Relation between weight and length at birth and body mass index in young adulthood: cohort study

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Few studies have thoroughly examined the relation between weight in early childhood and the later risk of obesity, but recent studies have shown an association between low birth weight and cardiovascular disease in adulthood.[1] High birth weight correlates with being overweight in late adolescence,[2] and intrauterine growth retardation is associated with a higher ratio of waist to hip circumference (an indicator of abdominal fatness) in men.[1] We examined the association between weight and length at birth and adult body mass index in Danish conscripts.

Subjects, methods, and results

We conducted our study in the fifth conscription district of Denmark. Nearly all Danish men have to appear before the draft board when they are between 18 and 26. We studied all men born after 1 January 1973 who were examined between 1 August 1993 and 31 July 1994. We calculated body mass index (weight/(height)^2) for each subject, defining normal weight as a body mass index of 20.0 to 24.9, overweight as 25.0 to 29.9, and obesity as ⩾30.

Data were linked to the Danish medical birth registry, which contains information on all births since 1 January 1973. Birth weight is reported in categories of 250 g, and we used the midpoints of the categories in the analyses.

We calculated the prevalence of obesity according to weight and length at birth. We fitted linear regression models that included weight and length at birth adjusted for gestational age and birth order and mother's marital status, age, and occupation.

We identified 4805 conscripts, of whom 505 were exempted from the examination mainly because of asthma but not because of obesity. The remaining 4300 had medical examinations. The mean body mass index at examination was 23.4; 75.9% (3264/4300) of subjects were normal weight, 19.5% (837/4300) were overweight, and 4.6% (199/4300) were obese. There was a steady increase in mean body mass index from 22.7 at a birth weight of <2500 g to 24.9 at a birth weight of >4500 g (table). There was a similar pattern for length at birth and adult height. The mean birth weight of obese men was 3571 g (95% confidence interval 3493 to 3648 g), of overweight men 3548 g (3518 to 3584 g), and of normal weight men 3445 g (3427 to 3469 g). In a multiple linear regression model inclusion of the confounding variables showed an association between birth weight and body mass index (regression coefficient 0.82 , SE 0.17) but not between length at birth and body mass index (regression coefficient 1.52 , SE 3.87).

Weight and length at birth in relation to body mass index and prevalence of obesity at around 20 years of age

	No of subjects (n=4300)	Mean body mass index*(95% CI)	No of subjects with body mass index ⩾30	Prevalence of obesity (%) (95% CI)
Birth weight (g)				
⩽2500	171	22.7 (22.2 to 23.2)	6	3.5 (0.7 to 6.3)
2501-3000	604	23.0 (22.7 to 23.2)	20	3.3 (1.9 to 4.7)
3001-3250	607	23.1 (22.8 to 23.4)	22	3.6 (2.1 to 5.1)
3251-3500	845	23.2 (23.0 to 23.5)	37	4.4 (3.0 to 5.8)
3501-3750	776	23.7 (23.4 to 23.9)	47	6.1 (4.4 to 7.7)
3751-4000	677	23.7 (23.4 to 24.0)	37	5.5 (3.8 to 7.2)
4001-4500	515	23.7 (23.4 to 23.9)	18	3.5 (1.9 to 5.1)
⩾4501	105	24.8 (24.1 to 25.6)	12	11.4 (5.2 to 17.6)
Length at birth (cm)†				
⩽46	75	22.1 (21.8 to 23.5)	3	4.0 (0.0 to 8.5)
47-48	168	22.7 (22.2 to 23.2)	5	3.0 (0.4 to 5.6)
49-50	657	23.2 (23.0 to 23.5)	31	4.7 (3.1 to 6.3)
51-52	1329	23.2 (23.1 to 23.4)	48	3.6 (2.6 to 4.6)
53-54	1338	23.5 (23.3 to 23.7)	66	4.9 (3.8 to 6.1)
55-56	609	23.9 (23.6 to 24.1)	36	5.9 (4.0 to 7.7)
⩾56	120	24.1 (23.4 to 24.7)	10	8.3 (3.3 to 13.4)

*Weight/(height)^2
†Information on length at birth was missing for four subjects.

Comment

With adjustment for gestational age, length at birth, and maternal variables, birth weight was positively associated with body mass index 20 years later. Previous studies have shown divergent associations between birth weight and obesity,[2-5] but our findings are consistent with those of another large study with a follow up of 17 years.[2] This indicates that weight in adulthood is to some extent determined by or shares determinants with birth weight. Neither our study or that of Seidman et al shows that intrauterine growth retardation and low birth weight are risk factors for obesity, but low birth weight is a predictor of coronary heart disease, stroke, and diabetes.[1] Our findings of a weak association between high birth weight and obesity later in life—itself a predictor of coronary heart disease—suggest that these risk factors may operate through separate causal pathways.

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