Parental education and income: independent and combined effects on childrens growth and weight status

Bramsved R[1], Regber S[2], Mehlig, K[3], Novak, D[1], Lissner, L[3], Mårild S[1]

[1] Department of Pediatrics, Sahlgrenska Academy, University of Gothenburg, Sweden

[2] School of Health and Welfare, Halmstad University, Sweden

[3] Section for Epidemiology and Social Medicine, Institute of Medicine, University of Gothenburg, Sweden

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Background

Low socioeconomic position (SEP) is associated with childhood obesity in affluent countries but the mechanisms are still unclear.

Objectives

To explore the relative importance of parental education and income on the development of their child's body mass index (BMI), and the influence of confounding factors.

Subjects and methods

Growth data from birth to 8 years of age for 3030 children from the Swedish IDEFICS cohort and register-derived control children (July 1, 2008; complete for 37%).

Predicting factors from national registries:

- Parental education = highest level in either parent based on the International Standard of Education 97, dichotomized into low (ISCED 1-3) vs. high (ISCED 4-6)
- Disposable family income dichotomized at median income (459.700 SEK/year, 1€ = 9.25 SEK)
- Other parental factors: Foreign background (both parents born outside Sweden), maternal smoking in relation to pregnancy, maternal age at birth of child, maternal BMI
- Child characteristics: birth weight, sex, age at examination

Figure 1:
Mean BMI with 95% CI stratified by education (top) and income status (bottom)

P-values from two-sample t-test,
* p<0.05, ** p<0.01, *** p<.001

Results

Age-specific BMI by education and income (Figure 1)

- Low parental education was associated with higher BMI from infancy (6 months) on
- Low income was associated with lower values of weight and BMI at birth, but with higher BMI by the age of 8

BMI trajectories by education and income (Table 1)

- Positive associations of BMI with low education and low income (Figure 1) were also observed after mutual adjustment (model 1).
- After adjustment for parental factors associations were seen only with education, and for age 4 – 8 (model 2)
- Maternal BMI was the strongest confounder for education

Table 1: Beta-values for education and income from 2 linear models for repeated measures of BMI (kg/m^2).

BMI	1. Mutually adjusted for education and income, age, and child characteristics		2. Mutually adjusted for education and income, age, and child & parental characteristics	
	Low vs. high education	Low vs. high income	Low vs. high education	Low vs. high income
0.5 years	**0.22 (0.11, 0.33)***	-0.06 (-0.17, 0.04)	0.11 (-0.02, 0.24)	-0.09 (-0.22, 0.03)
1 year	**0.21 (0.10, 0.32)***	-0.04 (-0.15, 0.06)	0.09 (-0.04, 0.21)	-0.08 (-0.20, 0.04)
1.5 years	**0.15 (0.04, 0.25)**	-0.05 (-0.15, 0.04)	0.04 (-0.09, 0.15)	-0.08 (-0.19, 0.03)
2.5 years	**0.22 (0.11, 0.32)***	-0.03 (-0.13, 0.07)	0.12 (-0.01, 0.24)	-0.07 (-0.19, 0.05)
4 years	**0.28 (0.17, 0.38)***	0.05 (-0.05, 0.14)	**0.16 (0.05, 0.28)**	-0.02 (-0.13, 0.09)
5.5 years	**0.40 (0.28, 0.52)***	0.12 (0.01, 0.24)*	**0.25 (0.12, 0.39)***	0.05 (-0.08, 0.18)
8 years	**0.70 (0.51, 0.88)***	**0.18 (0.01, 0.36)***	**0.55 (0.35, 0.76)***	0.11 (-0.08, 0.31)

BMI trajectories by combinations of education and income (Figure 2)

- no interaction between education and income (p = 0.1)
- highest BMI for high income and low education at all ages

Figure 2: Differences in BMI by category of education and income

Mixed linear regression of BMI on categories of SEP and age category, adjusted for child characteristics, and other parental factors
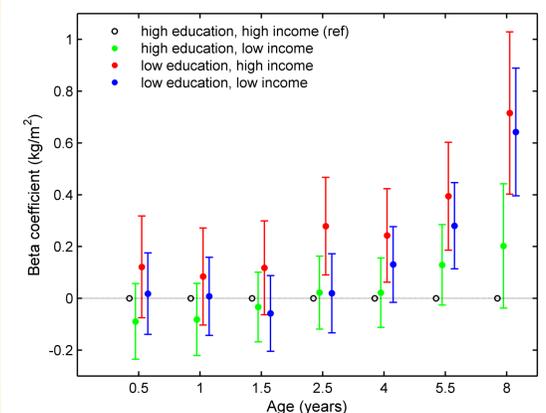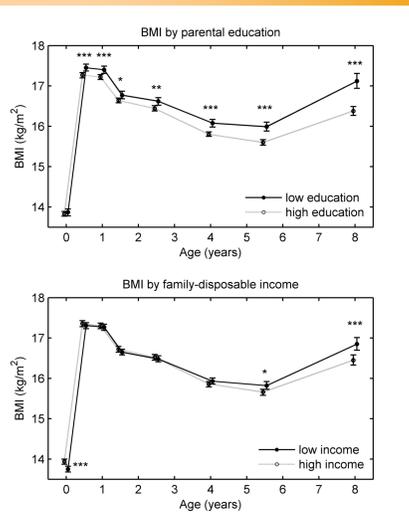
Height trajectories by education and income (Table 2)

- positive associations with income from 6 months of age
- negative confounding with maternal BMI
- no or weak associations with education

Table 2: Beta-values for education and income from 2 linear models for repeated measures of height (cm).

HEIGHT	1. Mutually adjusted for education and income, age, and child characteristics		2. Mutually adjusted for education and income, age, and child & parental characteristics	
	Low vs. high education	Low vs. high income	Low vs. high education	Low vs. high income
0.5 years	0.00 (-0.14, 0.15)	-0.11 (-0.24, 0.03)	-0.05 (-0.22, 0.12)	**-0.20 (-0.35, -0.04)***
1 year	**0.18 (0.01, 0.36)***	-0.09 (-0.25, 0.07)	0.13 (-0.07, 0.32)	-0.16 (-0.35, 0.02)
1.5 years	**0.19 (0.00, 0.38)***	-0.09 (-0.27, 0.09)	0.14 (-0.08, 0.36)	**-0.22 (-0.42, -0.01)***
2.5 years	0.21 (-0.03, 0.46)	-0.18 (-0.42, 0.05)	0.15 (-0.13, 0.43)	**-0.31 (-0.57, -0.04)***
4 years	0.24 (-0.05, 0.54)	-0.27 (-0.55, 0.01)	0.13 (-0.21, 0.46)	**-0.38 (-0.70, -0.06)***
5.5 years	0.24 (-0.10, 0.59)	**-0.47 (-0.79, -0.14)**	0.11 (-0.28, 0.50)	**-0.55 (-0.92, -0.18)**
8 years	0.12 (-0.30, 0.54)	**-0.53 (-0.93, -0.13)**	-0.04 (-0.52, 0.44)	**-0.65 (-1.11, -0.20)**

Take home messages

- By the age of 8, low parental education more than doubled the odds of obesity, independent of income.
- At all ages, highest BMI values were observed for the combination of low education and high income.
- Low income was associated with lower height
- → These results suggest different mechanisms for the effects of education and income on child growth.

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