

A Comparative Study between Sonographic Estimation of Fetal Weight and Actual Birth Weight in Women at Term Pregnancy in Tertiary Care Hospital

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Abstract

Background: Accurate estimation of fetal weight at term is important for appropriate labour and delivery management, but available estimation methods have varying accuracy. Therefore, this study was undertaken to compare sonographically estimated fetal weight with actual birth weight in women at term pregnancy. **Methods:** This cross-sectional observational study was conducted at the Department of Obstetrics & Gynaecology, Shaheed Suhrawardy Medical College Hospital (ShSMCH), Dhaka, Bangladesh, from 17 March to 16 September 2018. Women with singleton term pregnancies (37–40 weeks) were included. Data were collected using a structured questionnaire and analyzed using SPSS version 22, with $p < 0.05$ considered significant. Written informed consent was obtained. **Results:** Among 100 participants, most were aged 18–25 years (56, 56.0%), housewives (84, 84.0%), primipara (74, 74.0%), and from the lower-income class (86, 86.0%); 82 (82.0%) received antenatal care. The mean sonographic estimated fetal weight was 3.06 ± 0.42 kg, while the mean actual birth weight was 3.11 ± 0.16 kg, with a significant difference ($t = 2.21$, $p = 0.028$). A significant positive correlation was found between estimated fetal weight and actual birth weight ($r = 0.409$, $p < 0.001$). **Conclusion:** Ultrasonographic estimation of fetal weight at term shows a significant positive correlation with actual birth weight and may assist in clinical decision-making during labour and delivery.

Keywords: Fetal Weight Estimation, Ultrasonography, Actual Birth Weight, Term Pregnancy, Obstetric Management.

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INTRODUCTION

An accurate prenatal assessment and estimation of fetal weight (FW) in late pregnancy and labour is important for the management of labour and delivery in many obstetric situations. For instance, management of diabetic pregnancy, vaginal birth after a previous caesarean section, and intrapartum management of fetuses presenting by the breech was greatly influenced by estimated fetal weight [1, 2].

High rate of perinatal mortality is still a major cause for concern in developing countries such as Bangladesh. A large portion of this problem is related to birth-weight, which remains the single most important

parameter that determines neonatal survival [3]. Identification of the fetus at risk still represents one of the main difficulties in modern obstetrics in spite of the availability of a wide range of clinical, biochemical and ultrasonographic techniques.

Clinical decisions during the management of labour regarding augmentation or mode of delivery rely partially on estimation of the fetal weight. This may apply where there is poor progress in labour and transfer of the patient is needed, or labour augmentation is being considered, or where fetal macrosomia may be suspected. In the latter situation, this is related to risk for shoulder dystocia. Intrapartum clinical estimation of fetal weight at term (but not preterm) has been shown to

be superior or equal to ultrasonographic assessment in a number of studies [4-8].

Numerous studies have been done to establish methods for clinical fetal weight estimation. The two main methods for predicting birth-weight in current obstetrics are: (a) clinical techniques based on abdominal palpation of fetal parts and calculations based on fundal height and (b) sonographic measures of skeletal fetal parts which are then inserted into regression equations to derive estimated fetal weight [3,4,9]. Although some investigators consider sonographic estimates to be superior to clinical estimates, others, in comparing both the techniques concurrently, conclude that they confer similar levels of accuracy [3,4,10-15]. Symphysio-fundal height measurement is used to estimate birth weight by using Johnson's formula. The formula is useful in estimation of fetal weight in vertex presentation. Available evidence showed that Johnson's formula is an effective method for estimation of birth weight [16-19].

Ultrasonography is the modern method for assessing fetal weight. The advantage of this technique is that it relies on linear and/or planar measurement of in-utero fetal dimensions that are definable objectively and should be reproducible. Recent studies showed that sonographic estimation of fetal weight was not better than clinical palpation for predicting fetal weight [14,20]. Several technical limitations of the sonographic technique for estimating fetal weight are well-known. Among these are maternal obesity, oligohydramnios, and anterior placentation. Other disadvantages of ultrasonography are that it is both complicated and labour intensive, potentially being limited by suboptimal visualization of fetal structure. It also requires costly sonographic equipment and specially trained personnel.

Chauhan *et al.*, in their comparison of accuracy of the two methods, observed no benefit in obtaining a sonographic estimate [2] because its accuracy is no better than that of the clinical method, except there is low birth-weight (<2,500 g) when ultrasound yields a better prediction. All currently-available techniques for estimating fetal weight have significant degree of inaccuracy, and various studies have been done to compare the accuracy of different methods of estimation.

Therefore, this study was undertaken to evaluate the accuracy of ultrasound-estimated fetal weight by comparing it with the actual birth weight of infants born at term.

Objective

- To compare sonographically estimated fetal weight with actual birth weight among women with term pregnancies in a tertiary care hospital.

METHODOLOGY & MATERIALS

This cross-sectional observational study was conducted at the Department of Obstetrics &

Gynaecology, Shaheed Suhrawardy Medical College Hospital (ShSMCH), Dhaka, Bangladesh, over a six-month period from 17 March 2018 to 16 September 2018. The study included women with singleton term pregnancies who were clinically assessed at the Department of Obstetrics & Gynaecology, referred to the Radiology Department for ultrasonographic assessment, and subsequently delivered their babies in the department during the study period.

Inclusion Criteria

- Gestational age of 37–41 weeks
- Known and reliable last menstrual period (LMP)
- History of regular menstrual cycles
- Close correlation between menstrual age and clinically measured gestational age
- Singleton pregnancy
- Live-born infant without congenital malformation or hydrops

Exclusion Criteria

- Preterm pregnancy
- Multiple pregnancy
- Advanced labour
- Antenatal diagnosis of congenital fetal malformation detected by ultrasonography
- Intrauterine fetal death
- Women unwilling to participate in the study
- Maternal obesity (absolute weight ≥ 95 kg)¹⁵
- Premature rupture of membranes
- Antepartum hemorrhage
- Unstable maternal condition, such as eclampsia

Data Collection and Processing

Data on socio-demographic and clinical variables were collected from all participants using a pre-designed, structured questionnaire. Following data collection, the information was checked for completeness and consistency, edited, coded, and entered into a computer for analysis. Dummy tables were prepared, and the data were analyzed according to the study objectives.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 22. Quantitative variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequency and percentage. Results were presented in tabular form. A *p* value of <0.05 was considered statistically significant.

Quality Assurance

A work manual and standardized questionnaire were prepared before data collection. The questionnaire was pretested to ensure clarity, comprehensibility, and appropriate responses from the participants. Data

collection procedures were conducted according to the predefined protocol.

Ethical Considerations

The study involved minimal physical, psychological, social, and legal risk to the participants. Appropriate safety measures were maintained throughout history taking, physical examination, and investigations, and access to study data was restricted to research personnel. Permission to conduct the study was obtained from the authority of Shaheed Suhrawardy

Medical College Hospital (ShSMCH). The study was conducted in accordance with the Declaration of Helsinki (1964). Participants were informed about the study design, underlying hypothesis, and their right to withdraw from the study at any time without affecting their standard care. Written informed consent was obtained voluntarily from each participant.

RESULTS

Table 1: Demographic and Socioeconomic Characteristics of the Study Participants (n = 100)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–25	56	56.0
	26–30	38	38.0
	>30	6	6.0
	Mean $\pm$ SD	24.74 $\pm$ 4.53 years	
	Range	18–38 years	
Occupation	Housewife	84	84.0
	Service holder	8	8.0
	Day labourer	2	2.0
	Others	6	6.0
Educational qualification	Non-formal	22	22.0
	Primary	36	36.0
	Secondary	32	32.0
	Higher secondary	10	10.0
Monthly income	Lower class (Tk. 5,000–14,999)	86	86.0
	Middle class (Tk. 15,000–24,999)	14	14.0

The majority of participants were aged 18–25 years (56 patients, 56.0%), followed by those aged 26–30 years (38 patients, 38.0%) and those older than 30 years (6 patients, 6.0%), with a mean age of 24.74 $\pm$ 4.53 years. Most participants were housewives (84 patients, 84.0%), followed by service holders (8 patients, 8.0%), those in other occupations (6 patients, 6.0%), and day labourers (2 patients, 2.0%). Regarding educational

qualification, primary education was the most common (36 patients, 36.0%), followed by secondary education (32 patients, 32.0%), non-formal education (22 patients, 22.0%), and higher secondary education (10 patients, 10.0%). The majority belonged to the lower-income class (86 patients, 86.0%), while 14 patients (14.0%) belonged to the middle-income class.

Table 2: Obstetric Characteristics of the Study Participants (n = 100)

Variable	Category	Frequency (n)	Percentage (%)
Parity	Primipara	74	74.0
	Multipara	26	26.0
Antenatal care	Taken	82	82.0
	Not taken	18	18.0

The majority of participants were primipara (74 patients, 74.0%), while 26 patients (26.0%) were multipara. Antenatal care was received by 82

participants (82.0%), whereas 18 participants (18.0%) had not received antenatal care.

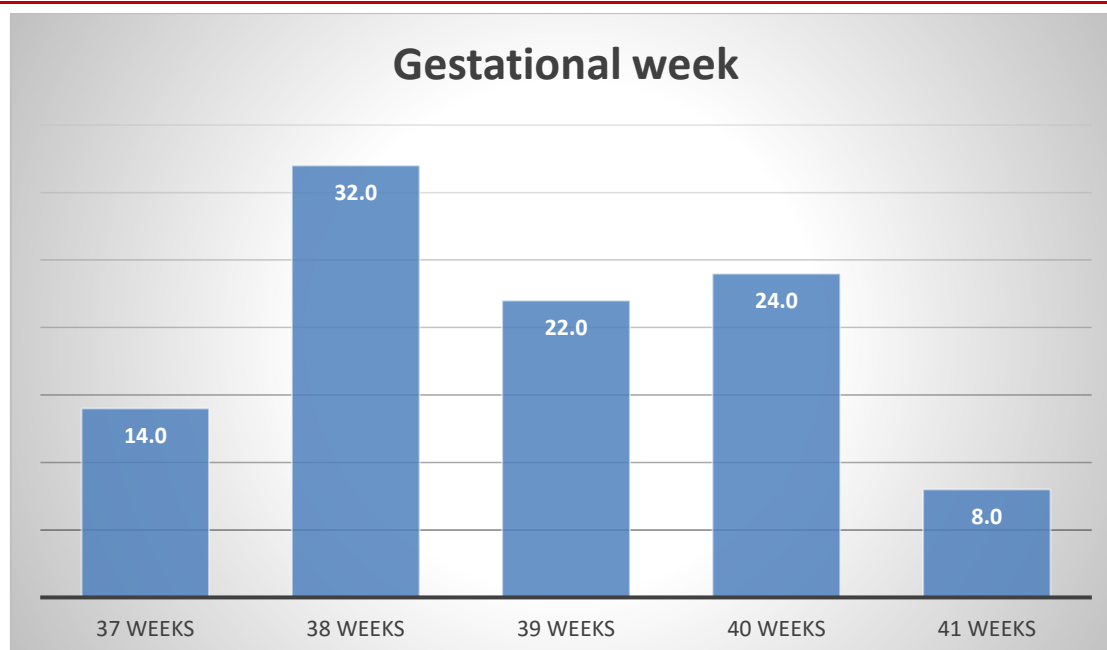


Figure 1: Distribution of the Study Participants According to Gestational Week (n = 100)

The majority of participants were at 38 weeks of gestation (32 patients, 32.0%), followed by 40 weeks (24 patients, 24.0%), 39 weeks (22 patients, 22.0%), 37

weeks (14 patients, 14.0%), and 41 weeks (8 patients, 8.0%).

Table 3: Distribution of Sonographic Estimated Fetal Weight Among the Study Participants (n = 100)

Estimated fetal weight by ultrasonography (kg)	Frequency (n)	Percentage (%)
<2.5	2	2.0
2.5–2.99	36	36.0
3.0–3.49	46	46.0
>3.5	16	16.0
Total	100	100.0
Mean ± SD	3.06 ± 0.42 kg	

The majority of participants had a sonographic estimated fetal weight of 3.0–3.49 kg (46 patients, 46.0%), followed by 2.5–2.99 kg (36 patients, 36.0%) and >3.5 kg (16 patients, 16.0%). Only 2 patients (2.0%)

had a sonographic estimated fetal weight of <2.5 kg. The mean sonographic estimated fetal weight was 3.06 ± 0.42 kg.

Table 4: Distribution of the Study Participants According to Actual Birth Weight (n = 100)

Actual birth weight (kg)	Frequency (n)	Percentage (%)
<2.5	22	22.0
2.5–2.99	20	20.0
3.0–3.49	40	40.0
>3.5	18	18.0
Total	100	100.0
Mean ± SD	3.11 ± 0.16 kg	

The majority of newborns had an actual birth weight of 3.0–3.49 kg (40 newborns, 40.0%), followed by <2.5 kg (22 newborns, 22.0%), 2.5–2.99 kg (20

newborns, 20.0%), and >3.5 kg (18 newborns, 18.0%). The mean actual birth weight was 3.11 ± 0.16 kg.

Table 5: Comparison Between Sonographic Estimated Fetal Weight and Actual Birth Weight (n = 100)

Comparison	Mean (kg)	SD	t	p value
Measurement by ultrasonography	3.06	0.42	2.21	0.028
Actual birth weight	3.11	0.16		

The mean sonographic estimated fetal weight was 3.06 ± 0.42 kg, compared with a mean actual birth weight of 3.11 ± 0.16 kg. The difference between

sonographic estimated fetal weight and actual birth weight was statistically significant ($t = 2.21$, $p = 0.028$).

Table 6: Correlation Between Sonographic Estimated Fetal Weight and Actual Birth Weight (n = 100)

Variables	Statistics	Ultrasonographic estimated fetal weight (kg)	Actual birth weight (kg)
Ultrasonographic estimated fetal weight	<i>r</i> value	1	0.409
	<i>p</i> value	—	<0.001
	N	100	100
Actual birth weight	<i>r</i> value	0.409	1
	<i>p</i> value	<0.001	—
	N	100	100

A positive, statistically significant correlation was observed between sonographic estimated fetal weight and actual birth weight ($r = 0.409$, $p < 0.001$), indicating that higher sonographic estimated fetal weight was associated with higher actual birth weight.

DISCUSSION

Ultrasonographic estimation of fetal weight is an important indicator for obstetric management during labour. Several studies have examined the prediction of birth weight using various methods, including maternal anthropometry, symphysis-fundal height (SFH), abdominal girth (AG), and other maternal factors, as well as the relationship between these maternal factors and birth weight.

This cross-sectional study was conducted in the Department of Obstetrics and Gynaecology of Shaheed Suhrawardy Medical College, Dhaka, from 17th March 2018 to 16th September 2018, among 100 pregnant women at term gestation. The objective of the study was to compare actual birth weight with ultrasonographically estimated fetal weight at term.

In this study, the mean maternal age was 24.74 ± 4.53 years. The majority (56.0%) of women belonged to the 18–25-year age group, 38.0% were in the 26–30-year age group, and the remaining 6.0% were aged >30 years. Among the 100 women, 74.0% were primipara and 82.0% had received antenatal care (ANC) during the current pregnancy. Regarding occupation, 84.0% were housewives, 8.0% were service holders, 6.0% had other occupations, and 2.0% were day labourers. The majority (86.0%) of women belonged to the lower-income class, while 14.0% belonged to the middle-income class. Regarding educational qualification, 58.0% had non-formal or primary-level education, 32.0% had secondary-level education, and 10.0% had higher secondary education.

These findings were consistent with those of other studies. In Eckhart Buchmann's study, the mean age of the women was 25 ± 5.8 years, and 63% of them were primipara [21]. In a previous study examining the relationship between birth weight, sociodemographic

variables, and maternal anthropometry in an urban area of Dhaka, Bangladesh, women aged 17–35 years were studied, and 21% delivered low-birth-weight (LBW) babies. LBW was more common among mothers aged below 20 years and above 30 years, those from low-income groups, and those with little or no education. The mean birth weight among women with higher education and higher income was, on average, 290 g and 260 g higher, respectively, than among uneducated women and those from lower-income groups. The study also showed that maternal weight, together with age, educational level, and income group, correctly predicted just over 35% of LBW cases [22]. Another study showed that, besides antenatal care and the woman's health status, birth order was one of the major factors affecting birth weight [23]. Several studies have also shown that birth weight increases with increasing birth order [24–26].

In the present study, 22.0% of newborns had low birth weight, defined as a birth weight of <2.5 kg. The National Low Birth Weight Survey 2015 in Bangladesh revealed that the mean birth weight of infants in Bangladesh was 2,898 g, while the LBW rate was 22.6%, with a higher prevalence among girls and infants living in slums [27]. Another report from the United States Agency for International Development showed an LBW rate of 22% [28]. A cross-sectional study conducted at Dhaka Medical College Hospital reported that 78.71% of newborn babies had a birth weight of 2.5 kg or more, while 21.29% had low birth weight (<2.5 kg) [29]. In deprived socioeconomic conditions, low birth weight may result from poor maternal nutrition and health over a prolonged period, including during pregnancy, a high prevalence of infections, or pregnancy complications, which are often associated with poverty [27].

In this study, all participants were at term gestation, ranging from 37 to 41 weeks. The majority were at 38 weeks of gestation (32.0%), followed by 40 weeks (24.0%), 39 weeks (22.0%), 37 weeks (14.0%), and 41 weeks (8.0%). These findings indicate that most participants were concentrated between 38 and 40 weeks of gestation. Similar studies have previously been conducted on this topic. In Eckhart Buchmann's study,

the mean gestational age was 39.3 ± 1.6 weeks, and the fetal head was engaged in 25.4% of pregnant women [21]. Another study published in the South African Medical Journal in 2009 showed that, among 294 parturients, the mean gestational age at delivery was 39.2 ± 1.4 weeks, and the fetal head was engaged in 60 cases (20.4%) at the time of examination. The mean SFH was lower with an engaged fetal head than with an unengaged fetal head, with no significant effect on birth weight [21]. A previous study by Watchree Numprasert showed that more than 85% of women had the fetal head at a negative station (above the ischial spines), while approximately 14% had the fetal head at a positive station (below the ischial spines). Among 400 delivered babies, the actual birth weight ranged from 1,900 g to 5,300 g, while the estimated weight obtained using Johnson's formula ranged from 2,325 g to 4,960 g, with a mean of $3,318.16 \pm 351.72$ g. The difference between estimated weight and actual birth weight ranged from -750 to $+530$ g, with a mean difference of 227 ± 180.38 g [17].

In the present study, all 100 women delivered live-born infants. The actual birth weight was 3.0–3.49 kg in 40.0% of newborns, followed by <2.5 kg (22.0%), 2.5–2.99 kg (20.0%), and >3.5 kg (18.0%). The mean actual birth weight was 3.11 ± 0.16 kg. Sonographically estimated fetal weight was 3.0–3.49 kg in 46.0% of cases, followed by 2.5–2.99 kg (36.0%), >3.5 kg (16.0%), and <2.5 kg (2.0%), with a mean estimated fetal weight of 3.06 ± 0.42 kg.

Previous literature has described the usefulness of clinical methods for estimating fetal weight, particularly where ultrasonography is unavailable. The accuracy of such methods may vary according to maternal and pregnancy-related factors [30-32]. Variations in fetal-weight estimation according to gestational age and maternal characteristics have also been reported [33-35]. These findings support the importance of selecting an appropriate method for fetal-weight estimation during late pregnancy and labour.

In the present study, the mean sonographically estimated fetal weight was 3.06 ± 0.42 kg compared with a mean actual birth weight of 3.11 ± 0.16 kg. Thus, ultrasonography slightly underestimated the actual birth weight, and the difference between the two measurements was statistically significant ($t = 2.21$, $p = 0.028$). However, a positive and statistically significant correlation was observed between sonographically estimated fetal weight and actual birth weight ($r = 0.409$, $p < 0.001$), indicating that higher sonographic estimates were associated with higher actual birth weights.

The present findings emphasize the clinical relevance of fetal-weight estimation during the intrapartum period, as an estimation of fetal weight may assist in labour management, anticipation of delivery-related complications, and preparation for appropriate obstetric care. Ultrasonography provides a useful

method for estimating fetal weight, although its accuracy may vary from the actual birth weight.

Limitations of the study

There are some limitations to this study, including the short study period and relatively small sample size. Due to the short study period, women could not be observed throughout the entire pregnancy. Most women presented at term gestation for their first antenatal care (ANC) visit. Some participants also provided incomplete or inaccurate information regarding their previous ANC visits. Therefore, larger and more comprehensive studies are needed to better understand the role of ANC and improve the prediction of birth weight, with the aim of reducing perinatal morbidity and mortality.

CONCLUSION

This prospective cross-sectional study confirms that sonographically estimated fetal weight at term is significantly correlated with actual birth weight. Accurate prenatal estimation of fetal weight in late pregnancy and labour is useful for guiding clinical decision-making and reducing perinatal morbidity and mortality. It may assist obstetricians in decisions regarding instrumental vaginal delivery, trial of labour after caesarean delivery, and elective caesarean section in cases of suspected fetal macrosomia. Although all currently available methods of fetal weight estimation have some degree of inaccuracy, ultrasonographic estimation provides a useful assessment of fetal weight before delivery. The present study demonstrates a significant positive correlation between ultrasonographically estimated fetal weight and actual birth weight, supporting its clinical utility in the management of term pregnancies.

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