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Original Research Article

Vibroacoustic Stimulation Test (VAST) as a Predictor of Fetal Wellbeing in Women with Decreased Fetal Movements

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Abstract:

Background: Decreased fetal movements (DFM) are a frequent concern during pregnancy and are linked to unfavourable perinatal outcomes such as stillbirth, intrauterine growth restriction (IUGR), and neonatal complications. Prompt and accurate assessment of fetal well-being is crucial. The vibroacoustic stimulation test (VAST) is a non-invasive, quick, and easy method that evaluates fetal well-being by provoking fetal heart rate accelerations and movements in response to accoustic stimulus.

Aim: This study aims to assess the usefulness of VAST as a predictive tool for fetal well-being in pregnancies complicated by decreased fetal movements.

Objectives: (1) To investigate the various underlying causes of decreased fetal movements. (2) To evaluate the role of VAST in antenatal assessment of fetal health in women reporting reduced fetal activity. (3) To correlate VAST findings with perinatal outcomes.

Materials and Methods: A prospective observational study was carried out involving 196 pregnant women beyond 32 weeks of gestation who reported decreased fetal movements. VAST was administered following a standardized procedure and categorized as reactive or non-reactive based on fetal heart rate response. Outcomes such as mode of delivery, amniotic fluid characteristics, APGAR scores, NICU admissions, and birth weights were recorded.

Results: Among the 196 participants, 80.6% exhibited a reactive vast response, while 19.4% had a non-reactive result. A non-reactive vast was significantly associated with increased rates of emergency cesarean deliveries 81.6%, meconium-stained amniotic fluid, 39.5% lower APGAR scores, NICU admissions 52.6%, and low birth weights 55.3%. VAST demonstrated a sensitivity of 66.7% and a high specificity of 98.6% in identifying adverse perinatal outcomes.

Conclusion: VAST serves as an effective supplementary tool in the evaluation of pregnancies with decreased fetal movements. It provides prompt reassurance of fetal health in most cases and helps identify those at risk who may benefit from closer monitoring or intervention. Due to its simplicity, cost-effectiveness, and non-invasive nature, VAST can be efficiently incorporated into both primary and tertiary healthcare settings for routine fetal surveillance.

Keywords: VAST, APGAR SCORE, PERINATAL OUTCOME, DFM

Introduction

Fetal movement is one of the earliest indicators of fetal life and a vital sign of neurological and overall fetal health. It reflects the integrity of the central nervous system and is considered a reassuring marker of fetal well-being. Typically, multiparous women perceive fetal movements around 16 weeks of gestation, while primigravidae may notice them by 20–22 weeks [1].

Monitoring fetal movements is a simple, non-invasive method for assessing fetal condition. A noticeable reduction may suggest fetal distress, as decreased activity helps conserve oxygen and energy. Such complaints often raise maternal anxiety and require prompt clinical evaluation. The causes of decreased fetal movements (DFM) range from benign factors—such as fetal sleep cycles, maternal obesity, or anterior placentation—to serious conditions including placental insufficiency, intrauterine growth restriction (IUGR), or fetal hypoxia[2].

Vibroacoustic Stimulation test (VAST): The vibroacoustic stimulation test (VAST) offers a quick and non-invasive method to assess fetal well-being, particularly in cases of DFM. It involves

applying a sound stimulus to the maternal abdomen, typically over the fetal head. In a healthy fetus, the auditory stimulus triggers a startle reflex, resulting in fetal movements and a temporary increase in fetal heart rate (FHR) [3].

A reactive vast, characterized by FHR acceleration, suggests good oxygenation and an intact nervous system, pointing to a physiological cause for DFM. A non-reactive vast, however, may indicate potential fetal compromise and necessitates further evaluation or intervention.

Clinical advantages of vast: Vast serves as a useful complement to the non-stress test (NST), especially when NST results are non-reactive. It can help shorten test duration by eliciting a reactive pattern in previously non-reactive cases, thus reducing unnecessary prolonged monitoring [^4]. This is particularly advantageous in high-volume clinical settings and areas with limited resources.

The test is most effective after 28 weeks of gestation, as the auditory system matures around this time. However, it may not provide reliable results in cases of severe fetal neurological abnormalities, such as anencephaly.

Relevance in low-resource settings: VAST is especially beneficial in peripheral and rural healthcare facilities where advanced fetal monitoring tools are often unavailable. It is low-cost, easy to administer, and does not require sophisticated equipment or extensive training. The immediate feedback provided by VAST supports timely decision-making—helping reduce unnecessary referrals while ensuring high-risk cases receive appropriate care.

This study was undertaken to evaluate the effectiveness of vast in predicting fetal well-being in pregnant women presenting with decreased fetal movements.

Materials and Methods

The study titled "Vibroacoustic Stimulation Test (VAST) as a predictor of fetal well-being in women with decreased fetal movements" was conducted in the department of obstetrics and gynaecology at Gauhati medical college & hospital, Assam.

Study design: Observational, prospective study.

Study duration: January 1, 2024 – December 31, 2024 (1 year)

Study location: Department of obstetrics and gynaecology, gauhati medical college & hospital, assam.

Study population

Pregnant women presenting with complaints of decreased fetal movements (DFM), who were admitted from the antenatal OPD and emergency labour room in wards.

Sample size: A total of 196 patients were enrolled in the study.

Inclusion criteria

- Singleton pregnancy
- Gestational age >32 weeks
- Cephalic presentation
- Postdated or post-term pregnancy
- History of intrauterine growth restriction (IUGR)
- Gestational hypertension
- Gestational diabetes or diabetes complicating pregnancy
- Bad obstetric history

Exclusion criteria

- Gestational age <32 weeks
- Multiple gestations
- Patients in active labour
- Fetal malpresentation
- Congenital fetal anomalies
- Placenta previa
- Abruptio placentae
- Irregular fetal heart rate

Vibroacoustic stimulation test (vast): The vast was performed in the departmental observation room using:

- **CTG machine**: keyar dt max (janitri pvt. Ltd., model no. 221)
- **Vibroacoustic stimulator**: mediveron 10 ct fetal monitor (mediveron)

Interpretation of results

Reactive (normal) response

- FHR acceleration ≥15 bpm lasting ≥15 seconds within 30 seconds of stimulation
- Visible fetal movement on CTG/NST
- Return to baseline FHR without decelerations

Non-reactive response

- Absence of FHR acceleration after three stimulations at 10-minute intervals
- No fetal movement observed

Patients were categorized based on their response as either reactive or non-reactive, and clinical management proceeded accordingly.

Follow-up and perinatal outcome: Patients were monitored until the postpartum period, and the following perinatal outcomes were recorded:

- **Mode of delivery**: vaginal (spontaneous/instrumental) or caesarean section
- **Amniotic fluid**: clear or meconium-stained liquor
- **APGAR scores**:

- Assessed at 1 and 5 minutes after birth
- Based on Appearance, Pulse, Grimace, Activity, and Respiration

- Each parameter scored from 0 to 2
- Score 7–10: good condition
- Score 0–6: depressed condition

- **NICU admission**
- **Baby weight**

Results:

Table 1: showing various conditions associated with decreased fetal movements

Conditions associated with decreased fetal movements	No of cases	Percentage
Prematurity	35	17.9%
Postdated	21	10.7%
GDM	24	12.2%
Gestational hypertension	36	18.4%
Hypothyroid	20	10.2%
Heart disease	7	3.6%
Asthma	10	5.1%
Anemia	43	21.9%
Deranged LFT	15	7.7%
Oligohydramnios	**44**	22.4%
Polyhydramnios	9	4.6%
IUGR	57	29.1%

In this study, the most frequently observed condition associated with decreased fetal movements (DFM) was intrauterine growth restriction (IUGR), which accounted for 29.1% of cases. IUGR reflects impaired fetal growth often due to placental insufficiency, which compromises oxygen and nutrient supply to the fetus, leading to reduced fetal activity as an adaptive response.

The second most common cause was oligohydramnios, identified in 22.4% of patients. Reduced amniotic fluid volume can restrict fetal movement physically and is often linked to fetal hypoxia or placental dysfunction, making it a significant contributor to maternal perception of decreased fetal activity.

Maternal anemia was present in 21.9% of cases, which may indirectly affect fetal well-being by diminishing oxygen delivery, potentially leading to fetal hypoxia and reduced movement.

Other important maternal and fetal conditions contributing to decreased fetal movements included gestational hypertension (18.4%), which can impair uteroplacental blood flow; prematurity (17.9%), where immature fetal neurological systems may reduce movement; gestational diabetes mellitus (12.2%), which can affect fetal metabolism and growth; hypothyroidism (10.2%), known to impact fetal neurodevelopment; postdated pregnancy (10.7%), where placental aging might impair fetal oxygenation; and deranged liver function tests (7.7%), indicative of maternal systemic illness that could compromise fetal health.

Less frequently encountered causes in this cohort were maternal asthma, which can reduce oxygenation, polyhydramnios, associated with fetal anomalies or diabetes, and maternal heart disease, which can compromise overall maternal-fetal circulation.

Overall, these findings underscore the multifactorial etiology of decreased fetal movements, highlighting the importance of thorough maternal and fetal assessment to identify underlying conditions and optimize perinatal outcomes.

Association between amniotic fluid index (AFI) and VAST reactivity

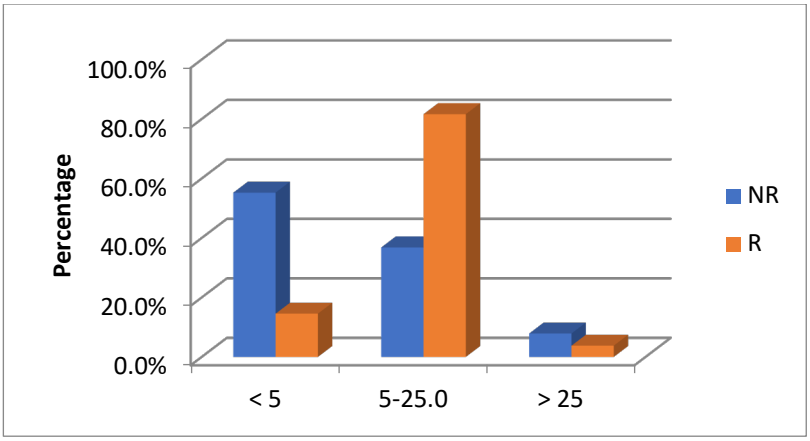

Figure 1:

A significant correlation was found between amniotic fluid volume and vast outcomes (p=0.001). Among women diagnosed with oligohydramnios (AFI < 5), 55.3% exhibited a non-reactive vast response, indicating potential fetal compromise. In contrast, 81.6% of women with normal AFI values (5–25) showed reactive vast results, suggesting better fetal well-being. A smaller subset of patients presented with polyhydramnios (AFI > 25), among whom only 7.9% demonstrated a non-reactive vast, reflecting relatively preserved fetal status in this group.

Association between VAST response and color of liquor:

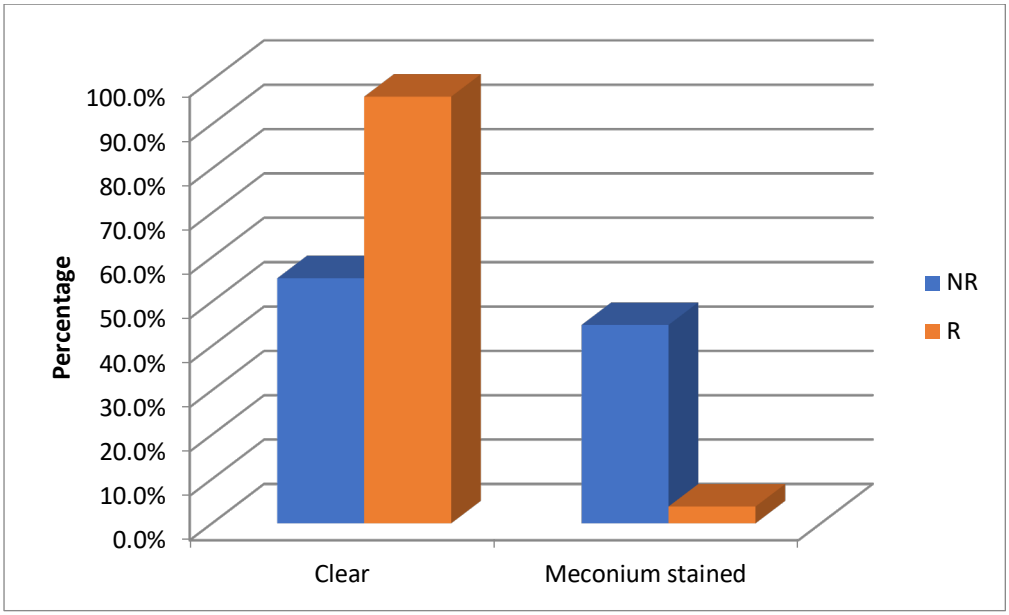

Figure 2:

A strong association was observed between the color of amniotic fluid and VAST reactivity, with a chi-square value of 49.568. Among women with non-reactive VAST results, 44.7% had meconium-stained liquor, indicating fetal distress. In contrast, 96.2% of women with reactive vast demonstrated clear amniotic fluid, reflecting better fetal condition.

Association of umbilical artery Doppler findings with VAST reactivity

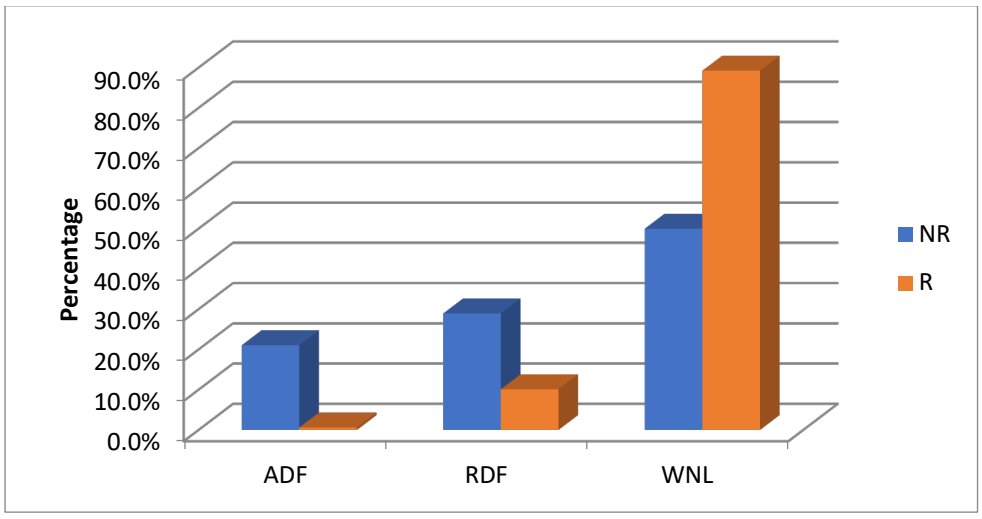

Figure 3:

A highly significant association (p = 0.001) was found between umbilical artery Doppler findings and vast reactivity. Among women with abnormal Doppler patterns—specifically absent diastolic flow (ADF) and reduced diastolic flow (RDF)—there was a marked increase in non-reactive vast results. 21.1% of all NR cases had ADF, despite representing only 9 subjects in total. 28.9% of nr cases showed RDF, compared to only 10.1% of R cases. In contrast 89.2%of reactive VAST results

were observed in women with normal Doppler findings.

Association between VAST response and APGAR score:

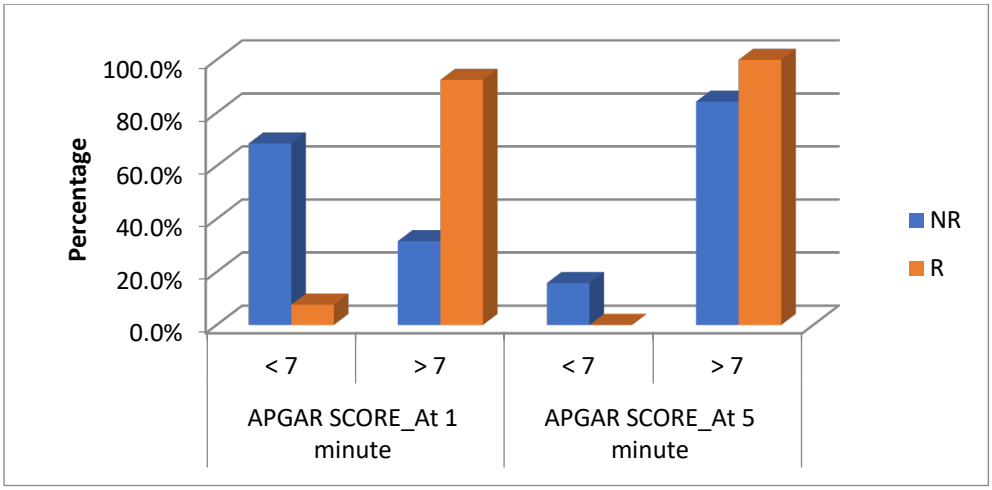

Figure 4:

The study demonstrated a significant correlation between vast reactivity and neonatal APGAR scores at both 1 and 5 minutes after birth, underscoring the test's predictive value for immediate newborn health.

At the 1-minute mark, a substantial 68.4% of neonates born to mothers with non-reactive vast results had APGAR scores below 7, indicating initial signs of distress or compromised condition. In contrast, 92.4% of neonates in the reactive vast group achieved scores of 7 or higher, reflecting good initial adaptation to extrauterine life (p = 0.001). By 5 minutes post-delivery, all neonates from the reactive group improved or maintained APGAR scores ≥ 7, indicating recovery or stable condition. However, 15.8% of neonates from the non-reactive group continued to have scores below 7, suggesting ongoing challenges such as respiratory difficulty, poor muscle tone, or other complications (p = 0.001). This persistent low score in the non-reactive group highlights the clinical importance of vast in identifying fetuses at risk of adverse outcomes. Overall, these findings highlight the utility of VAST not only in assessing fetal well-being antenatally but also in predicting immediate neonatal health and the likelihood of requiring advanced postnatal care. Early identification of at-risk fetuses through VAST can facilitate timely interventions, potentially improving perinatal outcomes and resource allocation in neonatal care.

Table 2: showing association of vast response with perinatal outcome

Perinatal outcome	Nr (n=38)	R (n=158)	Total (n=196)	Chi- square	P- value
Mode of delivery (lscs)	31 (81.6%)	64 (40.5%)	95 (48.5%)	**28.456**	**0.001**
Color of liquor (meconium stained)	15 (39.5%)	1 (0.6%)	16 (8.2%)	**61.642**	**0.001**
Apgar score at 1 min < 7	26 (68.4%)	12 (7.6%)	38 (19.4%)	**7.516**	**0.001**
Apgar score at 5 min < 7	6 (15.8%)	0 (0.0%)	6 (3.1%)	**25.735**	**0.001**
Nicu admission (yes)	20 (52.6%)	4 (2.5%)	24 (12.2%)	**71.554**	**0.001**
Baby weight < 2.5 kg	21 (55.3%)	68 (43.0%)	89 (45.4%)	1.847	0.205

Among nr cases, 81.6% underwent lSCS, 39.5% had meconium-stained liquor, 68.4% had APGAR <7 at 1 minute, 15.8% had APGAR <7 at 5 minutes, and 52.6% required NICU admission. These associations were statistically significant (p<0.001). Although low birth weight (<2.5 kg) was more frequent in nr group (55.3%) compared to r group (43.0%), the difference was not statistically significant (p=0.205).

Effectiveness statistics

In above table effectiveness statistics was applied and results are following

- Sensitivity = tp / (tp + fn) = 36 / (36 + 18) = 66.7%
- Specificity = tn / (tn + fp) = 140 / (140 + 2) = 98.6%
- Ppv = tp / (tp + fp) = 36 / (36 + 2) = 94.7%
- Npv = tn / (tn + fn) = 140 / (140 + 18) = 88.6%
- Accuracy = (tp + tn) / total = (36 + 140) / 196 = 89.8%

Tp – true positive, fn- false negative, tn – true negative, fp – false positive, ppv – positive predictive value, npv – negative predictive value.

Discussion & Conclusion

In the present study, a total of 196 antenatal women presenting with complaints of decreased fetal movements were evaluated to assess the effectiveness of the vibroacoustic stimulation test (VAST) in determining fetal well-being. Among these, the most frequently identified causes were intrauterine growth restriction (29.1%), oligohydramnios (22.4%), and maternal anemia (21.9%). These findings align with risbud et al. (2011), who associated IUGR and low birth weight with poor perinatal outcomes. Das et al. (2020) observed that reduced fetal activity, often seen in later gestation, improved significantly following vast, indicating its role in differentiating physiological reduction from pathological causes. Kaur et al. (2020) similarly identified GDM, PIH, and prematurity as common etiological factors, consistent with the maternal profiles observed in this study.

Statistically significant associations were observed between non-reactive vast results and maternal comorbidities including gestational diabetes mellitus ($p = 0.001$), gestational hypertension ($p = 0.019$), postdated pregnancy ($p = 0.001$), deranged liver function tests ($p = 0.001$), and oligohydramnios ($p = 0.001$). These findings are in line with sambarey et al. (2016), who found that 92% of non-reactive vast cases were associated with poor perinatal outcomes, most linked to high-risk maternal conditions. Kiran et al. (2018) found that integrating vast into the modified biophysical profile improved its specificity, especially in the context of PIH and IUGR. These results reinforce the significance of vast non-reactivity as an early indicator of fetal compromise.

A significant correlation was also found between vast reactivity and amniotic fluid levels. Among women with oligohydramnios (AFI <5), 55.3% had non-reactive responses, whereas 81.6% of those with normal AFI (5–25) had reactive vast ($p = 0.001$). This is consistent with risbud et al. (2011), kaur et al. (2020), who highlighted that low amniotic fluid volume is associated with abnormal fetal response to stimulation. Similarly, abnormal umbilical artery doppler findings—such as reduced diastolic flow (28.9%) and absent diastolic flow (21.1%)—were significantly associated with non-reactive vast ($p = 0.001$), corroborated by kiran et al. (2018) and singh et al. (2015), who emphasized the enhanced diagnostic accuracy of combining vast with doppler in detecting placental insufficiency.

Neonatal outcomes also differed significantly: at 1 minute, 68.4% of neonates in the nr group had APGAR <7, compared to 92.4% in the reactive group with APGAR ≥7. At 5 minutes, all reactive cases scored >7, while 15.8% of nr cases remained <7 ($p = 0.001$). Furthermore, 55.3% of nr group neonates had low birth weight (<2.5 kg) versus 22.8% in the reactive group. These outcomes are in accordance with singh et al. (2015) and gupta et al. (2018), confirming the link between vast non-reactivity and adverse neonatal parameters. The diagnostic performance of vast in predicting adverse outcomes was high, with a sensitivity of 66.7%, specificity of 98.6%, ppv of 94.7%, npv of 88.6%, and overall accuracy of 89.8%. These findings align with those of kiran et al. (2018) and risbud et al. (2011), establishing vast as a reliable and efficient bedside tool in fetal monitoring.

In conclusion, VAST is a non-invasive, time-efficient, and clinically valuable diagnostic test in assessing fetal well-being in women presenting with decreased fetal movements. It not only aids in distinguishing high-risk from low-risk cases but also helps guide timely interventions, optimize delivery planning, and anticipate neonatal care needs. Its predictive value is further enhanced when used alongside Doppler studies and amniotic fluid assessment. Given its high specificity and strong correlation with neonatal outcomes, vast should be considered a vital component of fetal surveillance protocols, especially in resource-constrained settings managing high-risk pregnancies.

References

1. Royal college of obstetricians and gynaecologists (rcog). (2019). Reduced fetal movements (green-top guideline no. 57).
2. Julia unterscheider and keelin o'donoghue (2012). Reduced fetal movements, from preconception to postpartum, dr. Stavros sifakis (ed.)
3. East ce, smyth rm, leader lr, henshall ne, colditz pb, lau r, tan kh. Vibroacoustic stimulation for fetal assessment in labour in the presence of a nonreassuring fetal heart rate trace. Cochrane database syst rev. 2013 jan 31; 2013(1): cd004664.
4. Yong-jin park, seon-hye park, young-jae kim, jeong-kyu hoh, young-sun park, moon-il park,computerized fetal heart rate monitoring after vibroacoustic stimulation in the anencephalic fetus,early human development, volume 86, issue 9,2010, pages 569- 572
5. risbud ns, prakash s. Visual acoustic stimulation test (vast) as a predictor of fetal wellbeing. Indian journal of applied research. 2011; 1 (3):192-95.
6. Das r, jana n, arora n, sengupta s. Ultrasound assessment of fetal hearing response to vibroacoustic stimulation. The journal of maternal-fetal & neonatal medicine. 2020 jul 17;33(14):2326-32.
7. Kaur n, sharma s. Role of non-stress test and vibroacoustic stimulation test in prediction of perinatal outcome in high-risk pregnancies.
8. Singh k, das c. Role of vibroacoustic stimula-

tion test in prediction of fetal outcome in terms of apgar score. International journal of reproduction, contraception, obstetrics and gynecology. 2015 sep 1;4(5):1428.
9. Sambarey p, bilagi dm. non-stress test and vibroacoustic stimulation test in high-risk pregnancies and its relation to perinatal outcome. Int j sci study. 2016 feb 1;3(11):173- 7.
10. Kiran s, sinha ar. Comparison of modified biophysical profile and vibroacoustic stimulation for intrapartum fetal assessment and prediction of perinatal outcome. International journal of reproduction, contraception, obstetrics and gynecology. 2018 apr 1;7(4):1464-9.
11. Gupta o, masand d, jhajhria r. Role of vibroacoustic stimulation test in assessment of fetal well-being in high-risk pregnancy and comparison with nonstress test. Int j clinic obstet gynecol. 2018; 2:33-5.