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Original Research Article

To Compare the Accuracy of Clinical and Sonographic Estimation of Fetal Weight among Different BMI Antenatal Groups

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ABSTRACT

Objective: To assess the accuracy of clinical and sonographical estimation of fetal weight in different BMI groups of term antenatal patients

Methods: This was a prospective observational study in which 1000 term antenatal patients admitted for delivery were recruited. Their present BMI was calculated to know the effects of current BMI on both clinical and sonographical methods of fetal weight estimation and were divided into four groups – Underweight, Normal, Overweight, and Obese. In each group fetal weight was estimated by both methods and compared with actual birth-weight after delivery.

Statistical Analysis: Bland and Altman plots were used to show the limits of agreement, and intra class correlation coefficients to show the performance for estimating fetal weight.

Results: The accuracy of sonographically estimated fetal weight was better than clinically estimated fetal weight in all groups of BMI as well as for whole group. The ICC of ultrasonic measurements were 0.82(95%CI 0.65-0.89), 0.62(95%CI 0.26-0.80), 0.78(95%CI 0.52-0.83), 0.86(95%CI 0.54-0.94) and 0.80(95%CI 0.71-0.86) respectively for whole sample and underweight, normal, overweight and obese women and found to be statistically significant at 1% level of confidence.

Conclusion: The sonographically estimated fetal weight was better than clinically estimated fetal weight and not affected by maternal BMI.

Key words: estimated fetal weight, body mass index, term antenatal, clinical, sonographically estimated fetal weight

INTRODUCTION

Apart from gestational age, correct estimation of fetal weight is very useful for management of labour. It helps us to decide the mode and place of delivery in order to optimize feto-maternal outcome, e.g. decisions regarding instrumental delivery, trial of labour after LSCS or elective LSCS for patients with suspected macrosomic fetus. If not estimated accurately, it can lead to increased risk of shoulder dystocia if underestimated or increased risk of LSCS if overestimated.

Fetal weight estimation can be done by clinical methods or obstetric ultrasound which in turn could be affected by maternal BMI. Though increased maternal BMI poses a risk for sonographically estimated fetal weight but studies have shown that they are better than clinical palpation in predicting weight. [1-3] Nevertheless, sometimes it causes failure of USG to diagnose fetal anomalies. [4] On the contrary few studies have documented no affect on accuracy of fetal weight estimation in all BMI groups. [5,6]

On the other hand, clinical methods have their own limitations due to inter-individual variation depending on experience of observer in addition to their skills. [7]

This study was done to compare the accuracy of clinical and sonographic estimation of fetal weight in different BMI group of term antenatal patients admitted for delivery.

MATERIALS AND METHODS

This was a prospective observational study conducted at SRMS IMS, Bareilly, between September 2014 to August 2015 among term pregnant patients who were admitted for delivery.

Inclusion criteria were:

- Singleton live pregnancy
- Full term (37-42 weeks of gestation)
- Cephalic presentation
- Intact membranes
- In first stage of labour or admitted for elective induction or LSCS

Exclusion criteria were:

- Multiple pregnancy
- Non-cephalic presentation
- Intrauterine demise
- PROM
- Oligohydramnios/ Polyhydramnios
- Uterine fibroid or any uterine anomaly
- Fetal congenital malformation
- Medical complications like Diabetes, Hypertension, Heart disease etc.

All eligible patients were recruited for study after proper informed consent. Maternal BMI at the time of admission rather than pre-pregnant or 1st trimester was taken to determine the effects of current BMI on the two methods of fetal weight estimation. These were then subdivided into four groups according to their BMI – Underweight (BMI<18.5), Average weight (BMI 18.5-24.9), Overweight (BMI 25-25.9) and Obese (BMI≥30). Selected patients were asked to empty her bladder and lying flat on her back with legs extended, their SFH (Symphysio-fundal height) was calculated using flexible non-elastic measuring tape and rounded to nearest cm. SFH was measured from mid-point of upper border of symphysis pubis to highest point of uterine fundus after centralizing the uterus. Pelvic examination was performed for cervical dilatation and degree of descent of fetal head into pelvis and station of head was calculated ("-" if lower part of fetal head above ischial spine, "+" if below ischial spine & "0" if at the level of ischial spine). Fetal weight was estimated clinically by using Johnson's formula = (SFH-12, if vertex at or above ischial spines or -11, if below level of ischial spines X 155) gm. All patients were then subjected to obstetric ultrasound and their EFBW was calculated using Hadlock's formula. After delivery, their actual birth weights were taken from case notes & delivery summary.

Statistical analysis*:* Bland and Altman [8] plots were used to show the limits of agreement, and intraclass correlation coefficients [9] to show the performance for estimating fetal weight. For visual assessment of limits of agreement, a plot of difference between the true birth-weight and the respective method of fetal weight estimation against the mean values was used. Both the mean difference and limits of agreement are plotted on same graph. ICC was defined as a ratio of variance due to true estimates of fetal weight to the total variance. ICC will be high, if the variance due to difference between estimates of fetal weight and true birth weight is small. An arbitrary cut-off of >0.75 was considered as good agreement. [10] All the analysis was done with help of SPSS version 21 software.

RESULTS

1000 pregnant women were included in this analysis, who delivered within 36-48 hrs of assessment. We divided the whole sample into four categories according to BMI - 36 were in underweight group (BMI<18.5), more than 50% (601) were of normal BMI (18.5-24.9), 253 were in overweight (BMI 25-29.9) and 110 were obese (BMI>30) [Fig.1].

For the whole group, the mean discrepancy between actual birth weight and estimated weight was calculated to be -525g and -163 for Johnson's and sonographic estimation respectively [Table 1(a)]. This revealed that ultrasound has minimum error for the whole sample.

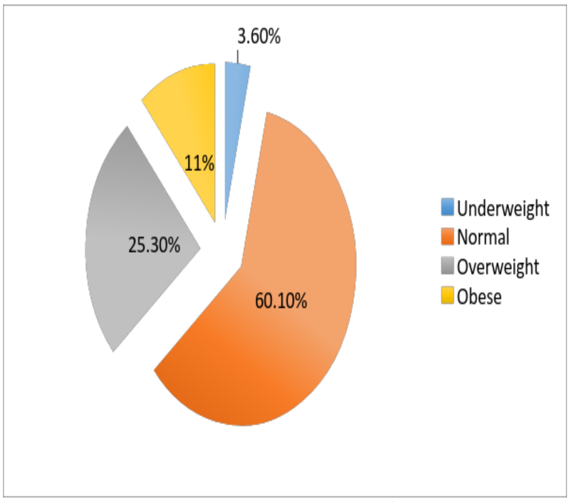

Fig-1: Percentage Distribution of Sample

Table-1(a) The mean birth weight (SD), mean discrepancy between actual birth weight and estimated birth weight (SD) and limits of agreement (2SD) for the whole study group

Whole Group(n=1000)			
	Mean Birth weight gm(SD)	**Mean Actual birth weight-estimated weight gm(SD)**	**Limits of agreement(gm)**
JF	3305(385)	-525(403)	-1331 – 281
Actual	2779(387)	-	-
USG	2042(409)	-163(281)	-725-399

Table-1(b) The mean birth weight (SD), mean discrepancy between actual birth weight and estimated birth weight (SD) and limits of agreement (2SD) for Underweight group

Underweight Group(n=36)			
	Mean Birth weight gm(SD)	**Mean Actual birth weight-estimated weight gm(SD)**	**Limits of agreement(gm)**
JF	2893(450)	-476(553)	-1582-630
Actual	2416(119)	-	
USG	2533(403)	-116(304)	-724-492

Table-1(c) The mean birth-weight (SD), mean discrepancy between actual birth weight and estimated birth weight (SD) and limits of agreement (2SD) for Normal group

Normal Group(n= 601)			
	Mean Birth weight gm(SD)	**Mean Actual birth weight-estimated weight gm(SD)**	**Limits of agreement(gm)**
JF	3232(385)	-456(359)	-1174-262
Actual	2776(321)	-	
USG	2949(379)	-173(271)	-715-369

Table-1(d) The mean birth weight (SD), mean discrepancy between actual birth weight and estimated birth weight (SD) and limits of agreement (2SD) for Overweight group

Overweight Group(n=253)			
	Mean Birth weight gm(SD)	**Mean Actual birth weight-estimated weight gm(SD)**	**Limits of agreement(gm)**
JF	3443(333)	-735(398)	-1531-61
Actual	2708(423)		
USG	2899(411)	-190(237)	-664-284

Table-1(e) The mean birth weight (SD), mean discrepancy between actual birth weight and estimated birth weight (SD) and limits of agreement (2SD) for Obese group

Obese Group(n=110)			
	Mean Birth weight gm(SD)	**Mean Actual birth weight-estimated weight gm(SD)**	**Limits of agreement(gm)**
JF	3518(220)	-443(426)	-1295-409
Actual	3075(493)	-	
USG	3134(447)	-59(384)	-827-709

Table 1(b) to 1(e) shows the mean estimates of fetal weight, the mean discrepancy between actual birth weight and the two methods of estimating fetal weight in different BMI groups along with limits of agreement. Among all BMI groups, both ultrasound and Johnson's method overestimated the actual birth weight.

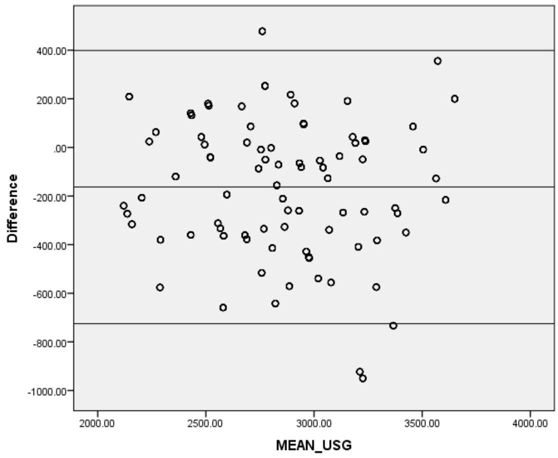

Fig. 2(a) Limits of agreement plot of the difference between the actual birth weight and Ultrasound estimate against the mean of their values in women in the whole group

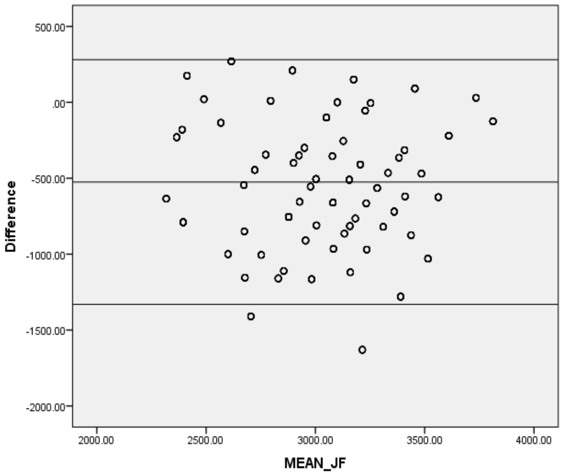

Fig.2 (b) Limits of agreement plot of the difference between the actual birth weight and Johnson's estimate against the mean of their values in women in the whole group

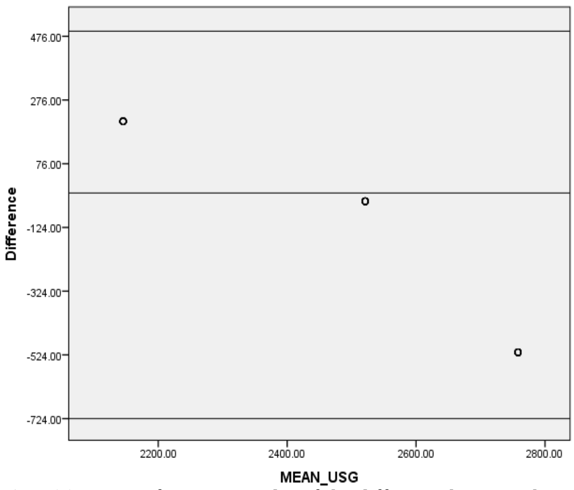

Fig.3 (a) Limits of agreement plot of the difference between the actual birth weight and Ultrasound estimate against the mean of their values in Underweight women

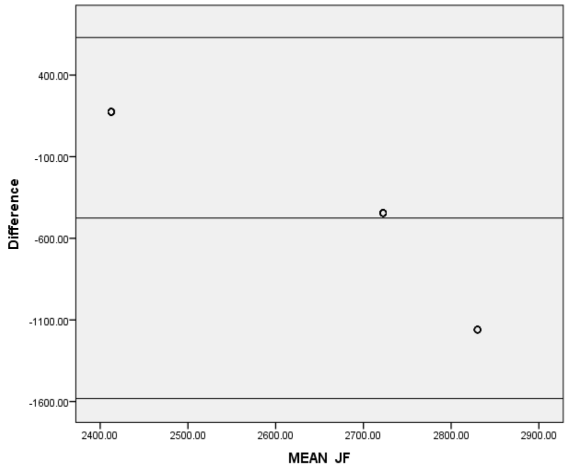

Fig.3 (b) Limits of agreement plot of the difference between the actual birth weight and Johnson's estimate against the mean of their values in Underweight women

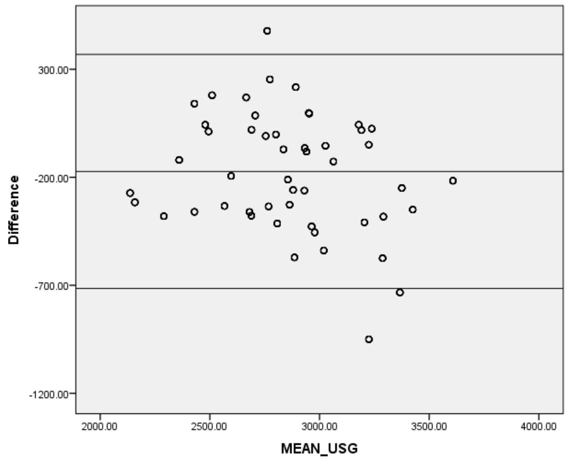

Fig.4 (a) Limits of agreement plot of the difference between the actual birth weight and Ultrasound estimate against the mean of their values in Normal women

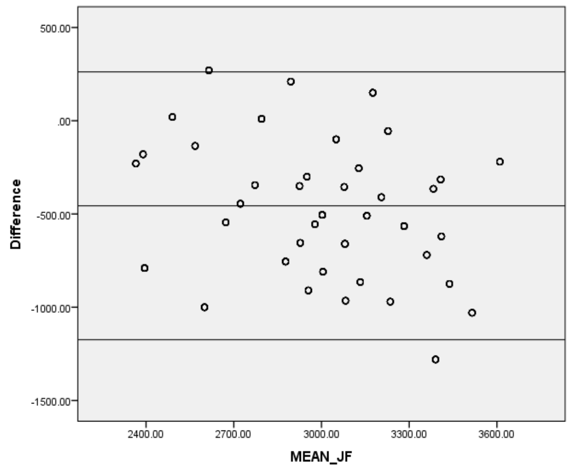

Fig.4(b) Limits of agreement plot of the difference between the actual birth weight and Johnson's estimate against the mean of their values in Normal women

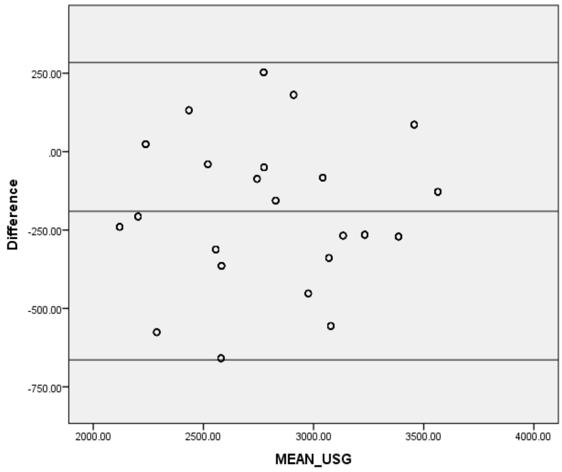

Fig.5(a) Limits of agreement plot of the difference between the actual birth weight and Ultrasonic estimate against the mean of their values in Overweight women

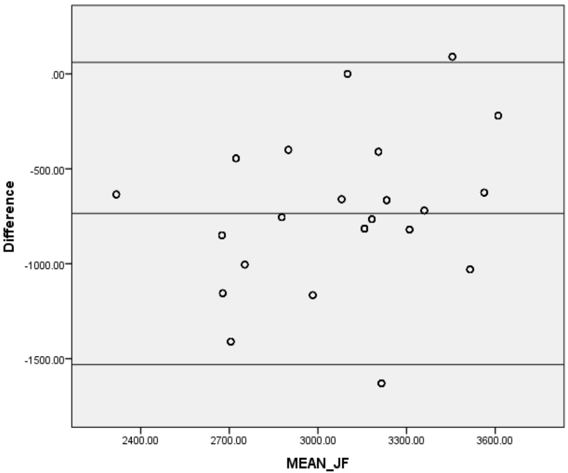

Fig.5(b) Limits of agreement plot of the difference between the actual birth weight and Johnson's formula estimate against the mean of their values in Overweight women

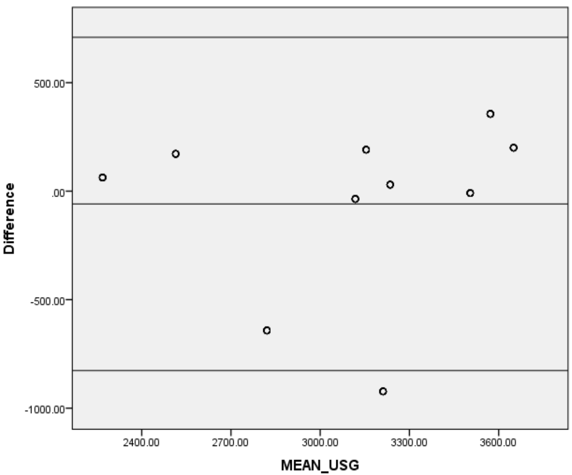

Fig.6 (a) Limits of agreement plot of the difference between the actual birth weight and Ultrasound estimate against the mean of their values in obese women

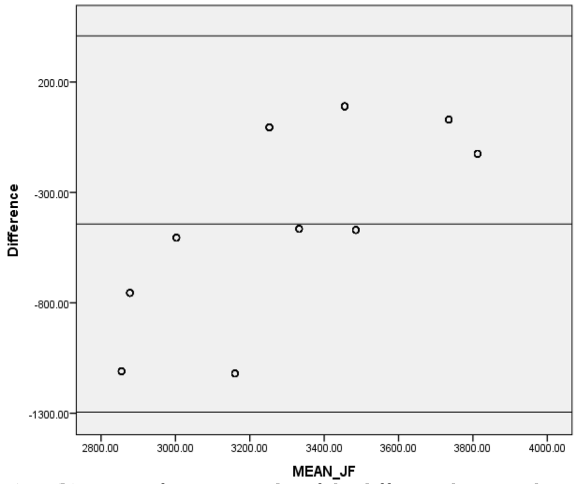

Fig.6 (b) Limits of agreement plot of the difference between the actual birth weight and Johnson's estimate against the mean of their values in Obese women

Figure 2(a) to 6(b) shows the limits of agreement between the differences from actual birth weight to the mean estimated fetal weight for both methods in different groups of BMI. It was quite obvious that the agreement between ultrasound estimation of fetal weight was higher than Johnson's formula estimation in whole sample as well as in all different categories of BMI. The mean difference (2SD) of approximately (2200g) was highest in underweight group, followed by obese group women (1700g) and then (1500g) in overweight group, lowest in normal group women (1400). As we had small sample size in underweight group, so in the figures outliers were not presented.

The ICC for sonographic method of fetal weight estimation in total as well as in different groups of BMI was higher in comparison to Johnson's formula estimate. For total sample size, it was 0.82(0.65-0.89) and for overweight group it was highest 0.86(0.59-0.94) among all four groups of BMI and found to be significant at 1% level of significance. This shows that sonographic estimation was closer to the actual value as compared to Johnson's formula for estimating fetal weight in all BMI groups.

Table-2: The ICC (95% CI) for the whole group and according to BMI categories

	Whole Group (n=1000) ICC(95% CI)	Underweight Group (n= 36) ICC(95% CI)	Normal weight Group (n=601) ICC(95% CI)	Overweight Group (n=253) ICC(95% CI)	Obese Group (n=110) ICC(95% CI)
JF estimate	0.382(-0.178-0.663)**	-0.510(-1.344-0.267)*	0.421(-0.177-0.697) **	0.274(-0.172-0.592) **	0.369(-0.122-0.635) **
USG estimate	0.818(0.646-0.891)**	0.619(0.267-0.804)**	0.770(0.523-0.863) **	0.864(0.548-0.938) **	0.798(0.705-0.861) **

*not significant p=0.991, ** Significant at 1% level of confidence

DISCUSSION

There are many methods to assess the validity of continuous variables like birth weight. [9] In this study we opted for Bland and Altman's limits of agreement and intra class correlation coefficient (ICC) and as both the methods were blinded, this fulfills the criteria to assess validity. [11] Thus, our study suggests that sonographically estimated fetal weight is more reliable as compared to clinical fetal weight estimation by Johnson's method. This finding is similar to that observed by Farrell *et al* [12] who concluded that the accuracy of ultrasound estimation was better than maternal and clinical estimation of fetal weight and not influenced significantly by maternal BMI. Many previous studies suggested sonographic estimation of fetal weight actually may be more accurate at predicting birth-weight in term patients with fetus weighing more than 4000g, [1-3,13] whereas other studies suggest its superiority over clinical fetal weight estimation mainly in preterm patients. [14] Hence, clinical method of fetal weight estimation can only be recommended for use as a screening test for normal weight and macrosomic fetus. [15] Further, study by Blann [16] found that post-amniotomy clinically estimated fetal weight had strongest correlation with actual birth weight.

Although, ultrasound is best estimator but in practical, the large magnitude of error produced by the limit of agreement would seem unacceptable.

CONCLUSION

Thus, fetal weight estimation by ultrasound plays a major role in obstetric decision making and is currently the most accurate method available in clinical practice for all BMI groups of antenatal patients.

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