

Excess weight in the pregnant woman and the newborn

by

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The rate of foetal biosyntheses depends first of all on the genetic information which decides the metabolism, for example, through the regulation of enzyme syntheses; it also depends on the availability of precursors of low molecular weight provided by the mother (ribose and carbamyl phosphate for nucleoproteins, α -ketoacids for proteins, phosphopyruvate and malate for sugars, acetate and malonate for lipids). The causes of any variations from normal in foetal size will be amongst these factors. When growth is excessive the precursors are available in greater amount and/or they are utilized at a greater rate by the foetus in order to increase its size.

Starting from these premises we have conducted a study to ascertain if, in the absence of pathological changes, a larger dietary intake can be related to an increase in foetal size.

MATERIALS AND METHODS

300 patients who had delivered newborn «large for dates» (according to the gestogram of Dunn and Butler (Fig 1) in the Obstetrical and Gynaecological

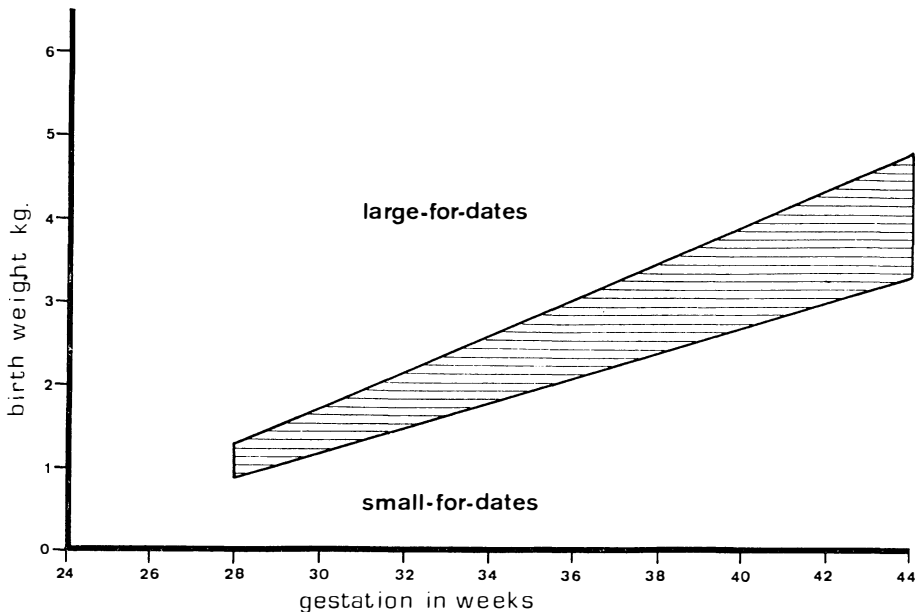


FIG. 1

From Obstetrics and Gynecological Clinic, University of Padua.

Clinic of the University of Padua were studied. This gestogram expresses the limits within which the neonatal weight is considered normal for the gestation time (from the 26th to the 44th week). Such a method eliminates one of the variables, that linked to the gestational age of the newborn, and is applicable to a non heterogeneous population, of Caucasian race, independent of the sex of the newborn.

In order to eliminate other variables, newborn from 1) diabetic mothers, 2) pathological pregnancies, 3) multiple pregnancies, 4) immigrant mothers, 5) mothers belonging to other races, coming from other regions or from regions with different ecological conditions, were excluded from the study.

The relationship between the sexes of these newborn was slightly in favour of the male, as has already been pointed out by Hübner (1).

In these patients the following clinical parameters have been considered: parity; age; pre-pregnancy weight; weight at the time of delivery (and therefore, by difference, the increase in weight during pregnancy); weight of the placenta. The relationship between these parameters and the birth weight was assessed statistically by using Student's t test and the coefficients of regression.

RESULTS

In Table 1, the statistical finding of the relationship between the weight of the newborn « large for dates » and the various parameters are given.

It can be seen that parity and maternal age are not determining factors in the occurrence of neonatal oversize. The relationship between birth weight and pre-pregnancy maternal weight is not statistically significant, while that between birth weight and maternal weight at the end of pregnancy is statistically fairly marked. The relationship between the increase in maternal weight during pregnancy and large birth weight is significant and that between placental weight and birth weight and birth weight is highly significant.

Table 1. *Statistical correlation between excessive neonatal weight and clinical parameters.*

	parity	maternal age	prepregnancy wt.	incr. in wt. during pregnancy	placental wt.	wt. of mother at deliv.
Neonatal wt. above average	N. S.	N. S.	p<0.1	p<0.01	p<0.001	p<0.05

DISCUSSIONS AND CONCLUSIONS

Birth weight can be influenced by many factors: sex, whether a first-born or later born child, weight and height of parents, maternal age, race, ecological situation, socio-economic-nutritional factors, pathology of the pregnancy.

It is known that the male foetus grows more during the course of intrauterine life (2, 4, 5). Birth weight is lower in firstborn infants (6); however, there appears to be little correlation between the order in birth sequence and birth weight (7); this would only become significant from a maternal age over 20 years; below this age, with the increase in parity, the birth weight would diminish (8). Quinto

(⁹), however, maintains that multiparity is an important factor in women who give birth to an oversized infant; he has also shown a relationship between birth weight and the height of the mother; when she weighs more than 70 kg and is more than 1.7 m tall it is more likely that an excessively large infant will be born. On the other hand, according to Love and Kinch (¹⁰), there is no correlation between maternal height and foetal weight.

It is now generally accepted that the age of the mother has no importance in relation to the birth weight (¹¹). It seems, on the other hand, that race is a determining factor: among the most recent reviews on this subject are those of Salber and Bradshaw (¹²), Roberts (¹³), Meredith (¹⁴) and Hytten and Leich (¹⁵).

It is worth noting that the frequent combination of genetic factors with ecological factors, with socio-economical conditions and with nutritional habits, makes it difficult to evaluate the importance of each of these separately. It is seen, for example, that the birth weight of children from Mexican parents who live in the United States is higher than that of children from Mexican parents who live in their own country, probably on account of the different conditions of life during pregnancy. Weight and height are greater in the newborn of mothers in better socio-economical conditions (¹⁶).

With regard to ecological conditions, there are two principal factors which can modify the birth weight; the average annual temperature and the height above sea level. Roberts (¹³) has established that there is an inverse correlation between average birth weight and average annual temperature. European women who live in the tropics give birth to slightly lighter babies. The altitude can directly influence birth weight, affecting oxygenation of the maternal blood and therefore also that of the foetus; in mountainous regions smaller infants are born and the placenta weighs more (¹⁷).

If we try to remove as far as possible the occurrence of factors so far considered, and rely on a sample of people who are homogeneous in genetic make-up and environmental and social condition, then the metabolic conditions of the mother and foetus and the placental-uterine exchange become all important in determining the weight of the newborn. A close correlation between maternal blood glucose levels and foetal growth has been observed («large for dates» in diabetic pregnancies; «small for dates» in hypoglycaemic pregnancies with little response to glucose tolerance tests).

In this context also overfeeding of the pregnant woman, shown by excessive increase in weight without illness, should cause a larger availability of precursors of low molecular weight for synthesis of biological molecules in the foetus and therefore a tendency to oversize. According to a statistical study of Codaccioni et al. (¹²), foetal overgrowth is linked to maternal obesity, whether or not associated with diabetes.

It is concluded from our studies that foetal oversize may be linked to excessive weight before pregnancy but it is certainly induced by excessive dietary intake during pregnancy (Table 1). On this subject there are contradictory data in the literature; Lund and Weese (¹⁹) and McEvan and Murdoc (⁴) deny that weight at birth is related to increase in maternal weight while Hytten and Leich (¹⁵), Singer et al. (²⁰), Nathanson (²¹) and Bolton (²²) hold the contrary view.

An efficient uterine-placental interchange is necessary for an abnormal and unbalanced diet to produce its effects on foetal metabolism. The protein-building influence of the prolactin of placental origin should not be neglected; its level is proportional to the quantity of the trophoblast and finally to the weight of

the placenta. In our study of cases, which did not include pathological pregnancies, statistical calculation has shown a highly significant relation between the placental weight and neonatal weight; overfeeding appears, therefore, to increase the development of the placenta, but this aspect requires further study.

In conclusion, one can say that excessive caloric intake during pregnancy, common on account of the average improved economic conditions of the population and because of reduced physical activity during the last two months of pregnancy, (due partly to the current legal position regarding working mothers), often leads to foetal and neonatal oversize. Taking into account the relationships between diabetes and obesity one could put forward the hypothesis of an analogous mechanism for the appearance of oversize. A study of the relationship between diet and placental function could be interesting.

SUMMARY

Clinical study of the mothers of 300 newborn « large for dates » has shown a statistically significant correlation between excess neonatal weight and the increase in the mother's weight during pregnancy, in the absence of pathological alterations associated with pregnancy. Neonatal oversize is also correlated with an increase in the weight of the placenta.

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