

Evaluation of Newborn Arm Circumference as an Indicator of Low Birth Weight¹

JOÃO GUILHERME BEZERRA ALVES,² GEISY MARIA DE SOUZA LIMA,³ GEISER NERY DA COSTA AZEVEDO,³ VIRGÍNIA BUARQUE CORDEIRO CABRAL,³ RUBEN SCHINDLER MOGGI,³ & ROBERTO NUNES⁴



A sample of 1,024 newborns in Recife, Brazil, was studied to help determine the precision with which arm circumference measurements could be used to indicate low birth weight. The results support the view that when birth weight data are unobtainable, arm circumference measurements may be of value in screening for newborns needing special care.

Low birth weight (LBW), defined by the World Health Organization as a weight of less than 2,500 g at birth, is closely associated with high morbidity and mortality in the first year of life. The incidence of LBW varies with socioeconomic conditions, ranging from 2–4% in industrialized countries to rates exceeding 15% in developing countries. The result is that 90% of the 15 million LBW babies that come into the world each year are born in developing countries (1, 2).

In the rural areas of the Brazilian Northeast, where LBW and infant mortality have risen in a similar fashion since 1982, more than half of all babies are delivered at home. This creates difficulties

for determining birth weight—difficulties only heightened by the fact that even in-hospital deliveries often lack access to proper equipment in good working order for determining the weight of the newborn (3, 4).

Measurement of arm circumference, already widely used as a parameter for determining malnutrition in older children (5–8), has previously been described as useful for detecting low-weight newborns in the neonatal period (9). In this regard, some authors have found a strong association between an arm circumference below 9 cm and a birth weight of less than 2,500 g (9, 10).

Because this measurement method is so simple and practical as to be usable in virtually any primary or other health care facility, our study sought to determine the sensitivity and specificity of arm circumference as an indicator of LBW in a group of babies born in the Northeast Brazilian city of Recife in 1988.

MATERIALS AND METHODS

The study population consisted of 1,024 infants born at the Women's Care Center at the Maternal and Child Insti-

¹This article will also be published in Portuguese in the *Boletín de la Oficina Sanitaria Panamericana*, 111(3):215–217, 1991.

²Coordinator of Instruction, Maternal and Child Institute of Pernambuco (Instituto Materno Infantil de Pernambuco—IMIP); and Assistant Professor, Faculty of Medical Sciences of Pernambuco. Mailing address: Rua Rui Calaça, 94/802; Espinheiro, Recife-PE; Brazil. CEP: 52.020.

³Physician, IMIP.

⁴Associate Professor, Faculty of Medical Sciences of Pernambuco.



A newborn infant's arm circumference being measured in the course of the study.

tute of Pernambuco (IMIP) from July to December 1988. All the infants were weighed within the first hour of life by one of the researchers and were evaluated in terms of the WHO definition of low birth weight.

In addition, each newborn's arm circumference was measured by two of the researchers working separately, and the average of the two measurements was taken as the final result. These readings were made with a Japanese fiberglass tape measure graduated in 0.1 cm increments, which was always placed gently and firmly at the midpoint of the left arm with the infant supine.

RESULTS

The weights of the study infants ranged from 960 g to 4,300 g, the mean being 3,101 g with a standard deviation of 582 g. Their arm circumferences were in a range of 6.0–12.1 cm, the average

being 9.98 cm and the standard deviation 0.97 cm. The respective frequencies of low birth weight and an average arm circumference below 9 cm were 12.00% and 12.51%, respectively, with a correlation coefficient of +0.79. Data regarding the sensitivity and specificity of arm circumference as an indicator of low birth weight are shown in Table 1.

DISCUSSION AND CONCLUSIONS

Low birth weight was found in 12% of the cases studied, a frequency similar to that found by the Brazilian Pediatric Society in the city of Recife in 1986 (11). In this same vein, Dias et al. (3) found that the frequency of low birth weight in Recife rose from 10.20% in 1982 to 15.30% in 1984. Nationally, low birth weight and infant mortality have exhibited a noteworthy rise in Brazil since 1982, trends that have accompanied the economic downturn confronting the country.

Table 1. Sensitivity and specificity of different newborn arm circumference values for determining low birth weight.

Average arm circumference (cm)	Sensitivity (%)	Specificity (%)
<7.5	24.4	100.0
<8.0	40.6	100.0
<8.5	65.0	99.6
<9.0 ^a	84.5	94.9
<9.5	98.3	79.0
<10.0	100.0	54.3

^aPositive predictive value = 90.4%, negative predictive value = 98.3%.

Our results showed a close relationship between low birth weight and arm circumference. Previous studies of these two parameters by Gueri et al. (9), Landicho et al. (10), and Vaquera et al. (12) have found correlation coefficients similar to ours.

We also found that an average arm circumference below 9 cm indicated low birth weight with a sensitivity of 84.5% and a specificity of 94.9%. A similar Recife study by Dias found a sensitivity of 98.5% and a specificity of 81.5% (4).

An arm circumference of less than 9 cm has also been described as strongly associated with mortality in the first year of life. Vaquera et al. (12) found the risk of infant mortality 10 to 17 times higher among neonates with an arm circumference below 9 cm than among the general newborn population. Landicho et al. (10) also affirm that this anthropometric measure is an indicator of high mortality in the first year of life.

Birth weight is an essential indicator for identifying populations at risk and overseeing and evaluating maternal and child care programs. Under conditions where this weight is unobtainable, we believe arm circumference can serve as a useful value in screening for newborns needing special care during the first year of life, especially in the neonatal period.

REFERENCES

1. Puffer RR, Serrano CV. *Patterns of birth-weights*. Washington, DC: Pan American Health Organization; 1987. (PAHO Scientific Publication 504).
2. World Health Organization, Division of Family Health. The incidence of low birth weight: a critical review. *World Health Stat Q*. 1980;33:197.
3. Dias MLCM, Camarano MR, Lechtig A. Drought, recession, and prevalence of low birth weight babies in poor urban populations of the Northeast of Brazil. *J Trop Pediatr*. (In press).
4. Dias MCLM. *Perímetro do braço, da coxa e da panturrilha do recém-nascido como indicadores de baixo peso e do peso insatisfatório ao nascer*. [Master's thesis]. Recife: Universidade Federal de Pernambuco; 1986.
5. Jelliffe DB, Jelliffe EF. An evaluation of upper arm measurements used in nutritional assessment. *Am J Clin Nutr*. 1980;33:2058-59.
6. Margo G. Assessing malnutrition with the arm circumference. *Am J Clin Nutr*. 1980;33:385-87.
7. Trowbridge FL, Staehling N. Sensitivity and specificity of arm circumference indicators in identifying malnourished children. *Am J Clin Nutr*. 1980;33:687-96.
8. Velzeboer MJ. The use of arm circumference in simplified screening for acute malnutrition by minimally trained health workers. *J Trop Pediatr*. 1983;29:159-66.
9. Gueri M, Jutsum P, Knight P, Hinds V. The arm circumference at birth and its relations to other anthropometric parameters. *Arch Latinoam Nutr*. 1977;27(4):403-10.
10. Landicho B, Lechtig A, Klein RE. Anthropometric indicators of low birth weight. *J Trop Pediatr*. 1985;31:301-05.
11. Sociedade Brasileira de Pediatria. *Antropometria do recém-nascido: características antropométricas do recém-nascido e estudo de algumas variáveis maternas nas capitais e regiões brasileiras*. 1989.
12. Vaquera MV, Townsend JW, Arroyo JJ, Lechtig A. The relationship between arm circumference at birth and early mortality. *J Trop Pediatr*. 1983;29:167-74.