

# Role of Modified Biophysical Profile in Prediction of Fetal Asphyxia

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## Author's Contribution

<sup>1,2,3</sup> Conception of study

<sup>1,3</sup> Experimentation/Study conduction

<sup>1,2</sup> Analysis/Interpretation/Discussion

<sup>2,3,4,5</sup> Manuscript Writing

<sup>1,2,4,6</sup> Critical Review

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## Abstract

**Objective:** To determine the diagnostic accuracy of Modified Biophysical Profile (MBPP) in determining fetal asphyxia in high-risk pregnancies keeping actual birth asphyxia on Apgar Score as the gold standard.

**Materials and Methods:** After written informed consent from patients, 235 patients with high-risk pregnancies admitted to obstetric ward unit 2 Holy Family Hospital were enrolled in the study. BPP was done by the modified method in high-risk patients at > 36 weeks gestation. The amniotic fluid index was calculated by measuring 4 quadrant vertical pockets and if the sum of 4 pockets was < 5 it was considered abnormal. The total score in MBPP is 4.2 score for CTG and 2 scores of AFI. These patients were followed till delivery and newborn were assessed at the time of delivery for fetal asphyxia. Fetal asphyxia was assessed based on Apgar score at 5 min after birth.

**Results:** Mean age (years) in our study was 27.11±1.47 whereas mean parity was 2±1.06 with ranges from nulliparous to para four. The sensitivity, specificity, positive predictive value, and negative predictive value of Modified Biophysical Profile (MBPP) in determining fetal asphyxia in high-risk pregnancies keeping actual birth asphyxia on Apgar score as the gold standard was 95.02%, 71.43%, 98.13%, and 47.62% respectively.

**Conclusion:** MBPP was found to have high sensitivity and positive predictive value in predicting fetal asphyxia as assessed by Apgar score at birth.

**Keywords:** Modified Biophysical profile, Perinatal outcome, High-risk pregnancies, Non-stress test.

## Introduction

Perinatal mortality remains a worldwide problem, approximately 2.7 million pregnancies end as stillbirth, and 2.8 million newborns die in 1<sup>st</sup> month of life.<sup>1</sup> This rate differs according to the income status of the area, with low-income countries being affected more than high-income countries.<sup>2</sup> Pakistan has perinatal mortality of 60/1000 total births.<sup>3</sup> The neonatal mortality rate is 42 deaths per 1,000 live births.<sup>4</sup> Birth asphyxia contributes to a large number of perinatal deaths, especially in low-resource settings. Fetal surveillance is an integral part of antenatal and intrapartum care to ensure a good perinatal outcome. Various tools are being used in combination or alone to ensure fetal well-being. These include Fetal kick count, Biophysical Profile (BPP) including non-stress test, Doppler umbilical vessel, and venous Doppler.<sup>5</sup> Most commonly used fetal surveillance tool by gynaecologists is a biophysical profile that has five components. These components include fetal tone, breathing movements, amount of liquor, body movements, and non-stress test. Every component has a maximum score of 2 with a total of 10 scores. It is deemed reassuring with a score of 8-10/10, equivocal with a score of 6/10, and abnormal with a score of 4/10.<sup>6</sup> Result of this test affects time and mode of delivery in high-risk pregnancies in addition to perinatal outcome. Modified biophysical profile (MBPP) combines 2 components of BPP that is amniotic fluid volume and non-stress test.<sup>7</sup>

The ultrasound component of BPP requires 30 minutes to score different components which are quite difficult to manage in tertiary care hospitals of countries like Pakistan. Modified biophysical profile on the other hand measures amniotic fluid volume which can be done in few minutes. There is still inadequate evidence to recommend MBPP as a fetal surveillance tool.<sup>5</sup> The study was conducted to find out the diagnostic accuracy of modified biophysical profile in determining fetal asphyxia based on Apgar score at birth. So the test can be used as a primary surveillance tool in high-risk pregnancies in overcrowded obstetric units of our hospital owing to the simplicity, ease of performance, and less time and expertise required.

## Materials and Methods

A total of 235 pregnant ladies with high-risk pregnancies with hypertension, diabetes mellitus,

previous stillbirth, or previous scar at a gestational age of 36-41 weeks with singleton fetus were enrolled in the study after informed consent and approval by the ethical committee of the hospital. Patients admitted to the obstetric ward of the holy family hospital were included from 1<sup>st</sup> June 2020 to 31<sup>st</sup> December 2020. Evaluation of all patients was done by taking a detailed history and physical examination. Patients with polyhydramnios, congenital anomalies, oligohydramnios, intrauterine growth restriction, and pre-labour rupture of membranes were excluded.

A modified biophysical profile was performed by a resident of OBGYN. The amniotic fluid index was calculated for amniotic fluid volume. AFI was calculated by adding anteroposterior diameters of the largest empty fluid pocket (no umbilical cord or fetal parts) in each quadrant. Cut off of 5 was used. The score of 2 was assigned to AFI of more than 5 n zero for AFI of less than 5. Non-stress test was performed for 20 minutes and was assigned a score of 2 for reassuring NST. Reassuring CTG was defined as having a baseline fetal heart rate of 110 to 160 beats/minute, baseline variability of 5 to 25, with none or early decelerations or variable deceleration with no concerning features. Patients were followed till delivery and Apgar score for a newborn was noted. All patients delivering beyond 7 days of MBPP were excluded from the study.

Mean was calculated for age and parity. Sensitivity, specificity, positive predictive value, and negative predictive value was calculated for MBPP, as well as the frequency of true positives, true negatives, false positives, and false negatives was also calculated.

## Results

The mean age (years) in our study was 27.11±1.47 with ranges from 23 to 30 years.

In our study, mean parity was 2±1.06 with ranges from nulliparous to para four.

The sensitivity, specificity, positive predictive value, and negative predictive value of Modified Biophysical Profile (MBPP) in determining fetal asphyxia in high-risk pregnancies keeping actual birth asphyxia on Apgar score as the gold standard was 95.02%, 71.43%, 98.13%, and 47.62% respectively, whereas the frequency of true positive, true negative, false positive and false negative was mentioned and showed in Table 1.

**Table 1: Frequency and percentages of maternal risk factors for low birth weight**

Modified Biophysical Profile	Apgar Score after 5 mins		
	< 7	> 7	
< 2	210 True positives (TP)	4 False positives (FP)	Positive predictive value 98.13%
> 2	11 (False negatives) (FN) Sensitivity=95.02%	10 (True negatives) (TN) Specificity=71.43%	Negative predictive value 47.62%

## Discussion

BPP has been proven as an effective surveillance tool in high-risk pregnancies as opposed to low-risk pregnancies.<sup>8</sup>

A study by Putri RA et al showed comparable results to our study as regards sensitivity of MBPP keeping Apgar score of less than 7 at 5 minutes with sensitivity 94.7% as compared to 95.02% in our study.<sup>9</sup>

BPP and MBPP were compared in terms of fetal outcome and the sensitivity of this test was reported as 63.2%, the specificity of 98.1%, positive predictive value was 70.9%, and negative predictive value of 90.2% in a study by V.G. Vanamala et al in contrast to 95.02%, 71.43%, 98.13%, and 47.62% respectively in our study. The difference can partly be explained by outcome parameters studied such as meconium, low birth weight, NICU admission, and perinatal mortality and partly by the inclusion of gestation of 34 weeks which itself adds to low birth weight and NICU admission due to prematurity.<sup>10</sup>

Our study has demonstrated higher sensitivity of MBPP, in contrast, to the study reported by Shaikh et al who compared BPP with MBPP and found a sensitivity of 70.8% for BPP as opposed to 55.6% for MBPP. The same study reported a specificity of 93.4% for BPP as compared to 96.3% for MBPP as opposed to our study showing the specificity of 71%. Positive predictive value 77.2% for BPP as opposed to 72.8% for MBPP, the negative predictive value of 91% for BPP as opposed to 88.8% for MBPP was reported by the same study as opposed to our study showing the positive predictive value of 98% and negative predictive value of 47.62%.<sup>11</sup> The difference in results could be due to including a variety of problems as high-risk pregnancies in contrast to the study by Shaikh et al who included pregnancy-induced hypertension only. Individual components of the Modified biophysical profile were studied by Raparthy et al and AFI of less than 5 was found to be associated with increase

perinatal morbidity and abnormal NST was associated with perinatal morbidity and perinatal mortality.<sup>12</sup>

Limitations of the study included a small sample size, Single outcome parameter of Apgar score which alone is insufficient to be translated into perinatal morbidity or mortality. Moreover, the period between test and time of delivery, mode of delivery, and intrapartum hypoxia should have been catered to control confounding factors.

## Conclusion

MBPP was found to have high sensitivity and positive predictive value in predicting fetal asphyxia as assessed by Apgar score at birth.

Promising results of our study invite further multicentre trials with a large sample size to find out the accuracy of MBPP as compared to BPP. Given the simplicity and ease of performing this test can replace laborious time-consuming BPP in our overcrowded OPDs without compromising the outcome.

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