Medical Journal of Zambia (1977), 11, 4, 103.

Low birth weight: Some considerations in a Zambian population.

V.E. Davis, M.B., B.S., (Syd.), M.R.C.O.G.
Specialist Obstetrician and Gynaecologist, Nchanga Consolidated Copper Mines Limited, (Rokana Division), Medical Department, Kitwe.

(Received for Publication: 10th December 1976).

SUMMARY

A retrospective analysis of 2401 consecutive births revealed a lowbirth weight rate of 11.4 percent of all births and 14.2 percent of all live borns. Sixty-five percent of late fetal and first week neonatal deaths were low birthweight babies. The cause of low birthweight labour was unknown in 48.2 percent of cases. The major known associations with low birthweight labour and delivery were twin birth, antepartum haemorrhage, premature rupture of the membranes and toxaemia of pregnancy. Nutritional factors were considered to be of significance in the incidence of low birthweight. The earlier attendance of mothers at ante-natal clinics and the availability of experienced medical and nursing personnel with adequate facilities are necessary for perinatal mortality to be significantly reduced in the low birthweight group.

INTRODUCTION

In recent years statistical emphasis has been placed on birth weight for gestational age (Ounsted, 1971). There are differences in the definitions of prematurity and preterm (Ousted, 1971). Low birthweight infants are those who weigh 2500 grams or less at birth and they are considered to have either a shortened gestational period or a less than expected rate of intrauterine growth (Nelson et al, 1969). Low birth weight infants make a major contribution to both late fetal and neonatal mortality in the United States of America (Yerushlmay, 1967), Great Britain (Butler, 1965; Leading Articles, 1976) and Africa (Ebrahim, 1969).

In the British Perinatal Mortality Survey of 1958, "one-third of low birth weight babies were born before the 36th week (less than 252 days from the first day of the last menstrual period) one-third during the 36th, 37th or 38th weeks (252–272 days inclusive) and the remainder of 39 weeks or later" (Butler, 1965). Ebrahim and D'Sa, 1966 state "It has been the experience that many newborns in developing countries whose birth weight is below 2500 grams, possess a full potential for growth and health and are viable." The incidence of low birth weight varies considerably in various regions of the world (World Health Organisation Technical Report Series, 1970) and it is stated "that, in countries with low median

birthweight and a high percentage of babies of low birthweight, a considerable proportion of the babies may be small for dates." Stein and Ellis, 1974 and Stein, 1975 studying the low birthweight African baby found that 73 percent were small for gestational age and that "maternal protein depletion, and probably therefore malnutrition was associated with the high incidence of small-for-age-gestational babies". The Lancet Editorial, 1975 on Maternal nutrition and low birthweight refers to the different circumstances in communities where nutritional conditions are chronically unsatisfactory. This retrospective analysis was undertaken in order to assess the significance of low birth weight infants at Wusikili Hospital, Kitwe.

Material

Details were extracted from the Maternity Register, Nursing Reports and Nursery Register of all low birth weight infants (2500 grams or less), which were born in the Maternity Department of the Wusikili Hospital, Kitwe, 1971 – 1972 inclusive. These two years were analysed because nursing reports were of maximum value at that time. The records were destroyed in 1973 with the introduction of legal birth certification. The details extracted prior to this are considered relevant nonetheless.

The Maternity Department of Wusikili Hospital manages the high risk pregnancies from the antenatal clinics (Lewis, 1964) and as such is not a true reflection of the obstetric community. Accurate statistics were not available from the Township Clinics of low birth weight infants delivered in their Maternity units during the two years analysed. It is considered that the Hospital incidence is a reflection of the maximum incidence in the obstetric community, as most suspected premature (including low birth weight) labours were referred from the Clinics to the Hospital for delivery. Taylor, 1976 stresses the increased incidence in an obstetrical service involving a large number of complicated cases.

RESULTS

During the two years reviewed there were 2401 births registered of which 374 were low birth weight infants, an incidence of 11.4 per cent of all births. The incidence of live-born low birth weight infants among live births was 14.2 per cent (Table 1).

The main contributory factor clinically in all stillbirths in 1971–1972 is shown in Table II. Separate analysis of lowbirth weight infants was not possible. Prolonged pregnancy with resultant hypoxia is thought to have made a major contribution to the undetermined group due to the large number of mothers with no recollection of the date of their last menstrual period. Low birth weight was less likely in the circumstances. Lowbirth weight infants therefore probably made a major contribution to the other groups.

The clinically significant associated factor in live-born low birth weight labour is shown in Table III. There was no documentation of any two or more major factors operating together in any one case. There is a small element of error therefore in this table. All multiple pregnancies with low birth weight infants were recorded. The atepartum haemorrhage group (excluding cases of placenta praevia) excludes local causes in the lower genital tract, but otherwise does not differentiate the site of bleeding, as descriptions of the placental appearances were generally inadequate.

Classification by weight and sex in recorded cases is shown in Table IV. Male infants had a higher first week mortality than female infants (36.3 per per cent as against 24.6 per cent respectively). A birth weight of more than 2000 grams markedly improved the chances of first week survival.

A significant improvement in first week survival was apparent in comparing the two years under review (Table V). Despite the different number of cases, the incidences of the associated factors were very similar in the two years.

The incidence of induction of labour was 2 per cent being almost exclusively in the hypertension of pregnancy groups. No case was caused by elective induction with incorrect dates.

Details in relation to low birth weight in infants delivered by caesarean section were incomplete. There was one case due to placenta praevia and one case due to abruptio placentae, but the incidence in the only other relevant groups (pre-eclampsia and essential hypertension) could not be calculated. The maximum possible caesarean section rate of 3.2 per cent was less than the Hospital rate of 4.1 per cent of the two years analysed.

TABLE 1

2401 Consecutive Births, Wusikili Hospital, 1971– 1972.

Group	Total	Still Births	First Week Deaths	Perinatal Mortality
All births	2401	106	88	81/1000
Low Birth Weight	374	48	78	337/1000

TABLE II

2401 Consecutive births, Wusikili Hospital, 1971–72. All stillbirths – main contributing factor.

Main Contributing Factor	Number
Undetermined	52
Cord Complication	19
Antepartum Haemorrhage (other than due to praevia)	14
Placenta Praevia	8
Pre-eclampsia/eclampsia	7
Congenital abnormality	6
TOTAL	106

syndrome was 17.6 per cent in the nursery admissions who subsequently died.

There were no maternal deaths associated with the low birth weight deliveries.

Analysis was not possible of maternal age, height, parity, obstetric history, pre-pregancy weight, gain, time of antenatla clinic booking, anaemia and the quantity of routinely supplied iron, folic acid and multivitamin consumed.

DISCUSSION

The retrospective analysis confirmed the substantial contribution made by low birth weight infants to overall perinatal mortality. Sixty-five per cent of the babies who died weighed 2500 grams or less. In the 1970 British Births Survey, 68 per cent of the babies who died weighed less than 2500 grams at birth, (Leading Article, 1976). The low birth weight

TABLE III

326 Consecutive labours producing low birth weight live-born infants, Wusikili Hospital, 1971–1972. The associated factor and first week mortality.

Associated Factor	Total	First Week Deaths
Undetermined	157 (48.2)	21
Multiple pregnancy (one set of triplets)	95 (29.1)	28
Antepartum Haemorrhage (other than due to praevia)	27 (8.6)	17
Premature rupture of the membranes	26 (8.0)	8
Pre-eclampsia	12 (3.7)	1
Essential hypertension	4 (1.2)	—
Congenital Abnormalities	2 (0.6)	2
Placenta praevia	1	1
Maternal viral infection	1	—
Maternal gastro-enteritis	1	—
TOTAL	326	78

Numbers in parentheses are percentage incidences.

The cause of first week death is shown in Table VI. Twenty-seven infants died in the delivery room and no details were available of possible causative factors in these cases. No autopsies were performed during the two years. The cause of death was unknown in 72.5 per cent of nursery admissions. Breech delivery was associated with 23.5 per cent of deaths. The incidence of clinically diagnosed respiratory distress rate for England and Wales for 1963 was 7 per cent of all births (Butler, 1965), compared with 11.4 per cent in this analysis. The World Health Organisation Technical Series, 1970 reported a low birth weight rate varying between 5.9 and 28 per cent of all live-borns in "some institutions in selected areas." The rate in this analysis was 14.2 per cent.

In the British Perinatal Mortality Survey of 1958

TABLE IV

Low birth weight live-born infants, Wusikili Hospital, 1971–1972. Classification by weight and sex in recorded cases.

Weight in Grams	LIVED			DIED (FIRST WEEK)		
	Male	Female	Total	Male	Female	Total
501 – 1000	–	–	–	13	10	23
1001 – 1500	6	7	13	14	10	24
1501 – 2000	22	17	39	13	6	19
2001 – 2500	96	94	190	5	3	8
TOTAL	124	118	242	45	29	74

TABLE V

Low birth weight live-born infants. Comparison of first week mortality in 1971 and 1972 respectively.

ASSOCIATED FACTOR	1971		1972	
	Number	Deaths	Number	Deaths
Undetermined	86	13	71	8
Multiple pregnancy	52	20	43	8
Antepartum Haemorrhage (other than due to praevia)	15	10	12	7
Premature rupture of the membranes	16	7	10	1
Pre-eclampsia	8	1	4	–
Essential hypertension	1	–	3	–
Congenital Abnormalities	1	1	1	1
Placenta praevia	–	–	1	1
Maternal infection	1	–	1	–
TOTAL	180	52	146	26
FIRST WEEK MORTALITY	28.9 per cent		17.8 per cent.	
Corrected first week mortality Infants 501–1000 grams excluded	20.5 per cent		15.5 per cent	
Percentage 1001–2000 grams	30.4 (49/161)		32.4 (46/142)	

Number of cases in parentheses.

(Butler, 1965), the major associations with low birth weight were twin birth 19 per cent, maternal hypertension 18 per cent and anatepartum haemorrhage 12 per cent of cases respectively. The corresponding figures in this analysis were 27.6 per cent, 4.9 per cent and 8.8 per cent respectively. Stein, 1974 reported an incidence of twinbirth of 26 per cent and toxaemia of pregnancy of 9 per cent in a low birth weight group at Baragwanath Hospital, Johannesburg, South Africa. Ebrahim, 1969 reported an incidence of twin birth of 33.3 per cent and pre-eclamptic toxaemia of pregnancy of 9 per cent in a low birth weight group (4 pounds 8 ounces or less) in Dar es Salaam, Tanzania. The incidence of twin pregnancy at Wusikili (1971–1975) of 1 in 67 confinements was higher than the 1 in 84 in England and Wales. Sixty-three per cent

TABLE VI

The cause of first week death in 51 infants admitted to the nursery.

Birth Weight	Cause of Death	Number
1500 grams or less.	Undetermined	22 (5)
	Respiratory distress syndrom	6 (3)
1501 – 2500 grams.	Undetermined	15 (4)
	Respiratory distress syndrome	3
	Jaundice	2
	Hypoxia	1
	congenital Heart disease	1
	Sclerema	

Numbers in parentheses are breech deliveries.

of twin births were of low birth weight in the Wusikili series (unpublished). Multiple pregnancy thus makes a major known contribution to low birth weight.

The antepartum haemorrhage incidence (excluding placenta praevia) of 8.6 percent is an increase on the Hospital incidence of 3.2 percent for 1971 – 1972 inclusive. In the overall analysis of low birthweight labour, with or without premature rupture of the membranes, the association with previous unrecorded episodes of threatened premature labour remains unknown. Many women delivering at home in this community ignore the earliest signs of labour before attempting to come to Hospital or Clinic for delivery (Davis and Lochhead, 1976). This pattern of behavour may lead to episodes of threatned premature labour going unrecorded and exclude these women from intensive medical care. Baillie and Milton, 1973 stress that premature labour is an obstetric emergency not recognised as such by many patients doctors and midwives alike.

The 0–7 day mortality rate in 1971 among low birthweight infants in Sweden was 128/1000 and in England and Wales 100/1000 (Pharaoh, 1976) compared with 242/1000 in this series.

The higher first week neonatal death rate in male infants may have been associated with increased susciptibility to hypoglycaemia (Butler, 1965). The improvement in perinatal mortality in 1972 is believed to have been particularly due to the acquisition of an experienced Paediatric Medical Officer, who paid special attention to the adequate staffing of the nursery with experienced nurses and to the teaching of the principles of the nursing care of premature and low birth weight infants. The association of breech delivery with 23.5 percent of first week deaths highlights the risks of low birth weight breech delivery (Davis, in press). The incidence of respiratory distress syndrome in infant nursery deaths of 17.3 per hundred is less that the figure of 27 to 46 per hundred for Caucasians (Scopes, 1971). This agrees with the impression of Holmes, 1973 in Moshi Tanzania that respiratory distress syndrome is less common in the African neonate compared with neonates in "Western countries". Low birth weight associated with antepartum haemorrhage was a particularly lethal combination.

The Zambian Copperbelt is about 1300 metres above sea level. An increase in altitude of about 1000 metres results in a decrease of about 100 grams in birth weight (Hytten and Leitch, 1971).

There are reported associations with primiparity (Butler 1965, Ebrahim, 1969) teenage pregnancy and previous low birth weight delivery (Kaltreider and Johnson, 1976). There was a 45 per cent incidence of low birthweight delivery in nulliparous patients who had two or more previous spontaneous abortions (Kaltreider and Johnson, 1976). An association with previous induced abortion is controversial (Edstrom, 1975). Fedrick and Anderson, 1976 reported associations with spontaneous pre-term (before 37 weeks) low birth weight of low maternal age, low maternal weight, maternal smoking, low social class, illegitimacy, threatened abortion and previous history of ante-partum haemorrhage, perinatal loss or low birth weight liverbirths.

Ebrahim and D'Sa, 1966 demonstrated the effect of Social Class on African birth weights in Dar es Salaam, Tanzania. The patients in this analysis would be Grade III to IV according to their criteria i.e. lower socio-economic grouping and they had a lower mean birth weight with an 11 per cent live-born low birth weight rate in Dar es Salaam. Maternal nutrition was regarded as the outstanding difference between the two groups.

Maternal smoking (Butler 1965) is not a factor in this community. Maternal nutrition may still be more important in smoking mothers (Davis et al., 1976). Malnutrition is widespread in Zambia including the reproductive age group (National Food and Nutrition Surveys). Severe Malnutrition will reduce birth weight (Susser and Stein, 1975). High calorie supplementation (=20,000 calories per day) in a maternal population in Guatemala showing moderate malnutrition significantly reduced the incidence of low birth weight and infant mortality (Lechtig et al., 1975). They concluded that moderate protein-calorie malnutrition during pregnancy leads to lower placental weight without significantly changing the concentration of the biochemical components and this may be the mechanism by which maternal malnutrition causes

high prevalence of low birth weight in the populations studied.

Folic acid is an important growth factor (Hibbard, 1975). The staple diet of maize is low in folic acid content and the high folic acid content of green leafy vegetables is all but destroyed by prolonged cooking prevalent in some cultures. Fortification of maize with folic acid has been suggested (Colman et al., 1975). Folic acid supplementation with iron will reduce low birth weight incidence compared with iron supplementation alone (Baumslag et al., 1970; Iyengar and Rajalakshmi, 1975). Mean placental weight is increased and the greatest effect was found in the first born (Iyengar and Rajalakshimi, 1975). The effect of folic acid is not seen in those communities with adequate nutritional status (Martin and Davis, 1964; Baumslag et al., 1970). Maternal serum iron had no relationship to birth weight or placental weight (Nhonoli et al., 1975). Vitamin B12 had no apparent relationship to birth weight (Baumslag et al., 1970).

Anaemia throughout pregnancy, especially sickle cell anaemia increases the incidence of low birth weight by intrauterine growth retardation (Harrison and Ibeziako, 1973). Malaria will reduce birth weight (Bruce-Chwatt, 1952) but it was not clinically significant in this community as they live in a malarial controlled environment. Anti-malarials were not routinely prescribed during the two years analysed. There was no clinical evidence to suggest that bacterial viral or protozoal infections made any significant contribution to low birth weight in this series, but detailed studies were lacking.

Though not assessed in this series, congenital uterine abnormalities and the incompetent cervical is probably only contributed to a few cases. The significant factor requiring further study is the 48.2 per cent of cases in which no specific cause could be found associated with low birth weight labour and delivery.

Zambia requires birth weight for gestational age statistics in order to differentiate between the normal and small for dates infants, which have different clinical problems and prognoses (Butler, 1965; Drillien; 1965; Taylor, 1976). Earlier attendance at antenatal clinic is essential (Davis and Lochhead, 1976).

ACKNOWLEDGEMENTS

I would like to thank Miss C. Nsama for preparing the manuscript and the Management of Nchanga Consolidated Copper Mines Limited for permission to publish.

REFERENCES

Baillie, P., and Milton, P.J.D., (1973), South African Medical Journal, Supplement: South African Journal of Obstetrics and Gynaecology, 47, 1299.

Baumslag, N., et al., (1970), British Medical Journal, 1, 16.

Bruce-Chwatt, L.J., (1952), Annals of Tropical Medicine and Parasitology, 46, 173.

Butler, N.R., (1965), Journal of Obstetrics and Gynaecology of the British Commonwealth, 75, 1001.

Colman N., et al., (1974), South African Medical Journal, 48, 1763.

Colman, N., (1974), Ibid, 1795.

Davies, D.P., et al., (1976), Lancet, 1, 385.

Davis, V.E. (in press), Medical Journal of Zambia.

Davis, V.E., and Lochhead, A.C., (1976), Medical Journal of Zambia, 1, 7.

Drillien, C.M., (1965), Journal of Obstetrics and Gynaecology of the British Commonwealth, 75, 993.

Ebrahim, G.J. (1969), East African Medical Journal, 46, 102.

Ebrahim, G.J., and D'Sa, A., (1966), Journal of Tropical Paediatrics, 12, 55.

Edstrom, K.G.B., (1975), Bulletin of the World Health Organisation, 52, 128.

Fredrick, J., and Anderson, A.B.M., (1976), British Journal of Obstetrics and Gynaecology, 83, 342.

Harrison, K.A., and Ibeziako, P.A., (1973), Journal of Obstetrics and Gynaecology of the British Commonwealth, 80 798.

Hibbard, B.M., (1975), South African Medical Journal, Supplement, : South African Journal of Obstetrics and Gynaecology, 49, 1223.

Holmes, G.E., (1973), East African Medical Journal, 50, 498.

Hytten, F.E., and Leitch, I. (1971), The Physiology of Human Pregnancy, 2nd edition, Blackwell Scientific Publications, Oxford, P. 323.

Iyengar L., and Rajalakshmi, K., (1975), American Journal of Obstetrics and Gynaecology, 122, 332.

Kaltreider, D.G., and Johnson, J.W.C., (1976) American Journal of Obstetrics and Gynaecology, 124, 251.

Lancet Editorial, (1975), Lancet, 2, 445.

Leading Article, (1976), British Medical Journal, 1, 854.

Lechtig, A., et al., (1975), American Journal of Obstetrics and Gynaecology 123, 191.

Lewis, T.L.T., (1964), Progress in Clinical Obstetrics and Gynaecology, 2nd edition, Churchill, London, P. 17.

Martin, J.D., and Davis R.E., (1964), Journal of Obstetrics and Gynaecology of the British Commonwealth, 71, 400.

Nelson, W.E. et al., (1969), Textook of Pediatrics, 9th edition, Saunders, Philadelphia, P.364.

Nhonoli, A.M., et al., (1975), British Journal of Obstetrics and Gynaecology, 82, 467.

Pharoah, P.O.W., (1976), Proceedings of the