

Current Research

School Breakfast Program but Not School Lunch Program Participation Is Associated with Lower Body Mass Index

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ABSTRACT

Background Rates of overweight and obesity have increased dramatically during the past 2 decades. Children obtain a large fraction of their food energy while at school.

Objective To estimate the relationship between participation in school meal programs and children's body mass index (BMI) and their likelihood of being overweight or obese, testing the hypothesis that school meal participation influences students' weight status, as measured by their BMI and indicators of overweight and obesity.

Design A cross-sectional design in which a regression model was used to estimate the association between participation in the School Breakfast Program and National School Lunch Program and children's BMI and risk of overweight or obesity, controlling for a wide range of student and school characteristics.

Subjects/setting Participants included a nationally representative sample from the third School Nutrition Dietary Assessment Study of 2,228 students in grades 1 through 12 for whom height and weight measurements were obtained. These students, along with their parents, each completed a survey.

Statistical analyses performed Multivariate regression models were used to examine the relationship between usual school meal participation and BMI and indicators of whether students were overweight or obese. These models controlled for students' demographic and socioeconomic characteristics, levels of physical activity, usual eating habits, screen time, and school characteristics.

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STATEMENT OF CONFLICT OF INTEREST: See page S127.

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Results No evidence was found of any relationship between usual school lunch participation and any of four different measures of weight status based on students' BMI. School breakfast participation was associated with significantly lower BMI, particularly among non-Hispanic, white students.

Conclusions There was no evidence that either the school breakfast or lunch program is contributing to rising rates of childhood obesity. In fact, School Breakfast Program participation may be a protective factor, by encouraging students to consume breakfast more regularly.

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In recent decades, prevalence of overweight and obesity among children has been growing rapidly. According to data from the National Health and Nutrition Examination Survey (NHANES), 16% of school-aged children were classified as obese in 2005-2006, an approximately threefold increase since 1980, although there is evidence that the prevalence of obesity among children has leveled off since 1999 (1,2). The large and increasing rates are particularly troublesome because childhood obesity is commonly viewed as having potentially serious long-term health consequences—including an increased likelihood of obesity in adulthood, type 2 diabetes, and coronary heart disease—as well as having more immediate effects on children's social and emotional outcomes (3-6).

School meal programs, including the National School Lunch Program (NSLP) and the School Breakfast Program (SBP), play an important role in children's diets and can thus influence their weight status. On school days, children obtain a substantial proportion of their calories while at school, largely from the meal programs (7,8). The third School Nutrition Dietary Assessment Study (SNDA-III) data indicate that more than one fourth (26%) of calories consumed by the average child on a school day were both obtained and consumed at school (9). The proportion of calories consumed at school was higher among school meal participants, with NSLP participants getting 35% of their daily food energy from foods obtained and consumed at school and those who participate in both the SBP and NSLP getting 47% of their energy from these foods. Children also expend a large proportion of their daily energy (up to half) while at school (10). Several commentators have suggested that by boosting children's intake of saturated fat and total calories, the meal programs may have contributed to the rising levels of childhood obesity (11,12). And even if they have not caused the

problem, the SBP and NSLP constitute two major avenues through which federal policy may influence—for better or worse—what children eat.

Previous research on the school meal programs has focused mainly on their impact on children's dietary intake. Including the other articles in this Supplement, this research has shown that NSLP participation leads to higher intakes of fat in children's diets, but lower intakes of carbohydrates in general and added sugars in particular; NSLP participation also leads to higher daily intakes of a number of key vitamins and minerals (13-17). Findings on the effects of the SBP are less consistent, and suggest that impacts on children's intakes at breakfast alone often do not persist over their 24-hour intakes (8).

The relatively little research conducted on the impacts of the meal programs on children's weight status has not been conclusive. A recent literature review (conducted in 2004) concluded that there was no strong evidence linking meal program participation and overweight or obesity; existing studies either were not sufficiently rigorous or did not find strong evidence of a relationship (18). Two studies completed since this review produced contradictory findings. One study found no evidence that the school meal programs contribute to overweight among poor children (19); the other found that NSLP participation leads to increases in body mass index (BMI; calculated as kg/m²) among children in kindergarten and first grade (20).

To address the lack of conclusive findings in the existing research on the effects of the school meal programs on children's weight status, this article estimates the relationship between participation in the SBP and NSLP and children's BMI and likelihood of being overweight or obese. In particular, the article tests the hypothesis that school meal participation influences students' weight, as measured by BMI and indicators of overweight and obesity. The analysis was based on a large, nationally representative sample of participants and nonparticipants in the school meal programs, with controls for student, household, and school characteristics that are more extensive than the ones previous studies have used. With no clear *a priori* expectations about whether school meal participation would lead to an increase or a decrease in BMI, two-sided hypothesis tests were used. Through better understanding of the relationships between NSLP/SBP participation and BMI-based outcomes, policies influencing the school meal programs can be better designed to reduce obesity and promote children's health.

METHODS

Data and Sample

Data from SNDA-III were used to estimate the relationship between school meal participation and children's BMI and obesity. The SNDA-III student sample of 2,314 1st through 12th graders was selected through stratified sampling of public school districts, schools within districts, and students within schools. This sample was representative of all public school students nationally as of the 2004-2005 school year. Twenty-four-hour dietary recalls, along with student and parent surveys, were completed with each sample member. The student interviews and 24-hour dietary recalls were conducted in person. For the dietary recall, interviewers used the Automated Mul-

tiple Pass Method software (version 2.3, 2003, Agricultural Research Service, Food Surveys Research Group, Beltsville, MD) on laptop computers. Parents of elementary school children were also interviewed in person, while parents of older children were interviewed by telephone.

In addition to the surveys, the study team measured the height and weight of each sample member in person. Data collection instruments and procedures for SNDA-III were approved by the US Department of Agriculture, Food and Nutrition Service, the 2004 Education Information Advisory Committee of the Council of Chief State School Officers, and the Office of Management and Budget. In addition, the study worked with any institutional review process a school district required. A detailed discussion of the SNDA-III sample design, data collection methodology, and study procedures is presented elsewhere in this Supplement (21).

Key Outcomes

Each outcome measure used in the study is based on students' BMI—the ratio of weight (in kilograms) to the square of height (in meters). Study team members measured and weighed sample members in their schools, and 2,228 sample members (96% of the main SNDA-III analysis sample) had valid height and weight data. Those without valid data included a small number of children for whom height and weight measurements were never completed and a few others that were excluded because they had biologically implausible values. We used standards for biologically implausible values as defined by the World Health Organization (22). The height and weight measurements were taken by trained interviewers using standardized procedures and a common set of equipment across all schools. Standing height was measured with a portable stadiometer or height measuring board (Seca model 214, Seca Corp, Hanover, MD) using a slightly modified version of a procedure developed for NHANES and other national and international surveys (23). The child was asked to remove his or her shoes, hats, hair ornaments, or other items that might affect the accuracy of the height measurement, and to remove heavy outer clothing, heavy jewelry, and anything else that might interfere with the weight measurement. At least two measures were taken of both height and weight for each child, with a third measure taken if the first two differed by more than a prespecified amount.

Four outcome variables were based on students' measured BMI, the first of which was BMI itself. Unlike for adults, the interpretation of BMI is age- and sex-specific among children—in other words, a given BMI will have a different meaning for children of a different age or sex. Therefore, all models with BMI as an outcome controlled for sex and age.

The child's BMI was compared to the 2000 Centers for Disease Control and Prevention age- and sex-specific growth charts to determine the BMI-for-age percentile (24). The second and third outcome measures were based on the recommendations of the Expert Committee on the Assessment, Prevention, and Treatment of Child and Adolescent Overweight and Obesity (25). According to these recommendations, a child was classified as "overweight" if his or her BMI is ≥ 85 th, but < 95 th percentile for age

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