin and Aldamazin specialized Ultrasound Clinic in the period from October 2015 to December 2020 and aimed to assess the fetal biophysical profile by using ultrasound.

Table (1) shows most of the study sample in the age group 24-32 years (31.4%) followed by 15-23 years (28.7%), 33-41 years (27.2%), and 42- 50 years(12.7%) which was the less group of pregnant women age.

Table (2) shows that display Frequency distribution of fetal gender about 168 were males sex gender represent 41.9% and 233 of the study were females sex gender represent 58.1% that means girl sex gender was more than boys one.

When the biophysical profile is complete, your health care provider will likely discuss the results with you right away. Each area that's evaluated during a biophysical profile is given a score of 0 or 2 points, depending on whether specific criteria were met. A score can be given immediately during the examination. A biophysical profile (BPP) test measures the health of your baby (fetus) during pregnancy. The results are scores on five measurements in a 30-minute observation period. Each measurement has a score of 2 points if normal and 0 points if not normal. Some BPPs do not include all the measurements. When all five measurements are taken, a score of 8 or 10 points means that your baby is healthy. A score of 6 or 8 points means that you may need to be retested in 12 to 24 hours. A score of 4 or less may mean the baby is having problems. Further testing will be recommended.

Table (3) represent Frequency distribution of score, The study found that 188 fetuses had a score 8 represent 44.1%, 86 fetuses had score 6 represent 21.4%, 85 fetuses had score 4 represent 21.2%, 49 fetuses had score 2 represent 12.2%, two fetuses had score 2 represent 0.5% and also two fetuses had score 7 and represent 0.5%. some previous studies discuss that The individual scores are then added together for a total score. Typically, a score of 8 to 10 is reassuring. If you receive a score of 6, your health care provider will likely repeat the test within 24 hours or, if your pregnancy is near term, delivery might be recommended. A score of 4 or lower means that further testing is needed or that you might need to deliver the baby early or immediately. Also, if your health care provider finds that you have a low amount of amniotic fluid, you'll need further testing and might need to deliver your baby early - regardless of your overall score. a similar study done by Dr. Serdar Aydin, et al, 1993 concluded that about 104 pregnant patients, 84 (80.7%) had normal FBP score (>8); 17 had an equivocal fetal biophysical score (-6). whereas 3 patients (2.9%) had an abnormal score (<4).[4]

Certain factors can affect the results of the BPP test, including the recent use of corticosteroids medication to speed your baby's lung maturity. Taking certain medications, such as morphine, also can affect the test score. Be sure to discuss the results of your biophysical profile with your health care provider to fully understand what they might mean for pregnant women.[6,7]

The study revealed that the minimum and maximum of patient age, weight, height, BMI, and Gestational Age were 15 and 50 years, 8 and 110 Kg, 100 and 210cm, 2.47 and 57.85 kg \cm^2 and 22 and 40 weeks respectively, also found that the mean of patient age, weight, height, BMI and Gestational Age were 29.72±8.79 years, 69.47±14.84 Kg, 161.39±18.81 cm, 27.26±6.61 kg \cm^2 and 33.03±3.40 weeks respectively. (Table 4)

Table (5) the study revealed that most females in the age group 24-32years followed by 15-23 years. in age group 15-23 years 81 fetuses had score 2 and 34 had score 0 fetal body movement, 108 fetuses had score 2 and 7 had score 0 fetal breathing movement, 89 fetuses had score 2 and 26 had score 0 fetal tone, 90 of pregnancies had score 2 and 25 had score 0 liqure volume and 49 of pregnancies had score 2 and 66 had score 0 placental grading, in age group 24-32 years 80 fetuses had score 2 and 46 had score 0 fetal body movement, 109 fetuses had score 2 and 17 had score 0 fetal breathing movement, 73 fetuses had score 2 and 53 had score 0 fetal tone, 90 of pregnancies had score 2 and 36 had score 0 liquor volume and 75 of pregnancies had score 2 and 51 had score 0 placental grading, in age group 33-41 years 70 fetuses had score 2 and 39 had score 0 fetal body movement, 95 fetuses had score 2 and 14 had score 0 fetal breathing movement, 76 fetuses had score 2 and 33 had score 0 fetal tone, 80 of pregnancies had score 2 and 29 had score 0 liqure volume and 61 of pregnancies had score 2 and 48 had score 0 placental grading, in age group 42-50 years 38 fetuses had score 2 and 13 had score 0 fetal body movement, 46 fetuses had score 2 and 5 had score 0 fetal breathing movement, 38 fetuses had score 2 and 13 had score 0 fetal tone, 30 of pregnancies had score 2 and 21 had score 0 liquor volume and 28 of pregnancies had score 2 and 23 had score 0 placental grading. There was no significant difference in fetal body movement, fetal breathing movement, liquor volume, and placental grading in different age groups (P. value > 0.05), but there was a significant difference in fetal tone in different age groups (P. value = 0.01).

Table (6) study demonstrated that there was a weak significant relationship between fetal sex and fetal body movement, fetal tone, placental grading and score (P-value < 0.05, r = 0.115. 0.127, 0.134 7 & 0.159) respectively. but no significant relationship between fetal sex and fetal breathing movement and liquor volume (P-value > 0.05). There was a moderate significant correlation between the Gestational Age and fetal body movement, fetal tone, liquor volume and score (P-value < 0.01, r = 0.338, 0.324, 0.371, 0.231 &

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0.442) respectively and there was a weak significant correlation between the Gestational Age and placental grading (P-value < 0.01, r = 0.239) but no significant correlation between Gestational age and fetal breathing movement (P-value >0.05). This result is similar to Kakoli 2009 which mentions that in some cases there is There was a moderately significant correlation between the Gestational Age and fetal body movement.[8].

In table (7) the study found that there were no differences in fetal body movement, fetal breathing movement, liquor volume, and placental grading in different gestational age group (P. value > 0.05), but there was a significant difference in fetal tone in different gestational age group (P. value = 0.04).

5. Conclusion

The study revealed that the minimum and maximum of patient age, weight, height, BMI, and Gestational Age were 15 and 50 years, 8 and 110 Kg, 100 and 210cm, 2.47 and 57.85 kg \cm^2 and 22 and 40 weeks respectively, also found that the mean of patient age, weight, height, BMI and Gestational Age were 29.72±8.79 years, 69.47±14.84 Kg, 161.39±18.81 cm, 27.26±6.61 kg \cm^2 and 33.03±3.40 weeks respectively.

There was no significant difference in fetal body movement, fetal breathing movement, liquor volume, and placental grading in different age groups, but there was a significant difference in fetal tone in a different age group.

The study revealed that there was no significant correlation between patient age and fetal body movement, fetal breathing movement, fetal tone, liquor volume, placental grading, and score. There was a weak significant correlation between the patient weight and fetal tone, liquor volume, and score and no significant correlation between the patient weight and fetal body movement, fetal breathing movement, and placental grading. There was no significant correlation between the patient height and fetal body movement, liquor volume, placental grading, and score but there was a weak significant correlation between patient height, fetal breathing movement, and fetal tone. The Body Mass Index had no significant correlation with fetal body movement, fetal breathing movement, fetal tone; placental grading, and score. and had weak with liquor volume.

Sonographic examination in the second trimester of pregnancy should include evaluation of the situation, presentation, and cardiac activity of the fetus; placental localization assessment of the amniotic fluid; fetal biometrics; and assessment of fetal anatomical structures and fetal movements. The sonographer might also recommend a biophysical profile if you're between 40 and 42 weeks pregnant according to special pregnancy condition, health care provider might recommend that some pregnant women should have a biophysical profile once a week or twice a week, depending on pregnant health condition - until she delivers.

6. Ethical Clearance

Ethical approval has been granted from the hospital as well as the radiology department; that this data will be used for research purposes only and the patient will not be subjected to any harm and his information will not be revealed as well as verbal consent from the patients were taken.

7. Other recommendations

Availability of Obstetrical ultrasound machines in all departments should be most recommended, to facilitate adequate training of master degree students to apply their knowledge of Biophysical Profile in their working departments.

Further studies should be done in different ethnic groups and can be performed in correlation to the participant‘s jobs. We recommended further studies should be done on Umbilical Artery Doppler as an Addition to the Assessment of Fetal Well-Being.

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