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ORIGINAL ARTICLE

ANTENATAL DIET AND ITS INFLUENCE ON STILL-BIRTHS AND PREMATURITY

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THERE has been a steady fall in the infantile mortality rate since the beginning of the present century. A reduction in the deaths from the end of the first month to the end of the first year is responsible for most of this fall but there remains the "hard core" of neonatal mortality which has shown very little improvement. By far the largest factor in these neonatal deaths is prematurity and of these premature deaths, roughly fifty per cent occur in the first 48 hours. Most of these deaths are among the smallest and most weakly infants and it is unlikely that medical science even at the cost of more research and the spending of much time and money will save more than a few of them.

A more rational method of approach to the problem would seem to be that of prevention. In this connection still-births should also be considered since they are potential lives lost which must be added to the premature deaths, it being often purely accidental whether the birth is classed as still-birth or premature birth. It will also be accepted that, apart from certain well-recognised causes, such as obstetrical hazards, multiple births and toxic conditions, the ætiology of still-births and premature births is obscure. In these days of low birth rates and a dwindling population, it is scarcely necessary to stress the importance of this problem.

In considering the question in the light of prevention, an opportunity presented itself to investigate the diets of expectant mothers during the last three months of pregnancy. The work was carried out at the Glasgow Royal Maternity and Women's Hospital where the number of indoor births per year is over 3,000 and the still-births and premature births each over 300 per annum. Thus ample material for investigation was available with results quickly obtainable, so avoiding errors due to seasonal and environmental changes. The patients were in most cases in poor financial circumstances, although probably not as bad as in pre-war years, since the spectre of unemployment had largely disappeared.

A record was made of the food intake of 300 mothers—100 mothers of still-born infants, 100 mothers of prematurely born infants and 100 mothers of normal full-time infants. There was no selection of cases in any way and obstetrical causes were not considered. The standard of prematurity was the usually accepted one, namely, an infant with a birth weight of 2·5 kilos or under. The investigation was made after the confinement and before the mother left hospital, but covered the last three months of pregnancy. The method employed was similar to that used in certain American clinics and takes into account all foods which supply the main food factors as well as any supplementary foods. Thus the constituents were grouped under main headings—dairy produce, meat, vegetables and cereals (dark or refined), and then the number of times the various foods were taken per week or fortnight was noted. The actual amounts consumed were assessed by comparison with average hospital allowances. The accuracy of such a survey was greatly helped by the wartime system of rationing which enabled the actual amounts of many important foods to be assessed.

The diet of each of the 300 mothers was then recorded in terms of intake of calories, carbohydrate, fat, protein, calcium, phosphorus and iron. The average amounts of each of these constituents, together with the optimum requirements for expectant mothers, are given in Table I. The vitamins were not considered in this study although their importance must not be overlooked (Toverud and Ender, 1936).

Scrutiny of the group values indicates the superiority of

the diets of the mothers with full-time infants in every respect, but relatively this is most noteworthy as regards first class protein, calcium and phosphorus, where the figures for the two other groups are less than two-thirds of those for the mothers with full-time infants and of the optimum values. Mothers of still-born and prematurely born infants show remarkably little difference from one another in their diets. There is a consistent but very slight difference in favour of premature births in respect only of proximate principles but none in mineral values. Statistical analysis of the figures indicates that the superiority of the diets of those mothers of full-time babies is definitely significant but that the minor differences between the diets of the other two groups are quite unsubstantial, statistically or otherwise.

TABLE I.

	Optimum Requirements	Still-births	Premature births	Full-term births
Calories,	2,500	1644	1710	1946
Carbohydrate (gms.),	350	207	217	217
Fat (gms.),	80	61.9	64·9	80·4
Total protein (gms.),	90	52·4	54·5	72·1
First-class protein (gms.),	50	27·4	29·9	45·9
Calcium (gms.),	1·5	0·76	0·8	1·22
Phosphorus (gms.),	2·0	0·91	0·93	1·37
Iron (mgm.),	15·0	9·0	9·0	11·0
Age,		32·1	28·4	28·6
Parity,		4·2	2·9	3·12

The age and parity of the mothers were also considered in relation to the incidence of still-births and live births, and the figures correspond to the known differences. But the mothers of the still-born infants had also the poorest diet and the possibility of the dietary factor being as important as age and parity must be recognised.

To test the validity of these findings in a practical way it was decided to supervise the diets of a certain number of expectant mothers and compare the results of their pregnancies with those of a control series. Accordingly the diets of 500

women attending the ante-natal clinic at the hospital were supervised during the last three months of pregnancy. The period covered by this work was from July 1942 to October 1943. The cases were not selected in any way, but as the work progressed a few special cases were referred for instruction about diet by the attending physicians. These were usually women with a poor record of previous pregnancies, but as their numbers were small, it was felt that by including them the favourable effects would not be minimised to any appreciable extent.

Each mother at her first visit to the clinic was interviewed by one of us (C.C.) and the dietary habits were investigated. The regularity of meals and the types and amounts of food taken were inquired into and a rough idea of the amount of money which was available in the household was obtained. It was realised at the start of this work that the fullest confidence of the women was necessary, and we think it can justifiably be said that this confidence was obtained in all but a few instances. They attended regularly, in some cases weekly, in others fortnightly. They showed great interest in the dietary problems and a genuine desire to co-operate. The help of the almoner's department in this work is gratefully acknowledged.

The advice given to each patient consisted of detailed instructions about what foods were most beneficial and the amounts which should be taken. They were told about the planning of the meals, and actual recipes were given and the methods of cooking explained. It was seen too that they made application for their priority allowances of food—one pint of milk daily, two eggs instead of one at each allocation, an extra half ration of meat and bottles of fruit juice and cod liver oil or vitamin D tablets. The importance of these extras was stressed and at each visit the mother was encouraged to ask questions and discuss her problems with the dietician. A common complaint was of orange juice causing "heart-burn." It was often taken in a concentrated form and on an empty stomach. Many of the women were averse to taking cod liver oil, but would take vitamin D tablets instead. Often the need was to stress the quality of the food rather than the quantity. Cigarette smoking seemed to be a potent factor in

destroying the appetite and limiting the calorie intake. Cigarettes would be bought to the exclusion of essential items of diet. Erroneous beliefs as to the safety of certain foods during pregnancy and the nourishing qualities of some of the war-time substitutes were serious barriers in getting them to take an adequate diet. Many did not think it right to eat meat and others were slow to be convinced that dried milk and dried egg were dietetically valuable foods and could be made palatable.

To serve as a control, the records of 500 women attending the ante-natal clinic during the same period but whose diets were not supervised were used. They were chosen by taking the next name on the list following the supervised one. This ensured that as far as possible similar types of cases were compared. Both groups, for example, corresponded to what have been described as "booked" cases, that is, they had all attended the ante-natal clinic. This is important because it is recognised that the incidence of still-births and premature births is much lower in booked cases than in unbooked cases. The confinements in all cases took place in the hospital and accurate information was therefore available. The findings are recorded in Table II, and, as far as they concern still-births and premature births, are regarded as significant.

TABLE II.

	Supervised group	Control group
Still-births	21	36
Premature births	31	50
Neo-natal deaths (in hospital)	8	10
Infants breast-fed on dismissal from hospital	357	276
Average parity of mothers	2·96	3·08
,, age ,, ,,	28·38	28·8

More babies were breast fed on dismissal from hospital in the supervised group, but this may in part be due to the interest aroused in dietary factors and the instructions given at the ante-natal clinic and cannot be ascribed necessarily to the improved physical condition. The age and parity do not show any significant differences.

DISCUSSION

There has now accumulated considerable evidence of the effect of diet on the course and result of pregnancy. In rats maintained for four generations on a diet based on a dietary survey for human population and supplemented with milk and green food, Orr, Thomson and Garry (1936) showed that in comparison with the controls which were not given extra milk or green food, there was a reduction in the number of still-born fœtuses, and increase in the size of the litters and a markedly decreased death rate from infection in the offspring later. Ebbs, Tisdall and Scott (1942) in a study of the influence of ante-natal nutrition on the infant have also obtained significant results. Their cases were divided into three groups: (a) women on poor diets and low incomes, (b) women on poor diets and low incomes whose diet was supplemented for the last 4 or 5 months of the ante-natal period and (c) women on moderately good diets and adequate incomes who were given advice only. The premature births in the three groups were 8 per cent, 2·2 per cent and 3 per cent respectively, and the still-births 3·4 per cent, nil and 0·6 per cent. The authors further stated that in the poor diet group two babies died of pneumonia in the first six months and one of prematurity, with no infant deaths in the other two groups during the same period. Such evidence as this points to the fundamental importance of the diet of the expectant mother when considering still-births, premature births and even infant deaths throughout the first year.

In an interim report of the People's League of Health (1942), the committee found evidence statistically significant that the chances of a woman carrying her child to term were improved by the dietary supplements (vitamins and minerals) provided in their experiment. More recently in feeding experiments consisting of supplements of vitamins A, D and B-complex with calcium, phosphorus and iron, Balfour (1944) found a "significant reduction in the still-birth and neo-natal mortality rates in the fed group as compared with the controls."

The results in the present investigation are given without further comment. It is realised that there are certain valid criticisms which may be levelled at the methods employed, especially concerning the collection of data about the dietary

intake. Nevertheless, the values obtained in the three groups, if not indicating actual intakes, are at least comparable, and show the relative superiority of the diets of the mothers who bore full-term infants. Confirmation of these results was obtained in practice. When the diets of the expectant mothers were improved by instruction and encouragement given at an ante-natal clinic by a trained dietician, the incidence of still-births and premature births was reduced. The results of the second part of the investigation may be taken as indicating the minimum amount of improvement which might be expected if the diets of the expectant mothers were increased to the optimum.

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