Original Article

A study on calf circumference at birth as a screening indicator to predict low birth weight babies in and around rural area

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ABSTRACT

Background: Birth weight is a significant indicator for healthy survival and overall growth and development of the child. Appropriate timely care of low birth weight (LBW) newborns is important but it is difficult in developing countries since many are home deliveries with inadequate facilities to weigh the newborn. **Objective:** The present study is an attempt to utilize calf circumference (CC) as a screening indicator to predict LBW babies at birth. **Materials and Methods:** A hospital-based prospective cross-sectional study was conducted in a tertiary care hospital Mandya, Karnataka for a period of 3 months between September 2020 and December 2020 comprising total of 100 neonates delivered during this study period. Birth weight was recorded using a digital weighing scale within 24 h of the delivery. CC was measured according to the standard guidelines. Statistical analysis was performed using the SPSS statistical software. **Results:** The majority of mothers were in the age group of 20–24 years. Among 100 newborns, 21.00% were LBW babies. The mean CC of LBW babies was 9.53±1.10 cm, whereas for the normal weight babies, it was 10.80±1.05 cm. Pearson's correlation coefficient between CC and birth weight was statistically significant ($p<0.01$). The best cutoff value for CC to predict LBW babies was 9.70 cm. The sensitivity for the best cutoff value was 80.21% and specificity was 41.56%. **Conclusion:** Measuring CC was found to be a good test with higher sensitivity but lower specificity. Hence, it can be used as one of the screening indicators to predict low birth weight babies in remote and rural areas.

Key words: Calf circumference, Low birth weight, Newborn

Neonatal mortality is an increasingly important public health issue in developing countries such as India. Babies weighing birth weight <2500 g are termed as low birth weight (LBW) as per the World Health Organization (WHO). The risk and proportion of deaths are higher in LBW babies compared to normal birth weight [1].

The prevalence of LBW varies significantly across countries; however, the majority of them occur in poor income countries. India has the highest incidence with the highest number of LBW babies up to 7.5 million per year [1]. Globally, it is estimated that 15–20% of all births accounts for LBW, representing more than 20 million births a year. To combat this problem, the WHO has set global nutrition targets with the goal to achieve a 30% reduction of the number of infants born as LBW by the year 2025, indicating a reduction from approximately 20 million to about 14 million infants with low weight at birth per year [2].

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Recording of birth weight is universally used as a measure of LBW and ease of recording in the hospital setting. However, in developing countries such as India, births which take place at home are conducted by traditional birth attendants or relatives; estimation of birth weight is a problem due to unavailability of weighing scales and trained personnel [3]. Globally according to the UNICEF, the hospital delivery rate accounts for 90.9% and the remaining 9.1% of accounts for home deliveries [4].

As LBW continues to be a significant public health problem globally with a range of both short- and long-term consequences, early identification of LBW infants is the highest priority to provide effective perinatal care [5]. Several studies have been done in this context for finding suitable substitute screening indicators by utilizing other anthropometric measurements such as thigh circumference (TC) and head circumference (HC). For identification of LBW infants in remote and rural areas, where proper weighing machines are not available. The present study is an attempt to correlate calf circumference (CC) with birth weight as a screening indicator to predict LBW babies at birth.

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MATERIALS AND METHODS

A prospective cross-sectional study was conducted at the Department of Pediatrics, Adichunchanagiri Institute of Medical Sciences, Mandya, Karnataka, India, during the period between September 2020 and December 2020 comprising a total of 100 neonates delivered during this study period. All healthy neonates with term gestation were recruited in the study after obtaining written consent from the parents or legal guardians. Preterm neonates, sick neonates who got admitted in the neonatal intensive care unit within 24 h of birth, and those with congenital malformations were excluded from the study.

Post-natal mothers were interviewed using a pre-designed questionnaire capturing the details such as age, parity index, education status, the period of gestation, socio-economic status according to modified Kuppuswamy classification, and any significant associated maternal illness. Newborn details such as gender, date of birth, mode of delivery, and anthropometric measurements such as weight, length, HC, mid-arm circumference, chest circumference, TC, and CC were taken in a warm environment using standard technique and instruments. The naked birth weight of the babies was measured on the digital weighing scale to the nearest 5 g, protective measures to prevent hypothermia were taken while weighing the baby. CC was measured using a non-elastic, flexible measuring tape to the nearest 0.1 cm at the most prominent point in the semi flexed position of the right leg.

Data entry was done in a Microsoft Excel sheet. Statistical analysis was performed using the SPSS statistical software. Qualitative variables were expressed in percentages. Continuous variables were expressed in mean and standard deviation. Pearson's Correlation coefficient was used to relate between continuous variables. $p<0.05$ was taken as a significant level.

RESULTS

In our study population, majority of the mothers were in the age group of 20–24 years (50.00%). The majority of the mothers were educated up to primary school (39.00%). Among 100 mothers, 57.00% were delivered by lower segment caesarean section and the remaining 43.00% by normal vaginal delivery. Among the 100 newborns, 60.00% of them were male babies and 21.00% were LBW babies (Table 1).

The mean CC of LBW babies was significantly lower (9.53±1.10 cm) than that in the normal weight babies (10.80±1.05 cm), ($p<0.05$). In this study, the Pearson's correlation coefficient between CC and birth weight to screen LBW was statistically significant ($p<0.01$), as shown in Fig. 1.

The best cutoff value for CC was 9.70 cm. The sensitivity for the best cutoff value for CC was 80.21% and specificity was 41.56%. Positive and negative predictive values were 78.35% and 50.42%, respectively, and the diagnostic accuracy was 76.00%.

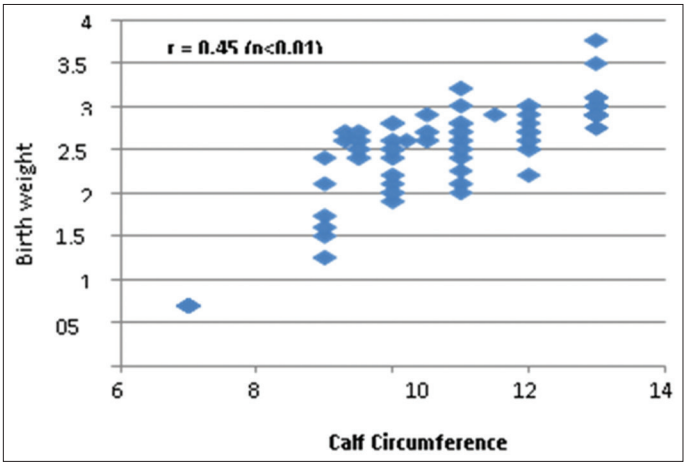

Figure 1: Correlation between calf circumference and birth weight

Table 1: Demographic characteristics in the study group

Characteristics	Percentage
Age group of mothers	
<20	4.00
20–24 years	50.00
25–29 years	42.00
30–35 years	4.00
Sex of the baby	
Male	60.00
Female	40.00
Weight of the baby	
<2500 g	21.00
≥2500 g	79.00

DISCUSSION

The important prerequisite to reduce the mortality and morbidity among LBW babies is early identification. In many developing countries including India, widespread accurate measurement of birth weight is not practicable; easily measurable substitutes for birth weight are therefore needed. Hence, this relentless, easy, and inexpensive method using CC to screen LBW babies at birth was attempted. In our study, there is a moderately positive correlation between CC and LBW. CC was 10.80±1.05 cm in normal-weight babies whereas it was 9.53±1.10 cm in LBW babies. The best cutoff value for CC was 9.70 cm with a sensitivity of 80.21% and specificity of 41.56%.

Kokku *et al.* [6] found a positive Pearson's correlation coefficient between CC and LBW, r=0.986 with a mean CC of 9.13 cm. Mani *et al.* [4] found that the mean values of CC were significantly lower in LBW babies ($p<0.0001$) and the cutoff value in LBW was 9.90 cm with the sensitivity of 85.6% and the specificity of 82.2%. The best cutoff value of CC was reported by 9.6 cm and 9.75 cm by Kulkarni *et al.* [7] and Taksande *et al.* [8], respectively, to screen LBW newborns. Suneetha *et al.* [9] showed similar results where cutoff CC was 9.7 cm, with a sensitivity and specificity of 86–88%, respectively.

In our study, results were having higher sensitivity (80.21%) and lower specificity (41.56%) for the cutoff point of CC. Similar results were found by Kumar *et al.* [10] and Jyothi *et al.* [11] with the sensitivity of 98.4%, 100%, and the specificity of 92–42%,

respectively. The cutoff values obtained from this study are from one particular hospital; hence, standardized cutoff value to overall population should be framed to screen for LBW in remote areas, where the facilities for weighing the baby at birth are not available.

CONCLUSION

CC as an indicator to predict LBW is a simple, inexpensive, and reliable method. Furthermore, it is easy to train the birth attendants to screen babies born in the community, where the facility of weighing the baby at birth is not available. Hence, measuring CC can be used as an alternative method to identify LBW babies in the remote areas.

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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