



FOOT LENGTH OF THE BABY IN RELATION TO THE WEIGHT OF THE BABY IN HEALTHY PRIMIPARAS WHO UNDERWENT NORMAL DELIVERY OR C-SECTION IN A TERTIARY CARE CENTER

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Abstract:

Introduction: Neonatal mortality remains a global issue, with low birth weight (LBW) being a major cause. In India, the neonatal mortality rate is 24.9 per 1000 live births. Birth weight is a key indicator of infant health, but foot length (FL) is gaining attention as an alternative measure. This study evaluates the correlation between foot length and birth weight in neonates born to healthy primiparas and examines differences based on delivery mode.

Methods: A 12-month prospective observational study was conducted with 300 healthy primiparas at a tertiary care center. Maternal and neonatal data, including foot length and birth weight, were collected. The correlation between these measurements was analyzed, and differences between normal and caesarean deliveries were assessed.

Results: Among 300 newborns, the mean birth weight was 2.91 ± 0.49 kg, and the mean foot length was 7.64 ± 0.62 cm. A positive correlation ($r = 0.431$, $p < 0.05$) was found between foot length and birth weight. The derived regression equation was: Birth weight = $0.3438(\text{FL}) + 0.2844$. No significant differences in foot length or birth weight were observed between delivery modes.

Conclusion: Foot length is a valuable proxy for estimating birth weight. Further research is needed to validate these findings across larger and more diverse populations

Keywords:

neonatal mortality, birth weight, foot length, healthy primiparas, correlation, mode of delivery, low birth weight, anthropometric measurements, neonatal growth

Introduction:

Globally, 2.3 million children died in the first month of life in 2021, approximately 6,400 neonatal deaths every day.¹ In India the neonatal mortality rate (NMR) is 24.9 per 1000 live births.² Low birth weight and preterm births are the most common causes of infant mortality in India.

The birth weight remains the primary factor in assessing both neonatal and infant survival. A low birth weight serves as a sensitive indicator of socioeconomic circumstances and acts as an indirect measure of both maternal and child health. Infants weighing less than 2500 grams, regardless of their gestational period, are classified as low birth weight (LBW) babies.^{3,4}

Birth weight has long been considered a crucial indicator of an infant's health and development. However, researchers and healthcare providers have increasingly recognized the importance of exploring other anthropometric measurements which play a crucial role in assessing their growth, development, and overall health. These measurements provide valuable insights into a newborn's nutritional status, gestational age, and potential health risks. One such parameter is the measurement of the baby's foot length, which can offer valuable insights into their health.^{5,6}

Foot length (FL) is a readily measurable parameter that has been associated with gestational age, nutritional status, and overall growth. Foot is easily accessible even in premature babies, babies nursed in incubators, and babies receiving intensive care making it easier to measure foot length.⁷ Investigating the relationship between a baby's foot length and their weight presents an intriguing avenue, particularly concerning healthy primiparas who undergo either normal delivery or caesarean section in tertiary care settings. Understanding the correlation between foot length and weight not only offers insights into neonatal growth patterns but also sheds light on potential differences arising from varied modes of delivery within a healthcare center. This area of inquiry carries significance for clinical practice, contributing to enhanced understanding and targeted interventions for infants born to healthy primiparas in tertiary care settings.

Objectives:

1. To determine the correlation between foot length and birth weight in neonates born to healthy primiparas.
2. To evaluate potential differences in foot length and birth weight correlation based on delivery modes (normal delivery vs. caesarean section) in a tertiary care setting.

Methods:

A Prospective observational study was conducted for a period of 12 months in a tertiary care center with access to maternity services among 300 healthy primiparas with singleton pregnancies. Multiple pregnancies, pregnancies with complications, neonates requiring immediate medical intervention and with no congenital anomalies or intrauterine growth restriction were excluded from the study.

Informed consent from eligible primiparas is obtained during antenatal visits. Confidentiality and anonymity of participants' information were ensured in the study. Using a semi-structured questionnaire demographic information, maternal health records, delivery details, and anthropometric measurements (foot length and birth weight) of neonates were collected.

Results:

In present study, out of 300 newborns, 49.7% were males and 50.33% were females. The mean birth weight of newborns in the present study was 2.91 ± 0.49 kgs. The birth weight was comparable among male and female infants (2.89 vs 2.93 kgs) respectively. The mean foot length of infants was 7.64 ± 0.62 cms. In <2.5, 2.5 – 3.5, >3.5 kgs birth weight group the mean foot lengths were 7.22, 7.74 and 8.09 cms respectively and there was a statistical significant difference of mean foot length between groups [$p < 0.05$].

In comparing the foot length and mode of delivery, the mean FL in vaginal delivery was 7.68 cms and in caesarean section it was 7.59 cms with no statistical difference between two groups. There was a positive correlation [$r = 0.431$] between birth weight and foot length with a statistical significant correlation between them. The estimated regression equation for birth weight of newborns was derived with foot length as the independent variable and birth weight as the dependent variable [Birth weight = $0.3438(\text{FL}) + 0.2844$].

Table 1: Birth weight according to gender

Birth weight [kgs]	Male	Female	Total
< 2.5	37 [24.8%]	41 [27.2%]	78 [26%]
2.5 – 3.5	97 [65.1%]	96 [63.5%]	193 [64.3%]
> 3.5	15 [10.1%]	14 [9.3%]	29 [9.7%]
Total	149 [100%]	151 [100%]	300 [100%]
Mean $\pm$ SD	2.89 ± 0.49	2.93 ± 0.50	2.91 ± 0.49

Table 2: Comparison of foot length based on weight of infant

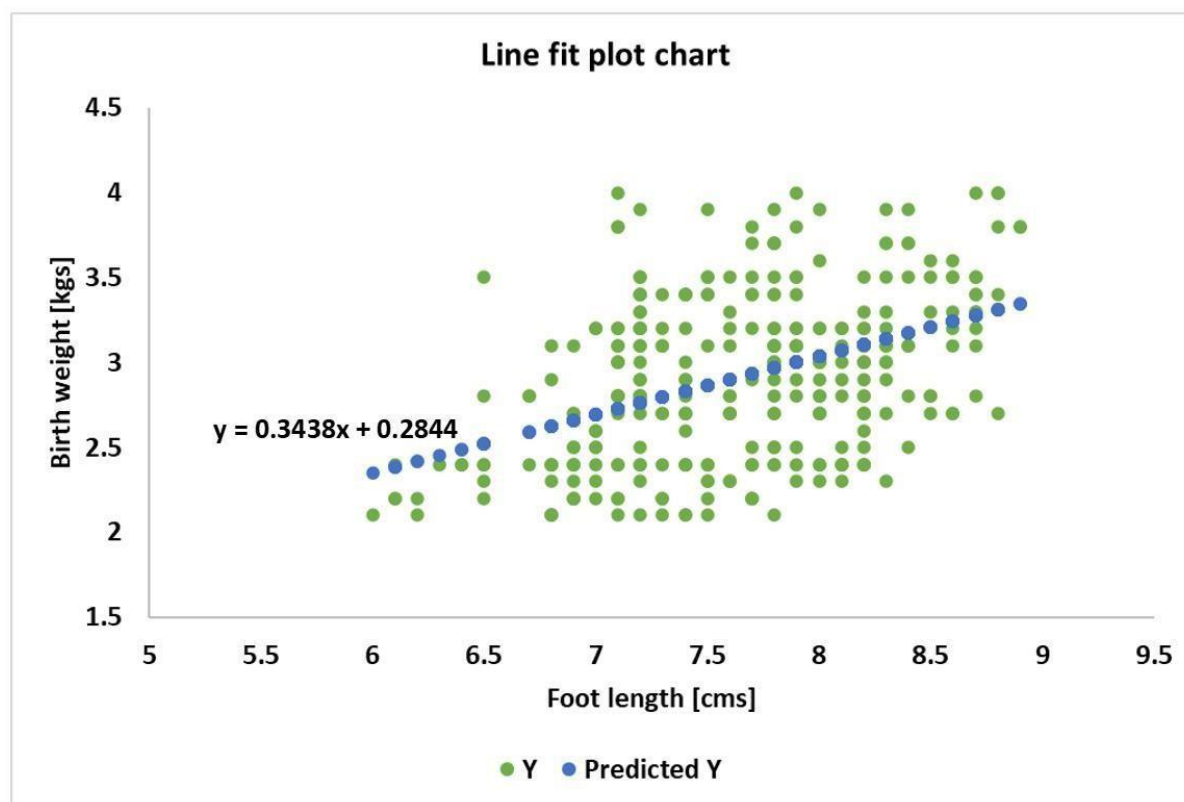
Birth weight [kgs]	Foot Length [cms]	
	Mean $\pm$ SD	95% Confidence Interval
< 2.5	7.22 $\pm$ 0.59	7.08 – 7.35
2.5 – 3.5	7.74 $\pm$ 0.55	7.66 – 7.82
> 3.5	8.09 $\pm$ 0.56	7.87 – 8.30
Total	7.64 $\pm$ 0.62	7.57 – 7.71
ANOVA test, p-value = 0.000 [Sig.]		

Table 3: Comparison of foot length, birth weight based on mode of delivery

	NVD [150]	LSCS [150]	p-value
Foot length [cms]	7.68 $\pm$ 0.62	7.59 $\pm$ 0.61	0.234 [NS]
Birth weight [kgs]	2.91 $\pm$ 0.48	2.91 $\pm$ 0.51	0.900 [NS]

Table 4: Correlation between birth weight and foot length based on mode of delivery

Mode of delivery	Birth weight vs Foot length		
	N	Correlation	P-value
NVD	150	0.528	0.000
LSCS	150	0.340	0.000
Total	300	0.431	0.000

Fig 1: Chart showing correlation between birth weight and foot length of infant

Discussion:

In this study, foot length was utilized as a surrogate measure for identifying the birth weight of newborns. The present study conducted an analysis of 300 newborns, finding a nearly equal distribution of males (49.7%) and females (50.33%), whereas other previous studies Arun Raj A et al.,⁸ Mukherjee et al.,⁹ had reported slight male predominance.

The mean birth weight observed was 2.91 ± 0.49 kgs, with a negligible difference between male and female infants (2.89 vs 2.93 kgs, respectively). Similarly, Elizabeth et al.,¹⁰ found the mean birth weight to be 3.1 ± 0.5 kg and Arun Raj A et al.,⁸ had reported the mean birth weight of 2.9 ± 0.3 kg. Ashish et al.,¹⁶ had also reported that the mean birth weight of infants was 2.93 ± 0.53 kgs. The birth weight was comparable among male and female infants (2.89 vs 2.93 kgs) respectively which was similar to study conducted by Gaur NL et al.

In the present study, 26% of the neonates were found to have low birth weight (<2.5kg) and 74% of the neonates had normal birth weight, similarly Gowri et al.,¹⁸ had reported 32% babies belongs to low-birth-weight group. However, Arun Raj A et al.,⁸ Elizabeth et al.,¹⁰ observed 10% and 12% babies having LBW (<2.5kg) respectively. According to NFHS-5 (National Family Health Survey), the prevalence of LBW was 16.4% in India.²

The mean foot length of infants was 7.64 ± 0.62 cms which was comparable to other previous studies. In Arun Raj A et al.,⁸ the mean foot length was 8.11 ± 0.47 cm. Marchant et al.,¹¹ observed that the mean foot length was 7.8 ± 0.4 cm. Taksande et al.,¹² Ashish et al.,¹⁶ and Gaur et al.,¹⁷ found the mean foot length as 7.84 ± 2.21 , 7.72 ± 0.02 and 7.68 ± 0.47 cm respectively.

The foot length varied across different birth weight categories (<2.5, 2.5 – 3.5, >3.5 kgs) with mean foot lengths of 7.22, 7.74, and 8.09 cms, respectively. The differences in foot length among these weight groups were statistically significant ($p < 0.05$), indicating a relationship between birth weight and foot length. It's evident that as the birth weight of newborns increases, their foot length also shows a corresponding increase. Similar differences were observed in Arun Raj A et al.,⁸ the mean foot length for the LBW and normal-weight babies was 7.32 ± 0.13 and 8.20 ± 0.40 respectively and Mullany et al.,¹³ mean foot length was 6.8 ± 0.4 cm and 7.3 ± 0.3 cm among LBW and normal-weight babies respectively. Gaur et al.,¹⁷ found that the birth weight correlated significantly ($p < 0.01$) with foot length in newborns less than 3.5 kg, with positive correlation in group <2.5 kgs and group 2.5-3.5 newborns (with correlation factor 0.494 and 0.624, respectively).

When comparing the mode of delivery, the mean foot length was 7.68 cms for vaginal deliveries and 7.59 cms for caesarean sections, with no statistically significant difference between the two groups.

There was a positive correlation [$r = 0.431$] between birth weight and foot length with a statistically significant correlation between them. A similar study conducted by Arun Raj A et al.,⁸ had also showed a positive correlation coefficient ($r = 0.905$) between birth weight and foot length. Similar significant correlation was observed by Srinivasa et al.,¹⁴ between foot length and birth weight. Gavhane et al.,¹⁵ did a study in Aurangabad and found that the foot length had a significant correlation with foot length in term and preterm infants. Gowri et al.,¹⁸ had found that a significant correlation between birth weight and foot length with maximum relation in low-birth-weight babies ($r = 0.94$).

The estimated regression equation for birth weight of newborns was derived with foot length as the independent variable and birth weight as the dependent variable [Birth weight = $0.3438(\text{FL}) + 0.2844$].

Authors	Place of study	Regression equation
Modibbo MH and Taura MG	Kano State, Nigeria	BW = $0.624 \times \text{FL} - 1.98$

Minhajuddin A et al., [22]	Karad, Maharashtra, India	BW (male)= (0.377) x FL – (-0.44) BW (female)= (0.424) x FL – (-0.444)
Gowri S and Kumar GV [14]	Tumkur, Karnataka, India	BW = 0.151 x FL- 2.69
Manivannan G et al., [5]	Bengaluru, Karnataka, India	BW=0.64638 FL- 2.16694
Gaur NL	Mathura, Uttar Pradesh, India	BW (male) =-2.2944+0.6609 FL BW (female) =-2.2516+0.6434 FL
Present study		Birth weight = 0.3438(FL) + 0.2844

Conclusion:

In the present study, with positive correlation between foot length and birth weight, footlength can be used as a proxy measurement to detect newborns birth weight. The findings of this study provide valuable insights into the relationship between birthweight, foot length, and mode of delivery in newborns. The observed correlation between birthweight and foot length, along with the derived regression equation, contributes to the understanding of neonatal growth patterns and could have implications for clinical practice, especially in predicting birth weight using foot length measurements. However, further research with larger sample sizes and diverse populations may be beneficial to validate and generalize these findings across different demographic groups.

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