

Birth weights in two rural hospitals in the United Republic of Tanzania

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Low birth weight has been designated by WHO as an indicator for monitoring progress towards health for all by the year 2000. Data on birth weight distribution in rural areas of Africa, where the percentage of low-birth-weight infants is estimated to be high, are, however, relatively scarce. Such data are therefore presented here for births in two rural hospitals in the south-western highlands of the United Republic of Tanzania.

Analysis of the data indicated that infants of birth weight ≥ 2500 g have a relatively high risk of perinatal mortality. This is interpreted as the contribution of cephalopelvic disproportion to perinatal mortality. It is concluded that the prevention of prolonged labour will probably have more impact than provision of neonatal intensive care facilities on lowering perinatal mortality.

Low birth weight is a strong determinant of neonatal and infant mortality as well as reflecting maternal nutritional status (1). The results of studies of low birth weight are therefore of public health importance.

Data on the incidence of low birth weight on a worldwide scale are collected and regularly updated by WHO. Globally, incidences range from 7% in Europe to 14% in Africa and 31% in middle south Asia (1-2).

The percentage of low-birth-weight infants in a community has been accepted by WHO as one of the indicators for monitoring progress towards health for all by the year 2000, and a global target of less than 10% for this indicator has been set (3).

Little information is available about the distribution of birth weights in Africa. Here, such data are therefore presented for two rural hospitals in the south-western highlands of the United Republic of Tanzania. Some differences in the methodological procedures used to calculate the percentage of low-birth-weight infants in the same population are also discussed.

MATERIALS AND METHODS

Birth weight data are presented on the following:

—2319 consecutive births (including 34 pairs of twins) in Lugarawa hospital from 1976 to 1979, where 24% of all births in Ludewa district took place; and

—4372 consecutive births (including 107 pairs of twins and two sets of triplets) in Mbozi hospital from 1980 to 1983, where 13% of all births in Mbozi district occurred.

Lugarawa hospital is the only hospital in Ludewa district (area: about 7000 km²; 75 000 inhabitants). Most women who give birth in this hospital are subsistence farmers who cultivate maize and beans. Mbozi district hospital is the only hospital in the district (area: about 10 000 km²; 250 000 inhabitants). People in this area grow coffee in addition to maize and beans, and both districts are situated in the south-western highlands of the country.

All newborns in these hospitals are weighed on a beam balance by nurse-midwives within 0.5 h of birth. The balance used in Lugarawa is graduated in pounds and ounces and the readings were expressed in kilograms using a conversion chart.

Low birth weight is defined by WHO as <2500 g (4). In the present study, infants who weighed <1000 g were registered as abortions and were therefore not included.

The percentage of low-birth-weight infants was calculated using the following four denominators: the total number of births, the number of live births, the number of singleton births, and the number of singleton live births.

Since data on gestational age and the age of the women were unreliable, and very often unknown, these variables were not used in the study. The birth weight distribution of infants delivered at the Mbozi hospital was investigated in relation to parity and maternal height as well as to the sex of the infant. Missing observations were few: the birth weight of two and the sex of 35 infants; and the parity of three

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and the height of 54 women. In contrast, in Lugarawa, the birth weight distribution could only be calculated for the last 1219 of the total of 2319 births studied, since for the first 1100 births it was recorded only whether or not the birth weight was less than 2500 g. The distribution found for the restricted number of births did not differ from that for Mbozi and will not be referred to further here.

Birth-weight-specific perinatal mortality in Mbozi was also compared with data on 24 897 births in a community of mixed ethnic origin in Amsterdam, the Netherlands.^a

RESULTS

Birth weight distribution

The birth weight distributions of singleton and multiple births in Mbozi hospital, both of which are approximately Gaussian, are shown in Fig. 1. Out of 4372 births, 678 (16%) infants had low birth weight. The corresponding proportion for Lugarawa was 402 (17%) out of 2319 live births.

The mean weight of singleton births in Mbozi was 2946 g (standard deviation (SD): 476 g; range: 1000–4700 g), while the mean weight of multiple births was much lower at 2249 g (SD: 433 g; range: 1100–3550 g). For purposes of comparison, the mean birth weights of infants born in a selection of hospitals or clinics in east and southern Africa are also shown in Table 1.

^a DOORNBOS, J. F. R. & NORDBECK, H. J. *Perinatal mortality — obstetric risk factors in a community of mixed ethnic origin in Amsterdam*. (Ph.D. Thesis, University of Amsterdam, 1985).

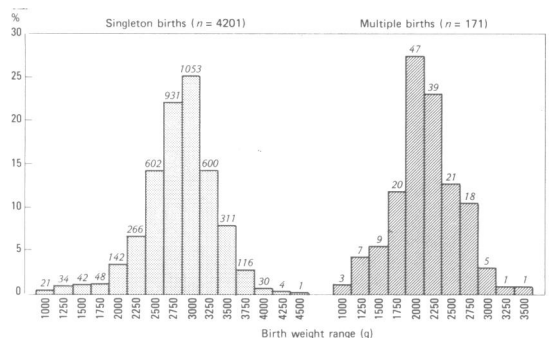


Fig. 1. Birth weight distribution for singleton and multiple births in two rural communities in the United Republic of Tanzania. Figures in italics indicate the number of infants in each weight interval.

Birth weight, parity, and maternal height in Mbozi

Primiparae in Mbozi delivered singleton infants with a mean birth weight of 2844 g, more than 100 g below the mean birth weight for multiparae (Table 2). In Mbozi 13% of women who were taller than 150 cm delivered low-birth-weight infants, while 26% of women who were less than 146 cm delivered low-birth-weight infants. Finally, the proportion of low-birth-weight infants born to women whose height was 146–150 cm was 18%.

Birth weight and sex of infants in Mbozi

In Mbozi male infants had a greater mean birth

Table 1. Mean birth weights of infants in some communities in east and southern Africa

Area (period)	All births (g)	Live births (g)	Singleton births (g)	Live singleton births (g)
<i>United Republic of Tanzania</i>				
Dar es Salaam (1975–76) ^a	2991	—	—	—
Lugarawa (1976–79)	2830	—	—	—
Mbozi (1980–83)	2919	2934	2946	2962
Ikwiriri (1972–80) ^b	—	—	—	3009
<i>Kenya</i>				
Machakos (1975–78) ^c	—	—	—	3133
<i>Lesotho</i>				
Quthing (1979–80) ^d	—	—	3052	—

^a See reference (5).

^b See reference (6).

^c See reference (7).

^d LAMBERS, M. D. A. *Early growth of the Mosotho child*. (Thesis, University of Amsterdam, 1984).

weight than that of their female counterparts (Table 2). However, the birth weight differences between the sexes diminished with increasing parity: for example, there was a 167-g difference between male and female infants for primiparae; a 115-g difference for parities of 1–4, and a 70-g difference for parities ≥ 5 .

Birth weight and perinatal mortality

The relation between birth weight and perinatal mortality can be seen from Fig. 2, which shows the birth-weight-specific perinatal mortality rates for singleton births in Mbozi. For purposes of comparison, Table 3 shows the birth-weight-specific perinatal mortality rate for all births in Mbozi together with analogous data from a recent study of a large community of Dutch, Negroid, Asian, and Mediterranean origin living in Amsterdam, the Netherlands. For all weight groups, the risk of perinatal death was greater in Mbozi than in Amsterdam, but the relative risks depended on the particular weight groups—the highest relative risk (5.1) being for infants of birth weight ≥ 2500 g and the lowest (1.2) for those of birth weight 1500–1999 g.

A simple logistic regression analysis of the data using a weighted least-squares approach indicated that for every 100-g decrease in birth weight the perinatal mortality increased by 18% in Mbozi and by 24% in Amsterdam.

DISCUSSION

The mean birth weights in Lugarawa and Mbozi are among the lowest that have been reported for African countries. The average birth weights of infants who died in the perinatal period and of multiple births are much lower than those of live-born singletons (Table 1).

It has been estimated that the proportion of low-birth-weight infants in east Africa “dropped” from 14% in 1979 to 13% in 1982 (2). The data reported

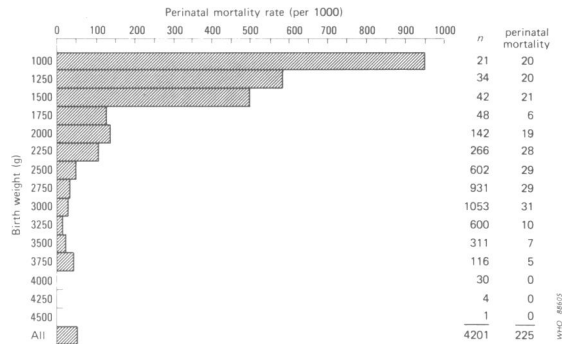


Fig. 2. Birth-weight-specific perinatal mortality rate (per 1000) for singleton births in Mbozi, United Republic of Tanzania.

for the United Republic of Tanzania, however, indicate that there was an “increase” from 13% in 1979 to 14.4% in 1982 (2). It has been suggested that such changes indicate a deterioration in the situation (2), but a deduction based on such small differences is problematic for the reasons indicated below.

(1) *Almost all low-birth-weight data are derived from hospital populations.* Clearly, it will be difficult for some years to come to obtain population-based birth weight data in developing countries: for example, even the well-known population-based Machakos study in Kenya refers only to hospital-based data (7). Moreover, the few population-based data that have been reported involved small sample sizes.^b

(2) *Different definitions of low birth weight.* Extension of the definition of low birth weight to include also infants who weighed exactly 2500 g at birth increased the proportion of low-birth-weight infants in Lugarawa and Mbozi by 2.7% and 2.1%, respec-

^b SRI KARDJATI, M. *Maternal nutrition profile and birth-weight in rural villages in Sampang, Madura (Indonesia)*. (Thesis, Airlangga University, Surabaya, 1985).

Table 2. Mean birth weight, parity, and sex of singleton births in Mbozi district, United Republic of Tanzania, 1980–83

Parity	Male infants (g)	n	Female infants (g)	n	Both sexes	n
0	2926 (425) ^a	505	2759 (455)	484	2844 (447)	989
1–4	3043 (468)	1136	2928 (449)	1105	2986 (462)	2241
≥ 5	2994 (549)	453	2924 (491)	492	2958 (521)	945
All	3004 (479)	2094	2888 (466)	2081	2946 (476)	4175

^a Figures in parentheses are standard deviations.

Table 3. Birth-weight-specific perinatal mortality in Mbozi, United Republic of Tanzania, and Amsterdam, Netherlands

Birth weight range (g)	Perinatal mortality		Relative risk (Mbozi/Amsterdam)
	Mbozi (<i>n</i> = 4372)	Amsterdam (<i>n</i> = 24 897) ^a	
1000–1499	69.2%; <i>n</i> = 45	49.0%; <i>n</i> = 79	1.4 (1.1–1.8) ^b
1500–1999	23.5%; <i>n</i> = 28	20.0%; <i>n</i> = 73	1.2 (0.8–1.7)
2000–2499	10.1%; <i>n</i> = 50	5.4%; <i>n</i> = 65	1.9 (1.3–2.7)
≥2500	3.1%; <i>n</i> = 113	0.6%; <i>n</i> = 139	5.1 (4.0–6.5)
All	5.4%; <i>n</i> = 236	1.4%; <i>n</i> = 356	3.8 (3.2–4.4)

^a Data from Doornbos & Nordbeck. (see footnote a, p. 654).

^b Figures in parentheses are the 95%-confidence intervals.

tively (Table 4). There is no reason for not complying with the WHO-recommended limit of birth weights <2500 g; however, many studies still appear in which low birth weight is defined as ≤2500 g (8–12).

(3) *Inclusion of birth weights less than 1000 g.* Although it is recommended that national statistics should include data on all deliveries of birth weight ≥500 g, different registration practices for highly premature births in various countries (13) prompted WHO to recommend the use of standard perinatal statistics, whereby calculation of rates is restricted to birth weights ≥1000 g.^c

^c FIGO STANDING COMMITTEE ON PERINATAL MORTALITY AND MORBIDITY: *Report of the committee following a workshop on monitoring and reporting perinatal mortality and morbidity, 19–21 March 1982, Heidelberg, Federal Republic of Germany.* Unpublished document, International Federation of Gynaecology and Obstetrics, London, 1982.

(4) *Different methods of calculating low-birth-weight rates.* The use of different denominators to calculate low-birth-weight rates resulted in differences in the percentage of low-birth-weight infants of up to 1.6% in Lugarawa and 3.4% in Mbozi (Table 4). Combining these differences with those discussed above in the section on the use of different definitions of low birth weight leads to a range in the proportion of low-birth-weight infants of 15.7% to 20% in Lugarawa and of 12.1% to 17.6% in Mbozi (Table 4).

These considerable differences call for use of a uniform definition of low birth weight to facilitate comparison with other studies.

Usually the proportion of low-birth-weight infants is expressed as a percentage of the total number of live births, as recommended by WHO (3). Calculated in this way, the proportion was higher (17.1%) in Lugarawa than in Mbozi (14.5%). In both these

Table 4. Incidence of low birth weight (LBW) in east and southern Africa for different definitions and calculated in various ways

Area (period)	Definition of LBW	All births	Live births	Singleton births	Live singleton births
<i>United Republic of Tanzania</i>					
Lugarawa (1976–79)	1000–2500 g	20.0%	19.4%	18.5%	18.0%
	1000–2499 g	17.3%	17.1%	16.0%	15.7%
Mbozi (1980–83)	1000–2500 g	17.6%	16.5%	15.1%	14.0%
	1000–2499 g	15.5%	14.5%	13.2%	12.1%
Dar es Salaam (1975–76)	<2501 g	—	15.2%	—	—
Ikwiriri (1972–80)	<2500 g	—	—	—	10.6%
<i>Kenya</i>					
Machakos (1975–78)	1000–2499 g	—	—	—	6.9%
<i>Lesotho</i>					
Quthing (1979–80)	<2500 g	—	—	—	7.7%

districts there was almost no difference in the distributions of maternal height (population below 150 cm: 19% in Lugarawa and 18% in Mbozi). The socio-economic circumstances in Mbozi district, with its coffee growing, were better than those in Ludewa district, where there is subsistence farming only.

The recent low-birth-weight data from other rural areas in east and southern Africa shown in Table 4 indicate that in these areas the percentage of low-birth-weight infants is lower than that found in the present study. In Tanzania, the only data on low-birth-weight rates in urban areas (calculated using birth weights ≤ 2500 g and all live births) are for Dar es Salaam, where the rate was 15.2% in 1975–76 (5). The comparable rates were 19.4% for Lugarawa and 16.5% for Mbozi. It is unlikely that these differences between urban and rural areas can be accounted for by differences in social class, since 97% of the study population in Dar es Salaam were of low socio-economic status. There was, however, a social class gradient in the Dar es Salaam sample since 6.5% of low-birth-weight infants were from the highest and 15.6% the lowest extremes of the low social class group (5). A considerably smaller proportion of low-birth-weight infants (10.6%) was found in Ikwiriri, a village in rural Tanzania, based on 70% of all births that took place in the local health centre, and calculated using live singleton births as the denominator. This is all the more surprising since the prevalence of malaria is higher in this area than in Lugarawa and Mbozi, and placental infection with malaria is connected with low birth weight. The high level of antenatal malaria and anaemia prophylaxis coverage in Ikwiriri village may, however, account for the rather low percentage of low-birth-weight infants born there (6).

Birth weight and perinatal mortality

As has also been observed previously, in the present study perinatal mortality increased with decreasing birth weight; however, surprisingly, the perinatal mortality rates of infants who weighed 1500–1999 g in Mbozi was almost the same as that found in Amsterdam. Facilities for neonatal intensive care were nonexistent in Mbozi.

In part, the similar perinatal mortality rates in Mbozi and Amsterdam might arise because of ma-

turity differences between infants of the same birth weight in the two locations (14, 15). Gestational age was not taken into consideration in the study, although it is an important determinant of perinatal mortality (16, 24), and this underlines that the correct interpretation of the results of low-birth-weight studies is difficult (17).

The results of the study demonstrate that, with increasing birth weight, the relative risk of perinatal mortality is greater in Mbozi than in Amsterdam. Also, the relative risk of perinatal death of "mature" as compared with that of low-birth-weight infants was much greater in Mbozi than in Amsterdam. This presumably arose because of the contribution of cephalopelvic disproportion to perinatal mortality. Obstructed labour was the most frequent cause of perinatal death in Mbozi (78 out of 298 perinatal deaths (26%) during the study period), and the majority of these deaths (66 of the 78) involved infants of birth weight ≥ 2500 g.^d This indicates that the prevention of prolonged and obstructed labour may be of great importance in reducing perinatal mortality, and this objective should therefore have a higher priority in rural areas than the provision of intensive neonatal care facilities.

The proportion of low-birth-weight infants in a community can be reduced by providing dietary supplements to pregnant women who are nutritionally at risk (18, 19).^e In this respect, high energy foods are more important than high protein supplements (20). A side-effect of such programmes to increase birth weights can, however, be an increase in the prevalence of cephalopelvic disproportion of neonates (21).

Selection of women at risk of delivering low-birth-weight infants is a far from easy task (22)—pre-pregnancy weight and height, maternal weight-for-height, and maternal weight gain during pregnancy are only some of the indicators (23, 24). Ultimately, however, the eradication of poverty and of illiteracy and the stimulation of rural socioeconomic development will eliminate the need for dietary supplements as indicated by nutritional studies in developed countries (20, 23).

^d VAN ROOSMALEN, J. *Maternal health care in the south-western highlands of Tanzania*. (Thesis, University of Leiden, 1988).

^e See footnote b, p. 655.

RÉSUMÉ

POIDS À LA NAISSANCE DANS DEUX HÔPITAUX RURAUX DE RÉPUBLIQUE-UNIE DE TANZANIE

L'OMS a choisi l'insuffisance pondérale à la naissance comme l'un des indicateurs des progrès réalisés vers la santé

pour tous d'ici l'an 2000. En Afrique, on dispose de peu de données sur la répartition des poids à la naissance. On a

donc présenté ici les résultats obtenus pour 2319 naissances consécutives à l'hôpital de Lugarawa (1976-1979) et pour 4372 naissances à l'hôpital de Mbozi (1980-1983), tous deux situés dans les montagnes du sud-ouest de la République-Unie de Tanzanie. A Mbozi, le poids moyen à la naissance pour les accouchements simples était de 2946 g (écart type (σ)=476 g), alors qu'il était bien plus faible pour les naissances multiples avec 2249 g (σ =433 g). En moyenne, les primipares ont donné naissance à des enfants plus petits que les multipares et les garçons étaient plus gros que les filles.

La mortalité périnatale due à l'insuffisance pondérale à la naissance à l'hôpital de Mbozi a été comparée avec la mortalité observée sur un large échantillon de population à Amsterdam (Pays-Bas). Le risque de décès périnatal était plus élevé à Mbozi qu'à Amsterdam pour tous les groupes de poids, mais avec un risque relatif variable en fonction du poids: le risque relatif le plus élevé (5,1) se retrouve pour les poids à la naissance ≥ 2500 g et le risque relatif le plus

faible (1,2) pour les poids compris entre 1500 et 1999 g.

L'emploi de définitions de l'insuffisance pondérale à la naissance et de méthodes de calcul différentes s'est traduit par des écarts d'environ 5% dans le pourcentage de nouveau-nés présentant une insuffisance pondérale dans une même population. Pour effectuer des comparaisons à l'échelon international, il est par conséquent recommandé d'adopter des critères uniformes dans ce domaine.

Le risque de mortalité périnatale relativement élevé observé pour les enfants ayant un poids à la naissance supérieur ou égal à 2500 g est probablement dû au fait que la disproportion fœto-pelvienne est responsable de davantage de complications chez les nourrissons normaux que chez les nourrissons ayant un faible poids à la naissance. La prévention des complications du travail aura probablement plus d'impact sur la diminution de la mortalité périnatale que la mise en place de services de soins intensifs pour les nouveau-nés.

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