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Impact of Biophysical Profile (BPP) Score on Method of Delivery

Sathi Khanom[1*], Mursheda Akter[2], Kamrun Nahar[3], Sajid Bin Ashraf Sami[4], Mitu Debnath[5], Begum Hosne Ara[6]

[1]Deputy Director Cum Consultant (Gynae), Nazira Bazar Maternity Centre, Dhaka South City Corporation, Dhaka, Bangladesh
[2]Junior Consultant, Department of Obstetrics & Gynecology, District Sadar Hospital, Narshingdi, Bangladesh
[3]Consultant, Department of Obstetrics & Gynecology, Lalkuthy Mother and Child Specialized Hospital, Dhaka, Bangladesh
[4]Medical Officer, Sir Salimullah Medical College Hospital, Dhaka, Bangladesh
[5]Consultant, Department of Obstetrics & Gynecology, Tangail Sadar Hospital, Tangail, Bangladesh
[6]Professor & Head of Department, Department of Obstetrics & Gynecology, Dhaka Central International Medical College & Hospital, Dhaka, Bangladesh

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***Corresponding author:** Dr. Sathi Khanom
Consultant, Department of Obstetrics & Gynecology, Nazira Bazar Maternity, Dhaka, Bangladesh

Abstract **Original Research Article**

Introduction: This study aims to investigate the impact of Biophysical Profile (BPP) scores on the method of delivery and perinatal outcomes in a Bangladeshi context. Considering the significant role of maternal age, socio-economic status, and occupational factors in perinatal health, this research provides insights into how these variables interact with BPP scores to influence delivery methods and perinatal outcomes. ***Methods:*** This cross-sectional observational study was conducted with 150 pregnant women at or above 36 weeks of gestation. Participants were selected through purposive convenient sampling from outpatient and admission departments. The study assessed demographic details, BPP scores, mode of delivery, and perinatal outcomes. Statistical analysis was performed using SPSS, with a focus on the association between BPP scores and delivery methods, as well as perinatal outcomes. ***Result:*** The study population predominantly consisted of younger women, with 62.00% aged between 18-25 years and 22.67% between 26-30 years. Regarding BPP scores, 75.33% had a score of 10, 14.67% had a score of 8, and 10.00% had a score of 6. No significant correlation was found between BPP scores and the method of delivery (p-value = 0.393). However, a significant association was observed between lower BPP scores and adverse perinatal outcomes: 53.33% of participants with a BPP score of 6 experienced birth asphyxia, and 20.00% faced neonatal death. In contrast, 97.35% of participants with a BPP score of 10 had healthy babies. ***Conclusion:*** The study highlights the complex interplay of BPP scores, socio-economic and demographic factors in determining perinatal outcomes and delivery methods. It underscores the need for a holistic approach in obstetric care, integrating BPP scores with a comprehensive understanding of each patient's socio-economic and cultural context. This approach is crucial for optimizing delivery methods and improving perinatal outcomes in similar settings.

Keywords: Pregnancy, Perinatal, Biophysical Profile Score, Cesarean, Delivery Method.

INTRODUCTION

Adverse perinatal outcomes, such as preterm birth, low birth weight, and neonatal morbidity, pose significant challenges in public health worldwide. The World Health Organization has reported that about 15 million babies are born preterm each year, which represents more than 10% of all births globally, with these rates showing considerable regional disparities [1]. In Asia, and particularly in Bangladesh, the impact of these adverse outcomes is notably severe. Studies in various South Asian and Latin American regions, including Bangladesh, have highlighted the complexity of managing perinatal risks, especially in low- and middle-income countries. These studies have shown significant variations in maternal and newborn outcomes based on the mode of delivery, particularly among women with a history of cesarean birth [2]. In rural Bangladesh, research evaluating the Institute of Medicine recommendations on gestational weight gain has linked it to various adverse perinatal outcomes, including preterm birth and low birth weight, reflecting the broader challenges faced by developing nations [3]. In this complex landscape, the Biophysical Profile (BPP) has emerged as a critical tool in obstetric care. This prenatal assessment, which includes fetal heart rate monitoring and observations of fetal movements, tone, breathing, and amniotic fluid volume, is invaluable in predicting adverse perinatal outcomes. The importance of BPP is further highlighted by the high frequency of

adverse outcomes in patients with suboptimal BPP scores. Research indicates a significant correlation between poor BPP scores and increased rates of cesarean sections, as well as poor Apgar scores at 5 minutes [4–6]. The potential impact of BPP scores on the method of delivery is a critical area of investigation. Studies have suggested that low BPP scores may lead to a higher likelihood of cesarean deliveries, as healthcare providers often opt for this method to mitigate risks associated with poor fetal assessments. This correlation is particularly important in contexts like Bangladesh, where the rates of cesarean sections have been rising and the decision-making process regarding the method of delivery is often influenced by fetal health assessments. Moreover, the relationship between BPP scores and perinatal outcomes is influenced by various maternal and fetal factors. Maternal anemia, prevalent in Bangladesh, is linked to increased risks of adverse outcomes, including preterm birth and perinatal mortality [7,8]. The prevalence of conditions such as oligohydramnios, associated with adverse outcomes like preterm delivery and low birth weight, stands at about 8.5% [9]. The ability of BPP to assess amniotic fluid volume makes it a crucial tool in managing high-risk pregnancies. Despite the established importance of BPP in clinical settings, there is a pressing need for more extensive research, particularly in diverse populations and settings like Bangladesh. The current literature, while informative, often lacks consistency in findings and sometimes overlooks specific demographic factors. This study aims to address this gap by exploring how BPP scores correlate with perinatal outcomes and the method of delivery, with a particular focus on the Bangladeshi population.

METHODS

This cross-sectional observational study was conducted at the Department of Obstetrics and Gynaecology, Institute of Child and Mother Health, Dhaka, Bangladesh, from November 2017 to October 2018. The objective was to investigate the impact of Biophysical Profile (BPP) scores on the method of delivery in a Bangladeshi setting. The sample size was calculated based on a 95% confidence level, targeting a population proportion of 50%. A total of 150 pregnant women, at or above 36 weeks of gestation, were selected through purposive convenient sampling from outpatient and admission departments. Inclusion criteria were limited to pregnant women who underwent BPP scoring at or above 36 weeks of gestation. Women with conditions such as pre-eclampsia, gestational diabetes, fetal distress, antepartum hemorrhage, or fetal anomalies were excluded. Data collection was conducted using a structured questionnaire after informed consent was obtained. This included a comprehensive history, physical examination, and recording of maternal and fetal outcomes. Key variables measured were demographic details (age, occupation, socio-economic status), BPP score, mode of delivery (spontaneous vaginal delivery or cesarean section), Apgar score at 1 and 5 minutes, and perinatal outcomes (healthy baby, birth asphyxia, NICU admission, stillbirth, neonatal death). The BPP score was determined using ultrasound parameters such as non-stress test (NST) results, amniotic fluid volume, fetal breathing movement, gross body movement, and fetal tone. Statistical analysis was conducted using SPSS version 20. Data were presented in tables and graphs, with the Chi-square (χ^2) test employed to explore associations between BPP scores and delivery methods. Ethical considerations were addressed with approval from the Ethical Review Committee of the Institute of Child and Mother Health. All participants provided written informed consent, and their privacy and right to withdraw from the study were respected throughout the research process.

RESULTS

Table 1: Distribution of the study patients by demographic variable (n=150)

Demographic Variable	Number of patients	Percentage
Age (Years)		
18-25	93	62.00%
26-30	34	22.67%
>30	23	15.33%
Mean±SD	25.23±5.12	
Range(min-max)	18-35	
Occupation		
Housewife	131	87.33%
Service	15	10.00%
Other	4	2.67%
Socio-economic status		
Low-income	79	52.67%
Lower-middle income	67	44.67%
Upper-middle income	4	2.67%

The demographic distribution of the 150 study participants is presented in Table 1. The age of the participants varied, with the majority falling into the 18-25 year age group, accounting for 62.00% (n=93) of the sample. The 26-30 year age group comprised 22.67% (n=34) of the participants, while those above 30 years represented 15.33% (n=23). The mean age of the participants was 25.23 years, with a standard deviation of ±5.12 years, indicating a moderate spread around the mean. The age range of the participants was from 18 to 35 years. In terms of occupation, a significant majority of the participants, 87.33% (n=131), identified as housewives. Those in service occupations constituted 10.00% (n=15) of the sample, and the remaining 2.67% (n=4) were categorized under 'other' occupations. This distribution suggests a predominantly non-working demographic in terms of formal employment. Regarding socio-economic status, more than half of the participants, 52.67% (n=79), were from low-income backgrounds. Participants from lower-middle-income backgrounds made up 44.67% (n=67) of the sample, and a small fraction, 2.67% (n=4), belonged to the upper-middle-income bracket. This indicates that the majority of the study population was from economically disadvantaged or moderately disadvantaged backgrounds.

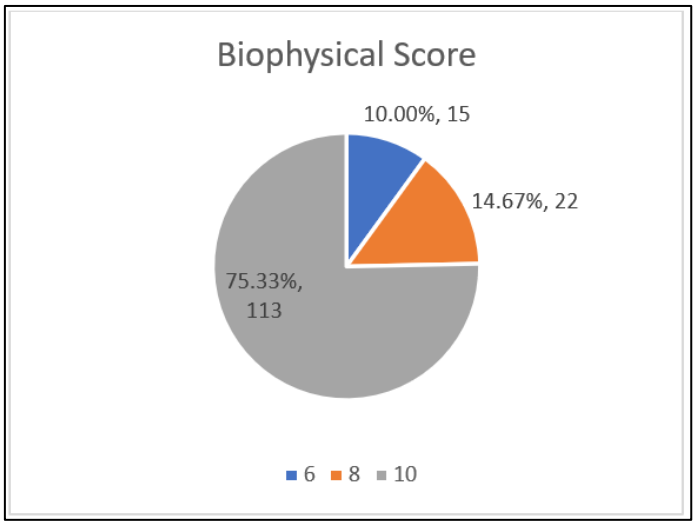

Figure 1: Distribution of the study patients by biophysical score (n=150)

The majority of the participants, 75.33% (n=113), had a BPP score of 10, indicating a generally favorable biophysical status in this group. The next largest group, comprising 14.67% (n=22) of the participants, had a BPP score of 8. A smaller proportion of the sample, 10.00% (n=15), had a BPP score of 6, which is the lowest score observed in this study. The mean BPP score for the study population was 9.31, with a standard deviation of ±1.31.

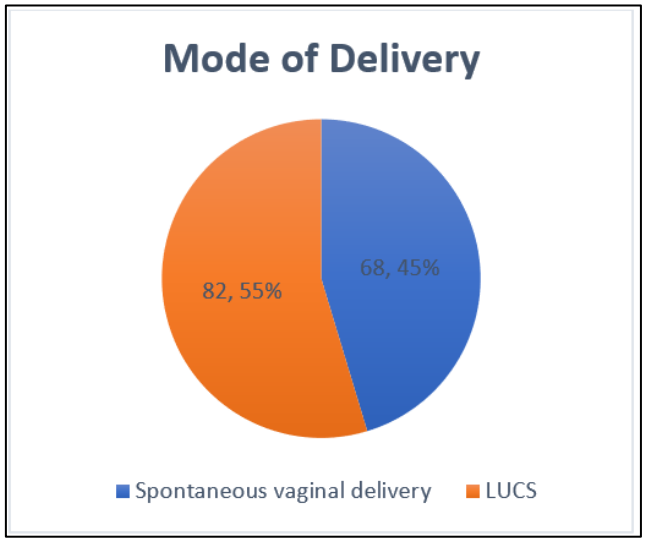

Figure 2: Distribution of participants by mode of delivery

The data shows a nearly even split between the two delivery methods. A total of 68 participants, representing 45.33% of the sample, underwent spontaneous vaginal delivery. In contrast, 82 participants, accounting for 54.67% of the sample, had deliveries via Lower Uterine Cesarean Section (LUCS).

Table 2: Association between biophysical score and mode of delivery (n=150)

Delivery Method	Score 6		Score 8		Score 10		P value
	n	%	n	%	n	%	
Spontaneous vaginal delivery	9	60.00%	11	50.00%	48	42.48%	0.393ns
LUCS	6	40.00%	11	50.00%	65	57.52%	

In examining the association between Biophysical Profile (BPP) scores and the mode of delivery among 150 participants, the study found no statistically significant correlation (p-value = 0.393). For a BPP score of 6, 60.00% (n=9) underwent spontaneous vaginal delivery, and 40.00% (n=6) had Lower Uterine Cesarean Section (LUCS). With a BPP score of 8, the distribution was even, with 50.00% (n=11) for each delivery method. Among participants with a BPP score of 10, 42.48% (n=48) experienced spontaneous vaginal deliveries, while 57.52% (n=65) underwent LUCS.

Table 3: Perinatal outcome of the participants (n=150)

Perinatal outcome	n	%
Healthy baby	129	86.00%
Birth asphyxia	18	12.00%
Early neonatal death	3	2.00%
Admission in INCU	12	8.00%

The majority of the outcomes were positive, with 86.00% (n=129) of the births resulting in a healthy baby. However, there were instances of adverse outcomes: 12.00% (n=18) of the births were complicated by birth asphyxia, and 2.00% (n=3) resulted in early neonatal death. Additionally, 8.00% (n=12) of the newborns required admission to the Intensive Neonatal Care Unit (INCU).

Table 4: Association between perinatal outcome and biophysical score (n=150)

Perinatal outcome	Score 6 (n=15)		Score 8 (n=22)		Score 10 (n=113)		P value
	n	%	n	%	n	%	
Healthy baby	4	26.67%	15	68.18%	110	97.35%	<0.001s
Birth asphyxia	8	53.33%	7	31.82%	3	2.65%	
Neonatal death	3	20.00%	0	0.00%	0	0.00%	
Still born	0	0.00%	0	0.00%	0	0.00%	

The study's analysis of the association between perinatal outcomes and Biophysical Profile (BPP) scores in 150 participants revealed a statistically significant correlation (p-value < 0.001). In the group with a BPP score of 6 (n=15), only 26.67% (n=4) resulted in a healthy baby, while a substantial 53.33% (n=8) experienced birth asphyxia, and 20.00% (n=3) faced neonatal death. For participants with a BPP score of 8 (n=22), the outcomes were more favorable, with 68.18% (n=15) having a healthy baby and 31.82% (n=7) encountering birth asphyxia, but no cases of neonatal death or stillbirth. In contrast, the group with a BPP score of 10 (n=113) showed overwhelmingly positive outcomes, with 97.35% (n=110) having a healthy baby and only a small fraction, 2.65% (n=3), experiencing birth asphyxia.

DISCUSSION

The study involved 150 pregnant women, largely in younger age groups, with 62.00% aged between 18-25 years and 22.67% between 26-30 years. This distribution of ages is notable because maternal age can significantly affect perinatal outcomes [10]. On average, the participants were around 25 years old, indicating a relatively youthful group, in line with regional reproductive trends. Most participants were housewives (87.33%), reflecting the societal norms of the study area. This distribution of occupations is important to consider as it could impact access to healthcare and health education, crucial factors in maternal and perinatal health. In terms of socio-economic background, the majority came from low (52.67%) and lower-middle (44.67%) income backgrounds, with a small percentage from the upper-middle income bracket (2.67%). This socio-economic mix is significant, given existing research highlighting its

profound impact on health outcomes. Lower socio-economic status is often associated with increased risks during perinatal periods due to potential factors such as limited access to quality healthcare, nutritional constraints, and higher stress levels [11,12]. Our study found no significant statistical correlation between BPP scores and the method of delivery, a finding that contrasts with some of the existing literature. For instance, the study by Nuru, Abuya, and Kaaria (2020) highlighted the significance of BPP scores in predicting perinatal outcomes in pre-eclampsia patients, suggesting a potential indirect influence on delivery method decisions [13]. However, our study's lack of a significant association suggests that in our specific demographic and clinical setting, other factors may play a more decisive role in determining the method of delivery. The high percentage of cesarean sections observed in our study, particularly among those with optimal BPP scores, raises questions about the factors influencing these decisions. This is in line with the findings of Awan *et al.,* (2022), who emphasized the utility of modified biophysical profiles in hypertensive pregnancies[14]. It suggests that while BPP scores are critical, they are part of a broader clinical picture that influences delivery methods. Our study's observation of a significant correlation between lower BPP scores and adverse perinatal outcomes, such as birth asphyxia and neonatal death, resonates with the findings of Rehman *et al.*, who reported a high frequency of adverse outcomes in patients with poor BPP (Rehman *et al.,*). This underscores the importance of BPP scores as an indicator of fetal well-being and their potential predictive value for perinatal outcomes. Similarly, the study by Kumari, Gandhi, and Deora (2023) on high-risk pregnancies corroborates our findings, emphasizing the heightened risk of perinatal morbidity and mortality associated with abnormal MBPP scores [15]. Interestingly, our study noted a substantial proportion of spontaneous vaginal deliveries even in lower BPP score groups, which could reflect a nuanced approach to delivery decisions, where BPP scores are a factor but not the sole determinant. This aspect of clinical decision-making, where BPP scores inform but do not dictate the method of delivery, highlights the complex interplay of clinical judgment, patient preferences, and institutional protocols.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

The findings of our study, conducted on a cohort of 150 pregnant women primarily from younger age groups and lower socio-economic backgrounds, contribute valuable insights into the complex dynamics of perinatal health and delivery methods. Despite the established importance of Biophysical Profile (BPP) scores in obstetric care, our study did not find a significant correlation between BPP scores and the method of delivery. This suggests that in our specific demographic and clinical context, other factors, possibly including socio-cultural norms, healthcare access, and individual health education, play a more influential role in determining the method of delivery.

The high incidence of cesarean sections, even among those with optimal BPP scores, prompts a reevaluation of the factors influencing these decisions. It aligns with the broader literature, which indicates that while BPP scores are crucial, they must be considered within a larger clinical and socio-economic context. Our study's observation of a significant correlation between lower BPP scores and adverse perinatal outcomes, such as birth asphyxia and neonatal death, reinforces the value of BPP scores as a predictive tool for fetal well-being. This finding is consistent with existing research, highlighting the risks associated with poor BPP scores.

Interestingly, the proportion of spontaneous vaginal deliveries in lower BPP score groups suggests a more nuanced approach to delivery decisions, where BPP scores are one of many factors considered. This reflects the complexity of clinical decision-making in obstetrics, where a balance is struck between medical indicators and individual patient circumstances.

In conclusion, our study underscores the need for a holistic approach to obstetric care, where BPP scores are integrated with a comprehensive understanding of each patient's socio-economic and cultural context, healthcare access, and individual preferences. This approach can help optimize delivery methods and improve perinatal outcomes, particularly in settings similar to our study population.

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