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Research Article

CORRELATION BETWEEN SONOGRAPHICALLY DETECTED PRENATAL WEIGHT AND ACTUAL BIRTH WEIGHT OF NEONATES

***Zoya Irfan Khan[1] and Kachewar S.G.[2]**
[1]Department of MBBS, Rural Medical College, PIMS (DU), Loni
[2]Department of Radio-diagnosis, PDVVPF`s Medical College, Ahmednagar
**Author for Correspondence*

ABSTRACT
Objective was to evaluate the correlation between sonographically detected prenatal weight and actual birth weight of neonates. In this retrospective analytical study all consenting primigravida females with full term normal pregnancy and normal vaginal delivery undergoing ultrasound within 48 hours before delivery were enrolled in study. Prenatal weight was determined by ultrasound scan of the fetus using Hadlock`s method. Post delivery neonatal weight was measured using digital weighing machine. The data in 100 primigravida was be pooled and statistically analyzed using Microsoft excel software. The range of fetal weight in this study was 1037- 4087 grams, while the neonatal weight ranged from 1165 - 4509 grams. The mean fetal weight was 2591.48 grams and had a standard deviation of 530 grams. The mean neonatal weight was 2629.4 grams and had a standard deviation of 495 grams. A positive correlation was found between neonatal weight and fetal weight as given by Karl Pearson`s Correlation Coefficient [r = + 0.5503] and this was significant as given by Students *'t'* test value of 53.58. In order to accurately predict the exact expected neonatal weight from the known sonographically determined fetal weight, the regression equation was y = 0.5791 x + 1111.9; where y is the neonatal weight and x is the fetal weight. A proper knowledge of exact fetal weight is important to plan how to receive the neonate post-delivery. This study not only proves the positive correlation between neonatal weight and fetal weight but also scientifically derives the regression equation so that an accurate prediction of actual birth weight of the neonate can be derived from the fetal weight.

Keywords: *Birth Weight; Correlation; Fetal Weight; Neonatal Weight*

INTRODUCTION
Pregnancies with low or excessive neonatal weights at delivery have been found to be at an increased risk of complications during labour as well as during the puerperal period (Wilcox *et al.,* 1993).
It has also been concluded that neonates with low birth weight (< 2500 g) or high birth weight (>4000 g) are at increased risks of peripartum morbidity and mortality (Basso *et al.,* 2006).
In low birth fetuses; mostly fetal prematurity contributes to complications and sometimes intrauterine growth restriction plays a role in it too (Wilcox *et al.,* 1992). In high birth fetuses, potential complications are in the form of possibility of shoulder dystocia during delivery leading to brachial plexus injuries, bony injuries, and even intrapartum asphyxia. Risks to mother are in the form of birth canal injuries and postpartum hemorrhage (Coutinho *et al.,* 2011).
Discrepancies in ultrasound determined fetal weight (FW) and neonatal weight (NW) post delivery can have adverse impact not only on the neonate or the mother but also on the preparedness and adequacy of measures available for neonatal reception. A proper knowledge of exact neonatal weight is important to plan how to receive the conceptus post-delivery. This gives time and space for arranging emergency services if neonatal weight is very low or very high; ultimately minimizing intrapartum and peripartum risks for both fetuses and mothers and possible litigations on medical service providers.

MATERIALS AND METHODS
Appropriate consent from the Institutional Ethical Committee and each participating mother was obtained. This was a retrospective analytical study which included all consenting full term normal primigravida females that delivered normal neonate by normal vaginal delivery. It was ensured that for

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inclusion in the study, the obstetric ultrasound was done within 48 hours before delivery. Females with eclampsia, preeclampsia, gestational diabetes and any chronic disorder were excluded from the study. Also, the fetuses with significant abnormal findings in the USG scan like growth retardation and various malformations were excluded.

Ultrasound [USG] Examination

USG examination was carried out using Siemens Sonoline G-60 USG machine. USG was carried out on the same machine and by the same experienced Sonologist.

Prenatal parameters recorded by USG examination were the expected date of delivery and Prenatal birth weight i.e. Fetal weight (FW). Postnatal birth weight i.e. Neonatal weight (NW); was recorded using digital weighing machine.

A total of 100 participants were successfully enrolled in this study over a 3 month period. The data was pooled and analyzed using Microsoft Excel software. Karl Pearson`s Correlation Coefficient was used to determine the correlation between NW and FW and Students '*t*' test value was used to assess the significance of this correlation**.** Regression equation was derived so that exact NW can be predicted from the known sonographically determined FW.

RESULTS AND DISCUSSION

Results

The data in 100 primigravida was pooled and analyzed using statistical tests in EXCEL programme by the Department of Statistics of this Institute.

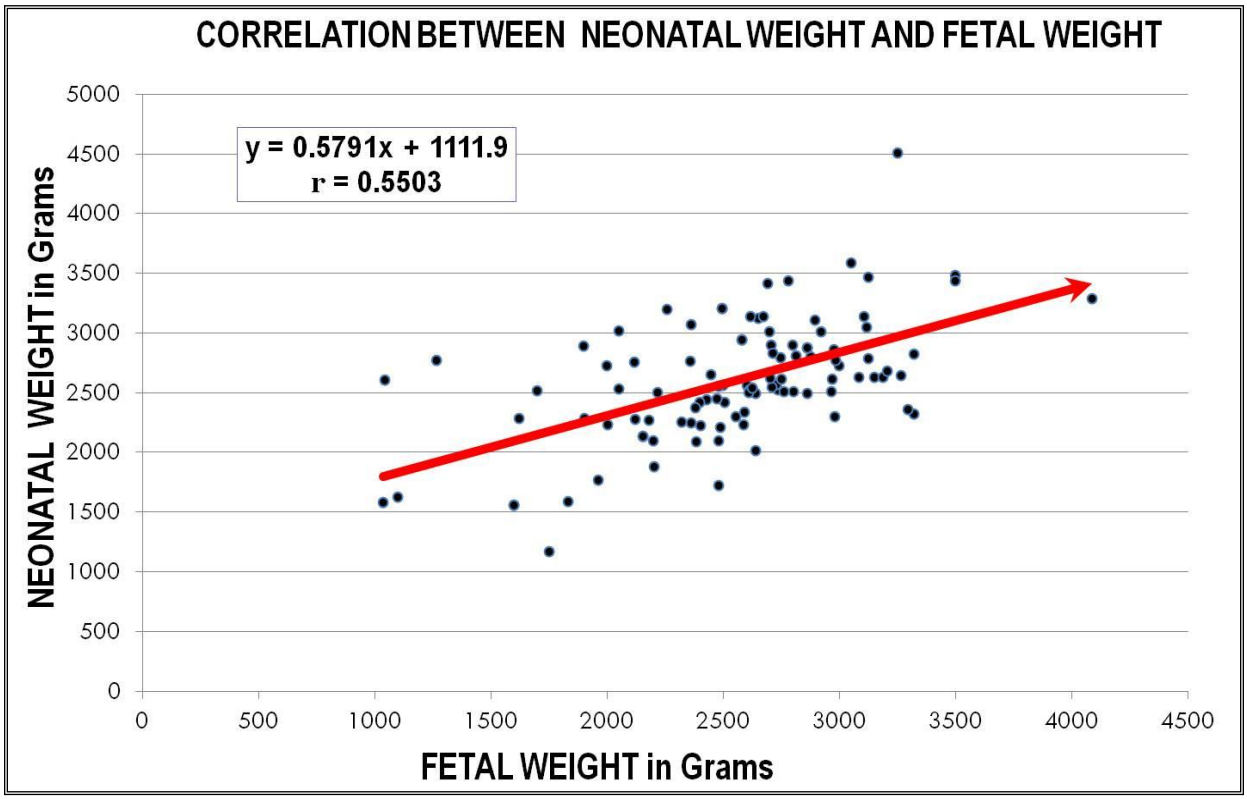

Figure 1: Correlation Diagram between Neonatal Weight and Fetal Weight

The range of FW in this study was 1037- 4087 grams, while the NW ranged from 1165 - 4509 grams. The mean FW was 2591.48 grams and had a Standard Deviation [S.D.] of 530 grams. The mean NW was 2629.4 grams and had a S.D. of 495 grams.

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To study the correlation between Neonatal Weight [NW] and Fetal Weight [FW]**,** a Correlation Diagram [Figure 1] was constructed using the Excel Statistical Programme. FW was plotted on X-axis and the NW was plotted on Y-Axis. The round blue dots demonstrate the scattering of different values of FW and NW against each other.

Correlation between Fetal Weight [FW] in grams and Neonatal Weight [NW] in grams was studied. Significance of difference was studied by Students *t* Test.

The Red Line in figure 1 is the Line of Regression of FW on NW. It starts on the left side of diagram at a lower base and gradually slopes upwards as it passes to the right side of the diagram, indicating that with increasing values of FW; the NW too was increasing. The slope of this line is used to find the value of '**r'- the Karl Pearson`s Correlation Coefficient.**

A positive correlation was found between NW and FW as given by Karl Pearson`s Correlation Coefficient [**r = + 0.5503**] and this was significant as given by **Students '*t*' test value** of **53.58.**

In order to accurately predict the NW from the known and ultra-sonographically determined FW, the following **Regression equation** was derived statistically.

y = 0.5791x + 1111.9 where y is the NW and **x** is the FW.

Discussion

Optimum maternity care and outcome is possible only if fetal weight is accurately known. This knowledge is vital for proper counseling, differential diagnosis, planning of delivery and arrangements for receiving the neonate (Wilcox *et al.,* 1993).

It has been realized by one and all that as neonatal complications are more associated with low birth weight (Coutinho *et al.,* 2011), and labor abnormalities as well as neonatal complications with large birth weight (Fuchs *et al*., 2013) correct prediction of NW from FW is vital.

In pregnancies where preterm delivery is a possibility, optimum prenatal counseling about neonatal survival, delivery mode, or the neonatal health care facility that is best suited; is based largely on the FW that is supposed to predict NE accurately (Coutinho *et al.,* 2011).

If very low birth weight babies are delivered vaginally there are increased chances of skull and extremity injuries and splenic or hepatic trauma secondary to prematurity. Thus perinatal morbidity and mortality rates may be affected adversely (Coutinho *et al.,* 2011). Performing cesarean delivery for extreme preterm babies sonographically predicted to have low NW and low chance of survival where specialized health care facilities are not available, may not be very justifiable. Such deliveries should preferably be planned at advanced centers. This planning can only be done if NW can accurately predict FW. Delivery of neonates with large weights, more than 4,000 grams may lead to prolonged labor, operative or traumatic delivery, and fetal neurologic injuries (Fuchs *et al*., 2013). Previous difficult deliveries including shoulder dystocia, diabetic mothers, macrosomic babies, maternal birth canal injuries are the clinical indicators which should raise the suspicions that neonate with a large weight is expected. Here again lies the importance of accurate NW to predict the exact FW. This information is vital not only in planning for a vaginal birth after a previous cesarean section but also in intrapartum management of fetuses with breech presentation.

Ultrasound determination of FW to predict NW is a non invasive, repeatable, cost effective and a time proven objective technique. It is widely available and has minimum inter and intra observer variability. But studies across the world have also pointed the possibility of differences between the FW and NW (Ugwu *et al.,* 2014). Hence, it is important to perform Institutional specific scientific studies to find the exact correlation between FW and NW and the relation between them in a given institution so that NW can be best determined based on the scientific study. With this aim in mind the present study was conducted.

In the present study, there was a positive correlation between NW and FW as given by Karl Pearson`s Correlation Coefficient **[r =+ 0.5503**] and this was highly significant as given by **Students '*t*' test value of 53.58.** The regression equation was **y = 0.5791x + 1111.9.**

The findings of the present study are compared with following studies across the world and are tabulated for ease of understanding in Table 1.

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Table 1: Comparison of present study with similar studies across the world

Reference	Location	Sample Size	Conclusion	r
Freire *et al.,* (2010)	Brazil	122	No significant difference between FW and NW	0.96
Colman *et al.,* (2006)	New Zealand	1177	Significant difference between FW and NW	0.77
Bajrajacharya *et al.,* (2012)	Nepal	150	Significant difference between FW and NW	----
Colman *et al.,* (2012)	Tanzania	800	No significant difference between FW and NW	0.89
Present Study	India	100	Significant difference between FW and NW	0.55

Studies by Freire from Brazil (Freire *et al.,* 2010) as well as that by Colman from Tanzania (Colman *et al.,* 2012) found good correlation was established between actual birth weight and estimated birth weight meaning that there was no significant difference between FW and NW. But studies by Colman A from New Zealand (Colman *et al.,* 2006*)* and Bajrajacharya from Nepal (Bajrajacharya *et al.,* 2012)found a significant difference between FW and NW. The present study is in agreement with studies by Colman A and by Bajrajacharya.

Limitations of this Study are that this study was carried out in a Single Institute and the Sample Size is also smaller. Hence, Multicentric Studies and Studies with Larger Sample Size are the need of the hour to validate the findings of the present study, before accepting the findings as a norm.

Clinical Implications of this study are that it serves as the basis for-

- **Obstetricians –** To know the NW from reported FW; so that they can plan correct mode of delivery i.e. Normal Vaginal Delivery / LSCS / Watchful Expectancy under expert supervision.
- **Pediatricians –** To plan in advance about how to receive the neonate i.e. whether special arrangement has to be made / routine arrangements would suffice.

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