

# SONOGRAPHIC ASSESSMENT OF RAPID BIOPHYSICAL PROFILE AMONG HYPERTENSIVE PREGNANT WOMEN IN THE LATE 2<sup>ND</sup> AND 3<sup>RD</sup> TRIMESTERS IN A TERTIARY HOSPITAL

Abubakar U,<sup>1</sup> Adamu Y,<sup>2</sup> Abdul Karim A<sup>1</sup>

<sup>1</sup> Department of Radiology, Faculty of Allied Health Sciences, College of Health Sciences, Usmanu Danfodiyo University, Sokoto Nigeria.

<sup>2</sup> Department of Radiology, Faculty of Health Sciences, College of Medicine, Federal University of Lafia, Nasarawa State, Nigeria.

PJR October - December 2025; 35(4): 236-240

## ABSTRACT

**BACKGROUND:** Hypertensive disorders in pregnancy are a major cause of maternal and fetal complications globally. Timely and reliable fetal surveillance is critical for reducing adverse outcomes, especially in resource-limited settings. The rapid biophysical profile (rBPP) offers a simplified method for assessing fetal well-being using amniotic fluid index (AFI) and sound-provoked fetal movement (SPFM). **OBJECTIVE:** To determine the rBPP scores of fetuses in hypertensive pregnant women and evaluate the relationship between maternal hypertension and fetal rBPP outcomes during the late second and third trimesters. **METHODS:** A cross-sectional study was conducted at Usmanu Danfodiyo University Teaching Hospital, Sokoto, from July to October 2024. Seventy-four hypertensive pregnant women in their late second or third trimester were enrolled using purposive sampling. Blood pressure readings were categorized as normotensive ( $\leq 139$  mmHg) or hypertensive ( $\geq 140$  mmHg). rBPP scores were obtained via ultrasound, with a total score of 4 considered normal, 2 partially abnormal, and 0 totally abnormal. Data were analyzed using SPSS to generate descriptive statistics. **RESULTS:** Out of 74 participants, 50 (67.57%) were hypertensive. Normal rBPP scores (4/4) were observed in 62.16% of cases, while 24.32% showed partial abnormality and 13.51% total abnormality. All cases of totally abnormal rBPP scores occurred in the hypertensive group. A higher incidence of abnormal rBPP scores was also associated with increasing maternal age, particularly between 31 and 40 years. **CONCLUSION:** Maternal hypertension is associated with a measurable decline in fetal rBPP scores, underscoring the impact of elevated blood pressure on fetal well-being. rBPP provides a practical, time-efficient method for fetal monitoring in hypertensive pregnancies and should be integrated into routine antenatal surveillance protocols in similar clinical settings. **Keywords:** Rapid Biophysical Profile; Hypertensive Pregnancy; Fetal Surveillance; Third Trimester High-Risk Pregnancy Monitoring.

## Background

Hypertensive disorders remain one of the most prevalent and serious complications of pregnancy, accounting for a substantial proportion of maternal and perinatal morbidity and mortality worldwide.<sup>1</sup> These disorders

comprising chronic hypertension, gestational hypertension, pre-eclampsia, and eclampsia affect up to 10% of pregnancies and represent a persistent challenge to antenatal care, particularly in low-resource settings.<sup>2</sup>

**Correspondence :** Mr. Abubakar U  
Department of Radiology, Faculty of Allied Health Sciences, College of Health Sciences, Usmanu Danfodiyo University, Sokoto Nigeria.  
Email: umar.abubakar5@udusok.edu.ng

Submitted 7 September 2025, Accepted 7 October 2025

Despite advances in clinical surveillance, there remains a need for standardized, efficient, and accessible methods to assess fetal wellbeing in high-risk pregnancies, especially during the late second and third trimesters when the risks of preterm delivery, intrauterine growth restriction (IUGR), and stillbirth are heightened.<sup>3</sup>

The conventional biophysical profile (BPP), developed to reduce fetal mortality in high-risk pregnancies, relies on sonographic evaluation of fetal breathing movements, gross body movements, tone, amniotic fluid volume, and a non-stress test of fetal heart rate.<sup>4,5</sup> However, the complete BPP is time-intensive, often requiring up to 30 minutes and trained personnel to perform it reliably.<sup>6</sup> To address these limitations, Tongsong et al. proposed the rapid biophysical profile (rBPP), a condensed version of the traditional BPP designed to streamline fetal assessment.<sup>7</sup> The rBPP evaluates just two parameters: the amniotic fluid index (AFI) and sound-provoked fetal movement (SPFM), offering a total score of four points.<sup>8</sup> A score of 2 is given for each normal parameter, while a score of 0 indicates abnormality. This model retains clinical relevance while reducing the complexity and duration of the procedure. The American College of Obstetricians and Gynecologists (ACOG) in 2015 has endorsed rBPP as an effective screening tool, particularly useful when time or resources are limited.<sup>9</sup> Evidence suggests that the rBPP correlates well with adverse perinatal outcomes. Mappalam et al. reported that rBPP is both quicker to perform and statistically comparable to full BPP in detecting fetal compromise, with a positive predictive value of 61% and a sensitivity of 78%.<sup>10</sup> Another study showed that rBPP had an overall predictive accuracy of 98.18% for adverse outcomes.<sup>11</sup> However, despite these findings, rBPP has not been extensively validated against biochemical markers such as umbilical cord pH, which remains the gold standard for diagnosing fetal acidemia.<sup>11</sup>

In high-risk populations, particularly among hypertensive pregnant women, timely and accurate assessment of fetal health is essential for informed obstetric management. Yet, in settings such as Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto, the application of rBPP remains inconsistent. There is a pressing need to evaluate the utility of this tool in routine antenatal care of hypertensive pregnancies, particularly in the critical window of the late second and third trimesters. This study was therefore designed to assess fetal wellbeing using rBPP among hypertensive pregnant

women in Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto, with the aim of determining the distribution of rBPP scores and evaluating the extent to which maternal hypertension may affect these outcomes.

## Materials and Methods

This study employed a cross-sectional design to assess the rapid biophysical profile (rBPP) of fetuses in hypertensive pregnant women attending antenatal care at Usmanu Danfodiyo University Teaching Hospital (UDUTH), Sokoto. The study population consisted of hypertensive pregnant women with confirmed gestational age greater than 20 weeks who presented for routine antenatal care between July and October 2024. Participants were selected through purposive sampling. Ethical clearance was obtained from the Sokoto State Ministry of Human Research Ethics Committee. All participants gave informed consent, which included detailed explanation of the study's aims, voluntary nature, confidentiality assurances, and their right to withdraw at any stage without prejudice. Only women diagnosed with hypertension during pregnancy and above 20 weeks of gestation were included in the study. Those with comorbid diabetes mellitus were excluded to eliminate confounding effects on fetal biophysical parameters. Data collection was carried out using a structured data capture sheet designed to record serial number, maternal age, blood pressure, gestational age, and fetal rBPP score. Maternal blood pressure was measured using a mercury sphygmomanometer, with systolic and diastolic readings recorded in millimeters of mercury (mmHg). Gestational age was confirmed through fetal biometric measurements, including biparietal diameter and femur length, using a SONOSCAPE S11 ultrasound scanner equipped with a 2.5-5 MHz curvilinear transducer. All ultrasound examinations were conducted by a certified sonographer with relevant obstetric imaging experience. The rBPP was assessed based on two parameters: the amniotic fluid index (AFI) and sound-provoked fetal movement (SPFM). Each parameter was scored as either 2 (normal/present) or 0 (abnormal/absent), yielding a total score ranging from 0 to 4. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Descriptive statistics were computed, including frequencies and

percentages, to describe the distribution of rBPP scores across maternal age and blood pressure categories. These were used to explore potential associations between maternal hypertension and fetal wellbeing as measured by the rBPP.

## Results

A total number of 74 pregnant women in their late 2<sup>nd</sup> and 3<sup>rd</sup> trimester was captured mostly within the age range 21-30 years 30 women (40.54%) and the least was age range 41-50years 3women (4.05%). The BP range of  $\geq 140$  shows the highest with frequency and percentage of 50 (67.57%) and BP range of  $\leq 139$  with the frequency of 24 (32.43%). For the rBPP score, majority of the pregnancy happens to show normal i.e. 4/4 score with the frequency and percentage of 46 (64.86%) followed by partially abnormal i.e. 2/4 (AFI defect) with the frequency and percentage of 16 (21.62%) and the least happens to fall under totally abnormal i.e. 0/4 (hypoxia) with the frequency and percentage of 10 (13.51%). Tables below show the distributions of data captured.

Maternal BP (mmHg)	Frequency	Percentage (%)
$\leq 139$	24	32.43%
$\geq 140$	50	67.57%
Total	74	100%

**Table 1:** Frequency and percentage of maternal blood pressure

Maternal age range (yrs.)	Frequency	Percentage (%)
11-20	15	20.27%
21-30	30	40.54%
31-40	26	35.14%
41-50	3	4.05%
Total	74	100%

**Table 2:** Frequency and percentage of maternal age ranges.

RBP Score	Frequency	Percentage (%)
4 (Normal)	46	62.16%
2 (Partially abnormal)	18	24.32%
0 (Totally abnormal)	10	13.51%
Total	74	100%

**Table 3:** Frequency and percentage of maternal age ranges.

M - age (years)	Frequency	Percentage (%)
11-20yrs	9	19.57%
21-30yrs	23	50%
31-40yrs	11	23.91%
41-50yrs	3	6.52%
Total	46	100%

**Table 4:** Frequency and percentage of mean age e with normal rapid biophysical profile score.

M - BP (mmHg)	Frequency	Percentage (%)
$\leq 139$	21	45.65%
$\geq 140$	25	54.35%
Total	46	100%

**Table 5:** Frequency and percentage of maternal blood pressure with normal rapid biophysical profile scores.

M - age (years)	Frequency	Percentage (%)
11-20	3	16.67%
21-30	4	22.22%
31-40	11	61.11%
41-50	0	0%
Total	18	100%

**Table 6:** Frequency and percentage of mean age with partially abnormal rapid biophysical profile score.

M - BP	Frequency	Percentage (%)
$\leq 139$	3	16.67%
$\geq 140$	15	83.34%
Total	18	100%

**Table 7:** Frequency of maternal blood pressure with partially abnormal rapid biophysical profile scores.

M - age	Frequency	Percentage (%)
11-20	2	20%
21-30	4	40%
31-40	4	40%
41-50	0	0%
Total	10	100%

**Table 8:** Frequency and percentage of mean age with totally abnormal rapid biophysical profile core.

M - BP	Frequency	Percentage (%)
≤139	0	0%
≥140	10	100%
Total	10	100%

**Table 9:** Frequency and percentage of maternal blood pressure with abnormal rapid biophysical profile scores.

## Discussion

This study reveals that while 62.16% of the participants recorded a normal rBPP score (4/4), a substantial 37.84% exhibited abnormal scores: 24.32% with partially abnormal scores (2/4) and 13.51% with totally abnormal scores (0/4). Notably, all cases of total abnormality occurred exclusively among hypertensive women, indicating a direct relationship between elevated maternal blood pressure and compromised fetal well-being.

These findings agree with Manzoor et al., who demonstrated that biophysical profile (BPP) scoring is effective in identifying high-risk fetuses and correlates strongly with perinatal outcomes. In their study, normal scores predicted favorable outcomes, whereas abnormal scores were linked with increased perinatal complications and the need for neonatal intensive care.<sup>13</sup> The current study confirms this by showing that abnormal rBPP scores were more frequent in hypertensive women, particularly those with blood pressure ≥140 mmHg. Similarly, Rima et al. investigated the impact of pregnancy-induced hypertension (PIH) on fetal outcomes and noted a higher incidence of intrauterine growth restriction and fetal compromise among hypertensive mothers. The present study aligns with this observation, particularly in demonstrating that 100% of the totally abnormal rBPP scores were associated with hypertensive pregnancies. This supports the view that hypertension compromises placental perfusion and can result in intrauterine hypoxia, which is detectable by diminished fetal movement and reduced amniotic fluid—the two core variables of the rBPP.<sup>14</sup>

Further comparison with Mappalam et al. reinforces the reliability of rBPP as a quick and effective alternative to the conventional BPP. In their study, the rBPP was shown to have a sensitivity of 78% in detecting abnormal fetal conditions, with a strong correlation ( $r^2 = 0.531$ ,  $p < 0.001$ ) between rBPP and full BPP scores.<sup>10</sup> In the

current research, rBPP successfully identified all cases of totally abnormal fetal status among hypertensive women, underscoring its value as an early-warning tool for fetal compromise in high-risk pregnancies.

However, the findings diverge slightly from the results of Chousawai et al., who reported a low positive predictive value (25%) for rBPP in identifying poor fetal outcomes in suspected intrauterine growth restriction (IUGR) cases. They argued that low amniotic fluid volume in IUGR could lead to equivocal rBPP results, warranting follow-up with full BPP or Doppler ultrasonography.<sup>12</sup> Although the current study did not measure perinatal outcomes post-delivery or correlate rBPP scores with Doppler findings, the observed association between hypertension and abnormal rBPP scores suggests that the test remains a valuable screening tool, particularly for initial triage in low-resource settings.

The maternal age distribution observed in this study, with most participants falling between 21-40 years, also mirrors existing demographic patterns in similar populations. Abnormal rBPP scores were notably higher among women aged 31-40 years, a pattern that may reflect age-related changes in vascular compliance and placental function. Though this study did not stratify outcomes based on parity or interpregnancy intervals, other studies, including that of Rima et al., have emphasized the role of these variables in the development of hypertensive disorders and their impact on fetal well-being.<sup>14</sup>

The use of ultrasound for rBPP assessment was consistent with standard practices,<sup>8,13</sup> leveraging its safety, real-time imaging, and accessibility. The focused approach of measuring AFI and SPFM allowed for prompt evaluation and classification of fetal condition, reinforcing its utility in fast-paced clinical environments.

## Conclusion

This study establishes that rapid biophysical profile (rBPP) is a reliable and efficient tool for monitoring fetal wellbeing in hypertensive pregnancies. A clear association was observed between elevated maternal blood pressure and abnormal rBPP scores, highlighting the impact of hypertension on fetal health. Given its simplicity, speed, and diagnostic value, rBPP proves especially useful in low-resource and high-risk settings. Its integration into routine antenatal care could support

earlier detection of fetal compromise and help guide timely obstetric decisions. Further studies are encouraged to correlate rBPP findings with neonatal outcomes.

## References

1. Jha S, Dangal G. Role of Modified Biophysical Profile in High-Risk Pregnancy in Predicting Fetal Outcome. *J Nepal Health Res Counc.* 2020; **18(3)**: 401-5.
2. Braunthal S, Brateanu A. Hypertension in pregnancy: Pathophysiology and treatment. *SAGE Open Med.* 2019; **7**: 2050312119843700.
3. Arvan M, Motlagh KM, Zare S, et al. Knowledge and attitude of pregnant women 15-49 years old about ultrasound examinations: A cross-sectional study. *J Res Med Dent Sci.* 2019; **7(2)**: 177-81.
4. Lalor JG, Fawole B, Alfirevic Z, Devane D. Biophysical profile for fetal assessment in high-risk pregnancies. *Cochrane Database Syst Rev.* 2008; **(1)**: CD000038.
5. Jensen S. Fetal Biophysical Profile: Practical Review. 2020.
6. Watanabe K, Naruse K, Tanaka K, Metoki H. Outline of definition and classification of pregnancy-induced hypertension (PIH). *J Hypertens Res Preg.* 2013; **1(1)**: 3-4.
7. Tongsong T, Piyamongkol W, Anantachote A, Pulphutapong K. The rapid biophysical profile for assessment of fetal well-being. *J Obstet Gynaecol Res.* 1999; **25(6)**: 431-6.
8. Nageotte MP, Towers CV, Asrat T, Freeman RK. The rapid biophysical profile: A validation study. *Am J Obstet Gynecol.* 2006; **194(2)**: 403-10.
9. The American College of Obstetricians and Gynecologists Committee (ACOG) Opinion no. 630. Screening for perinatal depression. *Obstet Gynecol.* 2015; **125(5)**: 1268-71.
10. Marrisalam SA, Dwarakanath L, Anand SH. Comparative study of rapid biophysical profile and conventional biophysical profile in predicting perinatal outcome in high-risk pregnancies. *Int J Clin Obstet Gynaecol.* 2021; **5(4)**: 297-300.
11. Czeresnia RM. Comparative Analysis of Biophysical Profile Accuracy. *Int J Clin Obstet Gynaecol.* 2013; **7(3)**: 193-200.
12. Manzoor R, et al. Evaluation of Biophysical Profile in High-Risk Pregnancies. *Int J Reprod Contracept Obstet Gynecol.* 2016; **5(1)**: 45-50.
13. Rima S, Kiswanjaya B, Sudarto H. Impact of pregnancy induced hypertension on fetal growth: an Indonesian study.
14. Chousawai S, Tongprasert F, Yanase Y, Udomwan P, Tongsong T. The efficacy of rapid biophysical profile in predicting poor pregnancy outcomes in suspected intrauterine growth restriction fetuses: preliminary study. *J Med Assoc Thai.* 2012; **95(4)**: 482-6.
15. Joan M, Smith L, Brown H. Biophysical profile: A comprehensive guide. *J Obstet Gynaecol.* 2012; **45(3)**: 123-35.
16. Pakinat H, Khajevand N, Molaverdikhani S, Chegini V. The relationship between the full biophysical profile and rapid biophysical profile in antepartum fetal surveillance. *J Inflamm Dis.* 2023; **26(4)**: 193-200.