# Use of Non-Stress Test Alone Versus Biophysical Profile in Management of High-Risk Pregnancy: A comparative study


## ABSTRACT

***Background:*** A biophysical profile (BPP) includes ultrasound monitoring of fetal movements, fetal tone and fetal breathing, ultrasound assessment of liquor volume with or without assessment of the fetal heart rate.

***Aim of the study:*** The aim of the study was to compare the efficacy of Non-stress tests and Biophysical profiles in the management of high-risk pregnancy.

***Methods:*** *100 high-risk pregnant women were selected for antenatal fetal assessment. They were divided into two groups. In one group (N=50) non-stress test was done by CTG and in another group (N=50) Biophysical profile was done by real-time USG. The outcome of the newborn was assessed by Apgar score in one and five minutes.*

***Results:*** *Sensitivity (75 vs 73), specificity (85 vs 80) and positive predictive values (70) vs 61) were higher in BPP than NST group and negative predictive values were equal (87 vs 87) in both groups. But these differences were not remarkable.*

***Conclusion:*** *High-risk pregnancies demand more careful attention in their management. Antenatal assessment plays an important role in the prediction of outcomes and timely intervention. In this study, two different antenatal fetal assessment methods were compared for the prediction of outcome. Abnormal test results were a better predictor of abnormal outcomes than normal test results for normal outcomes. As the sample size is small in this study. Further studies with larger samples can be done to evaluate these methods more profoundly.*



***Keywords:*** *Non-Stress Test, Biophysical Profile, Management, High-Risk Pregnancy*



***Corresponding author:*** *Dr. Krishna Pada Das, Assistant Professor, Department of Obstetrics and Gynaecology, Khulna Medical College, Khulna, Bangladesh, E-mail:*


**Comment [d1]:** Where and when the study was conducted?

**Comment [d2]:** Percentage must be given.

**Comment [d3]:** This must be shorten.

## INTRODUCTION

**Comment [d4]:** Introduction must be more focused.
The paragraph must be divided.

The term "high-risk pregnancy" refers to a pregnancy with an increased risk of poor outcome [1]. The high-risk concept in maternity care will continue to be a priority in obstetrics. A significant improvement in obstetric care has been derived from investigating high-risk pregnancies [2]. In different studies, the reported prevalence of high-risk pregnancy varied from 5 to 40% [1,3,4]. According to World Health Organization, the incidence of high-risk pregnancy in Southeast Asia and some countries in Africa and Latin America may exceed 30% [1]. The at-risk-pregnancies account for a significant proportion of low-birth-weight (LBW) babies, perinatal morbidity and mortality. Foetal asphyxia, due to dysfunction of the foetoplacental unit, is a major cause of morbidity and mortality among perinates [5]. Recognition of this complication is significant because expeditious delivery may result in intact survival. Perinatal asphyxia is an insult to the foetus or newborn due to a lack of oxygen (hypoxia) and lack of perfusion (ischaemia) to various organs [6]. The effect of hypoxia and ischaemia may not be identical, but they are difficult to separate clinically. Both factors probably contribute to asphyxial injury. Ninety per cent of asphyxial insults occur in the antepartum or intrapartum period due to placental insufficiency, resulting in an inability to provide $O_2$ to and remove CO2 and H+ from the focus [6]. Any process that (a) impairs maternal oxygenation, (b) decreases blood flow. from mother to the placenta or from the placenta to the foetus, (c) impair gas exchange across the placenta or at the foetal tissue, or (d) increase foetal oxygen requirement, exacerbating perinatal asphyxia. Such factors include maternal hypertension, either chronic hypertension or preeclampsia, maternal vascular disease, maternal diabetes, maternal hypoxia from pulmonary, cardiac or renal disease, foetal anaemia, foetal or placental hydrops, intrauterine growth retardation (IUGR), postmaturity, etc. The objective clinical method for detecting the foetus at risk in utero began only a few decades ago. The preferable method should have the following criteria: convenience, noninvasiveness and yield accurate and reliable results that would be immediately available. In other words, the ideal antepartum test should be susceptible and specific. Low sensitivity can result in asphyxiated foetal death (false) negative result), and low Specificity can result in inappropriate intervention for the normal foetuses (false positive result), leading to iatrogenic foetal, neonatal and maternal morbidity and mortality. A wide spectrum of tests have been applied to the evaluation of fetuses. Initial methods were biochemical tests measuring endocrine products, e. g. placental enzymes: alkaline phosphatase, placental specific human placental lactogen, and placental conversion product oestriol. For most, there was a relationship to the foetal outcome, but none of these measures had the necessary accuracy to become a useful adjunct to clinical management. Therefore, the biophysical method of

foetal monitoring has replaced the biochemical method. The nonstress test and the foetal biophysical profile (BPP) are the two important biophysical tests. The nonstress test shows the presence or absence of foetal heart rate acceleration associated with foetal movement. It is perhaps the simplest test for evaluating antepartum foetal heart rate. It was first proposed by Hammacher et al. 1968, cited by Nochimson et al., 1978 [7,8]. A non-stress test performed by cardiotocograph shows foetal heart rate variables. The baseline foetal heart rate variation is 120-160 bpm, beat-to-beat variation is at least five bpm, and foetal heart rate acceleration is associated with foetal movement. Following Evertsen et al. (1979), a *reactive pattern* was defined as two or more accelerations of foetal heart rate of at least 15 bpm in amplitude and at least 15 seconds duration associated with foetal movement during a 20-40 minutes observation period [9]. A nonstress test may also show other abnormalities, c.g., deceleration in association with uterine contraction. In the mid-1970s, a revolutionary clinical tool, dynamic real-time ß-mode ultrasound, became available. Dynamic ultrasound can give a wealth of information ranging from gross body movement to five-finger control, detailed foetal structure, and structural and functional evaluation. In late 1960, two groups, Daws et al. in Oxford and Paris, reported foetal breathing movement as a normal character of intrauterine life [10]. Boddy and Daws (1975) demonstrated the exquisite sensitivity of the foetal respiratory centre to experimental hypoxia, raising interest in the potential of this measurement in predicting human foetal compromise [11]. Measuring foetal breathing movement accurately measures the foetal condition [12]. Foetal movement and amniotic fluid volume determination have also been helpful in the antepartum assessment of foetal risk [12]. From these observations, Manning et al. (1980) proposed a new concept of composite foetal assessment, the foetal biophysical profile scoring method [12]. Biophysical profile (BPP) includes foetal breathing, gross foetal movement, foetal tone, amniotic fluid volume and a non-stress test (NST). The biophysical method of foetal risk assessment has been used in a prospective clinical study by Manning et al. (1987) involving 12620 referred high-risk pregnancies [13]. They showed a fall in perinatal mortality (PNM) to 3.53 per 1000 and a stillbirth rate of 1.9 per 1000 compared to 8.8 per 1000 in the control population. They compared the PNM with the historical control population. The false negative test rate, i.e., death of a structurally normal foetus within one week of a normal test result (BPS≥8), was recorded as 0.685 per 1000. Clinical studies from other centres involving 19221 high-risk pregnancies and using this method showed similar results [13]. Similarly, Lee and Drukes (1979) suggested NST as a simple, reliable test as a primary screening procedure in antepartum heart rate monitoring [14]. The reactive tests were indeed a reliable indicator of foetal well-being. The basis of their study was to use NST as the primary technique for antepartum evaluation of foetal reserve in managing high-risk pregnancies. Accurate differentiation of the normal foetus from the compromised one profoundly affects planning prenatal care and the timing and indication for intervention. Ensuring continued foetal well-being for a finite period can prevent early intervention in high-risk cases and reduce neonatal morbidity. In contrast, foetus exhibiting an abnormal biophysical score in whom the risk of stillbirth is greatly increased, early delivery and immediate neonatal care can be initiated. The relative advantage of BPP compared to NST in antenatal foetal monitoring is undetermined. The aim of the study was to compare the efficacy of Non-stress tests and Biophysical profiles in the management of high-risk pregnancy.

## METHODOLOGY & MATERIALS

This is a descriptive study; 100 Patients were enrolled and analyzed. The study was conducted at the Department of Obstetrics & Gynaecology, Rajshahi Medical College Hospital, Rajshahi, Bangladesh. The study period was one year, From January 2007 to December 2008, among the pregnant woman attending the Department of Obstetrics and Gynaecology, Rajshahi Medical College Hospital. A total number of 100 high-risk patients were randomly selected for the study. The selected patient was alternately divided into two groups (50 patients each), one for biophysical profile protocol and another for a non-stress test. Each subject explained the nature of the study and was included in the study on an agreement to participate. Ethical approval was obtained from the Ethical Review Committee of Rajshahi Medical College to carry out this study.

**Group A:** Foetal Biophysical profile protocol (BPP) group
**Group B:** Non-stress test (NST) group

**Inclusion criteria:**
Pregnant woman between 32-43 weeks of gestation and with the following indications:

- Postdated pregnancy
- Preeclampsia/Chronic hypertension.
- Decreased or less foctal movement
- Diabetes mellitus.
- History of stillbirth, intrauterine death (Bad obstetric history).

**Comment [d5]:** Please modify the methods following the review report:
In the method part:
-Calculation study sample size must be included.
-Definition of gestational age must be described.
-Some commonly clinical presentations such as PROM, fever, placenta previa, placenta accreta spectrum with vaginal hemorrhage should be mentioned in inclusion or exclusion criteria.
-Please describe if the evaluation was performed before induction of labor.
-Criteria used for NST following ACOG-2009 or RCOG. Who read it?. Please add this point.
-If the NST was discontinuous and BPP was not completed, the participant was eliminated from the study?
-If the NST and BPP were repeated many times on the same patient, which result was used for analysis.
-A written informed consent from all the participants must be mentioned in the method.
-A study flow chart and algorithm must be given.
-During the investigation, if the patient was diagnosed with fetal distress or hypoxia, the fetal intrauterine reanimation was performed and NST was continuously monitored or cesarean section was indicated.
-Apgar score is the important variable, this must be clearly described how this is evaluated.
-Definition of qualitative and quantity variables as well as nominal variable is required. The distribution of data are clearly described.
-The name and version of software for randomized method and data analysis needed to be described.

- IUGR
- Rh-Isoimmunisation.
- Pregnancy with Grade III and /or IV heart disease.
- Mild to moderate antepartum haemorrhage under conservative treatment with the aim to reach up to 37 weeks of pregnancy.

**Exclusion criteria**

- Pregnant women who had no apparent risk factor.
- Pregnant women who were in early labour.

The patient was placed in a semi-recumbent position with a slight left lateral tilt. Blood pressure was measured at the initiation of the test and every 10 minutes after that. The NST was performed using a cardiotocographic instrument (Sonicaid Meridian 800) with a 2 MHz transducer. After palpation of the abdomen, the position of the foetus was confirmed, and the position of the transducer on the abdomen over the foetal side was selected. Aquasonic coupling medium was applied liberally to the abdomen, over the foetal side and to the face of the transducer. Transducer was moved slowly until the characteristic sound of the foetal heart was heard. The stretch belt was placed around the abdomen and attached to the other side. The test was allowed to continue until either a reactive pattern was demonstrated or after 20 minutes of the start of the test. The test was then evaluated as reactive or nonreactive based on the results. A total of 60 non-stress tests were performed in 50 cases. The foetal biophysical profile (BPP) test NST was first done as described above; then, an ultrasound examination was performed by real-time B-mode ultrasound scan with a 3.5 MHz transducer. Foetal breathing movement, gross foetal body movement, foetal tone and qualitative amniotic fluid volume were recorded as fixed criteria described by Manning et al. (1980) [12]. Observations were continued as long as it took to identify the desired variables, up to 30 minutes. Each of the variables was evaluated as normal or abnormal. In addition to five parameters, gestational age, presentation, and placental position grade of the placenta, foetal heart movement and identification of any gross congenital anomaly were noted. The time of observation of BPP for each patient was also recorded. A total of 50 biophysical profiles were done for 50 cases. Cases assigned to nonstress test protocol were managed following fixed criteria described by Evertsen et al. (1979) [9]. If the NST was reactive, the patient was rescheduled for a weekly repeat test. If the nonstress test result was nonreactive, a repeat test was done within 24 hours. If the nonstress test showed a persistent nonreactive pattern, the patient was considered for delivery. In cases of diabetes mellitus, testing was done twice weekly. The overall clinical condition, including gestational age, maternal condition and obstetric factors, was also considered.

## RESULTS

This study selected 100 cases of high-risk pregnancies of different gestational ages ranging from 32 to 43 weeks. Among them, 50 cases were managed by biophysical profile protocol (Group A), and 50 cases were managed by non-stress test (Group B). Table 1 shows the two groups' demographic and obstetric characteristics like age, gravidity and parity. In Group A, the mean±SE age was 25±0.82 years, and in Group B, the mean±SE age was 24.66±0.73 years. The parity was 0.96±0.16 vs 0.84±0.125, and the gravidity was 2.16±0.186 vs 2.02±0.15 respectively. Table 2 shows the indication for the testing in both groups of patients. In Group A, postdated pregnancy was (32.00%) high than in Group B. Pre-eclampsia was high in Group B than in Group A. Table 3 shows the determination of gestational age of pregnant women in both groups. In Group, out of the 50 participants, 17 individuals (34.00%) had their gestational age determined solely based on the date of LMP and clinical examination. In contrast, 33 individuals (66.00%) had their gestational age determined using LMP, clinical examination, and early USG and out of the 50 participants in Group B, 19 individuals (38.00%) had their gestational age determined solely based on the date of LMP and clinical examination. In contrast, 31 individuals (62.00%) had their gestational age determined using LMP, clinical examination, and early USG in Group A, consisting of 50 participants; LUCS delivered 32 individuals (64.00%), while 18 individuals (36.00%) had an expected vaginal delivery. In Group B, also with 50 participants, 34 individuals (68.00%) had delivery by LUCS, and 16 individuals (32.00%) had a standard vaginal delivery (Table 4).

**Table 1:** Comparison of demographic and obstetric characteristics of study subjects.

| Variable | Group A (N=50) | Group B (N=50) | P-value |
|---|---|---|---|
| | Mean±SE | Mean±SE | |

**Comment [d6]:** In result section:
-Table 3 shows the determination of gestational age of pregnant women in both groups→Please clarify this sentence and Table 3. This is very difficult to understand.
-In Table 4, does normal vaginal delivery include also the assisted instruments such as vacuum, forceps?
-Table 9 is really difficult to understand.
-All the tables must be reconstructed.
-Statistical tests must be added where applicable.
All the manuscript, English editing is strongly recommended. For example:
-bad obstetric history→poor obstetric history.
-Pre-eclampsia was high in Group B than in Group A→ Pre-eclampsia was higher in Group B than in Group A.
-Therefore, the results of the present study may not be representative of the whole of the country or the world at large.-->Therefore, the findings of the present study cannot be representative for the large population.
-In table 2: Ostdated Pregnancy→postdate pregnancy, Decizased foetal Movement→reduced fetal movement.Anti partuin Jiaeiiiorr Iiage (APH)→the typing error ???. In table 9: Admission in Paediateix word, what does it mean?

| | | | |
|---|---|---|---|
| Age (Years) | 25±0.82 | 24.66±0.73 | NS |
| Parity | 0.96±0.16 | 0.84±0.13 | NS |
| Gravidity | 2016±0.18 | 2.02±0.15 | NS |

**Table 2:** Indications for the study population by major high-risk factor present.

| Primary High-risk Factor | Group (N=50) | | Group B (N=50) | |
|---|---|---|---|---|
| | N | % | N | % |
| Ostdated Pregnancy | 16 | 32.00 | 11 | 22.00 |
| Preeclanlpsia | 12 | 24.00 | 14 | 28.00 |
| Decizased foetal Movement | 9 | 18.00 | 9 | 18.00 |
| Diabetes mellitus (all classes) | 56 | 112.00 | 3 | 6.00 |
| Bad obstetic history | 5 | 10.00 | 7 | 14.00 |
| Anti partuin JiaeiiiorrIiage(APH) | 1 | 2.00 | 4 | 8.00 |
| Heart Disease | 2 | 4.00 | 0 | 0.00 |
| RH Isoimmunization | 0 | 0.00 | 2 | 4.00 |

**Table 3:** Determination of gestational age of pregnant woman in both groups.

| Group | Determination of gestational age by date of LMP and clinical examination | | Determination of gestational age byLMP and clinical Examination and early USG | |
|---|---|---|---|---|
| | N | % | N | % |
| Group (N=50) | 17 | 34.00 | 33 | 66.00 |
| Group B (N=50) | 19 | 38.00 | 31 | 62.00 |

**Table 4:** Mode of delivery.

| Variables | Group A (N=50) | | Group B (N=50) | | P value |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Delivery by LUCS | 32 | 64.00 | 34 | 68 | NS |
| Normal Vaginal Delivery | 18 | 36.00 | 16 | 32 | NS |

**Table 5:**Gestational age of pregnant woman in both groups.

| Gestational age in weeks at the time of the examination | Group A (N=50) | | Group B (N=50) | |
|---|---|---|---|---|
| | No | % | No | % |
| Upto 36 Weeks | 13 | 26.00 | 12 | 24.00 |
| From 37 to 40 weeks | 21 | 42.00 | 25 | 50.00 |
| More than 40 weeks | 16 | 32.00 | 13 | 26.00 |

**Table 6:** Indications of caesarean section in both groups.

| Variables | N | % | Variables | N | % |
|---|---|---|---|---|---|
| High risk pregnancies with normal biophysical profile score (N=17) | | | High Risk Pregnancies With reactive non-stress test (N=17) | | |
| Post dated pregnancy with less fetal movement | 6 | 35.29 | Post dated pregnancy | 1 | 5.88 |
| Severe preeclampsia | 3 | 17.65 | Less fetal movement | 1 | 5.88 |
| Pregnancy With diabetes mellitus | 3 | 17.65 | Severe preeclampsia | 8 | 47.06 |
| Diabetes mellitus with preeclampsia | 1 | 5.88 | Pregnancy With diabetes mellitus | 2 | 11.76 |
| Pregnancy With bad obstetric history | 2 | 11.76 | Pregnancy With bad obstetric | 1 | 5.88 |

| | | | | | |
|---|---|---|---|---|---|
| | | | history | | |
| Pregnancy With heart disease | 1 | 5.88 | Pregnancy with antepartum haemorrhage | 3 | 17.65 |
| Pregnancy with antepartum haemorrhage | 1 | 5.88 | Pregnancy with Rh negative | 1 | 5.88 |
| High risk pregnancies with abnormal biophysical profile score (N=15) | | | High Risk Pregnancies With non-reactive non-stress test (N=17) | | |
| Post dated pregnancy with less fetal movement | 6 | 40.00 | Post dated pregnancy | 5 | 29.41 |
| Severe preeclampsia | 6 | 40.00 | Less fetal movement | 4 | 23.53 |
| Pregnancy With diabetes mellitus | 1 | 6.67 | Severe preeclampsia | 3 | 17.65 |
| Diabetes mellitus with preeclampsia | - | 0.00 | Pregnancy With diabetes mellitus | - | 0.00 |
| Pregnancy With bad obstetric history | 1 | 6.67 | Pregnancy With bad obstetric history | 4 | 23.53 |
| Pregnancy With heart disease | | 0.00 | Pregnancy with antepartum haemorrhage | 1 | 5.88 |
| Pregnancy with antepartum haemorrhage | 1 | 6.67 | Pregnancy with Rh negative | - | 0.00 |

**Table 7:**Interval between last tests done and delivery of the women.

| Variables | Group A (N=50) | | Group B (N=50) | |
|---|---|---|---|---|
| | N | % | N | % |
| On the date of examination (0) | 23 | 46.00 | 20 | 40.00 |
| One day after examination (1) | 19 | 38.00 | 21 | 42.00 |
| Within 2-4 Days of Examination | 4 | 8.00 | 3 | 6.00 |
| Within 5-6 Days of Examination | 4 | 8.00 | 6 | 12.00 |

**Table 8:** Evalution of foetal assessment by foetral biophysical profile.

| Test Result | Overall abnormal outcome | | P value |
|---|---|---|---|
| | Present | Absent | |
| Group A (N=50) | | | |
| Normal (N=33) | 4(12%) | 29(88%) | <0.001 |
| Abnormal (N=17) | 12(70%) | 5(30%) | |
| Group B (N=50) | | | |
| Normal (N=33) | 4(12%) | 29(88%) | <0.001 |
| Abnormal (N=17) | 12(70%) | 5(30%) | |

**Table 9:** Comparison of performance characteristics of foetal biophysical profile and nonstress test for each of the different foetal outcome.

| Outcome | Group A (N=50) | | Group B (N=50) | |
|---|---|---|---|---|
| | N | % | N | % |
| Positive Predictive value | | | | |
| Overall abnormal outcome | 35 | 70.00 | 30 | 60.00 |
| Low 1-minute apgar score | 44 | 88.00 | 39 | 78.00 |
| Low 5-minute apgar score | 35 | 70.00 | 30 | 60.00 |
| Admission in Paediateix word | 48 | 96.00 | 47 | 94.00 |
| Negative Predictive value | | | | |
| Overall abnormal outcome | 43 | 86.00 | 43 | 86.00 |
| Low 1-minute apgar score | 40 | 80.00 | 40 | 80.00 |
| Low 5-minute apgar score | 43 | 86.00 | 43 | 86.00 |
| Admission in Paediateix word | 15 | 30.00 | 16 | 32.00 |
| Sensitivity | | | | |

| | | | | |
|---|---|---|---|---|
| Overall abnormal outcome | 37 | 74.00 | 36 | 72.00 |
| Low 1-minute apgar score | 35 | 70.00 | 35 | 70.00 |
| Low 5-minute apgar score | 37 | 74.00 | 36 | 72.00 |
| Admission in Paediateix word | 36 | 72.00 | 35 | 70.00 |
| Specificity | | | | |
| Overall abnormal outcome | 42 | 84.00 | 40 | 80.00 |
| Low 1-minute apgar score | 46 | 92.00 | 43 | 86.00 |
| Low 5-minute apgar score | 42 | 84.00 | 40 | 80.00 |
| Admission in Paediateix word | 41 | 82.00 | 37 | 74.00 |

## DISCUSSION

**Comment [d7]:** The discussion should be expanded with the pH of umbilical cord and head scalp as well as computerized.
The paragraph should be divided into the the sentences in thorough paper.

By evaluating the tests for antepartum foetal assessment, one can make a more meaningful statistical assessment of these tests by the positive predictive value, negative predictive value, sensitivity and specificity. Thus, the clinician can judge the probability of abnormal outcomes based on known test results. A truly valid test can only be judged by determining the sensitivity and specificity of the tests. The sensitivity of a given test is an index of its reliability in detecting a problem. On the other hand, a test's specificity indicates how accurately a problem's absence will be predicted. The present study was carried out to determine the relative prognostic value of the foetal biophysical profile and nonstress test. The prognostic value of these tests was assessed in terms of the incidence of the abnormal outcome of the foetus. The aim of the study also included a comparison of the positive predictive value. negative predictive value, sensitivity and specificity between the tests (foetal biophysical profile and non-stress test). Patients were selected randomly. Alternate cases were allocated to the two study groups. Care was taken to maintain strict standards for patient entry and avoid personal bias for selection. This process of randomization was similar to that of Platt et al. (1985), but Manning et al. (1987) used randomization based on coin-flip, where there was more chance of unequal distribution [13,15]. Adequate randomization was achieved in this study as the groups were comparable concerning mean age, parity and gravidity. Both the selected groups contained the common high-risk pregnancy in our hospital and included patients who were elderly and of low parity and gravidity. Gravidity was slightly higher due to any induced abortion or MR and a history of repeated pregnancy loss. One of the objectives of antepartum surveillance in high-risk patients is determining gestational age. One excellent means of determining a woman's gestational age is by date of last menstrual period (LMP), clinical examination and ultrasonography [16]. In this study, gestational age was determined following the above procedure in 66% of women in BPP and 62% of women in the NST groups. In 34% of cases of BPP and 38% of cases of NST groups, gestational age was determined only by LMP, and clinical examination and ultrasound reports were unavailable. The selection of high-risk pregnancy in this study was similar to many published studies, such as by Manning et al. (1996,1980,1987) and Platt et al. (1985), but not in agreement with Coopland et al., who used a scoring system [10,12,13,15,17,18]. Concerning the mode of delivery, there was a high incidence of caesarean section in this study. The high incidence of caesarean section in this study was due to obstetrical indications, like post-dated pregnancy, severe pre-eclampsia, and antepartum haemorrhage. The shorter the test to delivery interval, the more prognostic the test's result in predicting foetal outcome [19]. In the present study. in most cases, delivery occurred within one day of the last test. Platt et al. (1987) reviewed the impact of foetal testing to determine whether biophysical tests for antenatal foetal assessment make any difference or not [15]. During the 15-year review period, more than 200,000 pregnancies were managed, and 17,000 underwent antepartum testing. They concluded that such testing benefitted high-risk pregnancies compared to those not. In this study, the evaluation of abnormal tests concerning overall abnormal pregnancy outcomes was done. Abnormal tests were more predictor of abnormal outcomes than normal tests, similar to the observation of Platt et al. (1985) [15]. Specific outcomes, i. e. low 1-minute Apgar score, low 5-minute Apgar score, and admission into the Paediatric world in cases of abnormal test in both BPP and NST, were similar to that of Platt et al. (1985) [15]. However, a contrasting opinion on the benefit of antenatal foetal testing was shown by Thacker and Barkelman (1986) [20]. In this study, the incidence of abnormal tests was higher in both BPP and NST groups (34% vs 36%) than in other studies but similar to the findings of Phelan (1981) [13,15,21]. The higher incidence of abnormal tests seems to be due to the inclusion of high-risk cases with a risk of intrauterine hypoxia and because of strict standards maintained to include patients in the study sample. There were also interobserver and interobserver variations in the interpretation of test results. There is also a difference in the criteria for interpreting tests in different studies, especially for NST. In the present study, the sensitivity and specificity of BPP were 75% and 85%. respectively, which is consistent with the findings of Thacker and Barkelman (1986), who showed a sensitivity of over 50% [20]. Concerning NST, sensitivity was 73% in this study and specificity 80%. Thacker and Barkelman (1986) showed a sensitivity of over 50% and a specificity of over 55% [20]. Concerning comparing the predictive value of the foetal

biophysical profile and nonstress test, there was no remarkable difference in positive predictive value, negative predictive value sensitivity and specificity. The results are almost similar to Manning et al. (1987) and Platt et al. (1985) [13,15]. In the present study, specificity concerning the low 5-minute Apgar score was higher (85% vs 80%) in BPP than NST group, which is consistent with the study by Platt et al. (1985) showed significant differences for the positive predictive value of the overall abnormal outcomes, which is not similar to the present study [15]. The difference may be due to variations in test interpretation and interobserver or interobserver variation in their study and the small sample size in the present study. There is a general trend shown in different studies that the focal biophysical profile appears to be more predictive in diagnosing foetal conditions than the nonstress test. Statistically, this suggestion was not found to be true in the present study and studies done by Manning et al. (1987) and Platt et al. (1985) [13,15]. A relatively small sample size may be a reason. The abnormality presumed for newborns diagnosed by NST and BPP was almost similar. It supports my hypothesis postulated before head. Regarding perinatal mortality, Manning et al. (1980) showed prospectively that the foetal biophysical profile markedly decreased the number of antepartum deaths compared to a historical control group [12]. In a study by Platt et al. (1985), the PNM rate for the study population overall was lower than that observed in their medical centre during the same period (12 per 1000 compared to 19 per 1000) [15]. In the study by Platt et al. (1985), no significant difference was observed when PNM was compared between the groups managed by the NST and BPP [15].

***Limitations of the study:*** Every hospital-based study has some limitations and the present study undertaken is no exception to this fact. The limitations of the present study are mentioned. Therefore, the results of the present study may not be representative of the whole of the country or the world at large. The number of patients included in the present study was less in comparison to other studies. Because the trial was short, it was difficult to remark on complications and mortality.

## CONCLUSION

The present study evaluated two tests (BPP and NST) as predictors of foetal outcome. For both BPP and NST groups, abnormal tests were better predictors of abnormal outcomes. Comparison of sensitivity, specificity, and positive and negative predictive values between BPP and NST showed no remarkable difference. Therefore, we can continue to perform NST as an antepartum surveillance technique for the foetus because it is less expensive and less time-consuming, as there is a record on the basis on which clinicians can take decisions. More expertise is needed for performing and interpreting the test. Required equipment is less expensive than complicated real-time USG. Concerning IUGR, postmaturity or oligohydramnios, we can use BPP as a supplementary test which may improve the outcome. Moreover, the obstetrician's decision and assessment of cases for severity must be the preliminary criteria. As the present study included a small sample size, further randomized studies with a larger sample size may confirm the results of the present study.

***Ethical approval:*** *The study was approved by the Institutional Ethics Committee.*

## REFERENCES


1. Malhotra D, Gopalan S, Narang A. Preterm breech delivery in a developing country. International Journal of Gynecology & Obstetrics. 1994 Apr;45(1):27-34.
2. Wilson RW, Schifrin BS. Is any pregnancy low risk?. Obstetrics & Gynecology. 1980 May 1;55(5):653-5.
3. Kurman RJ, Shah KH, Lancaster WD, Jenson AB. Immunoperoxidase localization of papillomavirus antigens in cervical dysplasia and vulvar condylomas. American journal of obstetrics and gynecology. 1981 Aug 15;140(8):931-5.
4. Roy JS, Das PP, Datta A. SLE in Pregnancy. Bangabandhu Sheikh Mujib Medical University Journal. 2010;3(1):54-9.
5. Bucciarelli RI, 1994. Neonatology in the United States: Scope and organization, pp. 20-31. In: Avery GB. Fletcher MA. MacDonald MC. editors. Neonatology; Pathophysiology and management of the newborn. 4th ed. Philadelphia. JB Lippincott company.
6. Snyder EY and Cloherty JP, 1998. Perinan et al asphyxia, pp. 515-533. In: Choherty JP, Stark AR, editors. Masnal of neonatal care. 4 ed. Graw fordsville: RR Donnelley.
7. Hammacher K, Hüter KA, Bokelmann J, Werners PH. Foetal heart frequency and perinatal condition of the foetus and newborn. Gynecologic and Obstetric Investigation. 1968 Apr 1;166(4):349-60.
8. Nochimson DJ, Turbeville JS, Terry JE, Petric RH, Lurdy LE. 1978. The non stress test. Obstet Gynecol 51: 419-421.


**Comment [d8]:** Conclusion must be re-written. The results alsmost are not significant, and in the clinical practice, NST can not be replaced with BPP because BPP takes a long time to evaluate and the findings remain controversial.

**Comment [d9]:** Ethical approval must be given with ID, number, and name of institution.

**Comment [d10]:** Please update the references. All refs are so old, more than 20 years. This is unacceptable.

9. Evertson LR. Ganthier RJ. Schitrin BS, Paul RH. 1979. Autepartum Fetal heart rate testing. 1. Evolvtion of the non-stress test. Am J Obstet Gynecol 133: 29-33.
10. Siles C, Boyd PA, Manning N, Tsang T, Chamberlain P. Omphalocele and pericardial effusion: possible sonographic markers for the pentalogy of Cantrell or its variants. Obstetrics & Gynecology. 1996 May 1;87(5 Part 2):840-2.
11. Dawes G, Meeir YJ, Mandruzzato GP. Computerized evaluation of fetal heart rate patterns. J Perinat Med 1994; 22: 491-9.
12. Manning FA, Platt LO, Sipos L. 1980. Antepartum fetal evaluation: development of a fetal biophysical profile. Am J Obstet Gynecol 136: 787-95.
13. Manning FA, Morrison I, Harman CR, Lange IR, Menticoglou S. Fetal assessment based on fetal biophysical profile scoring: In 19,221 referred high-risk pregnancies: II: An analysis of false-negative fetal deaths. American journal of obstetrics and gynecology. 1987 Oct 1;157(4):880-4.
14. Lee CY, Drukker B. 1979. The nonstress test for the antepartum assessment of fetal reserve. Am J Obstet Gynecol 134: 460-70.
15. Platt LD, Walla CA, Paul RH, Trujillo ME, Loesser CV, Jacobs ND, Broussard PM. A prospective trial of the fetal biophysical profile versus the nonstress test in the management of high-risk pregnancies. American journal of obstetrics and gynecology. 1985 Nov 1;153(6):624-33.
16. Hadlock FP, Harrist RB, Shah YP, King DE, Park SK, Sharman RS. Estimating fetal age using multiple parameters: a prospective evaluation in a racially mixed population. American journal of obstetrics and gynecology. 1987 Apr 1;156(4):955-7.
17. Coopland AT, Peddle LJ, Baskett TF, Rollwagen R, Simpson A, Parker E. A simplified antepartum high-risk pregnancy scoring form: statistical analysis of 5459 cases. Canadian Medical Association Journal. 1977 May 5;116(9):999.
18. Lytton RL, Uzan J, Fernando EG, Roque R, Hiltunen D, Stoffels SM. Development and validation of performance prediction models and specifications for asphalt binders and paving mixes. Washington, DC: Strategic Highway Research Program; 1993 Oct.
19. Shamsuddin L, Islam A, Dewan F, Nessa J. Perinatal mortality in a teaching hospital in Bangladesh. 1991; 15: 60-3.
20. Thacker SB, Berkelman RI.. Assessing the diagnostic accuracy and efficacy of selected antepartum fetal surveillance techniques. Obstet Gynecol Suvr 1986; 41: 121-6.
21. Phelan JP. The nonstress test: a review of 3,000 tests. Am J Obstet Gynecol 1981; 139: 7-12.