ANTHROPOLOGIE • XLI/1–2 • pp. 165–171 • 2003

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PREPUBERTAL GROWTH PATTERN IN TWINS

ABSTRACT: The problems studied were: (1) whether singletons and twins and (2) whether twins of different maturation status differed in postnatal growth pattern.

The growth pattern had been followed for the first ten years of life. Maturation status of the twins was assessed by anthropometric measures at birth: the contrasted subgroups belonged to the upper and lower quartiles and the interquartile range of body weight, resp. weight for length.

Compared to singletons the body weight of twins caught up by the age of 2 years, the body height by the age of 3 years, resp. Taking peer-age singleton weight and height medians as 100%, median weight and height of maturation subgroups were expressed in percentage.

No difference was found among maturation subgroups in the duration of the fast catch-up growth period. After 3 years of age the rate of growth was similar to singletons in all the three subgroups of twins, but the weight of the lower quartile twins lagged consistently behind by about 5–10 %. The lag was more marked in the females.

By the end of the 3rd year of life the centile distribution of the maturation subgroups converged. However, there was at least one centile grade between the highest and lowest quartile subgroups up to the age of 10 years.

KEY WORDS: Budapest Longitudinal Twin study – Neonatal maturity status – Body mass and height centiles

INTRODUCTION

Human growth is a strictly regulated and target oriented process. However, the manifestation of a growth pattern can be facilitated or inhibited by several factors influencing the magnitude and the rate of growth. Since growth is one of the maturitation progress indicators, maturity status can be assessed by considering the changes of body dimensions with age.

It is a well-known fact that growth processes may become impaired by adverse environmental effects. Many studies have demonstrated that intrauterine environmental factors influence prenatal growth more markedly than foetal genotype (Penrose 1961, Rao, Morton 1974). There is evidence that increased perinatal mortality and premature delivery rates as well as the small neonatal body dimensions of twins are largely the direct results of suboptimal prenatal environment.

It is uniformly agreed that neonates of a multiple pregnancy run a greater risk as evidenced by the characteristically higher rates of morbidity and perinatal mortality. Premature delivery is more frequent in twins than in singleton pregnancies (Chandra, Harilal 1978). The pathological features of the placenta and umbilical cord are not uncommon causes of premature delivery and perinatal death in twins (Brody 1952, WHO 1976, Bender, Werner 1978, Corney 1978, O'Rahilly, Muller 1986). Significant relationship was found in the former part of this twin study between foetal development or postnatal maturation of twins and placental development, the type of placentation, the length of umbilical cord, and the number of umbilical arteries (Bodzsár *et al*. 2001).

If the deviation between the actual size of the children and the attainable size determined by their genetic potential is considerable during postnatal growth, accelerated growth can often be observed. Faster growth continues till the child attains the size they would have reached without growth retardation (Prader *et al*. 1963). The rate of acceleration and the length of this recuperation period are determined by the magnitude of the growth deficit.

In view of these considerations, the purpose of this study was to answer the following questions: Do or do not twins and singletons or twins grouped by neonatal maturity status differ in the growth pattern of body weight and height: that is is there any difference in the extent and rate of their growth during the first 10 years of postnatal life?

SUBJECTS AND METHODS

According to a decision of the Health Department of the Budapest City Council, multiple births have been recorded in the Budapest Twin Register since 1970. The Budapest Longitudinal Twin Study (Sárkány *et al*. 1974) based on this Twin Register also started in 1970 to meet the recommendations of WHO (1995). In the present study prepubertal body development of twins born between 1970 and 1980 was analyzed by comparing it to the prepubertal growth pattern of singletons born in Budapest during the same interval (Eiben *et al*. 1992). Case numbers for the respective age groups are shown in *Table 1*.

TABLE 1. Subjects by age and sex.

Age (yrs)	Boys	Girls
0.0	1555	1627
0.5	1060	1189
1.0	920	1056
2.0	782	843
3.0	692	806
6.0	364	389
7.0	139	154
8.0	20	18
10.0	71	59
Total	5603	6141

Subgroups of twins were compared on the basis of body measurement centiles. The centiles of 3, 10, 25, 50, 75, 90 and 97 were estimated by Cole's LMS method (1995). By this method centile lines can be constructed even for non-normally distributed data. To remove skewness a suitable Box-Cox transformation (1964) was applied in every age group. Using the smoothed curves of the power term (L), the mean (M), and the coefficient of variation (S) at each age, centiles (C_i) could be constructed by using the formula:

$$C_i = M'(1 - L \times S \times z_i)^{1/L},$$

TABLE 2. Criteria of sub-grouping in twins.

	Boys		Girls	
	(g)	(g/cm)	(g)	(g/cm)
I.	−2000	−4.32	−1900	−4.15
II.	2001−2700	4.33−5.37	1901−2550	4.16−5.20
III.	2701−	5.38−	2551−	5.21−

where z_i is the normal equivalent deviate for the required centile.

Twins were grouped by their neonatal maturation status on the basis of absolute and relative birth weight, i.e. birth weight expressed in the percentage of birth length (*Table 2*).

RESULTS AND DISCUSSION

Compared to singletons, the body weight of the twins was found to catch up by the age of 2 years after an initial developmental retardation (Bodzsár *et al*. 2001) in both genders (*Figure 1*). Although twins tended to have smaller median weights than singletons in each age group between 2 and 10 years of age, the difference between the centile distributions was not significant.

When the body height of the twins and singletons was compared, similar results were obtained in both the girls and the boys, singletons being taller than twins till the age of 3 years and without any significant difference between the 50. centiles of twins and singletons after 3 years of age. Due to accelerated growth the twins caught up with the average development of singletons, as it can be seen in the growth pattern of body height during the first 3 years of postnatal life.

By comparing body measurement medians of the subgroups of the twins formed on the basis of newborn maturity status expressed in the percentage of the singletons' medians, the following could be stated:

– In respect of the growth rate of the catch-up period in body weight, there were significant differences between the subgroups of the children, while the length of the period had not been influenced by neonatal maturity status (*Figures 2, 3*). Twins born with the weight of 2,000, respectively 1,900 g were still lighter than singletons with 5–10% at the age of 10 years. The growth pattern of body weight in the relative birth weight subgroups of the twins showed the same tendency, but weight retardation was slighter. The lags were more marked in the females both in the absolute and the relative birth weight subgroups.
– By comparing the growth patterns of the twins grouped by maturity status at birth to those of the singletons, no difference was found in body height: the absolute and relative birth weight subgroups of the twins caught up with the singletons, by the age of three years in both genders.
– As regards the growth pattern centiles of body weight by neonatal maturity, the initial weight retardation of twins born with a below-average weight compared to the twin subgroups of above-age birth weight decreased by the age of 2 years in both the boys and the girls (*Figure 4*). Nevertheless, the difference between the subgroups was maintained even after 2 years during the studied interval.

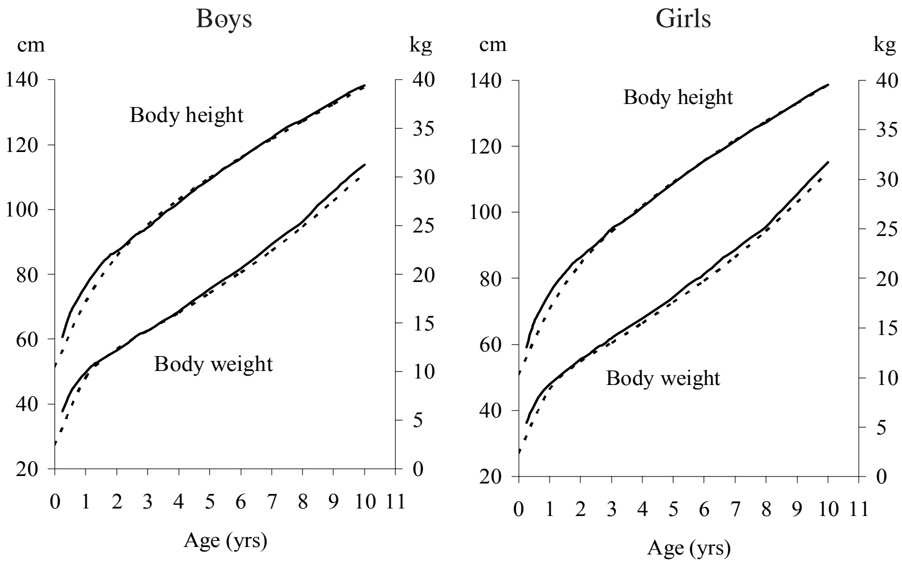

FIGURE 1. P50 of body weight and height in singletons (——) and twins (- - -).

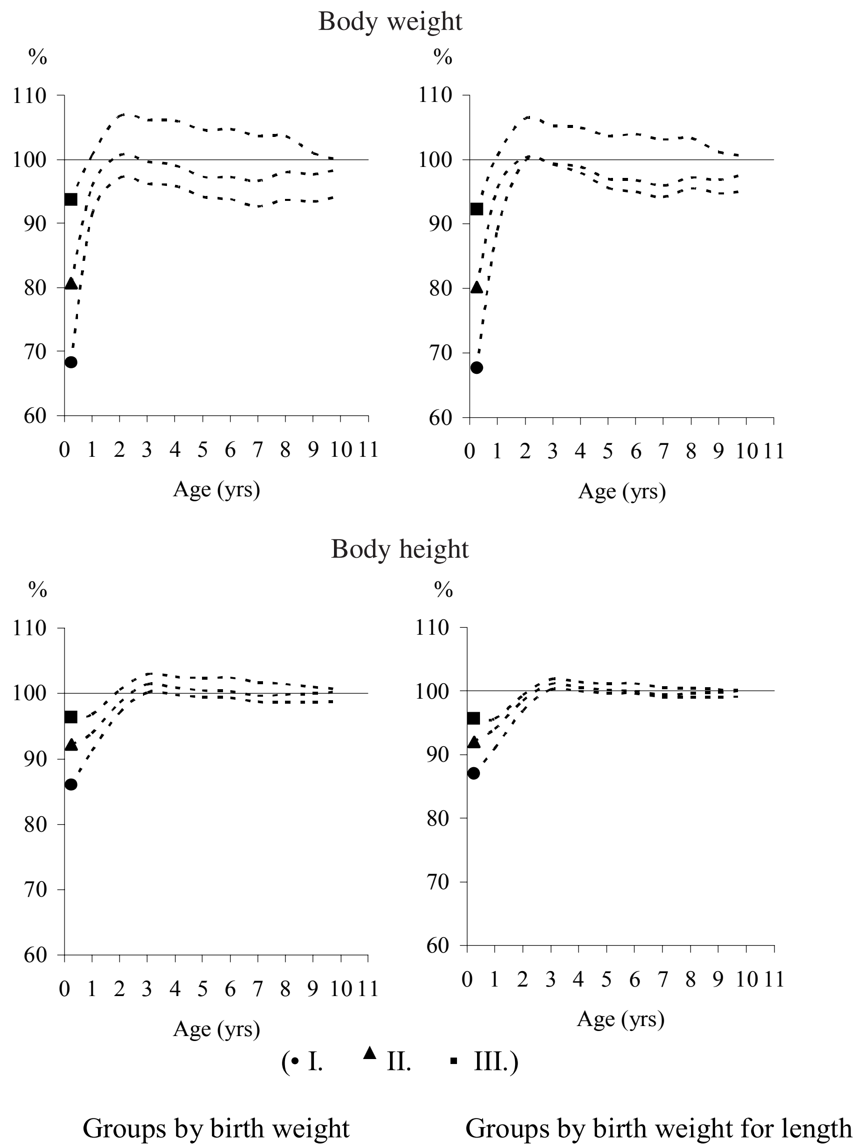

FIGURE 2. The median weight and height of twins' maturation subgroups expressed in the percentage of singletons' median – Boys (Abbr.: as in *Table 2*).

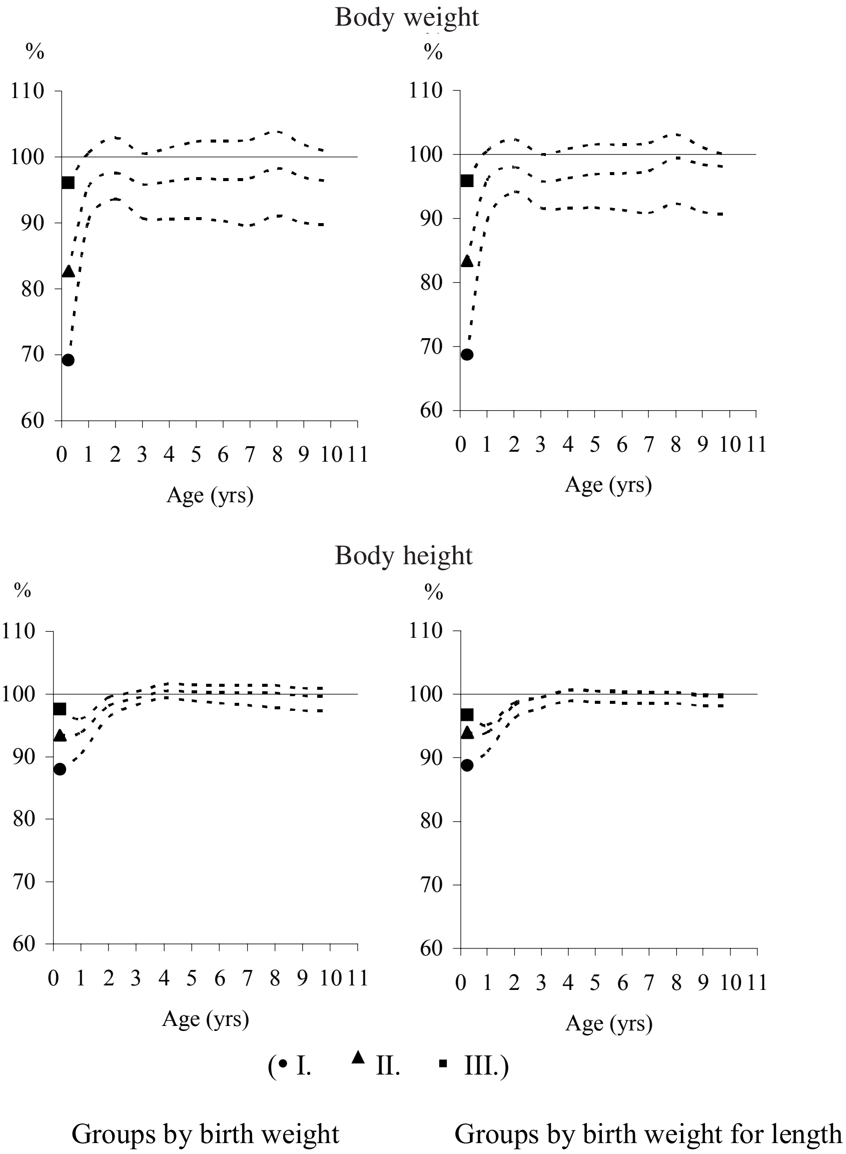

FIGURE 3. The median weight and height of twins' maturation subgroups expressed in the percentage of singletons' median – Girls (Abbr.: as in *Table 2*).

The respective centiles of the twins born with a smaller weight corresponded to the one lower centile curves of twins born with a greater weight.

Body height centiles of the twins grouped by birth weight ran very similar to the body weight centiles, except for the length of the catch-up period, namely, the height retardation of the twins born with a small weight disappeared by the age of three years. It could be also stated that the lag between the subgroups continued to exist after 3 years of age during the studied interval.

Differences in the centile curve patterns of the twins subgrouped by relative birth weight also indicated that during the first 10 years of postnatal life the twins most retarded in growth because of adverse conditions kept lagging behind singletons born with more advanced body development both in weight and height (*Figure 5*).

CONCLUSIONS

Postnatal growth pattern of twins was followed up in relatively few studies from the time of birth. Dissimilar results have been reported on the length of the twins' catch-up growth period that followed their impeded prenatal development. As reported by Wilson (1979), compared to singletons the postnatal growth retardation of twins decreases from the initial 30% to 10% by the age of 1 year in both genders and disappears by 8 years of age. In other studies (Hunt 1966, Falkner 1978) twins were found to catch up with singletons by the age of 6 years. Twins caught up with singletons after a retardation in body weight and length caused by the special intrauterine milieu and relatively smaller uterine space of multiple pregnancies by the age of 2–3 years in the present sample. The

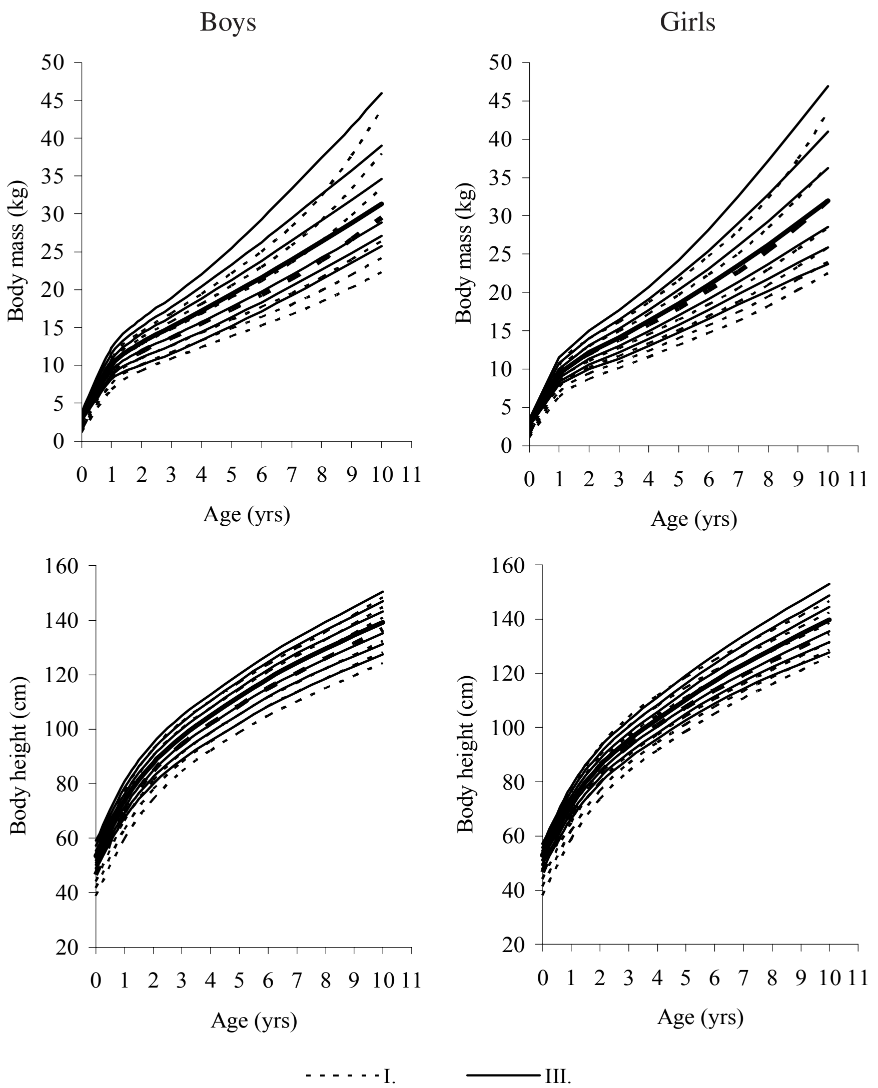

FIGURE 4. Body mass and body height in twins grouped by birth weight (Abbr.: as in *Table 2*).

variability in the length of catch-up growth may be explained by the different rate of monozygotic and dizygotic twins between the samples.

Growth pattern in the perspective of neonatal maturity status was studied in none of the studies mentioned above. Centile distributions of the neonatal maturity subgroups varied significantly. Although the rate and the length of catch-up growth did not differ significantly between the subgroups during the studied interval, significant differences were found between the extent of catch-up growth in twins grouped by neonatal maturity. Twins born with a small weight could not catch up with singletons despite their accelerated growth during the first 3 years of postnatal life, and they kept lagging behind by about 10% even at 10 years of age. There is evidence that twin pregnancies compared to singletons terminate by showing smaller birth weight and reduced gestation, with 20–50% of the twins born prematurely and more than 50% of them with a weight of less than 2.5 kg. The small birth weight of the twins was not only a consequence of premature delivery, as intrauterine growth retardation was demonstrated in more than 60% of the twins. Since prenatal growth retardation is more marked in body weight than in body length or head circumference, this may be one of the reasons for the fact that the centile curves of relative birth weight subgroups (i.e. birth weight related to birth length) and absolute birth weight subgroups showed almost the same distribution. It could be stated that birth weight was a more sensitive indicator of prenatal maturation troubles and postnatal catch-up growth than birth length. To summarize our result, we strongly emphasize the necessity of applying specific standards of neonatal maturity status not only in twins but also in singletons.

ACKNOWLEDGEMENTS

The authors are grateful to T. Cole for his courtesy in granting access to his computer program. This paper was funded by the Hungarian National Foundation for Scientific Research (OTKA grants No. T 030844 and T 034872).

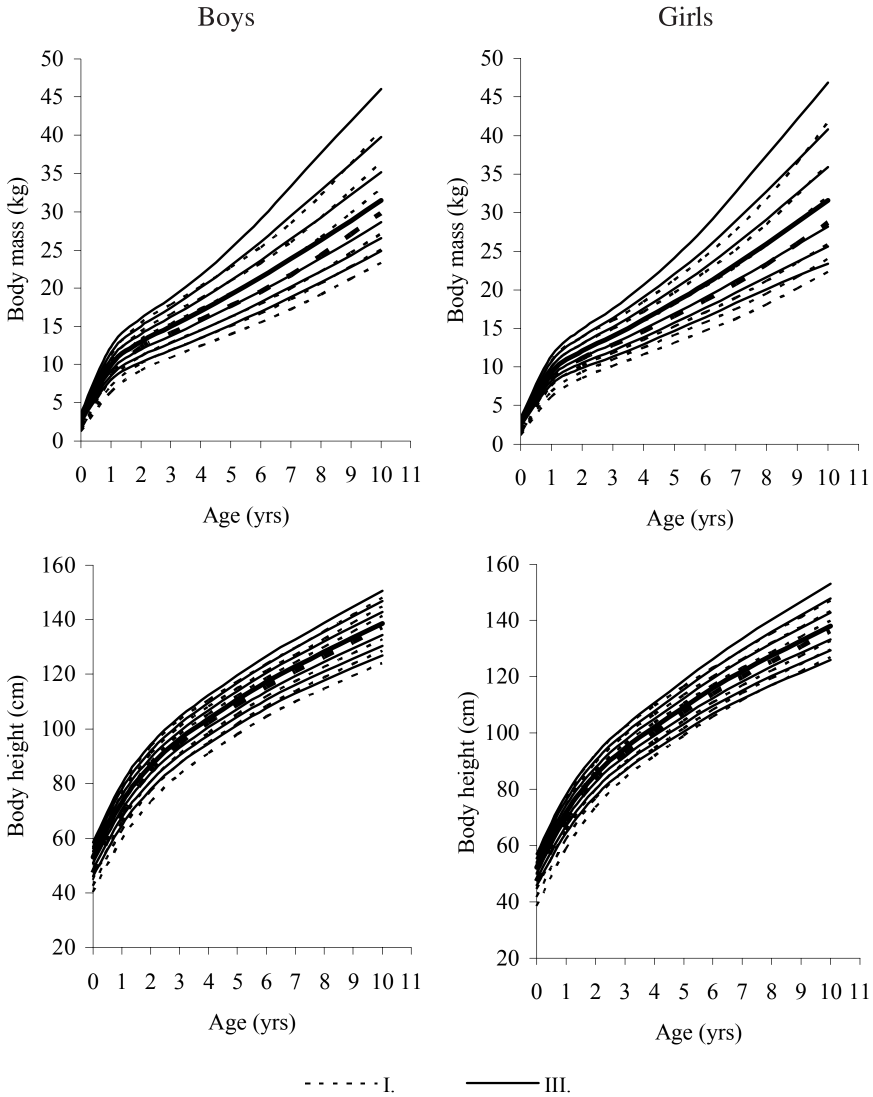

FIGURE 5. Body mass and body height in twins grouped on the basis of relative birth weight (Abbr.: as in *Table 2*).

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