

Children in Food-Insufficient, Low-Income Families

Prevalence, Health, and Nutrition Status

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Objective: To examine characteristics of US children living in food-insufficient households and to compare food and nutrient intakes, physical inactivity, and overweight and underweight status of children in food-insufficient households with those in food-sufficient households.

Design: Cross-sectional, nationally representative sample of children and households from the Continuing Survey of Food Intakes by Individuals, from 1994 to 1996.

Participants: A group of 3790 households, including 5669 children (ages 0-17 years).

Main Outcome Measure(s): Estimates of food insufficiency for children were based on the reported adequacy of their households, described as "often don't have enough to eat" or "sometimes don't have enough to eat." Nutrient consumption was based on two 24-hour dietary recalls from in-person interviews.

Results: Three percent of all households with children, and 7.5% of low-income families with children experienced food insufficiency. Several demographic and char-

acteristic differences were observed between the food-sufficient and food-insufficient low-income groups. Children of low-income families, either food-sufficient or food-insufficient, had similar macronutrient and micronutrient intake, reported exercise, television watching, and percentage of overweight and underweight. When compared with the higher-income food-sufficient households, children in the low-income food-insufficient households consumed fewer calories ($P = .05$) and total carbohydrates ($P = .004$), but had a higher cholesterol intake ($P = .02$). The low-income food-insufficient group included more overweight children ($P = .04$), consumed less fruits ($P = .04$), and spent more time watching television ($P = .02$).

Conclusions: While not different from low-income families who do not report food insufficiency, low-income families with food insufficiency had children who differed from high-income families in several nutrition and anthropometric measures. Clinicians should be aware of the possible effects of poverty and lack of access to food on child health and nutrition status. The long-term effects of these are not yet known.

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FOOD INSUFFICIENCY is defined as inadequacy in the amount of food intake because of a lack of money or resources to access enough food.¹ Despite the abundant food availability and high food wastage in the United States, recent evidence suggests that a large number of US children live in families that are food-insufficient. The Community Childhood Hunger Identification Project indicated that nearly 1 in 3 children younger than 12 years in low-income families often went hungry or were at risk of hunger during the survey year.^{2,3} The Third National Health and Nutrition Examination Survey found that approximately 2.4 to 3.2 million children younger than 12 years lived in food-insufficient families at any time between 1988 and 1994. An additional 0.7 to

1.3 million teenagers (12-16 years of age) lived in food-insufficient families.⁴

In 1985, the Physician Task Force on Hunger estimated that malnutrition resulting from hunger would affect more than half a million American children.⁵ Hungry children tend to suffer from more minor health problems (such as unintended weight loss, fatigue, dizziness, headache, ear infection, and cold) than nonhungry children.^{6,7} They are also more likely to have frequent physician visits, despite lower levels of health insurance.⁸ Furthermore, insufficient food intake has been associated with impaired growth and poor cognitive development in children.⁹⁻¹³ Recent evidence also suggests that food insufficiency and hunger may be associated with childhood obesity.¹⁴⁻¹⁶ In addition, behavioral, emotional, and aca-

POPULATION, MATERIALS, AND METHODS

STUDY POPULATION

The CSFII (1994-1996) data consisted of 3837 households with children. Basic information was collected on all household members, and more detailed data, including nutrient intakes, were collected on a subsample, which were designated as "sample persons." Twenty-one households, 16 of which included child sample persons, were missing a response on the food-insufficiency question. These households and children were excluded from the analysis. The higher-income food-insufficient group was excluded from the study because of its small sample size (26 households and 30 child sample persons), and its wide income range (\$19000 to \$90000). The final sample consisted of 3790 households and 5669 children, aged 0 to 17 years, who completed two 24-hour dietary recalls in an in-person interview. For breastfed infants ($n=133$), the amounts of breast milk were not quantified, but their nutrient intake from foods and drinks was included.

MEASURES AND STRATIFICATION VARIABLES

During household interviews, at least 1 adult sample was selected to answer questions about the educational and employment status of household members 15 years and older, household income, participation in food-assistance programs, food expenditures, food-insufficiency status, and other food-related practices. Food insufficiency was based on describing the food eaten in the household in the last 3 months as "often don't have enough to eat" or "sometimes don't have enough to eat." The answer provided by the respondent was

attributed to each individual who lived in that family. Thus, estimates of food insufficiency for children are based on the reported adequacy of their households.

During individual 24-hour dietary recalls, child sample persons aged 6 to 11 years were asked to describe their own food intake, assisted by an adult household member. Adolescents aged 12 to 17 years self-reported their own dietary intake. Proxy interviews were conducted to obtain dietary data for children younger than 6 years. Questions on weight, height, amount of television watching, amount of exercise, and health status were asked as trailer questions after the first 24-hour dietary recall.

The CSFII definition of low-income household was used and includes those households with income at or below 130% of the federal poverty line (eg, \$20000 for a family of 4). This is used as the income eligibility criterion for federal assistance programs, such as the Food Stamp Program. Households with income higher than 130% of the federal poverty line are defined as higher-income households.

STATISTICAL ANALYSIS

The CSFII is a stratified, multistage area probability sample. To account for this complex sampling design, the analysis for this article incorporated sampling weights, which adjust for unequal probabilities of selection, differing response rates, and potential undercoverage in the sampling frame. For continuous responses, weighted t tests were used to compare 2 groups, and weighted Pearson χ^2 tests were used for categorical responses.²⁵ Most analyses were performed using Stata (Stata Statistical Software, release 5.0; Stata Corp, College Station, Tex). Two-sided values of $P \leq .05$ were deemed significant, and P values were not adjusted for multiple comparisons.

demographic problems are more prominent in hungry children.^{7,16-18}

Food insufficiency is clearly related to poverty. The poverty rate is significantly higher for children than other age groups. While children represent only 27% of the US population, they account for 40% of all Americans living in poverty.^{19,20} In 1993, of the 14 million people on welfare, 69% of them were children.²¹

The Continuing Survey of Food Intakes by Individuals (CSFII) 1994 through 1996²² is the most recent national nutrition survey conducted by the Agricultural Research Service, US Department of Agriculture. The CSFII (1994-1996) includes a nationally representative sample of individuals of all ages and provides detailed data that serve as benchmarks of the food and nutrient intakes of the general and low-income populations. This survey thus provides the opportunity to assess the association of food insufficiency and poverty on various children's health and nutritional markers.

Data from the CSFII (1994-1996)²³ were used to examine characteristics of US children living in food-insufficient households, especially children of low-income families. Nutrient intakes, fruit and vegetable consumption, physical inactivity and exercise, and overweight and underweight determinations were compared in children who live in food-sufficient households and those

in food-insufficient households. Since food insufficiency and poverty are highly correlated,²⁴ an analysis of food insufficiency in children must accommodate for the potential independent confounding effect of poverty on these variables. Therefore, food insufficiency status was examined in 2 income levels: low-income and higher-income.

RESULTS

PREVALENCE AND CHARACTERISTICS OF CHILDREN IN FOOD-INSUFFICIENT FAMILIES

In all households surveyed, 2.2% reported food insufficiency. In households with children, 3.0% experienced food insufficiency. As expected, a higher percentage of low-income families (5.9%) reported food insufficiency; 7.5% of low-income families with children reported food insufficiency. Food-insufficient households with children averaged 5.5 days for not having enough to eat within the last month before the interview. Most of these families (92.8%) reported the reason for their food insufficiency was a lack of money, food stamps, or Special Supplemental Food Program Women, Infants, and Children vouchers.

When compared with food-sufficient, low-income families, the food-insufficient, low-income households

Table 1. Characteristics of Households With Children Based on Food Insufficiency and Income*

	Food-Insufficient Low-Income (n = 108)	Food-Sufficient Low-Income (n = 1008)	Food-Sufficient Higher-Income (n = 2674)
Mean total No. of children	2.6	2.3†	1.8‡
Mean household size	4.7	4.1†	3.9‡
Mean income (median), \$	10 378 (10 124)	11 576 (10 802)†	51 476 (46 638)‡
Poverty, mean %	62.3	75.8†	258.7‡
Female-headed household, %	39.2	43.0	11.7‡
Highest grade for head of household, mean	9.6	11.4†	13.7‡
Received AFDC or other general assistance last month, %	46.1	32.4†	2.0‡
Mean amount spent on food per week per household member, \$	22	24	35‡
Region, %			
Northeast	10.8	16.1†	19.1‡
Midwest	10.0	22.7†	23.3‡
South	29.2	36.8†	35.2‡
West	50.0	24.4†	22.4‡

*AFDC indicates Aid to Families With Dependent Children.

†Significant difference between food-insufficient low-income households and food-sufficient low-income households.

‡Significant difference between food-insufficient low-income households and food-sufficient higher-income households.

Table 2. Characteristics of Children Based on Household Food Insufficiency and Household Income*

	Food-Insufficient Low-Income	Food-Sufficient Low-Income	Food-Sufficient Higher-Income
Male, % of total	51.3	49.1	51.8
Ethnicity, % of total			
White	31.6	37.4†	75.9‡
Black	10.2	31.7†	10.4‡
Hispanic	53.0	25.2†	8.9‡
Eat school lunch, % of total	90.6	86.9†	73.6‡
Receive free or reduced-price lunch, % of total	97.1	88.1	18.7‡
Eat school breakfast, % of total	82.4	61.9	19.6‡
Mean No. of school breakfasts per week	3.9	3.0†	1.9‡
Receive free or reduced-price breakfast, % of total	95.7	97.5	47.1‡

*Based on all household children, not just child sample persons, with a completed day 1 interview.

†Significant difference between food-insufficient low-income group and food-sufficient low-income group.

‡Significant difference between food-insufficient low-income group and food-sufficient higher-income group.

with children were significantly ($P \leq .05$) larger, had more children in the family, had lower income, and had a less-educated head of household. They were also more likely to live in the western United States and received Aid to Dependent Families With Children or other general assistance. Additionally, when compared with the higher-income food-sufficient group, more of the low-income food-insufficient group had female heads of household, received Special Supplemental Food Program for Women, Infants, and Children, and Food Stamp benefits, and they spent significantly less money per household member on food ($P < .001$) (Table 1).

SCHOOL LUNCH AND SCHOOL BREAKFAST COMPARISONS

The percentages of children eating school lunch were similar between the low-income food-insufficient group and the low-income food-sufficient group (Table 2). Although not significant, a higher percentage of children in the low-income food-insufficient group ate school breakfast than did those in the low-income food-sufficient group (82.4% vs 61.9%) ($P = .09$). However, there was no difference be-

tween the 2 groups for free or reduced-price breakfast and/or lunch program participation. Furthermore, a significantly smaller percentage of children in the food-sufficient higher-income group participated in the school breakfast and/or lunch program (Table 2).

NUTRIENT AND FOOD INTAKES

There was no significant difference between children in low-income, food-insufficient and low-income, food-sufficient households for total energy, protein, carbohydrate, total fat, or cholesterol intake (Table 3). When compared with the higher-income food-sufficient households, children in the low-income food-insufficient households were reported to have significantly lower total energy ($P = .05$) and carbohydrate intakes ($P = .004$), and higher cholesterol intakes ($P = .02$), with a higher percentage of calories from protein ($P = .003$). There were no differences in the percentage of children receiving less than 70% of the recommended dietary allowance of vitamins (eg, vitamin C, B₆, B₁₂, folate) and minerals (eg, iron, calcium, phosphorus, magnesium, zinc). Children in the food-insufficient households ate less dark green

Table 3. Nutrient and Food Comparisons of Children's Dietary Intake Based on Household Food Insufficiency and Household Income

	Food-Insufficient Low-Income	Food-Sufficient Low-Income	Food-Sufficient Higher-Income
Nutrient Intake			
	(n = 179)	(n = 1570)	(n = 3920)
Energy, kJ	6736.2	7368.0	7631.6
Carbohydrates, g	210	230	252*
Protein, g	61	64	63
Total fat, g	61	67	66
Cholesterol, mg	252	236	193*
Energy from protein, %	15.2	14.6	13.8*
Energy from fat, %	33.7	34.2	32.2
Food Serving, No. †			
	(n = 142)	(n = 1272)	(n = 3222)
Vegetables	2.3	2.5	2.4
Fruits	1.3	1.4	1.6*
Vegetables and fruits	3.6	3.9	4.0
Nonwhole grains	4.97	5.46	5.66*
Dark green leafy vegetables	0.03	0.08‡	0.08*
Other vegetables	0.39	0.54‡	0.52*
Dry beans and peas	0.31	0.18	0.10*
Yogurt	0.005	0.01	0.02*
Eggs	0.55	0.36‡	0.22*
Nuts and seeds	0.06	0.12‡	0.17*
Added sugar, tsp	16.7	20.4‡	23.8*

*Significant difference between food-insufficient low-income and food-sufficient higher-income group.

†No food serving records for children younger than 2 years were used, since the food guide pyramid is intended for individuals 2 years and older.

‡Significant difference between food-insufficient low-income group and food-sufficient low-income group.

Table 4. Anthropometrics, Activity, Health, and Exercise for Children Based on Household Food Insufficiency and Household Income

	Food-Insufficient Low-Income	Food-Sufficient Low-Income	Food-Sufficient Higher-Income
Mean hours of television	3.1	2.8	2.4*
Health rated fair-poor, % of total	11.1	4.5	2.4*
Exercise \leq 1/wk, % of total†	46.3	23.3	19.8
Body mass index, % of total‡			
<10th percentile	12.4	11.2	11.7
>85th percentile	46.7	46.5	31.5*

*Significant difference between food-insufficient low-income group and food-sufficient higher-income group.

†Exercise question asked only of children 12 years and older.

‡Body mass index (calculated as weight in kilograms divided by the square of height in meters) is calculated only for those at least 1 year of age.

vegetables, nuts and seeds, and added sugar, and consumed more eggs than children in the low-income food-sufficient households. Children in the low-income food-insufficient group ate less fruits, nonwhole grains and yogurt, and consumed more dry beans and peas than the higher-income food-sufficient group (Table 3).

ANTHROPOMETRICS, ACTIVITY, AND EXERCISE

The percentage of overweight children, based on self-reported heights and weights, was statistically similar among low-income households, whether food-sufficient or insufficient. However, when compared with the higher-income group, the low-income groups included more overweight children. There was no significant difference between the low-income food-sufficient and insufficient groups, or in the higher-income group for underweight children. The low-income food-insufficient group reported similar amounts of television watching per day when compared with the low-

income food-sufficient group. However, when compared with the higher-income group, the low-income groups spent significantly more time watching television. Percentages of children who claimed they exercised once a week or less did not significantly differ among the 3 groups (Table 4).

COMMENT

The prevalence of food insufficiency based on data from the CSFII survey (1994-1996) is lower than reports of other recent national surveys of food insufficiency and food insecurity. In the Third National Health and Nutrition Examination (1988-1994), 4.1% of all survey households and 14% of low-income households reported food insufficiency.^{4,26} For the Community Childhood Hunger Identification Project (1995), 8% of the children younger than 12 years reported prolonged periodic food insufficiency, and 21% of them were at risk of hunger.³ The US Census Bureau found that nearly 20% of all

children lived in food-insecure households in 1998.²⁷ The lower prevalence in the CSFII (1994-1996) may be real or caused by differences in sampling frames, time, definition of low-income households, varied definitions of food insufficiency (insecurity), or methods specific for determining food insufficiency or insecurity. More contemporary data will be required to determine whether this is a significant continuous trend.

"Food insecurity" and "food insufficiency" are commonly perceived to be the same and are often used interchangeably. Whereas food insecurity is defined as limited or uncertain availability of nutritionally adequate and safe foods, or ability to acquire acceptable foods in socially acceptable ways,^{28,29} food insufficiency is defined as inadequacy in the amount of food intake because of a lack of money or resources that provide access to enough food.¹ Although these definitions are similar, food insecurity describes a broader condition. It includes not only food insufficiency, but also includes the psychological dimension and other qualitative and quantitative aspects of food supply and food intake. The CSFII (1994-1996) used only 1 question to determine food insufficiency, while food security is measured by an 18-item scale in other surveys. Previous survey years of CSFII (1989-1991)²⁴ found a similar prevalence of food insufficiency for all households (2.5%) when compared with the 1994 through 1996 data (2.2%), despite the higher response rate for the more current CSFII (1994-1996). The slight decrease in prevalence may reflect the year-to-year variation that indicates the influence of a changing economy. A recent report on household food security found that food insecurity in the United States improved from 1995 to 1997, although this report also suggested that food insecurity increased from 1997 to 1998, despite a continued strong economy.²⁷ More research is needed to better understand such year-to-year variations.

Families who report food insufficiency are clearly different in some sociodemographic characteristics, even when compared with families with low income. Our report on the characteristics of food-insufficient families is similar to those of other studies.^{4,30,31} Some studies previously indicated a positive association between food stamp participation and food insufficiency.^{4,32-35}

Despite the many demographic differences of the low-income food-insufficient group, no differences were detected in major nutrient intakes of children within the low-income group, whether or not they were food-insufficient. However, several differences in nutrient intakes between low-income and higher-income households were found. Earlier years of CSFII data (1985-1986) showed that perceived food insufficiency was associated with lower nutrient intakes for women and their children (aged 1-5 years) at a lesser extent.³³ However, our sample included children of all ages (aged 0-17 years). This increased age range would result in a reduced percentage of proxies. A proxy for a younger child might report a lower intake to reflect the food-insufficient household rather than the child's true intake. At the same time, our data included two 24-hour dietary recalls, which may give a more accurate estimation than does a 1-day recall.³³ Also, the nutrient intake differences between the

2 groups reported in the earlier study³³ might be caused by other factors, most likely the independent effect of low income as this study did not control for socioeconomic status measures. Another study using earlier CSFII (1989-1991) data also indicated that preschoolers' food intakes were not significantly associated with household food insufficiency, although the association was found in adult women and the elderly.³⁶ Further studies are needed to examine smaller increments of age groupings of children to pinpoint the impact of food insufficiency (if any) on particular age groups. Besides nutrient intakes, we found minor differences in food choices between the low-income food-insufficient and higher-income food sufficient groups. More legumes and eggs and less yogurt, dark green vegetables, nuts and seeds, and added sugar were eaten by the food-insufficient group. The use of cheaper sources of protein and sociocultural food preferences may play a role in such variations.

Although previous reports have suggested that food-insufficient groups have higher obesity rates than food-sufficient groups,^{14,16,37} our analysis did not show that food insufficiency by itself is associated with self-reported measures of obesity in children. However, we did find a higher percentage of overweight children in low-income families than in higher-income families despite their insufficiency status. Even though food deprivation has been implicated as a cause of overeating and resultant obesity,³⁸ more research is needed especially related to periodic or episodic overeating. The summary report of the Food Security Measurement Project by the US Department of Agriculture indicated that mild undernutrition is typically marked by periodic food insecurity and hunger, and affects an estimated 13.7 million American children.³⁰ If underweight is an indication of undernutrition, our results did not support the premise that undernutrition occurs among children in food-insufficient households. It should be noted that CSFII uses self-reported weight and height data, which may affect the validity of these data.³⁹⁻⁴²

Our analysis shows that food-insufficiency status is not associated with the amount of television viewing or physical activity level. However, low-income status may be a factor that increases the amount of television viewing. Although evidence suggests that television viewing and lack of exercise are strong risk factors for childhood and adolescent obesity,⁴³⁻⁵⁰ our study indicates that low socioeconomic status may be an important confounding associated factor.

The food sufficiency question has been used in US Department of Agriculture surveys since the mid-1970s to measure food deprivation and is well established in prior analytic research.⁵¹⁻⁵³ Concerns have been noted in the literature that CSFII methods for measuring food-insufficiency may be limited,²⁹ less reliable in describing usual intake,⁵⁴ and not reflect cash-flow problems.³⁶ Still, the CSFII provides a measure of nutrient intakes of children, which is lacking in other more sophisticated and comprehensive food-insufficiency and food-insecurity surveys (eg, Current Population Survey,⁵⁵ Community Children Hunger Identification²). Because CSFII only questions households' food insufficiency status, we assume children in food-insufficient households experience food insufficiency as well. Yet, it is pos-

sible that adults may save the limited household food for the children and meals served at school may prevent children from feeling food deprived. Furthermore, since the low-income, food-insufficient group had a smaller sample size compared with the other 2 food-sufficient groups, important differences may not have been detected because of decreased power.

Nord and Bickel⁵⁶ have proposed new methods to more accurately estimate the prevalence of children's food insecurity and hunger rather than relying on the designation of food-insufficient households with children. This is in response to the observation that the true prevalence of children's hunger is being underestimated in many survey analyses. They constructed a child hunger scale based on the 8 items of the 18-item Food Security Scale that are child-specific. In analyzing the 1995 US Food Security data, they found child hunger in 1.12% of the households with children, compared with 0.87% based on the household measure for the same households. This difference in prevalence of hunger using the child-specific scale is 29% greater. In addition, they found households with higher ratios of children to adults and older children showed more severe levels of children's hunger on the child-specific scale than would have been predicted from the household level scores. Households where all children were younger than 6 years had lower prevalence rates, confirming the suspicion that young children are protected from hunger, even at the expense of adult hunger, and to a greater extent than are older children.

CONCLUSIONS

While the CSFII (1994-1996) found a similar prevalence of household food insufficiency when compared with previous CSFII (1989-1991), our data indicated a lower prevalence than other surveys on household food security. Low-income households that report food insufficiency differ from low-income food-sufficient households in several demographic characteristics. Still, no differences were observed in nutrient intake, physical activity, or weight/height data between the food-sufficient and food-insufficient groups in low-income households. Some differences were noted in these nutritional and anthropometric variables between low-income and high-income households. Further studies are needed to establish a direct measure of children's food sufficiency status and its relationship to nutrient intake, as well as objective health and psychological outcomes data of food-insufficient children.

These data are presented to pediatricians to introduce the important concept of food insufficiency in children and its related clinical and methodological issues. The potential negative impact of food insufficiency on nutrition and health status of children is obviously important to pediatricians. Future research will improve our understanding of the prevalence, correlates, and effects of food insufficiency.

The 7.5% of US low-income families with children still represents a large number of children who experience food insufficiency. Clinicians should be aware of the possibility of food insufficiency among their patients, particularly in low-income families, and the possible asso-

ciated health and nutrition problems. Clinicians may also provide information on nutrition assistance programs, encourage participation in school meal programs, promote nutrition education and physical activity in public school systems, and support social policies to confront childhood poverty and food insufficiency.

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