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Short Communication

Parental Influence on the Development of Obesity in 9-year-old Japanese Children: the Toyama Birth Cohort Study

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Abstract

Objectives: To examine parental influence on the development of obesity in 9-year-old Japanese children.

Methods: A 6-year follow-up study of obesity among 6,102 children born in Toyama prefecture.

Results: After adjusting for obesity at age 3, either paternal obesity or maternal obesity at the age 3 survey more than doubled the risk of obesity at age 9 in both genders. Increases in parental body mass indexes (BMIs) from the age 3 survey through the age 9 survey were significantly associated with obesity at age 9 in girls.

Conclusions: Not only parental obesity but also increases in parental BMIs were likely to be associated with development of obesity in children.

Key words: children, obesity, body mass index, parental influence

Introduction

As in western countries, the prevalence of obesity has increased in both children and adults in Japan (1, 2). Since obesity is a major risk factor for chronic diseases (3), its prevention is important for minimizing the public burden of disease. Previous studies have suggested family resemblance for body size (4, 5). Parental obesity increases not only the risk of childhood obesity (6, 7) but also the risk of adulthood obesity (8). Thus, in a preventive strategy for obesity, the impacts of parental factors should not be ignored. However, most of the previous studies concerning obesity have been based on western countries' populations, who are different in backgrounds (ethnicity, lifestyles etc.) from the Japanese population, and there has been little epidemiological evidence for estimating the impacts of parental factors in Japan. This study aimed to examine parental influence on the development of obesity in 9-year-old Japanese children in the context of secular changes in parental body mass.

Subjects and Methods

The Toyama Birth Cohort Study is an ongoing population-based birth cohort study, which consists of almost all children born from April 2, 1989 to April 1, 1990 in Toyama prefecture, Japan (n=10,438). Detailed information about this study has been published elsewhere (9, 10). In summary, the initial questionnaire survey and anthropometric measurements were conducted in 1992 (at age 3). The follow-up surveys were conducted in 1996 (at age 6) and 1999 (at age 9). The database included information on family members, lifestyles and physical status of children and their parents at the age 3, age 6 and age 9 surveys. Heights and weights at both age 3 and age 9 were obtained for 7,058 children (3,537 boys and 3,521 girls). Among them, parental heights and weights were simultaneously obtained for 6,102 children (3,054 boys and 3,048 girls) who were included in the data analysis.

The heights and weights of children at age 3 were based on anthropometric measurements, which had been undertaken at regional public health centers by trained public health nurses, according to the protocol of the Law for the Health of Mothers and Children. The heights and weights of children at age 9 were based on the questionnaire survey, in which parents had specified their children's height to the nearest 0.1 cm and their children's weight to the nearest 0.1 kg. A previous study revealed that the height and weight values reported by parents were close to those actually measured (11). The International Obesity Task Force proved that body mass index (BMI) offers a reasonable measure of body fat in children (12). BMI is correlated with direct measures of body fat (13), blood pressure (14) and serum lipid concentrations (15). Thus, as well as in previous epidemiological studies (16), BMI was used as an index of obesity in children in this study. There is no established cut-off point for obesity in children. Since the heights and weights of children change dramatically even over a year, age in months should be taken into account for assessing

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BMI. Thus, cut-off points for obesity in children were defined as the 90th percentile of sex, age (years), and birth month (two groups, from April to September vs. from October to March) specific BMI value in this study: 17.5 for every combination of sex and birth month at age 3; 21.5 for boys in the former birth group, 20.7 for boys in the latter birth group, 20.2 for girls in the former birth group and 19.9 for girls in the latter birth group at age 9.

Parental heights and weights at the age 3 and age 9 surveys were self-reported in the respective questionnaires. Parental obesity was defined as a BMI of 25 kg/m^2 or more based on the Japanese expert committees' guidelines (17).

Statistical analyses were performed with the Statistical Analysis Systems (SAS, version 6.12). Adjusted odds ratios and their corresponding 95% confidence intervals for developing obesity at age 9 were calculated from logistic regression models, which incorporated obesity at age 3, parental obesity at the age 3 survey and increases in parental BMIs from the age 3 survey through the age 9 survey.

Table 1 Adjusted odds ratios (95% confidence intervals) for developing obesity at age 9† in the Toyama Birth Cohort Study: multivariate logistic regression analysis

	Boys (n=3,054)	Girls (n=3,048)
Obesity at age 3‡	4.81 (3.62–6.37)	5.57 (4.16–7.43)
Paternal obesity¶	2.12 (1.61–2.77)	2.25 (1.72–2.95)
Maternal obesity¶	2.43 (1.60–3.61)	3.77 (2.64–5.34)
Increase in paternal BMI#	0.98 (0.92–1.04)	1.11 (1.02–1.20)
Increase in maternal BMI#	1.03 (0.95–1.12)	1.09 (1.00–1.18)

BMI=Body mass index, kg/m^2.
† boys: BMI≥21.5 (former birth group), 20.7 (latter birth group); girls: BMI≥20.2 (former birth group), 19.9 (latter birth group).
‡ boys: BMI≥17.5 (former birth, latter birth); girls: BMI≥17.5 (former birth, latter birth).
¶ BMI≥25.0 at the age 3 survey.
# difference between the age 3 survey and the age 9 survey.

Results and Discussions

Table 1 shows the results of multivariate logistic regression analysis. After adjusting for obesity at age 3, either paternal obesity or maternal obesity at the age 3 survey more than doubled the risk of obesity at age 9 in both genders. Increases in parental BMIs from the age 3 survey through the age 9 survey were significantly associated with obesity at age 9 in girls.

According to current understanding of genetic architecture of obesity, obesity-related genes may account for 40 to 70% of the variation in obesity-related phenotypes such as BMI, skinfolds and percent body fat (18). However, manifestation of these genes (i.e. development of obesity) requires cooperative environmental factors (19, 20). Since genetic predispositions are mostly irremovable, it is important for prevention of obesity to improve environmental factors such as socioeconomic status (education etc.) (7) and lifestyles (diet, physical activity etc.) (2, 6, 21). Such environmental factors may be conveyed from parents to children and may persist into adulthood (22). The observed risk of obesity in children associated with parental factors might involve parent-child linkage of environmental factors. Not only parental obesity but also increases in parental BMIs were likely to be associated with development of obesity in children. It may be possible that improvement of parental environmental factors reduces the risk of obesity even in children, and it is worth emphasizing the importance of health education for parents. Children aged 3 through 9 years are considered to be ideal candidates for treatment because parents still have the opportunity to influence their children's activity and diet positively (8). For a more effective preventive strategy for obesity in both children and adults, a family-based approach to risk assessment and risk reduction should be considered (23).

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