

# Accuracy of ultrasound, clinical and maternal estimates of birth weight in term women

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**دقة التقديرات بالموجات فوق الصوتية والتقديرات السريرية (الإكلينيكية)، وتقديرات الأمهات لوزن ولدانهم في تمام الحمل**  
طاهرة أشرفكنجويي، طيبه نادري، بابك عشرتي، نوشين بابابور

**الخلاصة:** إن التقدير الدقيق لوزن الوليد وقت ولادته أثناء الحمل مفيد في تدبير المخاض والولادة. ويقارن الباحثون في هذه الدراسة بين دقة التقديرات بالأمواج فوق الصوتية والتقديرات السريرية (الإكلينيكية) وتقديرات 264 من الأمهات لوزن ولدانهم في تمام حملهن بجنين واحد، وقد أدخلن المستشفى تمهيداً لإجراء العملية القيصرية. وبلغت حساسية التنبؤ بوزن الوليد في تمام الحمل باستخدام الموجات فوق الصوتية 12.6٪ ونوعيته 92.1٪ فيما بلغت حساسيته باستخدام الفحص السريري بالجلس 11.8٪ ونوعيته 99.6٪، وبلغت حساسية تقديرات الأمهات 6.3٪ ونوعيتها 98.0٪. إن دقة تقديرات الأطباء لوزن الوليد في تمام الحمل تماثل دقة تقديره باستخدام الموجات فوق الصوتية في الأسبوع الذي يسبق الولادة. وتقديرات الحوامل لوزن الوليد في تمام الحمل أكثر دقة من كل من التقديرات السريرية (الإكلينيكية) والتقديرات بالموجات فوق الصوتية.

**ABSTRACT** Accurate prenatal estimation of birth weight is useful in the management of labour and delivery. This study compared the accuracy of ultrasound, clinical and maternal estimates of fetal weight in 246 parous women with singleton, term pregnancies admitted for scheduled caesarean section. The sensitivity and specificity of predicting birth weight by ultrasound measures were 12.6% and 92.1%, by clinical palpation were 11.8% and 99.6% and by maternal estimate were 6.3% and 98.0% respectively. Clinicians' estimates of birth weight in term pregnancy were as accurate as routine ultrasound estimation in the week before delivery. Parous women's estimates of birth weight were more accurate than either clinical or ultrasound estimation.

**Précision de l'estimation échographique, clinique et maternelle du poids du bébé à la naissance chez des femmes enceintes à terme**

**RÉSUMÉ** L'estimation anténatale du poids à la naissance est utile au niveau de la gestion du travail et de l'accouchement. Cette étude a comparé la précision de l'estimation échographique, clinique et maternelle du poids du fœtus chez 246 femmes pères, enceintes d'un seul enfant, et ayant mené leur grossesse à terme, admises pour une césarienne programmée. La sensibilité et la spécificité de la prédiction du poids à la naissance au moyen de l'échographie étaient de 12,6 % et 92,1 % respectivement, alors qu'elles étaient de 11,8 % et 99,6 % pour la palpation clinique et de 6,3 % et 98,0 % pour l'estimation maternelle. Pour les grossesses à terme, les estimations du poids à la naissance par les cliniciens étaient aussi précises que les estimations échographiques habituellement réalisées la semaine avant l'accouchement. Les estimations des femmes pères étaient plus précises que celles des cliniciens et de l'échographie.

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Received: 17/08/07; accepted: 04/03/08

## Introduction

Accurate prenatal estimation of fetal weight (EFW) in late pregnancy and labour is extremely useful in the management of labour and delivery, permitting obstetricians to make decisions about instrumental vaginal delivery, trial of labour after caesarean delivery and elective caesarean section for patients suspected of having a macrosomic fetus [1–5]. An accurate diagnosis of macrosomia for patients with gestational diabetes can reduce perinatal morbidity as it may assist the physician and staff in deciding the appropriate route of delivery to prepare for shoulder dystocia or to prevent a traumatic injury [6]. Correct EFW values are also important when intrauterine growth is restricted and in preterm labour [7,8].

EFW can be done by mothers (if they are parous), by clinicians using Leopold manoeuvres or by ultrasound. In the 1970s, the use of ultrasound to estimate fetal weight gained popularity because of the perceived ability to standardize and reproduce measurements [3,9], although the technique can be challenging, depending on the mother's physique, uterine anomalies or amniotic fluid index [10]. Clinical EFW has been shown to accurately predict birth weight. For example, Baum et al. showed no significant difference between clinical and sonographic estimates of fetal weight; 64.0% versus 62.5% of the estimates respectively were within 10% of the actual birth weight [1]. Maternal EFW is comparable to both clinical or ultrasound predictions in both term and postdate babies [11,12]. Some researchers concluded that clinical EFW has higher accuracy than ultrasound EFW [2,13], but other studies showed that ultrasound EFW is more accurate [14] and Chauhan et al. showed that the accuracies of both methods are the same [15].

Due to difficulties in accessing ultrasound equipment in rural areas of the Islamic Republic of Iran, this study aimed

to evaluate the benefits of ultrasound EFW by comparing the accuracy of maternal, clinical and ultrasound EFW in term women. In addition, we sought to evaluate potential variables that may affect the accuracy of the EFW during labour.

## Methods

Between July 2002 and December 2004, this prospective study evaluated 3 different methods of EFW—clinical, maternal and ultrasound measurements—on 246 parous women admitted for scheduled caesarean section within 1 week of delivery in the hospital of Kerman University of Medical Sciences, Kerman, Islamic Republic of Iran. The sample size was calculated to estimate a sensitivity and specificity of 80% with a precision of 5%. The inclusion criteria were: singleton pregnancy and live-born infant without congenital malformations or hydrops fetalis.

The mothers were instructed about the purpose of the study and gave informed consent for participation. Approval for the study was obtained from the research ethical committee of the University.

Ultrasound EFW was obtained for all women by the same physician with a 3.5 MHz transducer (Hitachi EUB-500, Tokyo, Japan) using standard Hadlock reference tables that used biparietal diameter, abdominal circumference and femur length for calculating fetal weight. The physician performing the ultrasound was unaware of the 2 other estimations. Clinical EFW was obtained on the day of operation by palpation using Leopold manoeuvres. A total of 3 physicians (2 obstetricians and 1 senior resident) examined every woman and we took an average of the 3 estimates. All were unaware of the other clinical and ultrasound EFWs. Maternal EFW was obtained by asking mothers, who were all parous, to estimate the weight of their baby. The 3 estimates of fetal

weight, patient demographic data and actual birth weight were recorded on data sheets that were kept separate from the patient's chart.

Neonatal birth weight was considered as the gold standard. Correlations were made of the actual birth weight with the ultrasound, clinical and maternal EFW independently. We also calculated the sensitivity, specificity and positive and negative predictive values for the ultrasound, clinical and maternal EFW compared with actual birth weight. Normal birth weight was considered as 2500–4000 g. We used ROC curve with the chi-squared test to compare the accuracy of different methods of estimation of fetal weight. A *P*-value of < 0.05 was considered statistically significant. Data were analysed using *Medcalc*, version 7.4.4.1 and *Stata*, version 8 software.

## Results

A total of 246 mothers participated in the study. The mean maternal age was 27.6 [standard deviation (SD) 5.4] years and mean parity was 1.2 (SD 1.2). The mean actual birth weight was 3339 (SD 443) g, while the mean estimated fetal weights by ultrasound, clinical assessment and maternal report were 3305 (SD 335) g, 3321 (SD 449) g and 3158 (SD 463) g respectively.

For the clinical EFW, there was no statistically significant difference in the mean estimates comparing the 3 physicians with different years of experience: obstetrician with 14 years' experience [3316 (SD 355) g, range 2500–4200], obstetrician with 13 years' experience [3319 (SD 343) g, range 2000–4200g] or senior resident with 3 years' experience [3327 (SD 378) g, 2500–4800 g].

The sensitivity values of predicting birth weights for ultrasound, clinical and maternal EFW were 17.6%, 11.8% and 6.3%, with specificity of 93.5%, 99.6% and 98.0%, respectively (Table 1).

**Table 1** Specificity, sensitivity, and positive predictive values for estimation of fetal weight using ultrasound, clinical and maternal estimations

Method of estimation	Normal weight children <sup>a</sup>		Abnormal weight children		Sensitivity	Specificity	Positive predictive value
	Correctly estimated	Incorrectly estimated	Correctly estimated	Incorrectly estimated			
	No.	No.	No.	No.			
Ultrasound	211	18	3	14	17.6	93.5	14.3
Clinical	228	1	2	15	11.8	99.6	67.0
Maternal	200	4	1	15	6.3	98.0	20.0

<sup>a</sup>Normal birth weight was considered as 2500–4000 g.

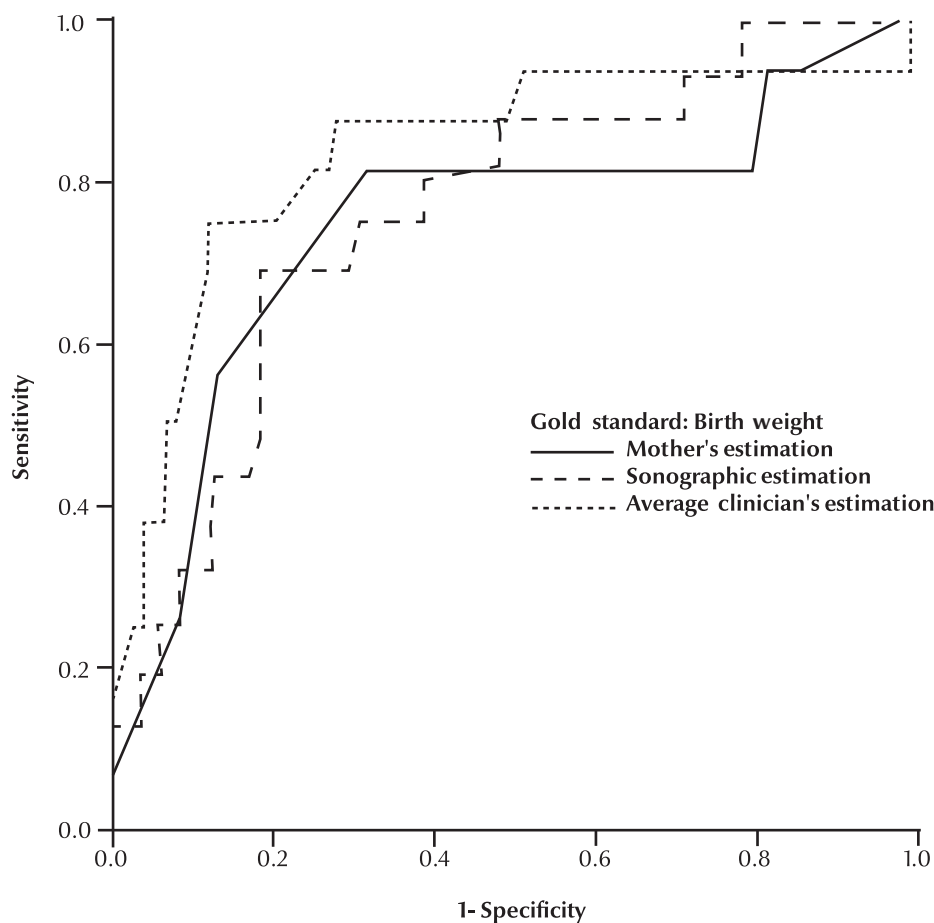
Figure 1 shows the results of ROC curve analysis. Using the chi-squared test it was evident that the accuracy of the 3 tests were not significantly different from each other ( $P = 0.35$ ). According to the maximum point of each curve of the 3 measures, a new cut-off point was used for each method of EFW and the sensitivity and specificity were estimated (Table 2).

## Discussion

Birth weight is a key variable affecting fetal and neonatal morbidity, particularly in preterm and small-for-dates babies. In addition, it is of value in the management of breech presentations, diabetes mellitus, trial of labour, macrosomic fetuses and multiple births [16].

We found that clinicians' estimates of birth weight in term pregnancy were as accurate as routine ultrasound estimation in the week before delivery. Furthermore, parous women's estimates of birth weight were more accurate than either clinical or ultrasound estimation.

There have been differing results about the accuracy of the various methods of estimating fetal weight.



**Figure 1** Receiver operating characteristic (ROC) curves for estimation of fetal weight

**Table 2 Sensitivity and specificity for estimation of fetal weight using ultrasound, clinical and maternal estimates based on the maximal point of receiver operating characteristic (ROC) curves**

Method of estimation	Cut-off point for weight (g)	Maximum specificity %	Maximum sensitivity %	ROC area
Ultrasound	3625	62.5	81.7	0.76
Clinical	3500	75.0	76.1	0.84
Maternal	3400	62.5	69.5	0.75

Clinical estimation of fetal weight using abdominal palpation has been shown to be accurate to within 500 g in 85% of cases, with more accuracy in the average, term fetus than in the preterm and macrosomic fetus [17–20]. Diase and Monga showed that in diabetic women, neither parity nor maternal weight affected the accuracy of any of the birth weight estimates [6]. Humphries et al. showed that the accuracies of birth weight estimation, both clinical and ultrasound, were still relatively low [16]. Some studies showed the ultrasound EFW was the best method for EFW, especially in preterm fetuses [2,12,21,22], but other studies, such as ours, did not conclude any difference between these methods [1,13,14,23,24]. Other studies have reported limited accuracy of

ultrasound EFW at term, particularly in macrosomic fetuses [25,26].

The advantage of using ultrasound for EFW has been questioned. Baum et al. concluded that ultrasound offered no advantage over clinical estimates of fetal weight at term [1]. Mother's estimates should be viewed as equally valid as clinical estimates, especially in the light of the need for realistic, achievable standards. They also reported that senior resident clinical estimates were superior to junior resident estimates. In contrast to this research, we found that the accuracy of physicians' estimates was similar regardless of their length of experience, which agrees with Ben-Aroya et al. [7]. Two studies reported no difference in the accuracy of EFWs by physician's palpation versus maternal estimation

[11,12], whereas others showed that clinical and ultrasound EFW were more accurate than maternal EFW [20]. In our study we found, as previously reported by O'Reilly-Green and Divon [27], that mother's EFW was the best method of fetal weight screening.

The major strength of our study, in contrast to similar studies, is that the number of patients was sufficient to ensure statistical validity of the finding of no difference between methods of EFW.

## Conclusion

Our results are supported by previous studies that indicate that ultrasound EFW offers no advantage over clinician's EFW when performed during late pregnancy or labour. An EFW should be recorded in the assessment of all patients who are at term and again when they are in labour, with full awareness of the limitations of the methods for making such estimates. This study and others show that parous mother's estimates of fetal weight are accurate and should be given due consideration.

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