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On the Cause of the Retardation of Fetal Growth in Multiple Gestations

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Abstract. The birthweights and placental weights of 3000 singletons, 1500 twin pairs and 67 triplets are studied in relation to the gestational age. From 30-32 weeks onwards, newborns of twin- and triplet gestation show lower birthweight as compared to singleton newborns. Placental indices (placental weights related to birthweights) are about alike in singletons, twins and triplets. From about 24 weeks onwards placental weights of twin and triplet newborns are smaller as compared to those of singletons. Obviously, children in multiple gestations become growth retarded, preceded by and very likely due to poor early placental development (placental crowding of the uterus).

Key words: Twins, Triplets, Birthweight, Placental weight, Intrauterine growth

INTRODUCTION

Compared to singletons, children of multiple gestations are born earlier, weigh less at birth and have smaller placentae [3-6].

The environmental cause for the retardation of fetal growth in multiple gestations was suggested by Naye [7] who found in twins an accelerated growth after birth reaching median levels for singleton at 12 months of age. That environmental cause may be placental and/or maternal. To study the importance of the placenta, placental weights related to both birthweights and gestational age were studied before. McKeown and Record [6] and Gruenwald [3] found proportionally greater placentae in twins than in singletons. They concluded that not the placenta proper but the "maternal supply line" must be held responsible for the retardation of fetal growth in multiple gestations.

In this cross-sectional study we compare the data from a large number of twins and singletons from Amsterdam with multicenter acquired data from 67 triplets.

MATERIAL AND METHODS

The study is based on 1500 twin pairs with a menstrual age over 20 weeks, born at two hospitals in Amsterdam from 1931 to 1975 [1].

A group of 3000 singletons was chosen at random, standarized for year of birth, gestational age, fetal sex and maternal parity.

The birthweights and placental weights of 67 triplets were obtained from all eight university hospitals in the Netherlands.

Only gestations in which no fetus died more than three days before birth were considered. Placental weights were recorded after trimming of the membranes and cutting of the umbilical cord within 2 cm from the placental surface. Most placentae were processed by one single coworker: Miss B.L. Huidekoper. From 1460 singletons, 1460 twin children and 165 triplet children the placental weights (per child or per litter) were known and the placental indices (placental weight devided by birthweight) could be calculated.

The mean values per week of the birth weight and placental weight and the placental index per two weeks as function of the gestational age are calculated. Because these data points are comparatively noisy, a method was used which gives a good approximation of the average position of the points in a course which has a smooth character. For this purpose a cubic smoothing spline function was used. Such a function can be considered as more or less equivalent to the way in which an elastic rod (spline) is bent over the actual data points.

Mathematically a smoothing spline function is appropriate because this function is a compromise between the desire to stay close to the data and to give a smooth presentation [2].

RESULTS

Birthweight

The mean birthweights of 3000 singletons, 3000 twin children and 201 triplet children in relation to gestational age are given in Fig. 1. From about 32 weeks onwards newborn children for twins and triplets show smaller mean birthweights as compared to singletons, triplet children being smaller than twin children.

Placental Weights

The mean placental weights of 1460 singletons, 1460 twin children and 165 triplet children in relation to gestational age are given in Fig. 2. From about 24 weeks onward mean placental weights of twin children and triplet children are smaller as compared to those of singletons. Mean placental weights of twin children and triplet children are rather alike.

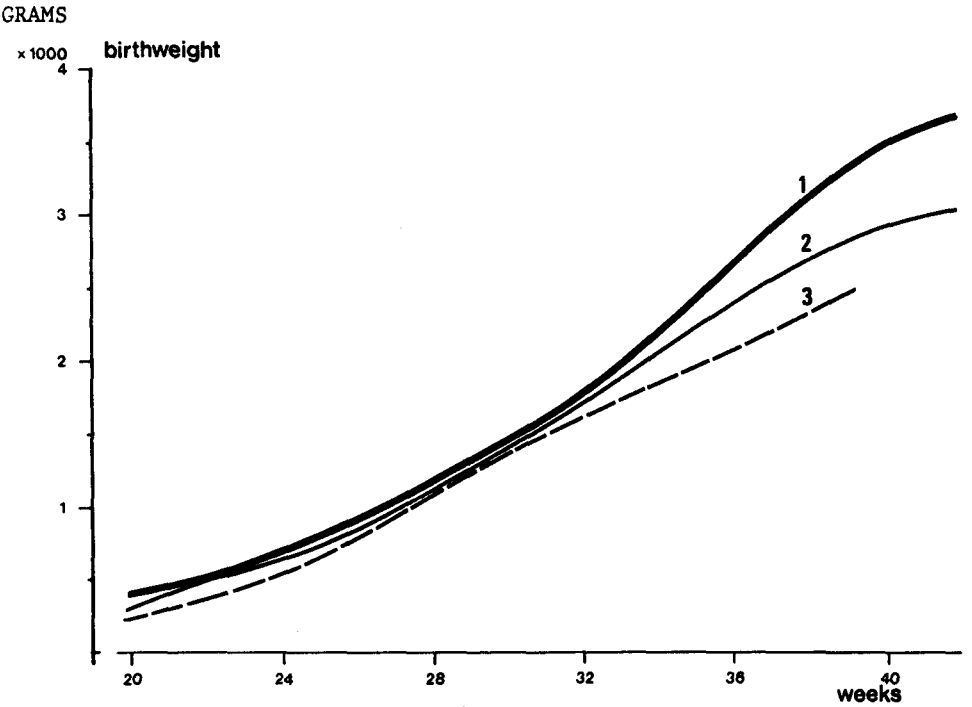

Fig. 1 - Mean birthweights of 3000 singletons, 3000 twin children and 201 triplet children in relation to gestational age.

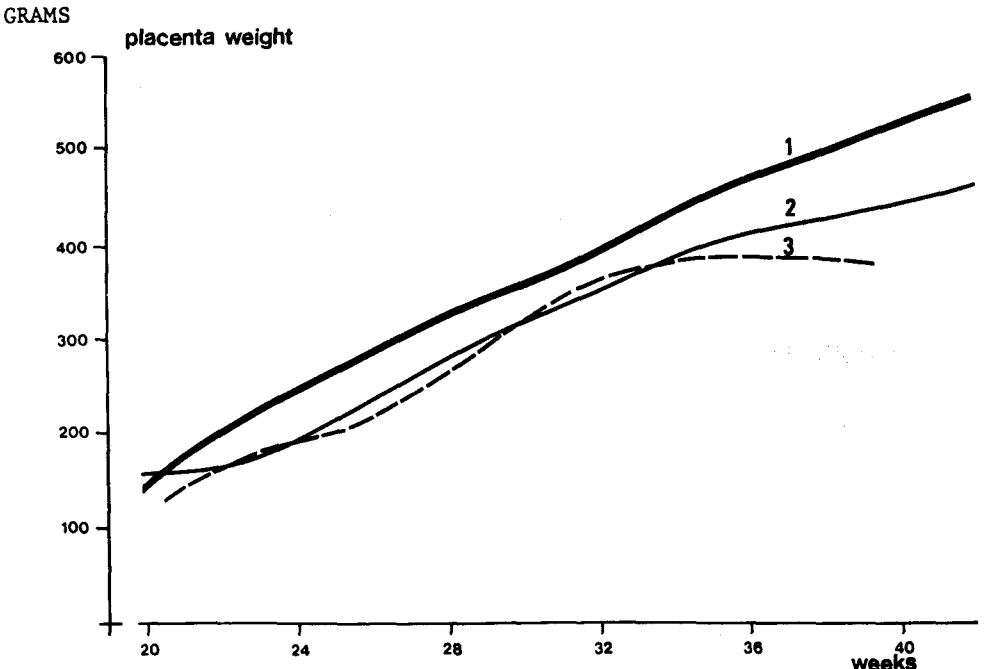

Fig. 2 - Mean placental weights of 1460 singletons, 1460 twin children and 165 triplet children in relation to gestational age.

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Placental Index

The mean placental indices of 1460 singletons, 1460 twin children and 165 triplet children in relation to gestational age are given in Fig. 3. Placental indices of twin children and triplet children are alike or even smaller than of singletons. The placentae in multiple gestations are therefore not proportionally heavier than in singletons.

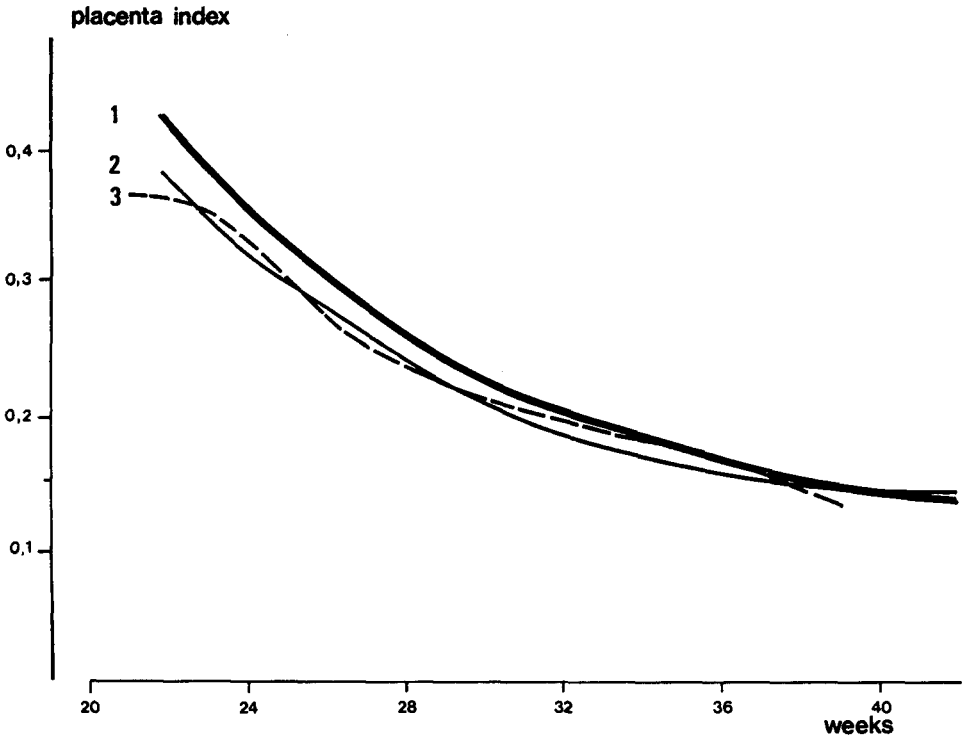

Fig. 3 - Mean placental indices (placental weight divided by birthweight) of 1460 singletons, 1460 twin children and 165 triplet children in relation to gestational age.

DISCUSSION

Our findings about retardation of fetal growth in multiple gestations are in good agreement with the literature [3-6]: from about 32 weeks onwards, newborns from multiple gestations are smaller than singletons. Obviously, not a certain total litter weight [5] but a certain duration of gestational age is of importance: about 30-32 weeks.

We cannot agree that in multiple gestations proportinally larger placentae exist [3,5]. Our singleton and twin placentae were processed along a standard procedure and by one hand. From those data it is evident that the mean placental indices in multiple gestations are alike or lower, but almost never greater than in singletons (Fig. 2), the placenta in multiple gestations being not proportionally greater (Fig. 3).

Therefore, the placenta proper cannot be excluded as the cause of the retardation of fetal intrauterine growth in multiple gestations.

Of interest is that, as compared to singletons, in multiple gestations the retardation of placental growth (Fig. 2: from about 24 weeks onwards) precedes the retardation of fetal growth (Fig. 1: from about 32 weeks onwards). Such sequence of events is known from the effect of maternal parity on birthweight: singleton children of multiparae show heavier birthweights than children of primiparae from about 32 weeks [4], where their mean placental weights already differ at 28 weeks and rather likely before (Fig. 4).

Obviously, both children of primiparae and children from multiple gestations are retarded in growth, preceded by a retardation of placental development. In primiparae, the widely accepted cause of that retarded placental development is the unexperienced uterus. In multiple pregnancies, an elegant explanation could be *placental crowding*, which means that early concurrence during placental development in multiple pregnancies limits primary placental growth and secondary fetal growth.

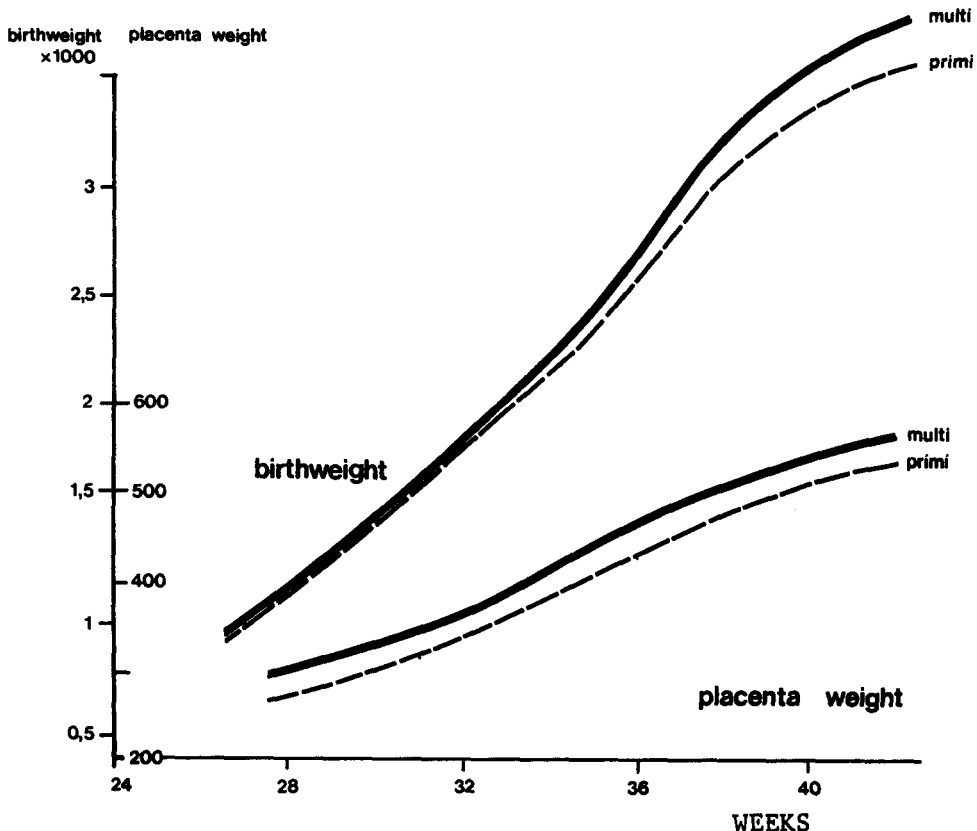

Fig. 4 - Mean birthweights and mean placental weights from singleton children from multiparae and primiparae in relation to gestational age, according to Kloosterman and Huidekoper [4].

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