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Maternal educational level and preschool children's consumption of high-calorie snacks and sugar-containing beverages: Mediation by the family food environment

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ABSTRACT

Objective. To examine the associations between maternal educational level and preschoolers' consumption of high-calorie snacks and sugar-containing beverages, and to assess the mediating effects of variables relating to the family food environment.

Methods. We analyzed data from 2814 native Dutch preschoolers enrolled in a birth cohort study in Rotterdam (the Netherlands), between 2002 and 2006. Logistic regression models were used to calculate odds ratios of snacking ≥2 times/day and consuming sugar-containing beverages ≥3 glasses/day for children of mothers with low, mid-low, and mid-high educational levels (reference group: high educational level), before and after adjustment for mediators.

Results. Children of low and mid-low educated mothers were significantly more likely to consume excessive amounts of high-calorie snacks and sugar-containing beverages compared with children of high educated mothers, with the highest odds in children of low educated mothers (OR: 2.44; 95% CI: 1.84, 3.23 and OR: 2.46; 95% CI: 1.87, 3.24 respectively). Parental feeding practices, parental consumption of sugar-containing beverages, and children's television time partly explained these associations.

Conclusion. Maternal educational level is inversely related to preschoolers' consumption of high-calorie snacks and sugar-containing beverages. Targeting the family food environment may be an effective way of reducing educational inequalities in children's unhealthy dietary behaviors.

Introduction

Over the past decades, the prevalence of overweight and obesity among children has increased dramatically worldwide (Ebbeling et al., 2002). Coinciding with this rise in childhood overweight and obesity has been an increase in the frequency and mean intake of soft drinks and snacks among children (French et al., 2003; Piernas and Popkin, 2010). These parallel developments suggest that unhealthy dietary behaviors may partly drive the current childhood overweight epidemic. This hypothesis is supported by research that showed positive associations of consumption of soft drinks and sweet snacks with body mass index and the prevalence of overweight (Ludwig et al., 2001; Malik et al., 2006; Nicklas et al., 2003).

Because dietary behaviors track throughout childhood and into adolescence (Pearson et al., 2011b), it is important to identify high risk groups as early as possible. Studies in preschool children have shown that soft drink consumption is more common among children from low socioeconomic families (De Coen et al., 2012; Dubois et al., 2007; Vereecken et al., 2004). However, less is known about the association between socioeconomic position and children's consumption of high-calorie snacks. Furthermore, only few studies have investigated intermediary factors that underlie the association between family socioeconomic position and preschool children's consumption of snacks and soft drinks (De Coen et al., 2012; Vereecken et al., 2004). Insight into these underlying mechanisms is crucial for the identification of modifiable determinants that may be targeted in intervention programs.

The family food environment is likely to play an important role in shaping (young) children's dietary behaviors. Studies among young

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children have shown that snacking and soft drink consumption are associated with parental feeding practices (e.g., parental permissiveness) and parental consumption of these foods (Campbell et al., 2006; Sleddens et al., 2010; Vereecken et al., 2004). Furthermore, children who watch a lot of television are more likely to consume snacks and sugar sweetened beverages (Campbell et al., 2006; Pabayo et al., 2012).

Therefore, the first aim of this study was to examine associations between maternal educational level, as indicator of family SEP, and consumption of high-calorie snacks and sugar-containing beverages in 4-year-old preschool children. Second, we aimed to assess to what extent parental feeding practices, parental consumption, and children's television viewing time mediate these associations.

Methods

Study design

This study was embedded in the Generation R Study, a population-based prospective cohort study from fetal life onwards. The Generation R Study was designed to identify early environmental and genetic determinants of growth, development and health, and has been described previously in detail (Jaddoe et al., 2012). The study was conducted in accordance with the guidelines proposed in the World Medical Association Declaration of Helsinki and has been approved by the Medical Ethical Committee at Erasmus MC, University Medical Center Rotterdam. Informed consent was obtained from all participants.

Study population

Invitations to participate in the study were made to all pregnant women who had an expected delivery date between April 2002 and January 2006 and who lived in the study area (Rotterdam, the Netherlands) at time of delivery. Postnatal consent was obtained for 7295 children of the original 9745 live born children of the Generation R cohort (Jaddoe et al., 2012). As socioeconomic inequalities in dietary behaviors may vary according to ethnic background (Stronks and Kunst, 2009), children of Dutch mothers were selected for analyses (n = 3787). We excluded participants with missing information on maternal educational level (n = 19) and with missing information on both snacking and consumption of sugar-containing beverages (n = 627). To avoid clustering of data, we also excluded second (n = 319) and third children (n = 8) of the same mother, leaving a study population of 2814 participants. Of these, 2759 participants had information on snacking and 2778 participants had information on sugar-containing beverage consumption.

Family socioeconomic position

We used maternal educational level as indicator of family socioeconomic position. The highest educational level attained by the mother was assessed by questionnaire at enrolment. The Dutch Standard Classification of Education was used to categorize four levels of education: low (<4 years high school), mid-low (college), mid-high (Bachelor's degree) and high (Master's degree) (Statistics Netherlands, 2004).

Children's dietary behaviors

Consumption of high-calorie snacks and sugar-containing beverages was assessed in a parent-reported questionnaire (90% mothers) when the child was four years old. For snack consumption the following question was used: 'How often does your child eat a high-calorie snack each day on average (something that is eaten in between the three main meals, for example sweets, potato chips, chocolate bars, ice cream)?'. Answer categories for this question included: 'never', 'once per day', '2–3 times per day', '4–6 times per day', and 'more than 6 per day'. Consumption of sugar-containing beverages was assessed using the question: 'How often does your child have sugar-containing drinks?' Sugar-containing beverages were defined as those beverages containing a lot of (added) sugar, including soft drinks, fruit juices, lemonade, and sweetened milk products (e.g. chocolate milk). Answer categories ranged from 'less than one glass per day' to 'more than 4 glasses per day' (6 categories in total). Due to skewed distributions, snack consumption was dichotomized into '≥2 times/day' and '≤1 time/day' and consumption of sugar-containing beverages was dichotomized into '≥3 glasses/day' and '≤2 glasses/day'. Cut-points for both variables were based on the distribution of the data and previous research on unhealthy dietary behaviors in young children (Veldhuis et al., 2012).

Family food environment

Potential mediators relating to the family food environment were assessed in a questionnaire when the child was four years old. Three subscales of the Child Feeding Questionnaire (CFQ) by Birch et al. (2001) were used to assess parental feeding practices, including monitoring (3 items), restriction (8 items), and pressure to eat (4 items). These three subscales of the CFQ have been validated in various populations (Anderson et al., 2005; Corsini et al., 2008; Geng et al., 2009), and are widely used to assess parental control over feeding (Birch et al., 2003; Campbell et al., 2010; Spruijt-Metz et al., 2002, 2006; Webber et al., 2010). Internal consistency of the administered scales was moderate-to-large in our study population ($\alpha = 0.90$ for monitoring; $\alpha = 0.71$ for restriction; $\alpha = 0.64$ for pressure to eat). Consumption of sugar-containing beverages by the primary caregiver was assessed on a 5-point Likert scale ranging from 'No, hardly any' (1) to 'Yes, an awful lot' (5). The same variable was used as a proxy variable for parental consumption of high-calorie snacks in the analyses on children's snack consumption, as information on snacking by the parents was not available for the present study. Frequency (0–7 days) and duration of television viewing (<0.5 h, 0.5–1 h, 1–2 h, 2–3 h, >3 h) by the children were obtained and converted into average daily television viewing time by multiplying the number of days by the duration of the session per day (middle number of hours), divided by seven (Wijtzes et al., 2012). This estimate was dichotomized in ≥2 h/day and <2 h/day according to recommendations of the American Academy of Pediatrics (American Academy of Pediatrics. Committee on Public Education, 2001).

Statistical analyses

Associations between maternal educational level and several child and family characteristics were studied using χ^2-tests for categorical variables and Kruskal–Wallis tests or ANOVA for continuous variables. The mediating effects of family food environment variables in the association between maternal educational level and children's consumption of high-calorie snacks and sugar-containing beverages were tested using Baron and Kenny's step approach (Baron and Kenny, 1986) (Fig. 1). First, the associations between maternal educational level and children consumption of snacks and beverages were examined using logistic regression models (basic models). Adjustment for child's sex and age did not influence the size or precision of the effect estimates and were therefore left out of the models. Second, the associations between maternal educational level and the potential mediators were assessed using logistic and linear regression models. Third, the associations between the potential mediators and children's snack and beverage consumption were assessed using logistic regression models, adjusted for maternal educational level. Potential mediators that were significantly associated with both maternal educational level and consumption of snacks and beverages were added separately to the basic models. To assess the size of mediated effects, we calculated the percentage change in odds ratios (ORs) for maternal educational level using the following formula: $(100 * [OR_{bm + mediator} - OR_{bm}] / [OR_{bm} - 1])$ (Richter et al., 2009). A full model containing maternal educational level

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