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Fetal weight estimation before delivery: comparison of ultrasound and Dare`s clinical assessment

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Fetal weight assessment is a standardized component of both prenatal care and labor management. In addition, it is important for managing high-risk pregnancies and monitoring fetal growth. During childbirth it is important to accurately determine the weight of the fetus. Assessment of fetal weight has been included in the standard routine antenatal examination performed in high-risk pregnancies and deliveries for the past ten years.
Scientific publications present data on the accuracy of fetal weight assessment methods based on ultrasound and clinical examinations, known as the Dare's method.
***The objective:* to compare the accuracy of fetal weight determination using ultrasound examination and the Dare's fetal weight maneuver in developing countries and peripheral centers.**
***Materials and methods*. A cross-sectional comparative study was conducted at the Mosul obstetric hospital and outpatient clinic from March 2020 to January 2022. The study included 340 pregnant women with a gestational age of 35–42 weeks. All included pregnant women were over 18 years of age and expected to give birth in 7 days. Fetal weight was assessed using ultrasonography examination and the clinical Dare's method. Both results were compared with the actual weight of the infant after birth.**
***Results*. All participants underwent Dare's clinical examination and ultrasound examination, and their predicted fetal weight was compared with actual fetal weight. The mean value and standard deviation of the estimated fetal weight was 3154.22±552.31 g when assessed by the Dare's method and 3238.76±495.28 g – by ultrasound examination, and the actual average birth weight of the infants was 3114.44± 582.59 g (P=0.07).**
***Conclusions*. The results of the study indicate that in conditions of lack of access to ultrasound examination for the purpose of assessing the weight of the fetus in medical institutions, the Dare's method is acceptable.**
Keywords: *fetal weight, ultrasound examination, Dare's method.*

Оцінювання маси плода перед пологами: порівняння УЗД та клінічної оцінки за Dare

А. В. Ахмед, Х. А. Сухейл

Оцінювання маси плода є стандартизованим компонентом як допологового догляду, так і ведення пологів. Крім того, це важливо для ведення вагітності високого ризику та моніторингу росту плода. Під час пологів важливо точно визначити масу плода. Оцінювання маси плода було включено у стандартний звичайний передпологовий огляд, який виконують під час вагітності та пологів високого ризику протягом останніх десяти років.
Наукові публікації представляють дані стосовно точності методів оцінювання маси плода на підставі ультразвукового дослідження та клінічного обстеження, відомого як метод Dare.
Мета дослідження: порівняння точності визначення маси плода за допомогою ультразвукового дослідження та маневру визначення маси плода за Dare у країнах, що розвиваються, та периферійних центрах.
Матеріали та методи. Порівняльне дослідження поперечного перерізу проведене в акушерській лікарні та амбулаторії Мосула з березня 2020 р. по січень 2022 р. До дослідження увійшли 340 вагітних із терміном вагітності 35–42 тиж гестації. Усі включені вагітні були віком від 18 років з очікуванням пологів через 7 днів. Маса плода була оцінена за допомогою ультразвукового дослідження та клінічного методу Dare. Порівнювали обидва результати з фактичною масою тіла немовляти після пологів.
Результати. Усі учасниці пройшли клінічне обстеження за методом Dare та УЗД, і їхню передбачувану масу плода порівнювали з фактичною масою плода. Середнє значення та стандартне відхилення передбачуваної маси плода становили 3154,22±552,31 г при оцінюванні за допомогою метода Dare та 3238,76±495,28 г – при ультразвуковому дослідженні, а фактична середня маса тіла немовлят при народженні становила 3114,44±582,59 г (P=0,07).
Висновки. Результати дослідження свідчать, що в умовах відсутності доступу до ультразвукового обстеження з метою оцінювання маси плода у медичних закладах метод Dare є прийнятним.
Ключові слова: *маса плода, ультразвукове дослідження, метод Dare.*

The estimation of the weight of the fetus is a standardized component of both antenatal care and the management of labor and delivery. In addition, it is essential for the management of high-risk pregnancies and the monitoring of the growth of the fetus. In the management of labor and delivery, it is essential to make an accurate estimation of the weight of the fetus. The estimation of the weight of the fetus has been incorporated into the standard routine antepartum examination that is performed on high-risk pregnancies and deliveries during the course of the past ten years.

The expected fetal weight will have a significant impact on the care of some pregnancy-related conditions,

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such as the management of diabetes throughout pregnancy, vaginal birth after a previous cesarean section, and intrapartum management of breech fetuses. Neonates can experience difficulties during delivery and puerperium if they have either a low or high birth weight [1]. A newborn's birth weight is the single most important factor in deciding whether or not they will survive [2].

Low birth weight and premature birth are two of the most common causes of death among newborns in countries that are still developing [3]. The incidence of cephalo-pelvic disproportion (CPD), shoulder dystocia, brachial plexus injuries, and fractures in macrosomia babies is significantly higher in vaginal deliveries than in other types of delivery. Instances of maternal complications include but are not limited to, rips in the cervical and vaginal structures, postpartum hemorrhage, an increased prevalence of assisted delivery, and cesarean section. Estimating the weight of the fetus is therefore quite important [4].

Making decisions concerning the mode of birth and preparing for potential problems that may develop during labor are both aided by this procedure. A clinical examination and an ultrasound scan are two approaches that can be utilized to determine the size of the fetus inside the uterus. Ten clinical techniques are easy to understand and direct [5]. These approaches include a significant amount of observer variability and are less exact than others. A clinical estimation of the weight of the fetus can be obtained by obstetrical examination [6].

There have been many studies that have utilized Johnson's and Dare's equations to clinically estimate the weight of the fetus. In ultrasound scans, the Hadlock formula is utilized to provide an estimate of the weight of the fetus [7]. The availability of ultrasound scanning might be limited in countries with low incomes. Both the acquisition of a costly machine and the training of personnel are required to accomplish this thing [8].

Comparisons between clinically assessed fetal weights and fetal weights which are determined by ultrasound examination give inconsistent results in many different experiments. It has been suggested that an accurate estimation of fetal weight would be beneficial in the successful management of labor and newborn care during the neonatal period. Additionally, it would help in the avoidance of complications associated with fetal macrosomia in low-birth weight babies, which would ultimately lead to a reduction in perinatal morbidity and mortality [9, 10].

Currently, the two primary approaches to predicting birthweight in the field of obstetrics are as follows: (a) clinical techniques that are based on abdominal palpation of fetal parts and calculations that are based on fundal height; and (b) sonographic measurements of skeletal fetal parts, which are then inserted into regression equations to derive estimated fetal weight [4–11].

Despite the fact that there are researchers who believe that sonographic estimates are preferable than clinical estimates, there are also researchers who have come to the conclusion that when compared concurrently, they provide comparable degrees of accuracy [3, 10–14].

The objective: to compare the result between fetal weight estimated by ultrasound examination and those obtained by Dare`s fetal weight maneuver in order to know if there is clinical dependable maneuver especially in developing countries or in rural area where there is no developed instruments and lack of good health care.

MATERIALS AND METHODS

In this comparative cross-sectional study, the investigation was carried out at Mosul Obstetric Hospital and at outpatient clinic between March 2020 to January 2022. In the end, a total of 340 consecutive patients were enrolled in the study. This decision was made to improve the accuracy of the study's findings.

For this study, the inclusion criteria included pregnant patients who were at least 18 years old, in term gestation (35 to 42 weeks), carrying singleton pregnancies, presenting cephalic orientation, and with the expectation of delivery occurring within seven days of the fetal weight estimation.

The births were further divided into two categories: those that were delivered vaginally and those that were delivered via cesarean section. Those patients who were unable to participate in the trial were those who had disorders such as oligohydramnios, polyhydramnios, fetal congenital abnormalities, ruptured membranes, uterine fibroids, abdominal masses, intrauterine fetal mortality, placenta Previa, antepartum hemorrhage, and eclampsia.

As part of the comprehensive evaluation of patients, extensive medical histories were collected, comprehensive general physical examinations were carried out, and obstetrical evaluations were carried out. The latter comprised parameters such as the fetal position, presentation, and the station of the fetal head. Symphysis-fundal height (SFH) was also included in this category.

To determine the weight of the fetus, both clinical and ultrasonographic techniques were utilized. After taking informed consent the woman is asked to empty her bladder and lie in the supine position. An obstetric examination was done to determine the lie, and presentation.

The measures of the woman's symphysis-fundal height were obtained with a non-elastic measuring tape. The tape was wrapped around the woman's waist at the level of the umbilicus, ensuring that the measurements were accurate from the upper edge of the symphysis pubis to the top of the fundus. Pelvic examinations were used to determine the position of the fetal head, and a scale that ranged from -3 to +3 was utilized to make the determination.

During the process of estimating the weight of the fetus, a formula, namely Dare's, was utilized that included multiplying the symphysis-fundal height by the abdominal girth.

Dare's formula: Fetal weight in (gram) = Fundal height (cm) × Abdominal girth (cm).

Furthermore, Hadlock's formula, which is derived from the measuring biparietal diameter, fetal belly circumference, and femoral length, was applied. By well-trained radiologist using 3.5MHz transducer color Doppler ultrasonography (DC-70 Shenzhen Mindray Bio-Medical Electronics Co,Ltd).

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Table 1-a.

The study's demographic features

Characteristics	Range	Mean	Median	P-value
Maternal age (years)	17–45	29.88±7.67	30.50	0.39
Parity	0–9	4.54±2.93	5.00	0.05
Maternal weight (Kg)	60–122	91.06±17.31	91.50	0.26
Gestational age (weeks)	35–42	39.07±2.07	39.00	0.51

Statistical analysis

The collected data over the course of the investigation, that followed by classification, tabulation, calculation of percentages, and frequency. The chi-square test was used to test the significant differences between the type of birth and gender, for the remaining tests, the mean and standard deviations (SDs) were also extracted such as the t-test for one sample and the t-test for two independent samples to assess the effectiveness of the method of calculating the weight of the fetus or newborn. The effectiveness of the estimating techniques was further evaluated using Duncan's multi-range test and the test of variance. Also, sensitivity, specificity positive predictive valve (PPV) and negative predictive value (NPV) were calculated and P-value which measures the probability of obtaining the observed results, assuming that the null hypothesis is true.

RESULTS AND DISCUSSION

There are demographic features in Table 1-a; all participant`s pregnant ladies' age ranged between 17–45 years old, mean is 29.88±7.67 years. In our study parity ranged between 0 and 9, while gestational ages all more than 35–42 weeks, with the mean value of 39.07±2.07 gestational weeks.

Table 1-b shows the type and frequency of primigravida (29.41%) and multiparous females included in our study (70.59%). A difference between genders (male 38.82 %, female baby 61.18%) was determined.

It was found that the number of pregnancies less than 36-week gestation were about 42 (12.35%) cases, whereas more than 36-week gestation was 298 (87.65%) (Table 2).

Fetal weight <2500 g estimated by ultrasound examination was determined in 22 (6.47%) pregnant women, between 2500–4000 g – in 298 (87.65%) patients, and >4000 g – in 20 (5.88%), that actual mean infant birth weight was 3238.76 g with 495.28 g as presented in table 3. The result of fetal weight less than 2500 g which was calculated by clinical examination by an experienced gynecologist was found 11.18% patients, between 2500–4000 g – in 86.76%, more than 4000 g – in 2.06% on more than 4000 g. And actual mean fetal weight was 3154.22±552.31 g (Table 4).

In the table 5 there are the results of fetal weight examined after birth by well experienced gynecologist and pediatrician in premature room. Actual weight less than 2500 g had 17.65% of newborns, 78.82% of newborns were 2500–4000 g, and 3.53% – more than 4000 g, mean weight was 3114.4±582.59 g.

By mean of fetal weight estimated by clinical examination and the actual fetal weight (3154.22 g and 3114.44 g, respectively) with 0.36, 73.72, 70.11, 67.65, and 75.88 in-

Table 1-b.

Frequency and percentage for type of birth and gender

Type of birth	No.	%	Chi2	P-value
Primigarvida	100	29.41	57.65	0.0001**
Multiparous	240	70.59		
Gender of fetus				
Male	132	38.82	16.99	0.0001**
Female	208	61.18		
Male: female ratio	38.82:61.18			

Note. ** – Refer to high significant differences between groups at (P<0.01), according to the test.

Table 2

Participants gestational age by ultrasound divided in to 2 groups as a preterm (before 36 weeks) and near term participant equal or > 36 weeks (near term and term) as the birth weight affected by gestational age

Pregnancy gestational age	No.	%
< 36 weeks, preterm labor	42	12.35
Equal or > 36 weeks, near term and term pregnancy	298	87.65
Mean gestational age (Mean+SD), weeks	39.07±2.07	

Table 3

Fetal birth weight estimated by ultrasound examination

Fetal weight (gram)	No.	%
<2500	22	6.47
2500–4000	298	87.65
> 4000	20	5.88
Mean fetal weight (Mean+SD), gram	3238.76±495.28	

Table 4

Result of fetal weight which was estimated by clinical examination

Fetal weight estimated by clinical examination (gram)	No.	%
< 2500	38	11.18
2500–4000	295	86.76
> 4000	7	2.06
Mean weight (Mean ±SD)	3154.22±552.31	

Table 5

Infant actual birth weight

Infant actual birth weight (gram)	No.	%
< 2500	60	17.65
2500-4000	268	78.82
> 4000	12	3.53
Mean weight (Mean ±SD)	3114.44±582.59	

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Table 6

Estimated birth weight by actual weight and with clinical examination (gram)

	N	Mean	S D	P-value	Sens.	Spec.	PPV	NPV
Actual weight	340	3114.44	592.59	0.36	73.72	70.11	67.65	75.88
Clinical examination	340	3154.22	532.31	NS				

Note. Refer to no significant differences between groups.

Table 7

Estimated birth weight by actual weight with fetal ultrasound examination (gram)

	N	Mean	S D	P-value	Sens.	Spec.	PPV	NPV
Actual weight	340	3114.44	582.59	0.11	76.16	70.82	67.65	78.76
Fetal ultrasound	340	3238.76	606.28	NS				

Note. Refers to no significant differences between groups.

Table 8

Estimated birth weight by clinical examination with Infant ultrasound birth weight (gram)

	N	Mean	S D	P-value	Sens.	Spec.	PPV	NPV
Fetal ultrasound	340	3238.76	495.28	0.06	76.50	78.18	78.76	75.88
Clinical examination	340	3154.22	552.31					

Note. Refers to no significant differences between groups.

cluding P-value, sensitivity, specificity, PPV and NPV, respectively (Table 6).

While mean estimated fetal weight by ultrasound examination and actual fetal weight are 3238.76 g and 3114.44 g, respectively, with 0.11, 76.16, and 70.82,67,65 and 78.76 including P-value, sensitivity, specificity, PPV and NPV respectively (Table 7).

Mean estimated fetal weight by ultrasound examination and clinical weight estimation as 3238.76 g and 3154.22 g, respectively, and 0.06, 76.50, 78.18, 78.76 and 75.88 representing P-value, sensitivity, specificity, PPV and NPV, respectively (Table 8).

At the end of results, we did a comparison between these three results infant actual weight, clinical examination and ultrasound calculation. It was found that there is no significance difference (P=0.07) between these methods (Table 9).

Table 9

The comparison between three results actual birth weight, fetal weight estimated by ultrasound examination and clinical method (gram)

	No.	Mean ± SD	P-value
Fetal ultrasound	340	3238.76±495.28	0.07*NS
Clinical examination	340	3154.22±552.31	
Actual weight(gram)	340	3114.44±582.59 B	

Note: * – Refer to no significant differences between groups, according Duncan multiple test.

This prospective study was done at out clinic and Mosul obstetric hospital, Mosul, Iraq between March 2020 to January 2022. In order to compare the clinical and ultrasound estimation of fetal weight at term this was done within 7 days of delivery to increase the power of prediction in each method. There are exclusion criteria like twin pregnancy, and pregnancy with hypertension and diabetes mellitus.

Our results are similar to those stated by other studies that involve accurate clinical estimation of all different methods are similar. The studies was done by N. W. Hendrix et al., and S. Raman et al., showed that clinical fetal weight estimation was more accurate than sonographic detection [15, 16].

While W. J. Watson et al. established no difference between all methods as our study [17] in fetal weight between 2500 and 4000 g. So, in this prospective study, the major finding is that both ultrasonography methods and clinical fetal weight estimation are accurate within the normal range of fetal weight. While in case of low fetal weight, it means it is less than 2500 g (intrauterine restricted growth) both will underestimate the weight of the fetus. Clinical examination of fetal weight in this study was done in Mosul and shows that 86.76% of fetuses weigh between 2500–4000g, whereas 11.18 % have weight less than 2500 g and 2.06% have weight more than 4000 g with mean fetal weight 3154.22±552.31 g.

F. O. Dare et al. in 1990 suggested a very simple formula for fetal weight clinical estimation, that concerned symphysis-fundal height multiplied by abdominal girth [18]. This method was involved in 498 full-term pregnant ladies and showed that there is a good association between fetal weight clinical and actually estimated weight (r=0.742). Also in our study, weight was estimated clinically by Dare`s method, which was good and correlated with an actual birth weight, with a P value of 0.36 and SD of (592.59 and 532.31) for actual birth weight and clinical estimation respectively.

The majority of neonates in the study had an actual birth weight within the range of 2500–4000 g (78.8%), followed by <2500 g (17.6%) and >4000 g (3.5%). The average actual birth weight in the study sample was found to be 3114.4±582.59 g. The association between fundal height and actual birth weight was statistically significant, consistent with findings from a study by R. Malik et al. [19].

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Which also compared actual birth weight using clinical and ultrasonographical estimation methods. The study revealed that both clinical and ultrasonography methods strongly correlated with actual birth weight, particularly in the birth weight range of 2500–4000 g (Fig. 1). The sensitivity of both methods was higher for this range compared to <2500 g and >4000 g. The mean absolute percentage error of the clinical method (7.2±7.7) was smaller than that of the sonographic method (16.2±11.1).

E. O. Ugwu et al. reported a strong positive correlation between actual birth weight and both clinically and ultrasonographically estimated birth weights (r=0.71 and r=0.69, respectively). Similar results were observed by C. Njoku et al. in 2014, where correlation coefficients for the clinical and ultrasonic methods were +0.740 and +0.847, respectively. Both methods positively correlated with the actual birth weight in their study [20, 21].

In the birth weight range of 2,500–4,000 g, the clinical method consistently overestimated birth weight. In the high-birth weight group (≥4,000 g), the clinical method tended to overestimate, while the ultrasonic method tended to underestimate. The current study observed that for birth weights <2500 g and 2500–4000 g Dare's method and ultrasonography tended to overestimate, whereas for >4000 g Dare's method tended to underestimate.

The accuracy of fetal weight estimation is crucial for obstetric decision-making, especially concerning the mode of delivery and the timing of labor induction. The present study emphasizes the importance of accurate birth weight estimation, as deviations of 500 g could significantly impact shared decision-making between the obstetrician and expectant mother. This consideration becomes particularly relevant when adhering to cut-off levels outlined in international guidelines [22, 23].

Obstetric ultrasound examinations become more challenging with higher maternal body mass index, primarily due to reduced visibility. However, the literature presents conflicting views on how this impacts fetal weight estimation [24–26]. Additionally, our study did not identify a significant difference in fetal weight estimation between clinical palpation with Dare`s maneuvers and ultrasound examination in women with normal weight pregnancies.

It's noteworthy that our study focused on women who delivered within an average of 7 days after fetal weight estimation. Some research and systematic reviews suggest that the most accurate estimates typically occur between four and seven days before delivery [27]. In a recent study by K. H. Nicolaides et al. the objective was to formulate fetal and neonatal population weight charts [27].

The rationale behind this approach was the belief that reference ranges of estimated fetal weight are more reflective of the entire population. The traditional method of creating birth-weight charts was considered misleading, as a significant number of preterm births are associated with pathological pregnancies. The study emphasized that seeking a single international standard for all countries is not appropriate [28]. It is ought to recommend health workers to be well trained and properly taught to do Dare`s maneuver, especially in the peripheral center to decrease obstructed labor and better fetal outcome.

Fig. 1. a: Biparietal diameter estimation of 38 weeks gestation of fetus; b: Femoral length estimation for the same fetus; c: Abdominal circumflex of the same fetus

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CONCLUSIONS

Our observational blinded study on normal-weight pregnant women shows no statistical differences between Dare`s maneuvers and ultrasound assessment of fetal weight. It is a useful maneuver and useful for estimation of fetal weight to be dependent on poor countries and peripheral centers that have poor availability of ultrasound devices.

We considered the overestimation of fetal weight by Dare`s method as a positive predictive factor because once there is the susceptibility of >4000 g fetal weight by health workers this makes easy pregnant women referral and thus will decrease difficult and obstructed labor and once there is fetal weight less than 2500g, we need ultrasound assessment to detect fetal well-being and to better check fetal biophysical profile.

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