WEIGHT IN RELATION TO PREGNANCY TOXAEMIA

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It is probable that pregnancy toxaeimias are due to a number of causes, of which some are somatic and some may be social and psychological. Very often the picture is a complicated one.

Of recent years much has been written on the dangers of obesity (*British Medical Journal*, 1953), and there is an admirable summary by Armstrong *et al.* (1951). Kennedy (1955) showed that rats which became obese developed degenerative changes in the kidney at an early age. In fact, "breakdown of function is the result of excessive hypertrophy at any age." Leitner (1955) concluded: "Obesity may thus be regarded as one of the known conditioning factors in the development of essential hypertension." He gave evidence which confirms "the widely accepted clinical observation that weight reduction in the obese is followed by a fall in blood pressure."

In 1957 Elvehjem stated that in experiments on rats nothing is gained by increasing the protein intake over the "minimum optimum." In fact, excess of certain amino-acids may delay growth and increase the fat in the liver. Parry (1955) has recorded large-scale observations with sheep. It is not certain how far "twin lambing disease" (pregnancy toxemia in ewes) can be compared with pre-eclamptic toxemia in women, but he is now able to control the disease in large numbers of flocks where his recommendations on diet have been followed. He stated that, though many ewes can become overweight and yet have a normal pregnancy, yet if these obese ewes are subjected to any form of stress they are then liable to develop toxemia.

There is in effect a great deal of evidence, both with humans and with animals, that obesity in itself is associated with hypertension and with disorders of the kidney, which may be functional or degenerative.

Dieckmann (1952) has shown that pregnant women who develop severe toxemia begin to put on an undue amount of weight early in pregnancy. He claimed that pre-eclamptic toxemia never occurred if the weight did not increase by more than 8 lb. (3.6 kg.) in any 10-week period. Hamlin (1953) reported that he had reduced the incidence of eclampsia from 1 in 500 to 1 in 7,000 by strict attention to diet and avoiding undue weight increase. A number of other papers have appeared in the literature. In 1957 Thomson and Billewicz confirmed that the average rate of gain is higher in pre-eclamptic toxemia than in normal cases. But, as they remark, "there is comparatively little exact numerical information."

Present Investigations

These investigations were started at the request of Professor W. C. W. Nixon, and the material used consists of records from University College Obstetric Hospital, London. From the beginning of the study it appeared that increase in weight during pregnancy was not the only important factor. Women who were already overweight at the time of the first antenatal attendance seemed to produce a large proportion of the toxaeimias even in some cases where the observed weight gain during pregnancy was only moderate.

Standard Weight for Height.—It was decided to compare the weights of a group of normal cases with a group of those diagnosed as pre-eclamptic toxemia, and to use the standard weight for height as a means of comparison. The tables used were those to be found in the Medico-Actuarial Mortality Investigation, vol. 1, New York, 1912. These are almost identical with those at present in common use in this country—for instance, in Burroughs and Wellcome's medical diary. These tables give average weights "after removing the outdoor clothes and shoes." In all the published tables a considerable increase is allowed for age as well as for height. For example, a woman of 5 ft. 5 in. (165 cm.) averages 127 lb. (57.6 kg.) at 19 years and 137 lb. (62.1 kg.) at 33 years. But these are averages and not optima. It was decided, therefore, to take the weight for height at 25 years as a generous optimum and use this as the standard of comparison.

Weight Gain in Pregnancy.—Most of the authorities agree that the permissible gain in weight during pregnancy should be in the region of 20–24 lb. (9.5–10.9 kg.). This gain is made up as follows: products of conception—foetus, placenta, liquor amnii, 11 lb. (5 kg.); maternal gain—uterus, breasts, and other tissues, 13 lb. (6 kg.).

The maternal gain consists of about 3 lb. (1.4 kg.) of extra protein, and 10 lb. (4.5 kg.) of extra water retained in the increased plasma and intracellular and extracellular tissues. This water is quickly lost after parturition (Leitch, 1957). But it was found that many women, when they attend the post-natal clinic, are still above their pre-gravid weight. This more permanent gain is due to fatty and other tissues, and not to increased fluid retention.

Total Weight.—In theory the patient should weigh the standard for her height at the beginning of pregnancy. At term she should weigh an additional 20–24 lb. (9.5–10.9 kg.), and within two weeks after delivery she should return to her pre-gravid weight. If she is lactating she may be permitted an extra pound or two for breast tissue.

Method

There are no records of the pre-gravid weights of the patients, but all the heights are measured at the first antenatal attendance. It is always possible, therefore, to calculate the standard weight for height. The patients are weighed at every attendance. They receive advice on diet as a routine, and special advice on salt and calorie intake, whenever this appears to be indicated.

For some years attention has been paid in this clinic to nutrition and to weight increase. The results of this study are considerably modified by advice and by treatment. However, some patients ignore advice, or develop overweight or toxemia in spite of it. Many of those who showed signs of toxemia were admitted to the wards some days or weeks before the onset of labour. Rest in bed and a low-salt diet of 1,200–1,800 calories appeared to be of great benefit in reducing the oedema and the blood pressure. Some patients were also given sedative and hypotensive drugs. Labour was induced if the symptoms did not abate, and in any case before the 42nd week. Because of these antenatal admissions, the average maturity at the final weighing of the toxaeimias was rather less than that of the normals, and the interval between the final weighing and the delivery was rather more. Both these factors would tend to show less weight gain in the toxaeimias than in the normals, so that the difference may be greater than is indicated in these figures.

The actual weights are used here, although it would have been better to express them as percentages of mean normal weight for height. The computations, however, would have been much more lengthy.

Diagnosis.—Patients have been classified according to the diagnosis made by the registrar, most of which was done before this study began. "Pre-eclampsia" is diagnosed when at least two out of the three following conditions are present: albuminuria in a catheter specimen, oedema,

and a blood pressure of 140/90 or over. "Normal" is diagnosed when delivery and puerperium have been free from complications. It does not exclude certain patients who had deviations from the normal during their pregnancy. For instance, it includes a proportion of patients who at some time had hypertension with oedema but who had responded to treatment before term. Twenty-two of the 50 "normal" patients showed some degree of oedema during pregnancy. None of them had albuminuria.

Selection of Cases.—This study compares 50 normal cases with 50 cases of pre-eclamptic toxæmia. It is confined to primiparae. The records for 1955-6 were examined, and the case sheets of those diagnosed as "pre-eclamptic toxæmia" were requested from the registry. Cases excluded from this survey were as follows: (a) multiparae, multiple pregnancies, abnormal presentations, and hydramnion; (b) essential hypertension, kidney disease, diabetes, and other pre-existing abnormalities such as gross kyphosis; and

(c) incomplete or inaccessible records. The 50 normal cases were selected at random by the registry clerks. The only cases excluded were multiparae, multiple pregnancies, and incomplete records.

Results

Initial Weight.—In comparing initial weights, three cases are excluded from each of the two groups. These are all patients whose first attendance was later than the 20th week. The remaining 47 cases in the "normal" group had a mean maturity of 13.4 weeks when first examined, and the pre-eclamptic toxæmia group had a mean maturity of 14.4 weeks. The latter group might therefore be expected to be slightly heavier. To relate the initial weights of the two groups, the comparison should be made between those of the same maturity. However, confining our attention to those patients between 10 and 20 weeks (inclusive) we find that the average increase of weight with maturity over this period (13.4-14.4 weeks) is negligible compared with their variation. Comparing, therefore, the initial weights of the two groups regardless of this slight difference in maturity, we find that the mean initial weight of the normals is 129.1 lb. (58.56 kg.), and that of the toxæmics is 136.4 lb. (61.87 kg.). The overlap is considerable.

FIG. 1.—Initial weight of 47 normal women and 47 with pre-eclamptic toxæmia.

FIG. 2.—Gain in weight per week in 46 normals and 44 toxæmics.

FIG. 3.—Final weight compared with standard weight.

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Gain per Week.—The gain in weight, measured by the difference between the weights at the first and last attendance, must depend to some extent on the number of weeks between. In order to make a more valid comparison only those patients observed for 20 weeks are included, and the gain is expressed as average gain per week. In this series 46 normals are compared with 44 toxæmics. The mean gain per week in the 46 normals is 0.912 lb. (0.417 kg.), and in the 44 toxæmics it is 1.156 lb. (0.524 kg.). The difference is statistically highly significant.

Total Gain Over Standard for Height.—In taking standard weight for height we have a baseline which is independent of the number of attendances or the date of the first attendance. In using the final weight as an end-point we depend to some extent on the date of the final weighing in relation to the date of delivery. But most patients showed comparatively small gains in the last three weeks before parturition, and therefore those discrepancies have been ignored. But in Fig. 3 only those are included who were under observation for at least 20 weeks. It appears that when the total weight at the end of pregnancy is compared with the standard weight for height the mean excess in the toxæmic group is higher than in the normals. It will be seen that there is a marked contrast between the two groups. This suggests that the relation to standard weight for height gives a more decisive distinction than either the comparison of initial weights or the gain in weight per week.

Now, if we consider the total of 50 toxæmic patients we find that 48 had either (a) reached more than standard weight +24 lb. (10.9 kg.), or (b) gained more than 24 lb. (10.9 kg.) during the period of observation, which averages 20 weeks, and not the whole period of pregnancy. Of the two remaining cases one had had a nervous breakdown and the other had had an arthrodesis of the hip.

Blood Pressure and Weight Gain.—All those diagnosed as pre-eclamptic toxæmia showed hypertension of 140/90 or more. But many of those who were finally diagnosed as normal also showed an occasional rise in blood pressure. Each case history was examined, and scored for every rise of systolic pressure to 140 or over or a diastolic of 90 or over, and the scores were reduced to a percentage of total observations. The 50 cases were then analysed as follows:

Blood Pressure Readings Abnormal	
15 patients who were more than 30 lb. (13.6 kg.) over standard weight for height at final weighing	11.7%
13 patients who were 20-30 lb. (9.1-13.6 kg.) over standard weight for height at final weighing	4.0%
22 patients who were less than 20 lb. (9.1 kg.) over standard weight for height at final weighing	3%

Of the 50 normal patients, therefore, those who were overweight tended to show occasional signs of hypertension, which was comparatively rare in those who kept in the region of standard weight or underweight.

Discussion

It is obvious that not all cases of pre-eclamptic toxæmia are associated with excess weight or weight gain. For instance, Case 49 of the toxæmic group first attended at 18 weeks weighing 110 lb. (49.9 kg.), which was 11 lb. (5 kg.) less than her standard weight for height. At 36 weeks she weighed only 122 lb. (55.3 kg.), having gained 12 lb. (5.4 kg.) in 18 weeks. She was delivered at 39 weeks by surgical induction of a 7-lb. (3.2-kg.) baby. It is also obvious that many pregnancies appear to remain normal throughout in spite of obesity or weight gain.

Nevertheless, it seems that most cases of pre-eclamptic toxæmia are associated with overweight preceding pregnancy or an excessive gain during pregnancy, or both.

It would seem to be advisable to compare the weight of the antenatal patient with her standard weight for height, as well as to observe the increase during pregnancy. It is important that this should be undertaken as early as possible in pregnancy, if not before.

It may in fact be dangerous to confine observations merely to the rate of increase during pregnancy. For instance, a healthy woman whose actual and standard weight for height is 120 lb. (54.4 kg.) becomes pregnant. As a result of anorexia or vomiting during the first three months she arrives at the antenatal clinic at 14 weeks weighing only 105 lb. (47.6 kg.). She may in fact be in a state of sub-nutrition, which will be overlooked unless reference is made to what, for her, should be normal.

It must be accepted that obesity has become one of the major health hazards in certain countries. Overweight in pregnancy is due to obesity and to increased fluid retention. Both can be controlled by attention to weight and weight increase.

Pregnancy toxaemia is now regarded as one of the primary causes of maternal mortality and morbidity. It is an important cause of prematurity and of perinatal mortality in the more advanced countries.

Theobald (1955) has reported excellent results from careful prenatal supervision from the 24th week, and he advises weekly weighing from this date. The observations at University College Obstetric Hospital indicate that overweight is itself a factor that may increase the risk of toxaemia. A large proportion of patients are already overweight before they become pregnant. It is quite possible for a woman to modify her diet so that she goes through a normal pregnancy with no increase in weight. In fact, obese women have been successfully reduced in weight while pregnant with no damage to the child. The majority of women are on an adequate and even excessive diet before they come to the antenatal clinics. However, it cannot be overemphasized that each patient should be considered separately: some women are badly or inadequately fed and are in need of extra nourishment.

Weight, with reference to height and maturity, must be checked as early as possible in pregnancy. The 24th week may be too late. Signs of malnutrition must not be neglected; but if there is any obesity it should be controlled as early as possible and throughout the antenatal period.

At present a large proportion of antenatal beds are taken up with cases of pre-eclamptic toxaemia, while a great deal of time and attention has to be devoted to observation and to intervention in these cases. It is probable that closer attention to weight in the early weeks would prevent a number of complications. This procedure should be carried out by all who undertake antenatal supervision or treatment. Patients should be urged to attend as early as possible in pregnancy. Each should be measured for height at the first attendance and weighed then and at every subsequent attendance. If there is much deviation from the standard the patient should be seen at weekly intervals. The standard weight for height should be entered on the antenatal card so that this can be referred to throughout pregnancy.

Each antenatal clinic should be equipped with (a) a rod or wall marking for height measurement, (b) adult scales, and (c) a table of standard weights for height at 25 years (the patient's age can then be ignored). The patient's attendance card (the one which she keeps) should have the dates and weights entered on the back so that she herself can remember its importance. Every doctor or midwife who undertakes antenatal care should be sufficiently trained in nutrition and in social medicine to give the appropriate dietetic advice.

It should be remembered that there seems to be a fairly wide margin of safety. Weighing need not be perfectly exact, and dietetic advice need not be too strict except in cases of gross abnormalities. But obesity and excessive gain should be observed, noted, and, if possible, remedied. If a patient comes to the antenatal clinic at 16 weeks already 40 lb. (18 kg.) over her standard weight, it is not advisable to put her on a strict reducing diet. If she is already hypertensive or oedematous she should, of course, be admitted; or she should be advised to restrict salt and calorie intake. She may be able to go to term without any further weight increase and deliver a normal baby. She may even reduce in

weight before term. But it is essential that her reaction to the diet and to the pregnancy should be observed at frequent intervals. It is certainly unwise to delay dietetic advice until a rapid rate of weight increase has been recorded.

Obesity and its complications are serious diseases, and they often start in pregnancy. Not only do they increase the hazards of pregnancy and parturition, they threaten health and well-being in later life. As Kennedy says, "Breakdown in function is the result of excessive hypertrophy at any age."

Obesity is a preventable disease which is not at present sufficiently prevented.

Summary

50 cases of normal pregnancy are compared with 50 cases of pre-eclamptic toxaemia from the records of University College Obstetric Hospital.

The cases of pre-eclamptic toxaemia average higher initial weight, and larger average weekly weight gain than the normals.

When compared with the individual standard weight for height the majority of the normals exceeded this by less than 24 lb. (10.9 kg.) at the end of pregnancy. The majority of the pre-eclamptics exceeded this by more than 24 lb. (10.9 kg.).

The normals who showed excessive weight tended to have more episodes of hypertension than those who did not.

The question of weight and of weight gain in relation to pregnancy and obesity is discussed.

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The report of the fourth session of F.A.O.'s nutrition committee for South and East Asia is now available through Her Majesty's Stationery Office (price 2s. 6d. net). It is a report of the meeting held in Tokyo from September 25 to October 2, 1956. The meeting was the fourth in a series, the first of which was held in the Philippines in 1948, the second in Burma in 1950, and the third in Indonesia in 1953. At each of these meetings nutrition problems of major importance in the region are considered. The fourth meeting was sponsored jointly by F.A.O. and W.H.O. The report discusses progress in nutrition in the region since 1953, and states that the attention which is being given to the expansion of sea and inland fishing industries is a promising development, since fish is a valuable supplement to diets characteristic of South and East Asia. It also gives information on nutrition and food production, the beriberi problem, improving the nutritive value of rice, and the study and prevention of protein malnutrition. There is a chapter on supplementary feeding and education in nutrition, the latter being regarded as the key to many of the region's nutritional problems.