Maternal protein depletion and small-for-gestational-age babies

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Stein, H. (1975). *Archives of Disease in Childhood*, 50, 146. **Maternal protein depletion and small-for-gestational-age babies.** It has been established that there is a high incidence of small-for-gestational-age babies among underprivileged urban Africans. This community suffers from endemic malnutrition. Serum albumin studies on mothers of low birthweight babies showed a direct correlation with size of babies for gestational age.

Thus maternal protein depletion, and probably therefore malnutrition, was associated with the high incidence of small-for-age-gestational babies.

It has recently been established that an exceptionally high incidence of small-for-gestational-age babies exists among underprivileged urban Africans (Stein and Ellis, 1974), the reasons for which are uncertain. Apart from multiple pregnancy, other known aetiological factors of small-for-gestational-age babies, such as toxæmia of pregnancy and intrauterine infection, play little or no part.

Because of the endemic malnutrition in this population it seemed likely that this would be of significance. There was, however, little overt clinical malnutrition among the mothers in this study. Nevertheless, biochemical evidence of maternal protein depletion as reflected by low serum albumin levels may be a more sensitive index of malnutrition than the clinical presentation. This study assesses such biochemical features in the mothers of small-for-gestational-age babies, and correlates this with fetal growth.

Investigation

One hundred and three mothers of single low birthweight babies admitted consecutively to our nursery were examined and serum albumin levels were estimated by the electrophoretic method (Smith, 1960). Midmorning, nonfasting venous blood samples were taken between the second and fourth days postnatally. Mothers of twins were excluded as these had previously been shown to contribute to the high incidence of small-for-gestational-age babies seen (Stein and Ellis, 1974). The babies of these mothers were weighed, examined, and gestational age estimated by the method

of Dubowitz, Dubowitz, and Goldberg (1970). This method has been shown to be reliable in similar population groups (Bructon, Palit, and Prosser, 1973; Singer, Blake, and Wolfsdorf, 1973; Jaroszewicz and Boyd, 1973). The weight and gestational age of the babies were correlated using the chart of Battaglia and Lubchenco (1967). The association between centiles of birthweight related to gestational age of the babies and serum albumin levels of the mothers was investigated. Maternal serum albumin levels below 30 g/l were accepted as evidence of protein depletion and babies below the 10th centile of birthweight for gestational age were regarded as being small for gestational age.

Statistical evaluation was carried out on standard principles (Bradford Hill, 1971).

Results

Of the 103 mothers, 54 had serum albumin levels of 30 g/l or above and 49 had levels below 30 g/l. Of the 103 babies born to these mothers 42 were on or above the 10th centile of weight for gestational age (appropriate for gestational age) and 61 were below the 10th centile of weight for gestational age (small for gestational age).

Of the 54 mothers whose serum albumin levels were 30 g/l or above, 30 (56%) had babies who were appropriate for gestational age and 24 (44%) had babies who were small for gestational age. Of the 49 mothers whose serum albumin levels were less than 30 g/l 12 (24%) had babies who were appropriate for gestational age and 37 (76%) had babies who were small for gestational age (Fig.). Comparison of maternal serum albumin levels in the appropriate-for and small-for-gestational-age baby

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FIG. Cases plotted on chart relating birthweights and gestational age of infants to maternal serum albumin levels.

groups shows a statistically significant difference ($t = 62$, no. = 101, $P < 0.0005$).

On more detailed analysis a correlation exists between maternal serum albumin levels and the percentage of the 50th centile of the babies' weight for gestational age in the small-for-gestational-age group ($r = 0.47$) but this falls away in the appropriate-for-gestational-age group ($r = 0.005$) and the difference between these two is significant ($P < 0.01$).

Discussion

The role of maternal malnutrition in the aetiology of small-for-gestational-age babies is unclear. Studies by Smith (1947) and Antonov (1947) during the war showed that acute starvation in mothers had relatively little effect on their babies' birthweights. Moreover, Ounsted (1971) and Drillien (1970) felt that the effect of maternal malnutrition on birthweight is slight.

There is nevertheless other evidence that the birthweight of children of underprivileged and

undernourished mothers is below average (Moodie *et al.*, 1970; Donnelly *et al.*, 1964; Naeye, 1972).

Our previous investigation (Stein and Ellis, 1974) showed a high incidence of small-for-gestational-age babies in an underprivileged population. It therefore remains to be established whether this was due to maternal malnutrition.

From this study it is apparent that there is indeed a correlation between low maternal serum albumin levels and the birth of small-for-gestational-age babies. This cannot be explained on the basis of the normal serum albumin variation during pregnancy. Though these levels fall during pregnancy there is a stabilization during the last trimester and in the early postnatal period (De Alvarez, Afonso, and Sherrard, 1961; MacDonald and Good, 1971).

Protein depletion is an index of malnutrition, and it is significant that malnutrition is endemic and chronic in the population under review. It therefore seems that whereas acute starvation has little effect on fetal growth, protein depletion, as

part of the picture of chronic malnutrition, may indeed be significant in the aetiology of small-for-gestational-age babies.

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