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The Outcome of Mothers Presenting with Reduced Fetal Movements in the Third Trimester of Pregnancy

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ABSTRACT

Introduction: There are different ways to evaluate the condition of the fetus during pregnancy. Counting fetal movements is the only way that the mother can use to check the health of the fetus without the need for a doctor and equipment. Fetal movements normally vary between 4 and 122 movements per hour. Awareness of fetal movements can aid in preventing stillbirths.

Materials and Methods: In this study, the term "reduction of fetal movement" referred to cases where pregnant mothers felt less than 12 fetal movements in two hours while at rest and focused on counting. The sample of this study was collected from pregnant women who reported reduced fetal movements and were referred to Al-Zahra Hospital in Tabriz between December 2022 to December 2023.

Results: In this study, 881 pregnant women between the ages of 18 and 42, with a mean age of 26.65, were included. The average age of these women was 26.61 years. In this study, 99.1% of the participants had a normal non-stress test (NST), and 92.8% had a normal biophysical profile (BPP). However, there were eight cases where the BPP results were not reported. Oligohydramnios was present in 10.6% of the patients. 19.7% of the mothers underwent a cesarean delivery. 6.3% of the neonates were admitted to the neonatal intensive care unit (NICU) following birth. Only one case of stillbirth occurred. We have discovered a correlation between a lower amniotic fluid index (AFI) and a lower BPP. There was a correlation between lower BPP scores and lower Apgar scores at the first and fifth minutes after birth. Lower AFI was found to be correlated with a lower pH in the placental artery.

Conclusions: According to our results, it can be concluded that a mother's complaint of reduced fetal movement can be a valuable test to determine the health status of the fetus.

Keywords: *Fetal movements, neonatal outcomes, Correlational study, maternal knowledge, stillbirth*

INTRODUCTION

It is widely recognized that a regular pattern of fetal movement is related to fetal health (1). Usually, the first fetal movement is felt in singleton pregnancies in weeks 18 to 20, and in multiplepregnancies it is felt in weeks 16 to 20 (2). Fetal movements increase until weeks 1 to 60, and then the number of fetal movements is usually reduced. They usually last 17.04 minutes (In a normal and healthy fetus, the sleep cycle rarely exceeds an hour and a half). Fetal movements normally vary between 4 and 111 movements per hour. The frequency of fetal movements in the third trimester is constant, although the quality of the felt movements can change (3). Fetal movements increase during the day, and their maximum amount is during the night (4). It has notbeen determined whether the number of movements in a healthy fetus can be distinguished from afetus at risk. This is due to the wide biological variability in the movements of a healthy fetus, as well as the wide differences in mothers' perception of fetal activity (5). It is common knowledge that decreased fetal movements are associated with unfavorable outcomes, including stillbirth. One of the main components of the prenatal care process is fetal health assessment. The purpose of thisassessment is to identify fetuses at risk and prevent complications, especially fetal and neonatal deaths (6).

Prenatal health status examinations include fetal movement counting test, non-stress test (NST), contraction stimulation test (CST), and biophysical profile (BPP) (7, 8). Fetal movement counting test is one of the oldest and simplest methods of assessing fetal health at the end of the second and third trimesters (9). Counting fetal movements is the only way that a mother can check the health of the fetus without the need for a doctor or equipment. Fetal movements normally range from 4 to 122 movements per hour (10). Mother's awareness of reduced fetal movement or loss of movements is a warning sign, especially when there is uterine-placental insufficiency. SinceSadovsky reported seven cases of decreased fetal movement before fetal death in 1973 (11), variousmethods have been described to evaluate fetal health based on fetal movement. Based on clinical experience, daily recording of fetal movements is known as a simple, safe, and cheap method to evaluate the health of the fetus. It provides the possibility of continuous evaluation of the fetus bythe mother (4).

By recording the movements of the fetus daily, it is possible to predict the possibility of fetal distress, along with other fetal health evaluation tests. When the fetus health status is disturbed, the movements are reduced and may not be felt for several days. A period of decreased fetal movements usually occurs before fetal death. However, the decrease in the sense of fetal movements by the mother necessarily indicates disorder and potential fetal compromise. It is not fatal and can also occur in a healthy fetus (12). Studies show that 12% of fetal organ movements and 82% of body movements are sensed by the mother (13). A review study shows that 33-88% of all fetal movements were initiated by the mother (14). The decrease in fetal movements can becaused by a decrease in amniotic fluid, various drugs, smoking, fetal sleep status, fetal hypoxia, malnutrition, placental disorder, and fetal disorder, among others.

We conducted this study to enhance our understanding of the factors that influence the maternal perception of fetal movements, from both maternal and fetal perspectives, in normotensivepregnant women who presented to our hospital with complaints of reduced fetal movements or theonset of labor pain. Our goal was to determine the association between these factors and signs of fetal compromises, such as decreased pH of amniotic fluid, amniotic fluid index (AFI), BPP, andAPGAR scores at one and five minutes after birth.

MATERIAL AND METHODS

National ethical regulations in medical research, including obtaining written informed consent, were followed during the study. In order to answer any questions from patients in the field of the above study, a contact phone number was provided. Samples and their families related to the studyand its objectives. The possibility of

withdrawing from the study and keeping their information confidential was justified, and informed written consent was obtained from them. The diagnostic methods used in this study were not invasive and did not have any side effects for the examined subjects. The study proposal was approved by the ethics committee of Tabriz Faculty of Medical Sciences with the ethical code IR.TBZMED.REC.1397.370.

The sample in this study was collected from all pregnant women who visited Al-Zahra Hospital inTabriz during March 2022-March 2023 due to reduced fetal movements or labor pain.

The inclusion criteria for this study included pregnant women who reported reduced fetal movements, had a reliable last menstrual period (LMP) or a first trimester ultrasound, and metthe following requirements: gestational age between 32-40 weeks, minimum literacy in reading and writing, age between 18 and 35 years, singleton pregnancy, no addiction to drugs or specific medications, no smoking or alcohol consumption, no rupture of the amniotic membrane, no spotting or bleeding, and no fetal abnormalities based on sonographic evidence. Exclusion criteria included patients' dissatisfaction with participating in the study, PROM, high-risk pregnancies, and underlying chronic diseases such as diabetes and hypertension.

The data collection for this study was conducted using a prewritten checklist to gather information on demographic characteristics, pregnancy history, mode of delivery, NST interpretation, biophysical profile, and the end of pregnancy. Factors such as the mother's weight, number of previous pregnancies, maternal health conditions, and other demographic and obstetric factors were classified and standardized to prevent any bias in the findings.

In this study, a reduction in fetal movement was defined as instances where the pregnant mother felt fewer than 11 fetal movements in a two-hour period while at rest and actively counting. The ultrasound was conducted at Alzahra Medical Center in Tabriz, and the radiologist who performed the biophysical profile was not informed about the research protocol. The biophysical profile includes five biophysical variables: non-stress test (NST), fetal breathing, fetal movements, fetal tone, and amniotic fluid index (AFI) determination. A score of two is assigned to each normal variable, while a score of zero is assigned to each abnormal variable. The highest possible score for the five variables is 8, while the lowest possible score is 0. The evaluation focused on the presence of changes in heart rate, particularly heart failure. During the amniotic membrane rupture, attention was given to the color of the amniotic fluid to check for the presence of meconium. The study evaluated the method of delivery, the condition of newborn babies during the first and fifth minutes after birth, and the incidence of fetal and maternal complications. All the information that was gathered has been recorded in the questionnaire.

Statistical Analysis

All collected information and studied data were analyzed by IBM® SPSS® Release 23.0.0 software. In this study, P-values less than 0.05 were considered statistically significant. Statistical methods such as mean ± standard deviation, frequency, percent frequency, cumulative frequency, frequency distribution table, and bar-cluster diagrams were used for the descriptive statistical analysis of the studied population. Chi-square test or Fisher's exact test, Spearman's correlation coefficient, and paired t-test were used to check the objectives of the study.

RESULTS

In this study, 110 pregnant women aged between 18 and 41 were included, with a mean age of

26.65. The youngest participant was 18 years old, while the oldest was 40 years old. 90.1% of the participants had a normal NST. 92.8% of the participants had a BPP score of 8 from 8. 10.6% of the participants were diagnosed with oligohydramnios (Table 1). The amniotic fluid of 12.6% of the individuals was contaminated with

meconium (Table 1). Cesarean delivery occurred in 19.7%of the mothers, while 79.3% of them delivered vaginally (NVD) (Table 1). 6.3% of the neonates were admitted to the neonatal intensive care unit (NICU) after birth (Table 1). Stillbirth occurred in 0.9% of the cases.

TABLE 1: The frequency distribution of oligohydramnios, meconium, vaginal delivery (NVD) or cesarean delivery, admission to the neonatal intensive care unit (NICU), and stillbirth in individuals who reported decreased fetal movements.

		percentage	Frequency
oligohydramnios	Yes	10.6	12
	No	88.3	98
Meconium	Yes	12.6	13
	No	87.4	97
Mode of delivery	Cesarean	19.7	22
	NVD	79.3	88
NICU admission	Yes	6.3	7
	No	92.8	103
Still birth	Yes	0.9	1
	No	98.2	109

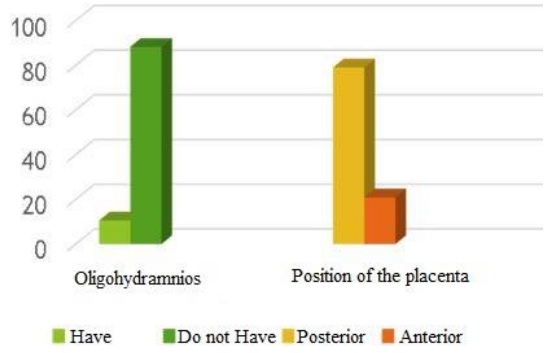

FIGURE 1: Distribution chart of the frequency of oligohydramnios and the position of the placenta in people who presented with the complaint of decreased fetal movement.

A first minute Apgar of 0, 6, 7, 8, and 9 was present in 0.9%, 0.9%, 0.9%, 7.2%, and 99.1% of the neonates, respectively, while a fifth minute Apgar of 0, 7, 8, 9, and 10 was present in 0.9%, 0.9%, 0.9%, 0.9%, and 96.4% of the neonates, respectively (Table 2).

TABLE 2: Distribution of various Apgar scores frequency in the first and fifth minutes among individuals who presented with decreased fetal movements.

		frequency	percentage
First minute Apgar	0	1	0.9
	6	1	0.9
	7	1	0.9
	8	8	7.2
	9	99	99.1

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Fifth minute Apgar	0	1	0.9
	7	1	0.9
	8	1	0.9
	9	1	0.9
	10	106	96.4

Using the Pearson test, we determined the correlation between BPP, AFI, umbilical cord artery pH, and Apgar score of first and fifth minutes after birth. In Table 3, the first number in each column represents the correlation coefficient, which is always a value between 1 and -1. A correlation coefficient between 0 and 1 indicates a positive correlation, and the closer the coefficient is to 1, the stronger the correlation. A correlation coefficient between 0 and -1 indicates a negative correlation between two variables. The closer the coefficient is to -1, the stronger the negative correlation. The second column shows the p-value, which is considered significant if it isless than 0.05.

According to our results, there was a positive correlation between BPP and first minute Apgar, fifth minute Apgar, and AFI. In other words, lower BPP was associated with lower first minute Apgar (p = 0.002), fifth minute Apgar (p = 0.002), and AFI (p = 0.001). Moreover, we found a positive correlation between the lower AFI and the lower placental pH (p = 0.03). First minute Apgar was also correlated with fifth minute Apgar (p = 0.001) (Table 3).

TABLE 3: The correlation between BPP, AFI, umbilical cord artery pH, and Apgar score of firstand fifth minutes after birth

	Placental Artery PH	Fifth minute Apgar	First minute Apgar	AFI	BPP
BPP	-0.071	0.857	0.851	0.413	1
	0.464	0.002	0.002	0.001	
AFI	0.199	-0.132	-0.187	1	0.413
	0.037	0.168	0.051		0.001
First minute	-0.136	0.966	1	-0.1870.051	0.851
Apgar	0.158	0.001			0.002
Fifth minute	-0.112	1	0.966	-0.132	0.857
Apgar	0.242		0.001	0.168	0.002
Placental	1	-0.122	0.136	0.199	-0.071
artery PH		0.242	0.158	0.037	0.464

Table 4-7 shows the results of the independent t-test for the correlation of the mode of delivery with BPP, umbilical cord arterial pH, AFI, and Apgar score of first and fifth minutes after birth. Our results revealed that the levels of BPP and AFI are correlated with the mode of delivery. If BPP and AFI decrease, the likelihood of cesarean delivery increases (Table 4)

TABLE 4: The association of the mode of delivery with BPP, umbilical cord arterial pH, AFI, andApgar score of first and fifth minutes after birth.

	Surgical procedure	mean	p-value
BPP	NVD	8.00	0.016
	Cesarian Delivery	6.73	
Placental artery pH	NVD	7.33	

	Cesarian Delivery	7.29	0.189
AFI	NVD		0.015
	Cesarian Delivery		
First minute Apgar	NVD	8.93	0.139
	Cesarian Delivery	8.27	
Fifth minute Apgar	NVD	10.00	0.137
	Cesarian Delivery	9.27	

DISCUSSION

The effectiveness of daily fetal movement counting by the mother has been confirmed by the factthat at least 18% of all fetal movements are perceived by the mother (15, 16). Fewer than three fetal movements in one hour or no movement for more than 2 hours have occurred (17). The most widespread technique that is used in most centers as an ideal screening test and the primary methodof assessing fetal health during pregnancy. The non-stress test (NST) is based on the accelerationof the heart rate in response to fetal activity (18). In this method, electronic monitoring is used to record the heart rate of the fetus. Since the development of Doppler technology, the examination of fetal activity before delivery has become possible through a non-invasive method from the mother's abdomen. The acceleration of the heart rate following the movements of the fetus can now be detected (19). This acceleration forms the basis of the stress-free test (20).

When the basic heart rate increases in response to the movement of the fetus, the fetus is healthy and shows normal pH levels in the umbilical cord blood (21). Therefore, using the criterion of two or more accelerations of the heart rate for 4 minutes for the non-reactive fetal stress test can have better sensitivity and specificity (22). However, this test has a high false positive rate of 75-90%,and most of the fetuses that show a non-reactive non-stress test are not at risk (21). Its predictive value in the diagnosis of metabolic acidosis at birth is only 0%) (22). In these cases, more detailedtests are needed, such as a BPP. Five variables are examined in the biophysical profile, which include acceleration of the heart rate in the test without fetal stress, breathing, movements, fetal tone, and amniotic fluid volume. The biophysical profile score is a combination of 4 short-term momentary variables (fetal tone, movement, breathing, and NST) and a long-term variable (AFI).All short-term biophysical variables are regulated by the central nervous system of the fetus. Thecentral nervous system of the fetus is highly sensitive to decreases in oxygen levels, and these variables are directly affected by changes in the fetus's oxygenation status. In the presence of progressive hypoxia, clinical studies have shown that reactivity is the first variable that disappears in the biophysical profile, followed by the loss of fetal breathing and then movement. The last variable in the presence of stable hypoxia within the uterus is the loss of fetal tone (23).

Fetal urine production is the main source of amniotic fluid volume and is directly dependent on renal perfusion. In response to sustained hypoxia, a long-term adaptive response is created by chemoreceptors present in the aortic arch and carotid arteries. The vital organs of the fetus, including the brain, heart, and adrenals, are fully developed. As a result, blood supply to non-essential organs like the lungs and kidneys is reduced due to the contraction of peripheral vessels.On average, a fetus lasts approximately 86 days. It takes time to change the volume of amniotic fluid from normal to abnormal (24).

According to the results of this study, most of the mothers who reported decreased fetal movement had normal BPP and NST results. Specifically, 90.1% had normal and reactive NST results, while only 9.9% had non-normal and non-reactive NST results. They had. Also, during the investigations, 92.8% of these people had normal biophysical profile (BPP). The results of this study showed that the feeling of decreased fetal

movement by the mother in weeks 39 to 41 was compared with the results of the stress-free test, which has a sensitivity of 81%, a specificityof 81%, a positive predictive value of 1.41%, and a negative predictive value of 81%. In the studyof Wilailak et al., the negative predictive value of the fetal movement count test by the mother compared to the results without stress was 33.48%, and the positive predictive value was 0% (25).

In another similar study conducted by Niroomanesh et al., the negative predictive value was 31%. The percentage and positive predictive value were 90% (26). It seems that the difference in the positive predictive value of these two studies with the present study is due to the high rate of falsepositive results of the stress-free test. In a study performed by Khooshideh et al., the sensitivity and specificity of the fetal movement count test by the mother compared to the gold standard of amniotic fluid stained with meconium were 0% and 39%, respectively (27). The difference in the diagnostic value of this study with the present study may be due to the difference in the type of gold standard. In Boog's research, the positive predictive value of the fetal movement count test by the mother in diagnosing fetal distress, compared to the occurrence of changes in the fetal heartrhythm 80 to 33 hours after the decrease in the number of fetal movements, was 30-71% (28).

In the study by Singh et al., the fetal mortality rate decreased from 0.140 per 1000 live births in the control group to zero in the study group (29). In the other research, the fetal mortality rate decreased from 0.343 per 1000 live births in the control group to zero in the study group. In the study by Twit et al., the stillbirth rate decreased from 2.9% to 0.4% (30). Hence, the count of fetal movements was introduced as an effective screening test with high sensitivity and specificity in the diagnosis of fetal risk. A study conducted for 41 weeks as a case-control, and another study on 222 people with a gestational age of 32, showed that in the group with decreased fetal movement, 26% had meconium excretion in the amniotic fluid, and only 31%of them had a normal delivery. While in our study, 12.6% had meconium excretion, and 81.7% had a normal delivery. This difference can be due to the 9% positive predictive value in our study (31).

CONCLUSION

According to the results of this study, it can be concluded that the mother's complaint of decreasedfetal movement can be a valuable test to find out the health status of the fetus. If the mother complains of decreased fetal movement, other tests to assess the health of the fetus, such as ultrasound, NST, OCT, and BPP, should be performed. The necessary action should be taken basedon the results. Suggestions are being made considering that the reduction of fetal movement can have dangerous consequences for both the mother and the fetus. It is recommended that mothers be given sufficient training about counting fetal movements in health and treatment centers and be provided with the necessary knowledge about the consequences of reduced fetal movements. Also, a larger and more comprehensive study is recommended on reducing fetal movements and its outcomes, and compared with the control group.

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