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Physical growth of children born small for gestational age

By

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In a longitudinal study the postnatal physical growth of 188 small for gestational age and 225 appropriate for gestational age children was compared. A significant retardation in weight, stature, head circumference and osseous development of SGA children was observed even at the age of 3 years.

The physical development of children with low birth weight and/or intrauterine growth retardation has attracted great interest in paediatric literature [1, 2, 3, 4, 5, 6, 7, 9, 10, 14, 15]. The results being equivocal, we undertook a prospective investigation of small-for-gestational age (SGA) subjects with special reference to weight, stature, circumference of the head and osseous development.

Material and Methods

In the year 1972, 2840 liveborn babies were born in our hospital. Out of them 250 singletons (165 girls and 85 boys) proved to be SGA, i.e. their birth weight fell below the 10th percentile of the local growth chart. Of these 188 were followed-up and examined at the age of 6, 12, 18, 24 and 36 months: 120 girls including 48 with a birth weight of less than 2500 g, and 68 boys involving 32 with a birth weight under 2500 g. Their distinction by birth weight and not by gestational age was justified by the fact that all official statistics consider the 2500 g border, irrespective of gestational age. At each examination weight, height and head circumference were measured, and at the age of 3 years an X-ray picture of the right wrist was taken. The latter was evaluated according to the standards of Tanner and Whitehouse [16].

Randomly selected 225 appropriate-for-gestational age (AGA) babies, among them 49 true prematures with a birth weight under 2500 g, served as controls. They were followed-up in exactly the same way as the SGA children.

A summary of the material is shown in Table I.

Results

As shown by the figures of Table II, the mean weight values for AGA girls and boys corresponded to the European standards [11, 12]. Whereas the average weight of AGA premature babies reached the mean value of full-term eutrophic infants by the end of the first year, a significant retardation of SGA children was still visible at the age of 3 years. As Figs. 1 and 2 show, the differences in weight

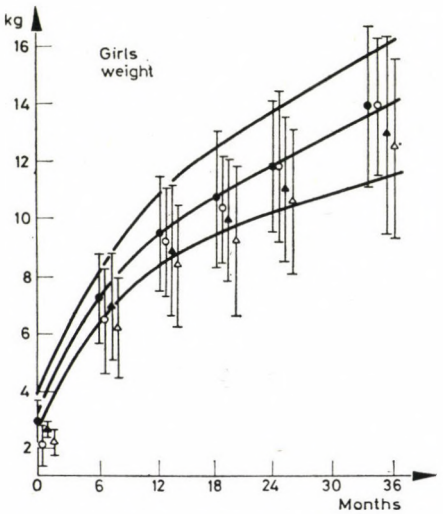

FIG. 1. Postnatal weight gain of girls. Mean ± 2 S.D. —●— AGA, birth weight ⩾ 2500 g; —○— AGA, birth weight <2500 g (true prematures); —▲— SGA, birth weight ⩾ 2500 g; —△— SGA, birth weight < 2500 g

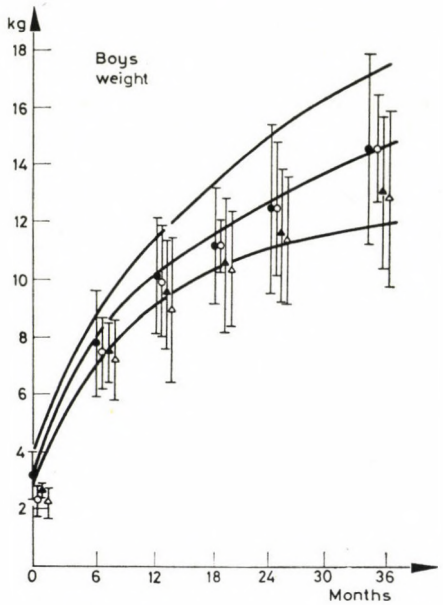

FIG. 2. Postnatal weight development of boys. Mean ± 2 S.D. The symbols are the same as in Fig. 1

TABLE I

Survey of material

	Birth weight		Total
	< 2500 g	⩾ 2500 g	
Small for gestational age			
Girls	48	72	120
Boys	32	36	68
Total	80	108	188
Appropriate for gestational age			
Girls	29	90	119
Boys	20	86	106
Total	49	176	225

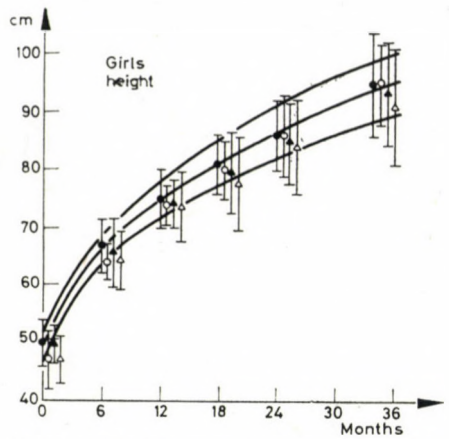

FIG. 3. Height development of girls. Mean ± 2 S.D. For symbols see Fig. 1

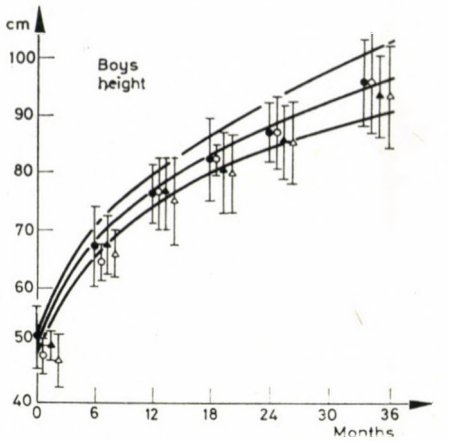

FIG. 4. Postnatal height values of boys. Mean ± 2 S.D. The symbols are the same as in Fig. 1

were more expressed in boys than in girls.

A similar tendency for height could be observed, although the average length of SGA subjects was only slightly less than that of the AGA children (Table II, and Figs 3 and 4).

Mean head circumference was smaller in all SGA girls and in low birth weight SGA boys throughout the 3-year period of the investigation. No significant differences among the other groups were found (Table II).

Compared with full-term AGA infants, both SGA babies and true preterm infants had a lower skeletal age at the age of 3 years (Table III). Because of the wide range this was only slightly or not significant statistically.

DISCUSSION

The present findings support the view that in addition to the well-known acute risks of the SGA newborn, attention should be focussed on the importance of gestational age and birth weight as a factor influencing postnatal growth and development.

In agreement with many authors [4, 5, 10, 14, etc.] we found that SGA children were retarded in postnatal weight, stature and osseous development. This could be demonstrated not only in SGA children whose birth was less than 2000 g [1], but to a moderate extent also in SGA subjects with a birth weight above 2500 g. Bjerre [4] reported a normal head circumference of SGA children at the age of 5 years. In our material head circumference was less than expected in all groups of SGA children during the 3-year period of observation.

A high postnatal growth rate in true prematures was found also in the present material. By the end of the first postnatal year, weight, height and head circumference of these children corresponded to the values of full-

TABLE II

Mean weight, length and head circumference at birth and at 6, 12, 18, 24 and 36
circumference in cm. P means significance compared

Age (months)	AGA controls					
	Girls			Boys		
	Weight	Length	Head	Weight	Length	Head
Birth	2 980	51.5	33.5	3 090	51.5	33.5
6	7 260	67.0	42.0	7 720	66.5	43.0
12	9 470	75.0	45.5	10 130	76.0	46.5
18	10 710	81.0	47.0	11 070	82.0	47.5
24	11 840	85.5	48.0	11 940	85.0	49.0
36	14 000	96.0	49.0	14 500	96.0	50.0
						Birth weight <
Birth	2 010***	47.0***	31.0***	2 230***	47.5***	31.5***
6	6 450***	64.0***	41.0**	7 470*	64.5*	42.5
12	9 200	74.0*	45.0	9 960	76.0	46.5
18	10 370	80.0	46.5	11 470	82.5	48.0
24	11 940	86.0	48.0	12 440	87.0	49.5
36	14 000	96.0	49.0	14 700	96.0	50.0

* = $p < 0.05$, ** = $p < 0.01$,

term AGA babies. This seems to be at variance with previous investigations in which permanent height retardation of low birth weight children was described [8, 13, 15, 17]. The discrepancy is probably due to sampling differences: the comparatively high birth weight of our AGA prematures might account for their rapid catch-up growth.

Investigations of the skeletal age of SGA children in later life are scanty. The data suggest that low birth weight of all types results in a later retardation of osseous development [4, 10]. This was confirmed in the present study, and the results are all the more convincing, since in evaluating the X-ray pictures our method differed from those of both Fitzhardinge [10] and Bjerre [4].

Although some sampling bias, and the role of environmental factors, except for significant malnutrition, cannot be excluded, our data provide further evidence that gestational age

months of age in the groups of children investigated. Weight is given in g, length and head with corresponding values of full-term AGA controls

Small for gestational age children

Girls			Boys		
Weight	Length	Head	Weight	Length	Head
2 650***	50.5***	33.0**	2 650***	50.0***	33.5
6 950*	65.5*	42.0	7 485*	66.5	43.0
8 900**	74.0*	44.5***	9 470**	76.0	45.5**
9 970*	79.5	46.5**	10 430*	80.0*	47.0
11 100***	84.5	47.5**	11 480*	85.0	48.5
13 000**	93.0*	48.5*	13 100***	93.0*	49.5
2500 g					
2 160***	47.5***	32.0***	2 160***	47.5***	32.5***
6 240***	64.5***	41.5*	7 190**	67.0	42.5*
8 400***	73.5**	44.0**	8 930***	75.0*	45.0***
9 250***	77.5**	45.5**	10 500*	80.5*	47.0*
10 640***	84.0*	47.5**	11 440*	85.0	48.0*
12 500***	91.0***	48.5*	13 100***	93.5*	49.0*

*** = $p < 0.001$

TABLE III

Skeletal age in 3-year old children

	Girls			Boys		
	Skeletal age (years)	Percentile position	P	Skeletal age (years)	Percentile position	P
AGA > 2500 g	3.11 ± 1.40	50		3.10 ± 1.52	50	
AGA < 2500 g	2.68 ± 0.68	25	< 0.02	2.65 ± 1.06	25	n.s.
SGA > 2500 g	2.85 ± 1.04	25—50	n.s.	2.85 ± 1.14	25—50	n.s.
SGA < 2500 g	2.52 ± 1.16	25	< 0.02	2.67 ± 0.74	25	n.s.

and birth weight should be considered in estimating the later physical development of a given child.

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