Lower Risk of Overweight in School-aged Food Insecure Girls Who Participate in Food Assistance

Results From the Panel Study of Income Dynamics Child Development Supplement

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Background: A quarter of US children are at increased risk of obesity-related health problems because of excess weight. The few national studies of child overweight and inadequate household resources available to purchase healthy foods, or food insecurity, have shown inconsistent results. We hypothesized that the inconsistency in these results may be attributed to a differential effect of participation in food assistance programs in food secure and food insecure households.

Methods: Using the 1997 Panel Study of Income Dynamics Child Development Supplement, we compared the risk of a child aged 5 to 12 years being at or above the 85th percentile of body mass index for age in food insecure and food secure, low-income households when controlling for participation in the Food Stamp Program and the national school lunch and breakfast programs as well as other covariates.

Results: We found that food insecure girls who participated in all 3 programs had a 68% reduced odds (odds ratio, 0.32; 95% confidence interval, 0.12-0.77) of being at risk of overweight when compared with food insecure girls in nonparticipating households and controlling for other factors. Girls in food secure households generally had no greater or less risk of overweight if they participated in any or all programs. Boys in both food insecure and food secure households had no greater or less risk of overweight by if they participated in any or all of the programs.

Conclusions: These results support our hypothesis that food assistance programs play a protective role for low-income children's health, particularly in girls in food insecure households.

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Eleven percent of US children are overweight (body mass index [BMI] at or above the 95th percentile on the National Center for Health Statistics–Centers for Disease Control and Prevention 2000 growth charts), and 14% are at risk of overweight (BMI ≥85th percentile and <95th percentile) according to the Third National Health and Nutrition Examination Survey (1988-1994). Therefore, fully one fourth of US children are at increased risk of adult obesity, hyperlipidemia, elevated blood pressure, hyperinsulinemia, type 2 diabetes mellitus, and other obesity-related disorders. Child risk of overweight has been studied primarily as a result of childhood behavioral problems or faulty parenting skills. These studies have demonstrated that sedentary behavior and high energy intake compared with expenditure are risk factors for child overweight. Furthermore, children with at least one obese parent are more likely to be overweight. However, there is a growing disparity in the prevalence of overweight among white, black, and Hispanic children and low-income and middle- and high-income children. More research that considers not only behavioral and family factors but also social and economic factors is needed to understand child overweight in the United States.

There remains a gap in the public health literature on the role of household participation in federal food assistance programs and the risk of childhood overweight in low-income households. Studies have demonstrated that participation in the Food Stamp Program, the Special Supplemental Nutrition Program for Women, Infants, and Children, and the National School Lunch Program increase household availability and consumption of nutrients. More information is needed about the relationship between household participation in food assistance programs and child overweight.

A second gap in the public health literature on childhood overweight concerns the household dynamics of low-income families. In particular, household food security as it is measured by the US Department of Agriculture Household Food

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Security Survey Module assesses not only the adequacy of overall household food supply, but also the perceived quality of foods available in the home to feed children. Before the development of the Household Food Security Survey Module, several national studies assessed food security status through a single question known as the “food sufficiency” question. Some recent research has suggested that women living in food insecure but not hungry households have significantly higher BMI than low-income women in food secure households.

However, 2 recent studies that examined the relationship between household food insufficiency and child risk of overweight and overweight found no consistent relationships. Alaimo and colleagues found a higher prevalence of overweight among white girls aged 8 to 16 years from low-income, food insufficient households than from low-income food sufficient households in the Third National Health and Nutrition Examination Survey. Household food sufficiency was not associated with risk of overweight (BMI ≥85th percentile) in any other age or ethnicity group in this study. Casey and colleagues reported significantly higher prevalence of risk of overweight (BMI ≥85th percentile) among children from low-income, food insufficient households than in those from high-income, food sufficient households in the Continuing Survey of Food Intake by Individuals (1994-1996). There were no differences in the prevalence of risk of overweight between food insufficient and food sufficient low-income households. Neither of these studies controlled for participation in food assistance programs.

The relationship between child risk of overweight and food security needs to be further explored in the context of other low-income household dynamics to be fully understood. The Panel Study of Income Dynamics Child Development Supplement (PSID CDS) offers a unique opportunity to analyze the relative importance of household factors, such as food assistance program participation and food security, for the risk of child overweight. In this article, we will examine the effects of participation in the school lunch program, the school breakfast program, and the Food Stamp Program on the risk of child overweight in low-income households in the United States. We have hypothesized that (1) the prevalence of child risk of overweight (BMI ≥85th percentile) will vary by household food security status and participation in food assistance programs in low-income households, and (2) food assistance programs moderate the association between household food security and child risk of overweight after controlling for other covariates.

METHODS

STUDY SAMPLE

We used data from the 1997 PSID CDS to examine the relationship between household characteristics and child risk of overweight. The CDS is a longitudinal survey collected since 1968 from a nationally representative sample of families. The CDS is a nationally representative subsample of 2- to 12-year-old children in 2380 families in the United States. Two hundred of these families were from the new immigrant sample and 507 were a supplementary sample of African American families, while the remaining families were from the original PSID core sample. To account for this complex sampling, the University of Michigan Survey Research Center, Ann Arbor, has developed a set of weights for each level of survey response, such as children, primary caregivers, other caregivers, and school or day care teacher. We restricted the sample to households that would be eligible for at least some food assistance programs on the basis of income and used the 185% income-poverty ratio cutoff point used by the National School Lunch Program and the Special Supplemental Nutrition Program for Women, Infants, and Children. We used the 1996 census poverty thresholds for families with 0 to 9 children and 1 to 9 family members to determine the 183% income-poverty ratio. Families with incomes that were below the child- and family-specific cutoff points were included in a low-income subsample of the PSID CDS. The total number of low-income families with a valid child BMI for a 5- to 12-year-old child used in this analysis was 772.

OUTCOME VARIABLE: CHILD RISK OF OVERWEIGHT

Weights were reported by the primary caregiver for each child. Heights were measured by the interviewer. Approximately 86% of children had been weighed within the 6 months preceding the interview, and 16% of weights were estimated by primary caregivers when they were not sure of the weight. We used the recent US National Center for Health Statistics–Centers for Disease Control and Prevention age- and sex-specific cutoffs based on BMI (calculated as weight in kilograms divided by the square of height in meters). We created a dichotomous variable to determine risk of overweight status, where BMI below the 85th percentile was designated 0 and BMI at or above the 85th percentile was 1. We exclude 43 children with BMIs that were either at the 90th percentile or greater than the 100th percentile.

PRIMARY EXPOSURE: FEDERAL FOOD ASSISTANCE PROGRAM PARTICIPATION

Dichotomous variables were constructed for participation during the past year in the following programs: only Food Stamp Program, only school lunch, both lunch and breakfast, and all programs. Only 2 children in this sample participated in the school breakfast program and not lunch. Program participation in the PSID is determined by asking the primary caregiver whether the family participated in the program within the previous year. For school lunch and breakfast programs, respondents were first asked whether the school lunch and breakfast programs were available at the child’s school, and then whether the child participated in them for free, at a reduced cost, or not at all. We collapsed free and reduced-cost lunch participation into a single participation category.

The USDA Household Food Security Survey Module was used to determine household food security status. The 18-item scale categorizes households as food secure, food insecure, food insecure with moderate hunger, and food insecure with severe hunger. The least severe food insecurity category may capture households with anxiety about food shortages, but these are otherwise secure in their ability to procure food, while the food insecure with severe hunger category corresponds to child hunger within the household. The PSID CDS includes a food security status variable based on these categories, and we constructed a dichotomous variable, food secure vs any food insecurity.

STATISTICAL ANALYSIS

Prevalence and SE estimates of risk of overweight reported by food security status and program participation were calculated in Stata software, version 8.0 (Stata Corp, College Station, Tex). The crude relative risk of the effect of federal food assistance program participation on child risk of overweight was 0.77 (95% CI 0.65 to 0.92).
assistance participation on at-risk-of-overweight status stratified by food security status was calculated. Multivariate logistic regression was used to control for confounding. Potential confounders previously reported in the literature that might affect a child’s BMI for age status and participation in federal food assistance programs include child race and sex and parental education and income. We included categorical race dummy variables: white, black, Hispanic, and other. Sex was defined dichotomously. Parental education was included as a dichotomous variable of less than 12 years of education and 12 or more years of education. We weighted analyses as noted in tables with poststratification weights provided with the CDS data to account for complex sampling using probability weighting in Stata. SPSS Suite statistical software, version 11.3 (SPSS Inc, Chicago, Ill) was used for data management.

Table 1 shows the characteristics of low-income families in the PSID. The prevalence of risk of overweight (BMI ≥85th percentile) and the prevalence of food insecurity are high in this sample. Thirty-nine percent of 5- to 12-year-old children classified as being at risk of overweight and 26% of low-income households with a 5- to 12-year-old child were food insecure. A majority of low-income households participated in 1 or more food assistance programs, with the National School Lunch Program being the most commonly used program. However, 16% of the low-income households reported no participation in any food assistance program in 1996.

Table 2 shows that, among 5- to 12-year-old low-income children, the prevalence of being at risk of overweight was higher for children from food secure households than from food insecure households. In this sample, the prevalence of being at risk of overweight was lower among children from food insecure households who participated in any programs than among children from food secure low-income households who participated in any program. Among children who did not participate in any food assistance program, the prevalence of underweight (BMI <5 percentile) was higher in food insecure households than in food secure households (16.2% vs 10.5%) (data not shown). Together, these data suggest that food assistance programs may play a role in reducing the risk of overweight and underweight in food insecure households.

Table 3 shows the adjusted odds of being classified as at risk of overweight on the basis of food security status and food program participation. Among boys in both food secure and food insecure households, participation in any or all programs did not increase or decrease the odds of being classified as “at risk of overweight” after controlling for demographic features of households (child race, age, and sex; head of household education; total family income; and participation in other food assistance programs). Among girls in food secure households, participation in general did not increase or decrease the odds of being at risk of overweight. However, girls in food secure households that participated in food stamps had a significantly reduced risk of overweight (odds ratio, 0.43; 95% confidence interval, 0.20-0.90). Girls in food insecure households had a significantly reduced odds of being at risk of overweight if they participated in any or all of the programs.

Table 4 shows the adjusted odds of being classified as at risk of overweight on the basis of food insecurity status and food program participation. Among boys in both food secure and food insecure households, participation in any or all programs did not increase or decrease the odds of being classified as “at risk of overweight” after controlling for demographic features of households (child race, age, and sex; head of household education; total family income; and participation in other food assistance programs). Among girls in food secure households, participation in general did not increase or decrease the odds of being at risk of overweight. However, girls in food secure households that participated in food stamps had a significantly reduced risk of overweight (odds ratio, 0.43; 95% confidence interval, 0.20-0.90). Girls in food insecure households had a significantly reduced odds of being at risk of overweight if they participated in any or all of the programs.

The first aim of this study was to explore the prevalence of risk of overweight (BMI ≥85th percentile) among children from low-income, food secure and food insecure households in the United States by food assistance participation status. In this sample of children from low-income households, the overall prevalence of child risk of overweight was 40.7% in food secure households and 34.2% in food insecure households. The prevalence of being at risk of overweight was higher in this sample than prevalence estimates from other studies of all US children. However, the estimates of overweight were lower than estimates of risk of overweight (BMI ≥85th percentile) in food sufficient and food insufficient low-income households from the Continuing Survey of Food Intake by Individuals (46.7% and 46.5%, respectively). Estimates of the prevalence of risk of overweight from the Third National Health and Nutrition Examination Survey ranged from 7.5% to 41.3% in food insufficient households to 16.0% to 34.8% in food sufficient households, depending on age and ethnicity. Consistent with national data, we found that the prevalence of risk of overweight among 5- to 12-year-old girls was lower than the prevalence of risk of overweight among boys.

In this study, we found that the prevalence of being at risk of overweight was consistently higher among boys from food secure households than from food insecure households, regardless of food assistance program participation, although the differences were greatest between boys from food secure and food insecure households participating in food stamps (52.4% vs 32.5%). While girls in food secure households had higher prevalence of overweight (29.2%) than girls in food insecure households (23.0%), there were no other differences in the preva-
lence of risk of overweight. One potential explanation of the lower prevalence of being at risk of overweight in children from food insecure households is a higher prevalence of wasting, stunting, or underweight. However, Reid24 used the PSID CDS to examine the relationship between wasting, stunting, and underweight and household food insecurity, and found no significant associations.

A second goal of this study was to identify associations between household food security status, food assistance program participation, and child weight status. The results of this study support our hypothesis that food assistance programs moderate the relationship between food security status and child weight status. When other household and child characteristics were controlled for, federal food assistance program participation did not increase or decrease the odds of being at risk of overweight among children from food secure households in general. In food insecure households, federal food assistance program participation generally decreased the odds of being at risk of overweight in girls but not boys.

It is unclear how food assistance programs might protect girls in food insecure, low-income households from developing overweight. A recent analysis of the Continuing Survey of Food Intake by Individuals (1994-1996) found that 4- to 8-year-old children from food insufficient households consumed significantly fewer servings of added sugars than children from low-income, food sufficient households when food assistance participation and other covariates were controlled for (Linda Knol, PhD, RD, Betsy Haughton, EDD, RD, Gene Fitzhugh, PhD, CHES, unpublished data, December 15, 2002). However, another analysis of the same data found no significant differences in the dietary intake between food sufficient and food insufficient, low-income households, but this analysis did not control for food program participation.20 It is plausible that food stamps and school lunch, through their federal mandates to provide nutrition education (former) and a meal in accordance with the dietary guidelines (latter), may be improving the dietary quality of children in food insecure households. Significantly fewer children from food secure, low-income households participate in food assistance programs than children from food insecure, low-income households.20 Therefore, children from food secure, low-income households may have lower exposure to the beneficial effects of these programs through lower benefit levels from food stamps and lower daily participation in school lunch.17 Further research that examines the direction and causality of a relationship between program participation, food insecurity, and weight status is needed.

Several strengths are associated with this analysis. The PSID CDS is a nationally representative sample of chil-

### Table 2. Prevalence of BMI At or Above 85th Percentile (at Risk of Overweight) Among Low-Income, School-aged Children Within Households Below 185% of Poverty by Household Food Security Status and Program Participation

<table>
<thead>
<tr>
<th></th>
<th>Food Secure (n = 587)</th>
<th>Food Insecure (n = 185)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of Boys at Risk* (SE)</td>
<td>% of Girls at Risk (SE)</td>
</tr>
<tr>
<td>All Participating in</td>
<td>All 3 programs</td>
<td>45.7 (2.9)</td>
</tr>
<tr>
<td></td>
<td>Food stamps</td>
<td>52.4 (4.6)</td>
</tr>
<tr>
<td></td>
<td>School lunch</td>
<td>50.3 (3.5)</td>
</tr>
<tr>
<td></td>
<td>School lunch and breakfast</td>
<td>55.9 (4.3)</td>
</tr>
</tbody>
</table>

Abbreviation: BMI, body mass index.

*Percentage at risk is the weighted prevalence of BMI for age at or above the 85th percentile among children who participated in the program by food security status.

### Table 3. Adjusted Odds of Risk of Overweight (BMI ≥85th Percentile) in Children Aged 5 to 12 Years in Low-Income Households by Food Insecurity Status and Food Assistance Program Participation

<table>
<thead>
<tr>
<th></th>
<th>Food Secure</th>
<th>Food Insecure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td></td>
<td>NP</td>
<td>Participants, AOR* (95% CI)</td>
</tr>
<tr>
<td>All 3 programs</td>
<td>1.0</td>
<td>0.97 (0.54-1.72)</td>
</tr>
<tr>
<td>Food stamps</td>
<td>1.0</td>
<td>0.92 (0.52-1.61)</td>
</tr>
<tr>
<td>School lunch</td>
<td>1.0</td>
<td>1.06 (0.53-2.08)</td>
</tr>
<tr>
<td>Both lunch and breakfast</td>
<td>1.0</td>
<td>1.33 (0.81-2.18)</td>
</tr>
</tbody>
</table>

Abbreviations: AOR, adjusted odds ratio; BMI, body mass index; CI, confidence interval; NP, nonparticipants.

*Odds ratios adjusted for child’s sex, age, race, total family income, education of household, and participation in other programs where only one is the main effect.
dren that includes information about individual children, such as heights, weights, and demographics, as well as their household economic circumstances. Although the PSID is a longitudinal data set, we have used a single cross-sectional sample of children from the PSID to explore the relationship among food security status, food assistance program participation, and child weight status. Further research is needed to address the temporal sequence in our findings. Also, these data have limited information about the dietary and physical activity behaviors of children. We have not controlled for potential variation in these behaviors by food security, weight, or participation status.

Also, the use of BMI percentiles developed from Centers for Disease Control and Prevention growth charts improves the generalizability of BMI information found in this study, by comparing these children with a national standard rather than references internal to the data set. However, the validity of self-reported anthropometry is questionable.23 In the PSID CDS, the parents or other primary caregiver reported weight and, in some cases, height. Children at this age are growing and changing rapidly, and parents may not be aware of the child’s actual anthropometric measurements. Our analysis was also limited by a small sample in some food assistance and food security categories.

This study suggests the benefit of screening for food insecurity and referral to appropriate programs. Families may not readily reveal food shortages because of stigma.26,27 Professionals who work with low-income children should ask questions about the family’s food resources in a sensitive manner and assess the need for referral to food assistance programs. Children from low-income, food insecure households could potentially reap long- and short-term benefit from referral to a food assistance program. Our results suggest that one long-term benefit may be moderation in weight gain.

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