

DETECTION OF LOW BIRTH - WEIGHT NEW BORN BY ANTHROPOMETRIC MEASUREMENTS IN IRAN

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Abstract — Birth weight is an important indicator of child survival. Appropriate and timely care of a newborn specially if he or she is born with low birth weight is important but this is difficult in developing countries since most of the deliveries are conducted at home where adequate facilities to weight a new born does not exist. This study was conducted to find out a surrogate which could efficiently be used for detecting low birth weight babies at birth when no weighing machine is around. A total of 1050 neonates, between 32 and 43 weeks of gestational age were measured with in 24 h of birth to interpret the validity of anthropometric measurements. Low birth weight was observed in 11.6 percent of the neonates. The study showed a significant correlation ($P < 0.001$) between chest circumference, mid-arm circumference and birthweight. A chest circumference of < 30.5 cm and a mid-arm circumference of < 10 cm had the best sensitivity and specificity for identifying neonates with a birth weight of < 2500 g. Chest circumference and/or mid-arm circumference can be used as simple and reliable indicators for predicting low birth weight when ever weighing of new borns is not feasible.

Acta Medica Iranica 34 (1 & 2): 43-45; 1996

Key words: Birth weight; newborn; anthropometry.

INTRODUCTION

Birth weight is a significant indicator for predicting neonatal survival and future outcome low birth weight is a well known risk factor associated with increased neonatal morbidity and mortality. Identification of low birth weight infants is crucial, because these babies, either preterm or growth retarded, are a large group at risk (1). Appropriate and timely identification of low birth weight newborns is specially difficult in developing countries since many of the deliveries are conducted at home where adequate facilities to weight infants do not exist. Every newborn must be weighed or evaluated by a method that helps to identify low birth weight (2). Several studies have shown that different anthropometric measurements at birth can predict birth weight and can be used as valid indicators of low birth weight (3). The objectives of this study were to assess the predictive values of mid-arm circumference and chest circumference for low birth weight in Iranian newborn population and to figure out a reliable measurement to identify low birth weight.

MATERIALS AND METHODS

A prospective design was utilized for this research.

Study Population

The study population consisted of 1050 newborn infants, between 32 and 43 weeks of gestational age, who were born between July first, 1996 and September 31, 1996 at Shariaty Hospital in Tehran, Iran. Those infants who were still born or who had major malformations were excluded from the study.

Data Collection

All anthropometric measurements were carried out by one of us within in 24 h of delivery and were taken with the newborn lying down. All circumferences were measured to the nearest 0.1 cm with nonstretchable plastic - coated tapes.

Birth Weight

Birth weight was measured by using a weighing scale which allowed readings to the nearest of log. The scale was periodically checked using a set of standard weights. Babies were weighed naked. Low birth weight was defined as birth weight less than 2500g.

Mid-arm Circumference

Mid-arm circumference was taken at the mid-point between the tip of the acromion and the olecranon process on the left arm with the baby supine.

Chest Circumference

Chest circumference was obtained at the level of the xiphoid process and below the inferior angle of the scapula during quiet respiration (4).

Statistical Analysis

Standard statistical methods of correlation, standard deviation, predictive value, specificity and sensitivity of the two measurements mentioned above were calculated to analyse the data and reach a valid conclusion.

RESULTS

The birth weight, distribution of mid-arm circumference and chest circumference for the 1050 neonates studied in both sexes are shown in Table 1,2,3 respectively.

Table 4 presents the mean (\pm SD) values for birth weight, mid-arm circumference and chest circumference irrespective of their sex.

Correlation Between the Anthropometric Measurements

Significant correlation between the chest, mid-arm circumference and the birth weight have been observed. The chest circumference has a relatively higher correlation value than the mid-arm circumference. Correlation coefficient for the chest and mid-arm circumference is being shown in Table 6.

Table 5 represents validity indexes of chest and mid-arm circumference at their serial cut-off values.

DISCUSSION

Birth weight is a sensitive indicator for predicting immediate postnatal problems requiring medical intervention. The percentage of low birth weight babies at birth varies from 5 to 45 percent in different communities (5). However, in many countries, because most of births are born at home at the hand of untrained or semi-trained traditional birth attendants (TBAs), relatives or neighbours, birth weight measurement may not be feasible. Several studies have been conducted to find out a relationship between birth weight and other anthropometric measurements to identify low birth weight (6,7,8,9). In our study among several anthropometric variables chest circumference and mid-arm circumference have shown the best correlations to birth weight. Bhargava and coworkers in India (10), Landicho and coworkers in Guatemala (11) and Huque and coworkers (12) in Bangladesh have found chest circumference to have the closest correlation with birth weight, r values of 0.869, 0.875 and 0.867, respectively (Table 6).

For predicting low birth weight, they have found

chest circumference of ≤ 30 , ≤ 30 and < 30.14 cm, respectively as their cut-off values. Fawcus and coworkers in zimbabwe (13) have also shown chest circumference to have a significant correlation with birth weight, r value of 0.97. As their cut-off value, they have found chest circumference of < 30 cm. Similarly, we have shown that chest circumference has the highest correlation to birth weight ($r=0.8117$) and a cut-off value of < 30.5 cm should be used for detection of low birth weight in our population. In 1987, WHO has suggested a mid-arm circumference of < 9 cm as a suitable cut-off value for most countries (14). However, the ideal cut-off should be tested separately for each population in our study, we have shown that there is a significant correlation between birth weight and mid-arm circumference and a cut-off point of < 10 cm should be used for predicting of low birth weight in Iran.

Table 1. Birth weight of newborns by sex

Birth weight of newborns in g	male	female	total
< 2500 g	55 (10.3%)	67 (13%)	122 (11.6%)
> 2500 g	481 (89.7%)	447 (87%)	928 (88.14%)
Total	536 (51.04%)	514 (48.6%)	1050 (100%)

Table 2. Distribution of mid-arm circumference by sex

Mid-arm circumference	male	female	total
≤ 10 cm	140 (26.1%)	166 (32.3%)	306 (29.1%)
> 10 cm	396 (73.9%)	348 (67.7%)	744 (70.9%)
Total	536 (51.04%)	514 (48.9%)	1050 (100%)

Table 3. Distribution of chest circumference by sex

Mid-arm circumference	male	female	total
< 30.5 cm	58 (10.8%)	87 (10.9%)	145 (13.8%)
≥ 30.5 cm	478 (89.2%)	427 (83.01%)	905 (86.2%)
Total	536 (51.04%)	514 (48.96%)	1050 (100%)

Table 4. Distribution of mean birth weight and mean chest and mid-arm circumference by sex

SD / Mean	male	female	combined
Birth weight (g)	3191.688 597.892	3069.397 605.255	3131.82 604.32
Mid-arm circumference	11.024 1.318	10.848 1.308	10.94 1.32
chest circumference	32.992 2.633	32.498 2.594	32.75 2.62

Table 5. Validity indexes of chest and mid-arm circumference at their serial cut-off values as indicators of low birth weight for 1050 newborns

Anthropometric measurement	cut-off value (cm)	sensitivity(%)	specificty(%)	positive(%)	negative(%)
Chest circumference	male < 30.5	82	92.8	63.2	97.1
	female < 30.5	82	92.8	63.2	97.1
	both < 30.5	80.32	94.5	64.8	94.5
Mid-arm circumference	female ≤ 10	89.5	76.2	36.1	98.9
	male ≤ 10	90.9	78.9	36.4	98.9
	both ≤ 10	90.9	78.9	36.2	98.5

Table 6. Correlation coefficients and cut-off values of mid-arm and chest circumference for predicting low birth weight in several studies

Study	Country	n	MAC		CC	
			r	cut-off (cm)	r	cut-off (cm)
Bhargava (17)	India	520	0.811	≤ 8.7	0.869	≤ 30
Bhargava (10)	India	501	-	≤ 9.0	-	-
Landicho (11)	Guatemala	1000	0.802	≤ 9.0	0.875	≤ 30
Sharma (16)	India	1000	0.891	≤ 8.6	-	≤ 29.5
Sauerborn (15)	Burkina Faso	973	0.880	< 9.5	-	-
Huque (12)	Bangladesh	217	0.842	< 8.9	0.867	< 30.14
Gozal (18)	Cameroon	490	0.910	≤ 9.5	-	-
Fawcus (13)	Zimbabwe	115	-	-	0.970	< 30
Arisoy (5)	Turkey	874	0.790	< 9.0	0.855	< 30
Present	Iran	1050	0.7199	< 10	0.8117	< 30.5

In conclusion in the absence of a weighing machine, measurement of the chest circumference and mid-arm circumference of a newborn may be the best indicator of a low birth weight.

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