

ANTENATAL NUTRITION AND FETAL GROWTH

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INTRODUCTION

The most important source for data on fetal growth is the weight of fetuses expelled after varying gestational periods. However it must be accepted that the factors that have caused the fetus to be expelled may have been operative earlier on and might lead to growth abnormalities.

Importance of size at Birth

It is well established that low birth weight is one of the most important determinant factors for subsequent mortality and morbidity. (1)

Thus it is claimed(3) the difference in perinatal mortality between black and white babies in New York State 1958 to 1961 can be wholly accounted for by the difference in birth weights: in other words if black babies had the same distribution of birth weights as white babies and if they were to experience the same weight specific perinatal death rate they have now their perinatal mortality will be identical with that for white babies.

In Britain it was found that only 7% of total babies(6) born would weigh 2500 gms or less. — However this small group of babies accounted for 65% of the perinatal deaths and moreover it was found that the variation of incidence of low birth weights in different parts of Britain correlated with the perinatal mortality in the respective area.

Fig. I is a typical demonstration of the relationship between low birth weight and perinatal mortality. There is a very high and steep increase in the perinatal mortality at birth weight under 2.5. kg. and the maximum perinatal mortality occurring at 1.5. kg. and the minimum occurring at birth weight of 3.7 kg. While birth weight is a convenient epidemiological index for measuring the extent and sequelae of 'prematurity', nevertheless it is important in its own right. Thus it was shown that (3) perinatal mortality varies to a much larger degree with birth weight than with gestational age, although the variables are highly interdependent. This is well illustrated in Fig. II which shows constantly high perinatal mortality in babies of very low birth weight irrespective of the gestational age. The effect of the longer gestational age in lowering the mortality rate is only apparent in the heavier birth weight babies (3000–3500 gms)

In a study on his series in Khartoum hospital the author(4) has shown the striking variation in mortality and morbidity in relation to birth weight as illustrated in Fig. III which shows very high mortality rates in the low

birth weight groups showing decrease in mortality with increasing birth weight.

The Importance of Maternal Nutrition as Determinant Factor in Birth Weight of the Baby:

Factors which would affect birth weight include gestational age, multiple pregnancy, the rank of pregnancy, socioeconomic environment of the mother, maternal smoking, prenatal medical care, preeclampsia, chronic maternal illness, besides pregravid and prenatal maternal nutrition – however it is not the intention to discuss all these factors in detail. I would like to focus only in the relationship of maternal nutrition and birth weight as I believe this is of extreme importance particularly to us in developing countries.

Evidence derived from Studies of Famine and War Conditions

A number of studies analysing the effects of famine and food shortages have shown a definite effect of maternal nutritional deprivation on birth weight.

The Leningrad Siege which lasted from August, 1941 to January, 1943 was associated with conditions of extreme food shortages and it was reported that (8) the average birth weight showed a definite drop. However other factors besides the food deprivation may have been at work to produce this result as the women during the siege suffered from physical exertion, nervous tension and cold.

Another study (9) analysed the effect of the chaotic conditions in Germany in 1945 by comparing the birth weights during that period with previous and subsequent periods – this study showed a definite drop in birth weight in 1945 compared to birth weights of 1937–1939. The prewar birth weight could only be attained again after 1948.

In Holland analysis of birth weights of babies born during and after the famine of 1944–1945 (10) showed that the nutritional deprivation in pregnancy was associated with a definite drop in the birth weight and that this effect was more marked when the deficiency occurred in the latter weeks of pregnancy.

During the same period a contrasting experience was reported from Britain (11) but nevertheless complementary to the studies quoted above: here a decline in still birth and neonatal deaths are reported probably related to the special attention given to the pregnant mothers during that period in the provision of nourishing food given to this group of the population.

Evidence Derived from Experimental Studies

In experimental animals it was shown that extreme nutritional deprivation leads to low birth weight, however studies on the human fetal growth have not been consistent, probably because of the difficulties in controlling these studies and the extreme difficulty of obtaining accurate diet history.

Nevertheless a number of experiments can be quoted as showing a positive relationship between maternal nutrition and birth weights of their babies.

In a study in Canada(12) three groups of women were compared: The first group has poor nutrition and was kept as control, the second group was supplemented with food and vitamins and the third group was found to have good diet and was given advice alone. The percentage of 'premature' birth in the first group (poor unsupplemented) was 8, in the second group (poor supplemented) was 2.2 and the third group (good unsupplemented) was 3.0.

In another study in Philadelphia (13) where four groups were assigned the first as control the second received protein supplements, the third vitamin supplements and the fourth both vitamin and protein. The incidence of babies weighing 5lb and less was significantly higher in the control group when compared with the group receiving protein and vitamin supplement.

In another study(7) it is claimed that the pregravid weight of the mother has a definite influence on the birth weight of the babies and it appears that overweight mothers irrespective of their height are programmed to produce large babies. It is also claimed that the birth weight of the baby has no relationship to the paternal height thus showing that environmental factors – maternal weight in this case – have more influence on the birth weight than genetic factors.

Another factor brought out quite well by the same study is the influence of gestational weight gain on fetal weight. As shown in table I there is definite increase in fetal weight in mothers with high gestational weight gain.

On the other hand mothers of the same stature, but with varying calorie intake produced varying (14) fetal size – thus it is reported that mothers with high calorie intake had babies with higher birth weight when the maternal pregravid weight was constant – this being demonstrated in Table II.

In view of this evidence it seems reasonable to state that the nutritional status of the mother before and during pregnancy has some effect on the birth weight of the baby. It is thus hoped if measures are taken to improve maternal nutrition that this will be reflected in a higher average birth weight and consequently on a reduced mortality and morbidity among newly born.

TABLE I:

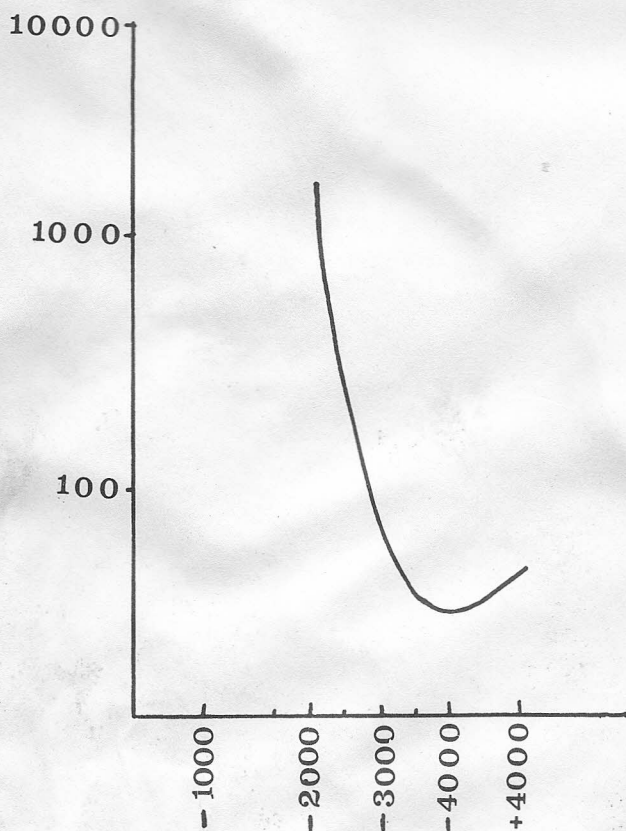
Pre gravid Nutrition	Gestational gain	Foetal Weight (as % of normal)
Over weight	High	118
Under weight		110
Over weight	Low	103
Under weight		97

TABLE II:

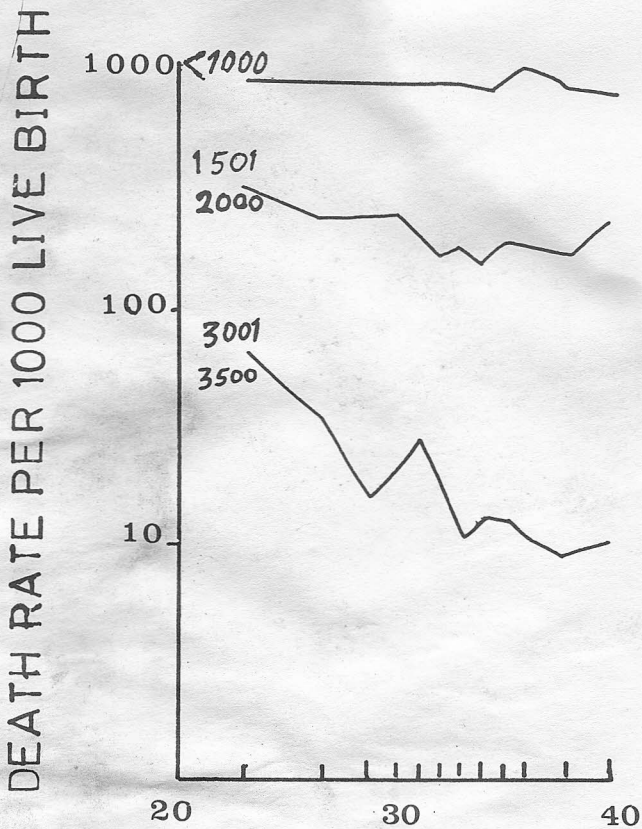
Maternal size		Calorie intake	Foetal Weight
Ht. (cm)	Wt. (kg)		(% of normal)
158	58	1500 (low)	94
157	59	2900 (high)	110

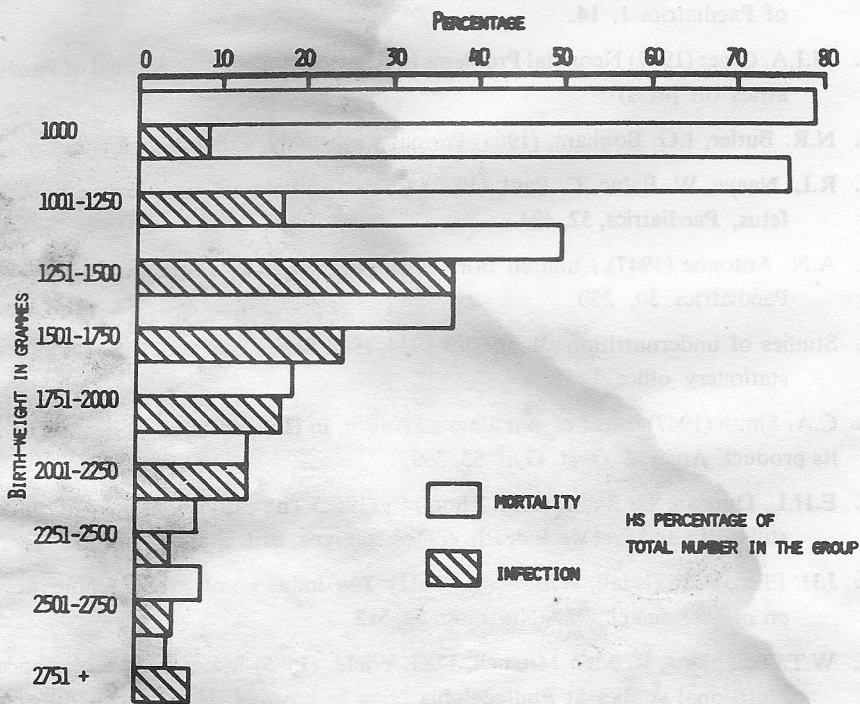
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STIL BIRTHS & NEONATAL DEATHS
PER 1000 LIVE BIRTH



PERINATAL MORTALITY FOR SPECIFIED WT.s AND DURATION OF PREGNANCY





DISTRIBUTION OF MORTALITY AND MORBIDITY TO INFECTION OF NEONATES IN KHARTOUM

REFERENCES

1. Patterns of Mortality in Childhood (1973) R.R. Puffer & C.V. Serrano.
2. Size at Birth (1974) Ciba Foundation Symposium 27.
3. L. Bergner, M. Sussaner, (1970) Low birth weight and prenatal nutrition, an interpretive review, *Paediatric* 46, 946.
4. M.I.A. Omer (1977) The Level of low birth weight in Khartoum. *Sudanese Journal of Paediatrics* 1, 14.
5. M.I.A. Omer (1977) Neonatal Problems in Khartoum, *Sudanese Journal of Paediatrics* (in press)
6. N.R. Butler, I.G. Bonham, (1963) *Perinatal mortality*, Edinburgh, Livingstone.
7. R.L. Naeye, W. Balnc, C. Panl, (1973) Effects of maternal nutrition on human fetus, *Paediatrics*, 52, 494.
8. A.N. Antonoe (1947) Children Born during the Siege of Leningrad in 1942 *J. Paediatrics* 30, 250.
9. Studies of undernutrition Wuppertal 1944-1949 Series No. 275, Her Majesty's stationery office 1951.
10. C.A. Smith (1947) Effect of war time starvation in Holland upon pregnancy and its product. *Amer. J. Obst. Gyn.* 53, 599.
11. E.H.L. Duncan, D. Baird, A.M. Thomson (1952) The causes and prevention of still births and first week death. *J. Obstet. Gyne. Brit. Emp.* 59, 183.
12. J.H. Ebbs, F.F. Tisdall, W.A. Scott (1941) The influence of prenatal Nutrition on mother and child. *J. Nutrition*, 22, 515.
13. W.T. Tompkins, R. Men Mitchell, D.G. Wiehl, (1955) *Maternal and Newborn Nutritional studies at Philadelphia lying in hospital*. New York, Milbank memorial fund, 1955.
14. M. Gebre, Medhin & A. Gobeze (1975) *American Journal of Nutrition*.