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Original Article

Prediction Of Birth Weight By Regression Equations

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Abstract

Introduction: The high neonatal morbidity and mortality rates attest to the fragility of life during this period. In the United States, of all the deaths occurring in the first year, two thirds are in the neonatal period. **Methods:** One hundred fifty newborns examined within 48 hours of their birth in the Department of Obstetrics and Gynecology/ Pediatrics at Guru Gobind Singh Medical College and Hospital, Faridkot. They were weighed naked on electronic weighing scale to the nearest of 5 grams and all anthropometric measurements taken by a fiber glass measuring tape to the nearest of 0.1 cm. **Results:** The present study is an attempt to isolate by a multiple regression analysis some factors probably influencing the birth weight and to utilize the results of the analysis for statistical prediction of birth weight at different gestational ages for various combinations of factors. **Conclusion:** One method is not significantly better than the other, when accuracy in prediction aimed, it is better to use the two methods and compare the results, and then decide on the selection of favorable method.

Keywords: Low birth weight, regression equations, prediction

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INTRODUCTION

The neonatal period is a highly vulnerable time for an infant. The high neonatal morbidity and mortality rates attest to the fragility of life during this period. In the United States, of all the deaths occurring in the first year, two thirds are in the neonatal period. [1] Body size is obviously proportional to age, not only in the foetus but also throughout childhood until the time of fusion of skeletal. Thus an infant's size at birth reflects the average growth rate for that infant from conception to birth, although not necessarily a steady stage, as there may have been periods of rapid and slow growth. Problems arise when the distribution of size at birth of different infants born at different gestation ages is used to make inferences about 'normal' foetal growth. Impairments in foetal growth can have adverse consequences in infancy and childhood in terms of mortality, morbidity, growth and performance. It has even been suggested that restriction of foetal growth may increase the risk of ischaemic heart disease, hypertension, obstructive lung disease and diabetes in adulthood. [2] Thus the birth weight of an infant broadly reflects the quality of its intra-uterine development. It is an important parameter which could be indicative of: (i) the immediate viability of the neonate; and (ii) the state of maternal health/nutrition during pregnancy. From the public health point of view, the mean birth weight in a community may provide a broad indication of the quality of maternal health/nutrition care that is available to it. Birth weights could be a useful criterion in monitoring trends with respect to improvements in the quality of antenatal care. [3 The periodic measurement of anthropometric variables in different

population and regions of a country reflect changes in children nutrition and health status and are a reliable tool to evaluate social health. [4] The main advantages of the measurements described above are practical, simple, non invasive, inexpensive, portable and highly suitable for pediatric use in the ward, clinic or community. [5]

MATERIAL AND METHODS

The study was conducted in the Department of Obstetrics and Gynecology/ Pediatrics at Guru Gobind Singh Medical College and Hospital, Faridkot. One hundred fifty newborns were examined within 48 hours of their birth in this hospital during May-December 2012. A random sampling technique was adopted to recruit the study subjects. The study included both term and pre-term newborns. Gestational age was calculated as total duration of pregnancy in weeks from first date of the last normal menstrual period (LMP) to the time of delivery. Gestational ages of these newborns ranged from 31 to 44 weeks.

Procedure:

- Babies were weighed naked on electronic weighing scale to the nearest 5 gm.
- Mid upper arm circumference (MUAC) was measured at the mid-point of the left upper arm between the tip of acromion process and olecranon process with a fiber glass measuring tape to the nearest 0.1 cm.
- Head circumference (HC) was measured with the help of a fiber glass measuring tape to the nearest 0.1 cm. Maximum occipitofrontal circumference of head was recorded.
- Chest circumference (CC) was measured at the level of nipple by a fiber glass measuring tape to the nearest 0.1 cm at the end phase of expiration.
- Crown heel length (CHL) was recorded to the nearest 0.1 cm on an infantometer with the baby supine, knees fully extended and soles of feet held firmly against the foot board and head touching the fixed board.
- Mid calf circumference(MCC) was measured with the help of a fiber glass measuring tape to the nearest 0.1 cm at the level of the greatest posterior protrusion of calf in semi
- flexed position of leg.

OBSERVATIONS AND RESULTS

The present study was carried out in one hundred fifty newborns in the Department of Obstetrics and Gynecology/ Pediatrics at Guru Gobind Singh Medical College, Faridkot and following observations were recorded.

In the present study, females (52.7%) outnumbered males (47.3%).

This fig-2 shows the distribution of newborn according to birth weight. Maximum numbers of newborns (38%) were in the birth weight range of 2500-2999 gm. In newborns weighing < 2500 gm, maximum number (26% of total) was in 2000-2499 gm group. This group of newborns needs only level-I care which can be given at home/PHC level by mother under guidance of AWW, ASHA worker, ANM or LHW. Only 10 newborns (6.6% of total) fell in the category of weight < 1500 gm, 1.3% were ELBW & 5.3% were VLBW.

The incidence of low birth weight was 48.66%. This included 1.33% of extremely low birth weight and 6.66% very low birth weight.

Table 1 Estimation of low birth weight by chest circumference of newborns

Chest circumference (cm)	Sensitivity (%)	Specificity (%)	Average (%) (sensitivity+specificity/2)
<29.45	86.3	93.5	89.9
<29.60	89	89.6	89.3
<29.75	91.8	87	89.4
<29.90	91.1	85.7	88.4

CI 95% = 94-98.9

P Value = .000

Highest average value is 89.9% so best cut off point for chest circumference is 29.45 cm.

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Fig-1 Low birth weight Distribution:-

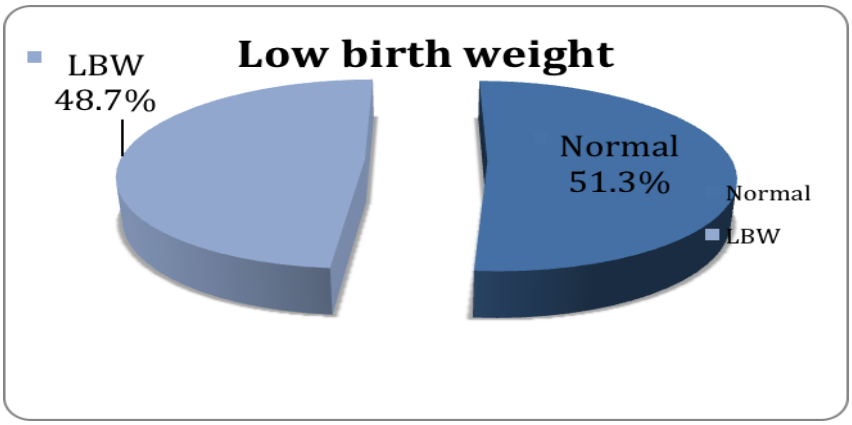

Fig-2 Distribution of newborns according to birth weight

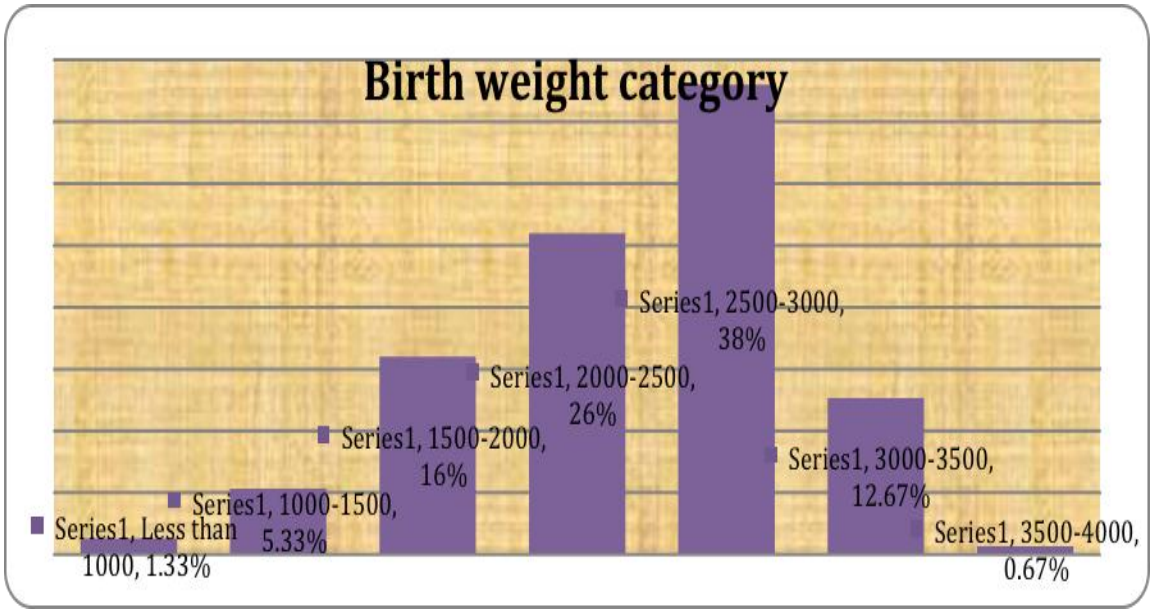

Table 2 Estimation of low birth weight by mid calf circumference of newborns

Mid calf circumference (cm)	Sensitivity (%)	Specificity (%)	Average (%) (sensitivity+specificity/2)
<10.55	82.2	97.4	84.3
<10.65	83.6	96.1	89.8
<10.75	90.4	96.1	93.2
<10.85	93.2	88.3	90.7

CI 95% = 94.3-99.6 P Value = .000

Highest average value is 93.2% so best cut off point for mid calf circumference is 10.75 cm. Table 3 shows the simple regression equations for prediction of birth weight of newborns from different anthropometric measurements.

Table-3 Simple regression equations for estimating birth weight

Anthropometry Adjusted R^2	Regression equations	p value
CHL(cm) .893	**WT=-4836.558+156.727CHL**	**.000**
HC(cm) .811	**WT=-5062.841+229.218HC**	**.000**
CC(cm) .897	**WT=-3490.021+201.574CC**	**.000**
MUAC(cm) .856	**WT=-1859.087+456.123MUAC**	**.000**
MCC(cm) .894	**WT=-2160.357+431.588MCC**	**.000**

BW=Birth-Weight, CHL=Crown heel length, HC=Head circumference, CC=Chest circumference, MUAC=Mid upper arm circumference, MCC=Mid calf circumference

DISCUSSION

In routine clinical practice the comparison of the weight of a newborn fetus or child with a standard reference is one of the methods used for judgement of its degree of development. It follows that this method requires availability of standard references. Several studies have tried to present standard reference materials. In Sweden, Engstrom & Sterky (1966) studied the birth weight of a primary material of 92 348 children born at various gestational lengths during 1956-07-01 - 1957-06-30, which means the majority of all children or liveborn fetuses in Sweden during this period (1 10 000). From the material were excluded all cases of stillbirth, malformation, multiple pregnancy, maternal diabetes, and toxemia of pregnancy. Furthermore, only mothers with regular menstrual intervals (21-35 days) were accepted for further evaluation. [6] Parameters of growth are the most sensitive indicators of nutritional status of a population. [7] In this study of 150 newborns delivered at department of gynecology/pediatrics at Guru Gobind Singh Medical College and Hospital, the birth weight ranged from 920 to 3500 grams with a mean of 2398±560 gm. One study in Bangladesh showed mean birth weight of 2889±468 gm [8]. Other study in India showed 2678±454 gm [9]. Which is higher than our study, but recently a study in Jansi (UP) showed a mean birth weight of 2348±505 gm [10]. This matches to our study. Many authors [8, 10, 11] given regression equations. In present study regression equations showed for prediction of birth weight. Kumarasiri et al. (2013) conducted study on accuracy of ultrasound estimated fetal weight formulae to predict actual birth weight after 34 weeks: prospective validation study. This was a prospective validation study done at General Hospital Ampara. The objective of this study was to determine the accuracy of established ultrasound EFW formulae to identify small and large for gestational age fetuses when used after 35 weeks gestation. An ultrasound examination was performed and fetal biometry was documented within one week before the delivery in well dated pregnancies. In conclusion no preferred formula for the ultrasound EFW was determined from this study. The size of the random measurement errors remains a major limitation to confident use of these formulae in clinical practice. Therefore, clinicians should be aware of these limitations before taking clinical decisions based on ultrasound EFW. [12] Titisari et al. (2013) conducted study on Risanto's Formulas is more Accurate in Determining Estimated Fetal Weight Based on Maternal Fundal Height. This was a cross sectional study conducted at Dr. Sardjito Hospital and 16 affiliated hospital in Central Jawa which might represent Malay race. To compare the accuracy of Johnson's and Risanto's formulas in determining estimated fetal weight based on maternal fundal height (FH). Mean EFW of Johnson's formula was 3136 ± 392.2 grams and EFW of Risanto's formula was 3056 ± 322.5 grams and mean actual birth weight was 3021 ± 341.1 grams. The mean difference between EFW of Johnson's formula and the actual birth weight was 156.1 ± 107.3 grams and mean difference between EFW of Risanto's formula and the actual birth weight was 100.8 ± 86.1 grams. Concluded that those two differences was statistically significant (p=0.001). This study showed that Risanto's formula was more accurate than Johnson's in predicting birth weight based on the maternal Fundal height. [13]

CONCLUSION

According to the results of present study, one method is not significantly better than the other, when accuracy in prediction aimed, it is better to use the two methods and compare the results, and then decide on the selection of favorable method.

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