Original Research Article

Simple anthropometric measurements to predict birth weight: A clinical study

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Abstract

Background: Of the approximately four million global neonatal deaths that occur annually, 98% occur in developing countries, where most newborns die at home while they are being cared by mothers, relatives, and traditional birth attendants. **Aims and Objectives:** To study Simple anthropometric measurements to predict birth weight. **Methodology:** After approval from institutional ethical committee this cross-sectional study carried out in the newborn's of a tertiary health care center, the anthropometric measurements were taken within the first 24 hours of life. The anthropometry which studied were ; the body length and the foot length (FL), as well as circumferences of head (OFC), chest (ChC), thigh (ThC) and calf (CaC) were measured to the nearest 0.1 cm using a non-elastic, flexible measuring tape, while the MUAC was measured using the UNICEF tri-coloured flexible measuring tape. The statistical analysis done by regression analysis , Area undercurve , Cutt-off value Positive predictive value (PPV) and Negative predictive value (NPV) SPSS Software 19 version . **Result:** In our study we have found that The parameters like ChC, MUAC, CaC, ThC, OFC, FL, Length well corelated with Normal birth weight i.e. 0.51 (0.01), 0.48 (0.01), 0.54(0.001), 0.46 (0.00), 0.39 (0.001), 0.29 (0.001), 0.31 (0.001); and with LBW<2.5 kg was 0.71 (0.001), 0.67 (0.002), 0.65 (0.001), 0.61 (0.001), 0.52 (0.001), 0.50 (0.001), 0.49 (0.001) and not corelated with VLBW except FL -0.44 (0.02) respectively co-relation co-efficient and p-value. Cut-off value (cm), PPV % (95% CI), NPV % (95% CI) respectively for; ChC -≤ 28.92, 76.0 (66.2–81.23), 93.9 (90.1–94.6) , CaC - ≤9, 73.82 (67.3–79.7), 93.4 (91.3–95.2) , MUAC -≤9.67, 73.8 (65.0–79.6), 90.9 (88.7–92.7) , OFC -≤30.2, 65.2 (58.4–71.7), 90.1 (86.5–91.0) ; FL-≤7.5, 62.1 (53.1–72.2), 84.1 (80.42–88.2) ; ThC -≤14.20, 50.0 (45.01–58.2), 94.1 (91.1–96.0) ; Length-≤46.12, 42.3 (37.2–47.1), 92.2 (89.54–95.3). **Conclusion:** It can be concluded that In resource-poor settings , a large proportion of deliveries take place at home and birth-weight is most often not recorded. Therefore, there is a need to develop simple, inexpensive and practical methods to identify LBW newborns soon after birth

Key Words: Low Birth Weight (LBW), foot length (FL), head circumference (OFC), chestcircumfere (ChC), thighcircumfere (ThC) , calfcircumfere (CaC)

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INTRODUCTION

Of the approximately four million global neonatal deaths that occur annually, 98% occur in developing countries, where most newborns die at home while they are being cared by mothers, relatives, and traditional birth attendants.[1] About 38% of total under-five mortality occurs during the neonatal period and nearly three quarters of these deaths occur during the first week of life [2].

Globally, about one-sixth of all newborns are low birth weight (LBW, <2500 grams), which is single most important underlying risk factor for neonatal deaths [1,3]. Only about half of the newborns are weighed at birth and for a smaller proportion of them gestational age is known.[4] An estimated 18 million babies are born with LBW.[5] They account for 60% - 80% of neonatal deaths [6]. Moreover, LBW babies who survive the critical neonatal period may suffer impaired physical and mental growth. Therefore, an early identification and prompt referral of LBW newborns is vital in preventing neonatal deaths [7]

In resource-poor settings, a large proportion of deliveries take place at home and birth-weight is most often not

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recorded. Therefore, there is a need to develop simple, inexpensive and practical methods to identify LBW newborns soon after birth [8]. One such method may be the use of anthropometric surrogates to identify LBW babies. A number of studies have focused on measuring the circumference of the head, chest, mid upper-arm, thigh or calf and observed the correlation with continuous measurements on a gold standard weighing scale (Bhargava *et al*., 1985; Singh *et al*., 1988; WHO Collaborative study of birth weight surrogates, 1993; Dhar *et al*., 2002). In general, chest circumference has performed better than other measures and has been recommended for continued investigation, although investigators have demonstrated correlations between birth weight and mid upper-arm circumference (Sauerborn *et al*., 1990, calf (Gupta *et al*., 1996) (Samal and Swain, 2001 or thigh (Sharma *et al*., 1989) that are as strong as with chest circumference.

METHODOLOGY

After approval from institutional ethical committee this cross-sectional study carried out in the newborn's of a tertiary health care center, the anthropometric measurements were taken within the first 24 hours of life. The anthropometry which studied were ; the body length and the foot length (FL), as well as circumferences of head (OFC), chest (ChC), thigh (ThC) and calf (CaC) were measured to the nearest 0.1 cm using a non-elastic, flexible measuring tape, while the MUAC was measured using the UNICEF tri-coloured flexible measuring tape. For each newborn, the length, OFC, ChC, MUAC, ThC, CaC and FL were measured . birth weights of all newborns to the nearest 100 g using Model 180 Salter weighing scale (England), calibrated with a bottle weighing 1000 grams as was done routinely for all babies. The statistical analysis done by regression analysis, Area undercurve, Cutt-off value Positive predictive value (PPV) and Negative predictive value (NPV) SPSS Software 19 version.

RESULT

The parameters like ChC, MUAC, CaC, ThC, OFC, FL, Length well corelated with Normal birth weight i.e. 0.51 (0.01), 0.48 (0.01), 0.54(0.001), 0.46 (0.00), 0.39 (0.001), 0.29 (0.001), 0.31 (0.001); and with LBW<2.5 kg was 0.71 (0.001), 0.67 (0.002), 0.65 (0.001), 0.61 (0.001), 0.52 (0.001), 0.50 (0.001), 0.49 (0.001) and not corelated with VLBW except FL -0.44 (0.02) respectively co-relation co-efficient and p-value.

Table 1: Distribution of the patients as per the regression analysis and p-values

	(r and P-value)		
Measurement (cm)	NBW>2.5 kg	LBW<2.5 kg	VLBW<1.5 kg
ChC	0.51 (0.01)	0.71 (0.001)	0.29 (0.9)
MUAC	0.48 (0.01)	0.67 (0.002)	0.17 (0.25)
CaC	0.54(0.001)	0.65 (0.001)	0.13 (0.42)
ThC	0.46 (0.00)	0.61 (0.001)	0.21 (0.12)
OFC	0.39 (0.001)	0.52 (0.001)	0.31 (0.85)
FL	0.29 (0.001)	0.50 (0.001)	0.44 (0.02)
Length	0.31 (0.001)	0.49 (0.001)	0.24 (0.22)

Cut-off value (cm), PPV % (95% CI), NPV % (95% CI) respectively for; ChC -≤ 28.92, 76.0 (66.2–81.23), 93.9 (90.1–94.6) , CaC - ≤9, 73.82 (67.3–79.7), 93.4 (91.3–95.2) , MUAC -≤9.67, 73.8 (65.0–79.6), 90.9 (88.7–92.7) , OFC -≤30.2, 65.2 (58.4–71.7), 90.1 (86.5–91.0) ; FL-≤7.5, 62.1 (53.1–72.2), 84.1 (80.42–88.2) ; ThC-≤14.20, 50.0 (45.01–58.2), 94.1 (91.1–96.0) ; Length-≤46.12, 42.3 (37.2–47.1), 92.2 (89.54–95.3).

Table 2: Distribution of the patients as per the Cut-off value, PPV and NPV

Anthropometric measurements	Cut-off value (cm)	PPV % (95% CI)	NPV % (95% CI)
ChC	≤ 28.92	76.0 (66.2–81.23)	93.9 (90.1–94.6)
CaC	≤9.73	73.82 (67.3–79.7)	93.4 (91.3–95.2)
MUAC	≤9.67	73.8 (65.0–79.6)	90.9 (88.7–92.7)
OFC	≤30.2	65.2 (58.4–71.7)	90.1 (86.5–91.0)
FL	≤7.5	62.1 (53.1–72.2)	84.1 (80.42–88.2)
ThC	≤14.20	50.0 (45.01–58.2)	94.1 (91.1–96.0)
Length	≤46.12	42.3 (37.2–47.1)	92.2 (89.54–95.3)

DISCUSSION

A major risk factor for neonatal mortality is low birth weight (LBW); a birth weight less than 2500 g. Every ten seconds, an infant from a developing country dies from a disease or infection that can be attributed to LBW 10. Nearly all of the newborns who die are LBW, and are mostly in rural communities [6]. More than half of these LBW babies die shortly after birth at home [9,11,12], mostly in rural families [13]. A World Health Statistics report asserted that 15% of babies are born worldwide with LBW 10. In sub-Saharan Africa, very similar figures were also reported with a LBW rate of 14%, and for Ghana 13% [14–17].

Many studies have reported strong positive correlations between birth weight and several anthropometrics: 0.60–0.97 [18,19]. Some studies found the correlation to be highest with MUAC, with estimates ranging from r = 0.66 to 0.95 and ChC (r = 0.60–0.85) 29, while others reported that ChC, OFC and ThC had the highest correlations [20,21], and Das and others added CaC (r = 0.95) [22]. In our study we have found that The parameters like ChC, MUAC, CaC, ThC, OFC, FL, Length well corelated with Normal birth

weight i.e. 0.51 (0.01), 0.48 (0.01), 0.54(0.001), 0.46 (0.00), 0.39 (0.001), 0.29 (0.001), 0.31 (0.001); and with LBW<2.5 kg was 0.71 (0.001), 0.67 (0.002), 0.65 (0.001), 0.61 (0.001), 0.52 (0.001), 0.50 (0.001), 0.49 (0.001) and not corelated with VLBW except FL -0.44 (0.02) respectively co-relation co-efficient and p-value.

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CONCLUSION

It can be concluded that In resource-poor settings , a large proportion of deliveries take place at home and birth-weight is most often not recorded. Therefore, there is a need to develop simple, inexpensive and practical methods to identify LBW newborns soon after birth

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