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Is maternal educational level associated with carbohydrate and fibre intake in 5-6-year-old children?

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ABSTRACT

Background

Obesity in children is currently an important international public health issue and is more prevalent in children from low-educated households. Dietary intake plays an important role in the development of obesity, with recent evidence for the adverse effects of high mono-/disaccharides and less fibre intake. The aim of this study was to examine the relation of maternal education to carbohydrate and fibre intake in 5-6 y olds.

Methods

Data from a large ongoing prospective population-based cohort study in the Netherlands (ABCD study) was used, including only children from Dutch descent (n=1712). Linear regression analyses were used to examine the association of energy-adjusted total carbohydrate, mono-/disaccharides, polysaccharides and fibre intake (quantity and source) in grams/day with maternal education.

Results

Children of low-educated mothers consumed (in energy-adjusted grams/day) more mono-/disaccharides (β 4.8; 95% CI 0.9 - 8.7), less polysaccharides (β -5.1; 95% CI -7.8 – -2.5) and less fibre (β -2.7; 95% CI -3.5 – -1.9) than children of high-educated mothers. The lower the educational level, the higher the odds of insufficient fibre intake. The lower intake of fibre was mainly due to a lower intake of bread, fruit, and vegetables.

Conclusion

Children of mothers with a low educational level consumed more sugars, less polysaccharides, and less fibre than children of mothers with a high education. Low-educated mothers should be trained to adopt healthy food choices, especially about bread, fruit, and vegetables, which may reduce the risk of obesity in their children.

INTRODUCTION

Obesity in children is an important international public health issue. Currently in Western Europe, overweight prevalence rates among 4-year-old children range from 15% in The Netherlands to 32% in Spain.[250] Obesity during childhood could be a cause of multiple health problems later in life since childhood obesity has been associated with adult obesity, hypertension, type II diabetes and metabolic syndrome. Obesity is caused by complex interactions between genes, environment, physical activity and dietary intake.[251]

Regarding dietary intake, there is convincing evidence for the adverse effects of high intake of mono-/disaccharides and less fibre intake in the development of obesity.[252] Food that is high in mono-/disaccharides is generally high in energy, while food that is high in fibre usually contains less energy. Moreover, a high intake of dietary fibres appears to promote satiation, and prolongs satiety, and subsequently decreases the risk of obesity.[252,253] Although the role of mono-/disaccharides and fibre intake in the development of obesity is not established in childhood, there is evidence linking obesity in childhood to sugar-sweetened beverages from prospective[254,255] as well as intervention studies.[256]

Since lower fibre intake has been associated with low socioeconomic status (SES) in adulthood,[257] the association between socioeconomic status and obesity[35] might –in part– be explained by differences in fibre intake. Although, some studies focussed on specific food differences indicating less intake of vegetables,[258,259] fruit,[258,260] and wholemeal bread[260] in children of least educated households, there were no studies that examined educational related differences in diet carbohydrate and fibre intake as a whole. As parents may transfer their personal preferences,[261] attitudes to food[262] and their understanding of the benefits of a healthy diet[263] to their children, we hypothesized that maternal education is associated with carbohydrate and fibre intake in their children. The aim of study was to examine the relation of maternal education to carbohydrate and fibre intake in 5-6 year olds.

METHODS

Research population

This work was performed in the Amsterdam Born Children and their Development (ABCD) study. The ABCD study is an ongoing large prospective population-based cohort study, which was established in 2003. The main objectives of the ABCD study are to investigate children's health, maternal factors and ethnic and socioeconomic disparities therein. The ABCD study is described in detail elsewhere.[43]

Figure 9.1 shows the study procedure and inclusion in the current analyses. As ethnicity was associated with both maternal education and dietary intake in our study, we decided to include children with a Dutch mother only to avoid potential confounding bias (n=1862). In

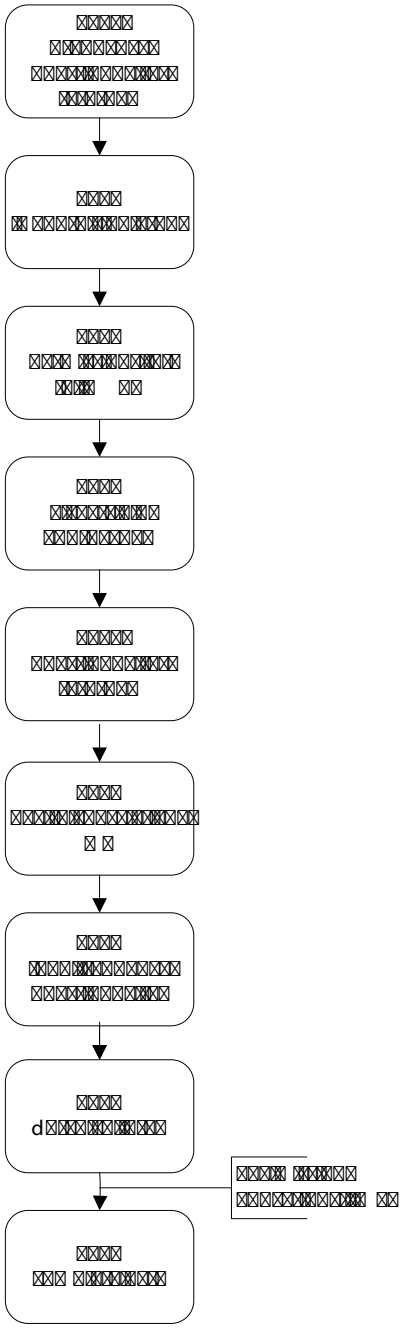

Figure 9.1. Sampling procedure

addition, 150 participants were excluded because mothers did not fill out their educational level, resulting in a final sample of 1712 participants. Approval was obtained from the institutional review board and the Registration Committee of Amsterdam. All participants gave written informed consent for themselves and their children.

Socioeconomic status

We used maternal educational level as SES indicator, since educational level has been described as the SES measure with the largest influence on adiposity in children.[35] Maternal educational level was divided into three groups: high (higher vocational education/ university), mid (higher vocational secondary education/academic secondary education/ intermediate vocational education) and low (primary school/technical secondary education/ lower vocational secondary education). Diet

The habitual food consumption was examined by the FFQ, which was a validated instrument to measure food intake in 4-6 year olds.[264] This self-administered questionnaire contains a total of 77 items, about the frequency per food type and portion size of the food that the child had eaten in the last four weeks. Mean intake of carbohydrates and fibre was calculated using the Dutch Food Composition table 2010 NEVO.[265] Following the criteria of the validation study, outliers were considered as missing values. Cases were excluded (n=69) if more than half of the questions per page were missing. All data entry was checked for quality by a registered dietitian. We calculated energy-adjusted nutrient intake, using the method of Willet,[266] which adjusts for total energy intake by regression analysis. In short, this method removes the variation caused by energy intake, as a higher caloric intake can indicate either overeating or a higher energy intake due to a higher level of energy expenditure. In addition, this method also tackles part of the problem of underreporting, since the proportion of nutrient intake is of importance and not the total amount of food intake. Using this method the outcome measure reflects the predicted intake of nutrients at the mean energy intake of the research population plus the individual variation. Sufficiency of fibre intake was defined according to the standard of the Health Council of the Netherlands, which was based on the American dietary reference intakes as drawn up by the Institute of Medicine (health council of the Netherlands, 2006). In this guideline, an intake of 3.0 grams of fibre per mega Joule (1 MJ= 239 kcal) energy intake is recommended. In order to get insight into the source of fibres, the amount of fibres per product was calculated.

Statistical analysis

Differences between educational groups were tested with ANOVA for continuous variables and Chi-Square test for categorical variables. Linear regression analysis was performed with energy-adjusted carbohydrate intake, energy-adjusted total fibre intake, and energy-adjusted fibre intake per source as dependent variables and maternal education as independent variable using the high-educated group as reference group. For sufficiency of fibre intake,

a multivariable logistic regression was performed. Linear and logistic regression analyses were corrected for maternal age (continuous), childhood age (continuous), sex, and income adequacy (categorical). We decided not to add maternal BMI and childhood BMI as these were considered factors in the causal path and therefore were no confounders. A p-value <0.05 was considered statistically significant. Statistical data analyses were all performed with SPSS 20.0.

RESULTS

The 1712 included children were 5.6 (SD 0.4) years old (Table 9.1). 86 children had a low-educated mother, 282 a mid-educated mother and 1344 a high-educated mother. Maternal age was 38.9 (SD 3.7) years. The higher the educational level, the higher the mean age of the mother. Low-educated mothers were more likely to have a less than adequate income. The final study sample had a lower maternal BMI (22.4 vs 22.6 kg/m^2), higher child's birth weight (3531 vs 3406 grams) and was more educated (10.8 vs 10.0 years after primary school) than the initial Dutch ABCD-cohort (n= 3992 out of 8266).

Table 9.1. Baseline characteristics by maternal education

		Educational level			
	Total	High	Mid	Low	p-value*
	(n=1712)	(n=1344)	(n=282)	(n=86)	
Child's age, yr (SD)	5.6 (0.4)	5.7 (0.4)	5.6 (0.4)	5.6 (0.4)	.51
Maternal age, yr (SD)	38.9 (3.7)	39.2 (3.5)	38.2 (4.4)	37.2 (4.7)	<.001
Sex (% boys)	51.1	51.7	50.7	51.2	.95
Income adequacy (%)					<.001
Inadequate	8.2	6.9	12.8	14.0	
Adequate	60.7	57.5	69.4	81.4	
more than adequate	31.1	35.6	17.8	4.7	
Food intake in grams/day					
Kcal (SD)	1508.9 (295.4)	1504.7 (275.3)	1518.0 (331.0)	1545.2 (440.9)	.40
Carbohydrates (SD)	192.4 (16.1)	192.9 (15.8)	189.9 (16.9)	192.4 (18.0)	.02
Mono-/Disaccharides (SD)	95.0 (17.5)	94.8 (17.2)	94.4 (18.3)	99.2 (19.4)	.07
Polysaccharides (SD)	97.4 (12.1)	98.1 (11.6)	95.5 (13.0)	93.2 (14.5)	<.001
Fibre (SD)	16.1 (2.9)	16.5 (2.7)	15.0 (3.0)	13.5 (2.7)	<.001
Insufficient daily fibre intake, < 3 g/MJ (%)	83	80	92	98	<.001

*p-values between groups of educational level were based on one-way ANOVAs and Chi square tests

Table 9.1 shows that mean energy-adjusted carbohydrate intake was 192.4 (SD 16.1) grams/day, mean mono-/disaccharides intake was 95.0 (SD 17.5) grams/day, and mean fibre intake was 16.1 (SD 2.9) grams/day. Children of low-educated mothers had a lower polysaccharides intake compared to children of high-educated mothers (β -5.1; 95% CI -7.8 – -2.5) (Table 9.2). Also mean fibre intake was lower in children of low-educated mothers compared to high-educated mothers by -2.7 (95% CI -3.5 – -1.9) grams/day. Of the children with high-educated mothers, 80% had an insufficient fibre intake, while 98% of the children with low-educated mothers had an insufficient fibre intake, according to the Health Council of the Netherlands. Children from mothers with a mid- and low-educational level had a higher odds of having an insufficient fibre intake compared to children from mothers with a high-educational level with odds ratios of 3.0 (95% CI 1.9 – 4.9), and 11.4 (95% CI 2.8 – 46.6) respectively.

Children of low-educated mothers had lower fibre intake from bread (β -2.2; 95% CI -2.6 – -1.7), fruit (β -0.3; 95% CI -0.5 – 0.0), vegetables (β -0.4; 95% CI -0.6 - –0.2), and rice/pasta (β -0.2; 95% CI -0.3 – -0.1) compared to children of high-educated mothers, but had a higher fibre intake from potatoes (β 0.3; 95% CI 0.2 – 0.5). In addition, children of mid-educated mothers had lower intake of fibre from bread, fruit, vegetables, and rice/pasta compared to children of high-educated mothers (Table 9.3).

Table 9.2. Multivariate regression analysis of maternal education and carbohydrate intakes (grams/day).

	Maternal education (reference: high)	
	Mid	Low
	beta (95% CI)	beta (95% CI)
Carbohydrates	-3.1 (-5.2 – -0.9)	-0.3 (-3.9 – 3.3)
Mono-/disaccharides	-0.2 (-2.5 – 2.1)	4.8 (0.9 – 8.7)
Polysaccharides	-2.9 (-4.4 – -1.3)	-5.1 (-7.8 – -2.5)
Fibre	-1.5 (-1.9 – -1.0)	-2.7 (-3.5 – -1.9)

Analyses were corrected for maternal age, childhood age, sex, and income adequacy.

Table 9.3. Energy-adjusted fibre intake per food group, expressed as a percentage of total fibre intake, as a mean (SD) for the high-educated group, and as beta (95% CI) for the mid- and low-educated group.

		Maternal education (reference: High)		
		High	Mid	Low
	% of total fibre	Mean (SD)	beta (95% CI)	beta (95% CI)
Total fibre, mean		16.1 (2.9)	-1.5 (-2.0 – -1.0)	-2.7 (-3.5 – -1.9)
Fibre from bread	38	6.1 (2.2)	-1.0 (-1.3 – -0.7)	-2.2 (-2.6 – -1.7)
Fibre from fruit	14	2.3 (1.1)	-0.3 (-0.4 – -0.1)	-0.3 (-0.5 – 0.0)
Fibre from vegetables	11	1.7 (1.0)	-0.2 (-0.3 – -0.1)	-0.4 (-0.6 – -0.2)
Fibre from potatoes	8	1.3 (0.6)	0.1 (0.0 – 0.2)	0.3 (0.2 – 0.5)
Fibre from rice/pasta	4	0.6 (0.5)	-0.1 (-0.2 – 0.0)	-0.2 (-0.3 – -0.1)

Analyses were corrected for maternal age, childhood age, sex, and income adequacy

DISCUSSION

Children from low-educated mothers consumed more mono-/disaccharides, less polysaccharides and fewer fibres than children from high-educated mothers. The latter was due to a lower intake from bread, vegetables, fruit, and rice/pasta. In addition, the lower the educational level, the higher the odds of an insufficient fibre intake. To our knowledge there has been no research regarding the intake of the type of carbohydrates and fibres in 5-6 year olds, though there are studies assessing the association between diet and SES.[257,258,260,267,268]

Previous studies have described a less healthy diet in children from mothers with low educational level. In preschoolers, low-education has been associated with poorer diet quality,[269] less healthier food choices,[270] a higher intake of added sugar,[271] and more snacks and fatty foods and less vegetables.[186] These results seem comparable to our results with a higher intake of mono-/disaccharides and lower intake of fibres in the low-educated group.

The low-educated group had lower fibre intake than the high-educated group, though the majority of the study population had an insufficient fibre intake. This could be because fibre intake was linked to total energy intake and sufficiency was based on recommendations for adults. Children with a low-educated mother had a lower intake from vegetables, fruit, and bread and consume more food high in sugars, which tend to be cheaper. As there was no association between macronutrient intake and income adequacy in our sample (results not shown), food prices may not be the main reason for educational differences in dietary intake. It is more likely that the education of the mothers influences their view on food and consciousness of health, which in turn influences what they feed their children.[272]

A higher intake of fibre and a lower intake of food high in sugars is likely to be protective against obesity,[252] and other cardiovascular risk factors.[273] However, we did not find an association of carbohydrates and fibre with obesity as other cross-sectional studies(data not shown).[274] This could be due to multiple factors. First, a cross-sectional study measures certain factors at one point in life, while adiposity is a result of multiple factors over a longer period of time and only a small difference in energy intake is needed to gain weight over time. Second, it is possible that parents from overweight children give their children less food in an attempt to make them lose weight. Third, there may be obesity-related underreporting with an underestimation of food intake in obese subjects.[275] A longitudinal study may shed more light on the role of diet in the development of adiposity in children.

There are some limitations of this study that need to be mentioned. Underreporting is inherent to epidemiologic food studies. Using the energy-adjusted outcome measures, we minimized the effect of underreporting. However, this does not exclude selective underreporting. It is possible that parents overreported foods generally considered healthy and underreported foods considered unhealthy, but it is not known whether this differs among educational groups and influences the results. In addition, selective loss to follow-up is present as mothers in our research population seem healthier and were more educated than the

initial ABCD study population. As the group of mothers with a low education is probably less educated at the population level compared to our sample, the actual associations are more likely to be underestimated rather than overestimated.

In conclusion, children of mothers with a low educational level consumed more sugars, less polysaccharides, and less fibre than children of mothers with a high education. Low-educated mothers specifically should receive more attention regarding healthy food choices such as bread that is rich in fibre, vegetables, and fruit, to help reduce the risk of obesity in their children.