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# Children's Consumption of WIC-Approved Foods

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**Victor Oliveira and Ram Chandran**

## Abstract

The WIC program offers supplemental foods to low-income women, infants, and children. This study compared consumption patterns of WIC children with those of three different comparison groups: eligible nonparticipating children living in non-WIC households, eligible nonparticipating children living in WIC households, and children living in households whose income is too high to be eligible for WIC. The study provides strong evidence that participation in the WIC program increases consumption of at least some types of WIC-approved foods. Although WIC-participating children consumed significantly more calories from WIC-approved foods than children in the two comparison groups of eligible non-participants, there was no significant difference in total calories consumed. The results suggest that WIC foods replace non-WIC foods in the diets of children participating in WIC rather than adding to their food consumption. This is the first study to examine in detail children's consumption of WIC-approved foods by WIC status. Understanding WIC's effect on the consumption of foods contained in the WIC food packages can help inform decisions on possible changes to the packages.

**Keywords:** WIC, Special Supplemental Nutrition Program for Women, Infants, and Children, food packages, WIC-approved foods, Tobit regression analysis, food consumption patterns, child nutrition.

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## Summary

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides supplemental foods that are good sources of nutrients typically lacking in the diets of the target population, as well as offering nutrition education and health care referrals. The provision of supplemental foods is assumed to lead to their increased consumption, which in turn is expected to improve the health of program participants. However, the relationship between participation in WIC and increased consumption of WIC foods has not been fully examined. Understanding WIC's effect on the consumption of foods in the WIC packages will help inform decisions on possible changes to the packages. This report examines children's consumption of these foods, using data from the Continuing Survey of Food Intake by Individuals (CSFII) 1994-96, 1998—a time period that captures the dramatic increase in the number of children participating in WIC during the late 1980s and 1990s.

On average, calories from WIC-approved foods account for at least one-quarter of the total calories from food and beverages consumed by children. To determine the effect of WIC participation on the consumption of WIC-approved foods, the authors compared the consumption patterns of WIC participants to those of eligible nonparticipants living in non-WIC households. Two additional comparison groups were constructed to account for (1) the possibility of spillover effects, whereby WIC foods are shared among non-WIC household members (eligible nonparticipants living in WIC households), and (2) the effect of higher household incomes (ineligible nonparticipants).

After controlling for other observed factors, the authors found that WIC participants consumed 24 to 45 percent more WIC-approved juice (about 68-128 grams), and 17 to 26 percent less of other beverages such as soft drinks (about 70-108 grams), over the 2 days than those in each of the three comparison groups. WIC participants also consumed about 75 percent more WIC-approved cereal (about 18 grams) over the 2 days than those in two of the three comparison groups. The findings support results from previous studies in which WIC participation was associated with significantly lower intake of added sugars. However, the analysis found little or no association between participation in WIC and the consumption of other WIC-approved foods. The fact that similar results were found among the different comparison groups provides stronger, more credible results than if one comparison group were used.

Results from the analysis show that WIC participants consumed significantly more calories (12-14 percent) from WIC-approved foods than each of the three groups of nonparticipants. On the other hand, the participants consumed significantly fewer calories from non-WIC foods than the two groups of eligible nonparticipants. In terms of total calories consumed from all foods and beverages, there was no significant difference between WIC participants and the two groups of eligible nonparticipants. Thus, there is little evidence that participation in WIC contributes to increased caloric intake among those children eligible to participate. However, WIC participants consumed more total calories than children not eligible to participate because their household income was too high.

Numerous differences in the consumption of WIC-approved foods were also found by race/ethnicity and geographic regions, suggesting strong cultural and regional dietary patterns. Children's consumption of WIC foods varied by day of the week: the consumption of many WIC-approved foods decreased on weekends.

The study highlights the importance of determining which foods to include in WIC food packages to influence change in the dietary patterns of participants in the program.

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Cover photos:

Girl drinking milk: Courtesy of National Dairy Council/Dairy Management Inc.

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## Introduction

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides a package of supplemental foods, nutrition education, and referrals to health care to low-income women, infants, and children up to age 5 who are at medical or nutritional risk. The cornerstone of the WIC program is its supplemental food packages that provide foods “containing nutrients determined to be beneficial” for the target population (7 CFR 246.2).<sup>1</sup> WIC can also affect the diet quality of recipients through its nutrition education program, designed to help recipients achieve a positive change in their food habits through the optimal use of the supplemental foods and other nutritious foods. WIC is based on the premise that early food interventions during times of critical growth and development will not only improve the health status of participants, but will help prevent later health problems.

WIC regulations specify the types of foods that can be included in the WIC food packages, which are rich in one or more of the five target nutrients—protein, iron, calcium, and vitamins A and C. Although the types of food in the packages have remained basically unchanged since the 1970s, food consumption patterns have changed, nutritional standards have been revised based on current scientific knowledge, the prevalence of obesity and overweight has increased markedly, and the WIC participant population has become more ethnically diverse (see the appendix for a detailed discussion of the history of the WIC food packages). As a result, the composition of the WIC food packages has received increased attention, and some authorities have recommended changes to better help program participants meet nutritional standards for a healthy diet. For example, in 2000 the National Association of WIC Directors recommended a number of changes to the WIC food packages, such as including fruits and vegetables for all women and children, reducing the maximum quantity of milk for children, and offering foods that reflect the cultural dietary patterns of participants (National Association of WIC Directors, 2000). Congress in 2001 stated that encouraging WIC children to eat fresh fruits and vegetables is crucial to establishing healthful, nutritious eating habits for life, and it urged USDA’s Food and Nutrition Service (FNS) to look into ways to increase the consumption of produce by WIC participants (U.S. House of Representatives, 2001). In 2002, the American Dietetic Association recommended flexibility in the WIC food packages in order to address cultural food practices and choices and participants’ nutrition needs, consistent with national guidelines (American Dietetic Association, 2002).

USDA recently solicited public comments on redesigning the WIC food packages to determine if they should be revised to better improve the nutritional intake, health, and development of participants, and if so, what specific changes should be made (68 FR 53903).<sup>2</sup> Understanding WIC’s effect on the consumption of the types of foods in the packages will help inform decisions on possible changes.

This report examines the consumption of the types of food provided in the WIC food packages, focusing on children 1-4 years of age, who make up half of all WIC participants.<sup>3</sup> The two major issues to be addressed are:

<sup>1</sup>The supplemental food package was consistently ranked by pregnant and postpartum women as being the leading positive attribute of the program in a recent WIC study (Fox et al., 1998). Food costs accounted for \$3.2 billion, or about 71 percent of the total cost of the program in fiscal 2003 (USDA, FNS, December 2003).

<sup>2</sup>USDA has contracted with the Institute of Medicine of the National Academies to develop cost-neutral recommendations to modify the WIC food packages based on the best available scientific information. A preliminary report was released in August 2004 and the final report is expected to be released in February 2005 (Institute of Medicine, 2004).

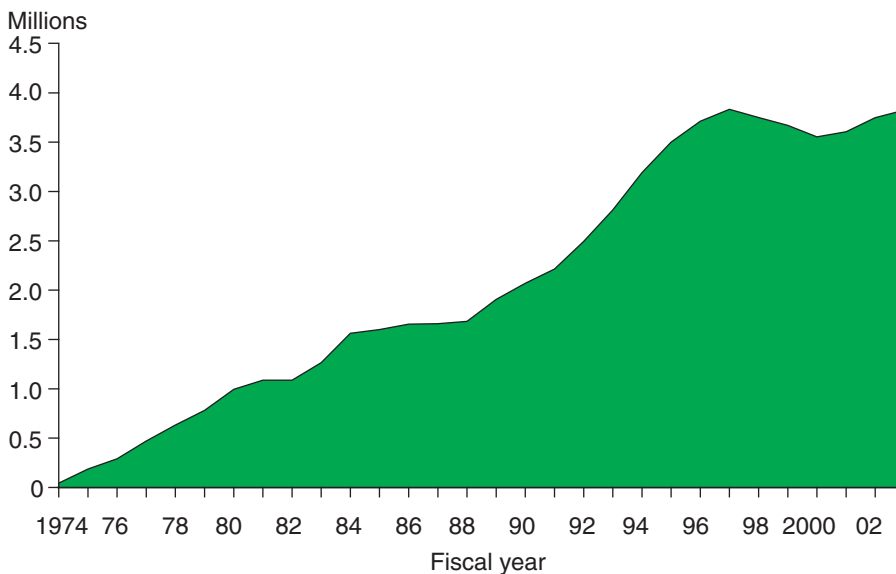
<sup>3</sup>Because of their limited diet, infants less than 1 year old were excluded from this analysis. Women were excluded due to the small number of women in the dataset used in this study who were identified as WIC participants.

*How does participation in WIC affect the consumption of WIC-approved foods?* Consumption of the food in the WIC packages is expected to improve the diet and nutritional status, and thus the health, of program participants. One of the key assumptions is that providing the supplemental foods leads to their increased consumption. However, the relationship between participation in WIC and the consumption of WIC foods has not been fully examined.

*Does participation in WIC result in increased caloric intake?* The dramatic increase in the prevalence of overweight and obesity among children is one of the most serious public health concerns in the United States today (National Center for Health Statistics, 2003). Questions have been raised as to whether providing free supplemental foods through WIC increases the caloric intake of recipients.

The source of data for this study is the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, 1998, a national survey designed to measure what Americans eat and drink. The study period captures the tail end of the dramatic increase in the number of children in WIC during the late 1980s and 1990s, when the number more than doubled (fig. 1).<sup>4</sup> Nearly one-quarter of the Nation's children from 1 to 4 years of age now participate in WIC.

Figure 1  
**Average monthly number of children participating in WIC, FY 1974-2003**



<sup>4</sup>WIC is not an entitlement program. Rather, it is a discretionary grant program funded by appropriations law on an annual basis. Therefore, the number of participants that can be served each year depends upon the annual appropriation and the cost of operating the program. The program provides services to as many eligible people as funding allows. Because WIC may not be able to serve all eligible applicants in all years, it has a priority system to ensure that those people at the greatest nutritional risk receive program benefits. The expansion of the WIC program during the late 1980s and 1990s, as a result of increased congressional funding as well as State cost-containment measures, allowed a greater number of lower priority children to participate in the program. As a result, the role of the priority system in allocating available program slots among applicants decreased in importance relative to previous years when program funds were more limited. The decrease in the number of WIC participants from 1997 to 2000 was predominantly among children, which may reflect favorable economic conditions that decreased the demand for food assistance (mothers of older children may be better able than pregnant women and women with infants to take advantage of increased job opportunities and higher wages resulting from economic growth).



## Overview of the WIC Program

WIC supplies a package of benefits to a targeted group of participants who must meet a number of eligibility requirements.

### Participant Eligibility

To qualify for WIC, applicants must meet categorical, residential, income, and nutritional risk eligibility requirements.

- (1) *Categorical eligibility.* To participate in the WIC program, a person must be:
  - A pregnant woman (includes up to 6 weeks postpartum),
  - A nonbreastfeeding woman up to 6 months postpartum,
  - A breastfeeding woman up to 1 year postpartum,
  - An infant under 1 year of age, or
  - A child up to his/her fifth birthday.
- (2) *Residential eligibility.* WIC applicants must live in the State where they establish eligibility and receive benefits.
- (3) *Income eligibility.* The family income of WIC applicants must meet specified guidelines. All WIC State agencies currently set the income cutoff at 185 percent of the Federal poverty guidelines. Applicants who participate in the Food Stamp, Medicaid, or Temporary Assistance for Needy Families (TANF) programs, or who have certain family members who participate in the Medicaid or TANF programs, are adjunctively income eligible, that is, they are deemed to meet the income eligibility criterion automatically.
- (4) *Nutritional risk.* Applicants must be at nutritional risk, as determined by a health professional such as a physician, nutritionist, or nurse. Federal regulations recognize five major types of nutritional risk for WIC eligibility: (1) detrimental or abnormal nutritional conditions detectable by biochemical or anthropometric measurements ; (2) other documented nutrition-related medical conditions; (3) dietary deficiencies that impair or endanger health; (4) conditions that directly affect the nutritional health of a person, including alcoholism or drug abuse; and (5) conditions that predispose persons to inadequate nutritional patterns, or nutritionally related medical conditions, including, but not limited to, homelessness and migrancy (7 CFR 246.2).

WIC children are generally eligible to receive benefits for 6-month periods, after which they must be recertified to continue to participate.

### Participant Benefits

The WIC program offers three types of benefits to participants: a supplemental food package, nutrition education, and referrals to health and other services.

- (1) *Supplemental food package.* WIC provides participants with supplemental foods that are high in five target nutrients: protein, calcium, iron, and

vitamins A and C. There are seven food packages, designed for different target populations: (1) infants through 3 months, (2) infants 4-12 months, (3) children 1-4 years old, (4) pregnant and breastfeeding women (basic), (5) nonbreastfeeding postpartum women, (6) exclusively breastfeeding women (enhanced), and (7) children or women with special dietary needs. The WIC-authorized foods in the package for children 1-4 years old are iron-fortified adult cereal, vitamin C-rich fruit and/or vegetable juice, protein/iron-rich eggs, calcium/protein-rich milk and cheese, and protein-rich peanut butter and dried beans/peas, as shown in table 1. The average cost of the WIC food package for children in fiscal 1998, the last year of the study period, was \$34.33 per month (USDA, FNS, November 2000).

WIC regulations specify the maximum quantities of supplemental foods that may be prescribed to participants (7 CFR 246.10). The authorized maximum monthly allowances of all WIC foods must be made available to participants if medically and nutritionally warranted.<sup>5</sup> Local WIC agencies may tailor individual food packages based on participants' nutritional or health status, their nutritional risk factors, and their food restrictions, intolerances, and preferences. For maximum effect on nutritional status, the WIC food package is intended to be consumed solely by the individual participant and not by other family members (57 FR 56233).

Typically, food benefits are provided to participants in the form of a food "instrument"—a voucher or food check—that they use to purchase approved foods at authorized grocery stores.<sup>6</sup> The food instrument specifies the types and amounts of supplemental foods that can be obtained.

(2) *Nutrition Education.* WIC makes nutrition education, including breastfeeding promotion and support, available to all participants (or to the parents or caretakers of infant or child participants). The nutrition education is designed to achieve two broad goals: (1) to stress the relationship between proper nutrition and good health and to raise awareness about the dangers of using drugs and other harmful substances during pregnancy and while breastfeeding, and (2) to assist the nutritionally at-risk individual in achieving a positive change in food habits—resulting in improved nutritional status and the prevention of nutrition-related problems—through the use of the supplemental foods and other nutritious foods (7 CFR 246.11). Local WIC agencies are required to offer participants at least two nutrition education sessions during each 6-month period, in either an individual or group setting. However, individuals who do not attend the nutrition education activities are not denied the WIC food package.

(3) *Referrals to Health Care and Social Services.* WIC was designed to operate as an adjunct to health care. Local WIC agencies assist WIC participants in obtaining health care and social services (such as food stamps, Medicaid, and immunizations), either through onsite health services or referrals to other agencies.

<sup>5</sup>Recipients are not required to accept all WIC foods offered to them.

<sup>6</sup>The exceptions are Vermont, in which the WIC foods are delivered to the participant's home, and Mississippi and parts of Chicago, where participants pick up the WIC foods from facilities operated by the State or local agency.

**Table 1—WIC food package for children 1 to 5 years: maximum monthly quantities<sup>1</sup>**

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Milk:

Fluid whole milk.....	24 qts (22.7 L)
or	
Fluid skim or low fat milk.....	May be substituted for fluid whole milk on a quart-for-quart (.9 L) basis.
or	
Cultured buttermilk.....	May be substituted for fluid whole milk on a quart-for-quart (.9 L) basis.
or	
Evaporated whole milk.....	May be substituted for fluid whole milk at the rate of 13 fluid oz (.4 L) per qt (.9 L) of fluid whole milk.
or	
Dry whole milk.....	May be substituted for fluid whole milk at the rate of 1 lb (.4 kg) per 3 qts (2.8 L) of fluid whole milk.
or	
Nonfat or lowfat dry milk.....	May be substituted for fluid whole milk at the rate of 1 lb (.4 kg) per 5 qts (4.7 L) of fluid whole milk.
or	
Cheese.....	May be substituted for fluid whole milk at the rate of 1 lb (.4 kg) per 3 qts (2.8 L) of fluid whole milk. The maximum amount that may be substituted is 4 lbs (1.8 kg). <sup>2</sup>

Eggs:

Fresh eggs.....	2 doz. or 2 ½ doz.
or	
Dried egg mix.....	May be substituted at the rate of 1.5 lb (.7 kg) egg mix per 2 doz. fresh eggs or 2 lb (.9 kg) egg mix per 2 ½ doz. fresh eggs.

Cereals (hot or cold)..... 36 oz dry (1 kg)

Juice:<sup>3</sup>

Single-strength juice.....	276 fluid oz (8.2 L)
or	
Frozen concentrated juice.....	288 fluid oz reconstituted (8.5 L)

Legumes:

Dry beans or peas.....	1 lb (.4 kg)
or	
Peanut butter.....	18 oz (.5 kg)

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<sup>1</sup>As defined in the Code of Federal Regulations (7 CFR 246.10).

<sup>2</sup>Additional cheese may be issued on an individual basis in cases of lactose intolerance, provided the need is documented in the participant's file by the competent professional authority.

<sup>3</sup>Combinations of single-strength and frozen concentrated juice may be issued as long as the total volume does not exceed the amount specified for single-strength juice.

## Previous Studies

Recent research on the effect of WIC on children's food consumption is limited to two studies that estimated the consumption of WIC foods without controlling for other factors.<sup>7</sup> Because reported differences in consumption levels between WIC participants and nonparticipants may actually be due to factors such as age or income, and not to whether they participated in WIC, not controlling for these other factors can confound the measurement of effects due to WIC. Therefore, the reported differences in consumption between WIC participants and nonparticipants in these two studies should be viewed as descriptive and not necessarily as a result of WIC.

The first study was based on a survey of 2-year-old children in 1994-97 that compared the usual eating habits of WIC children with other low-income children (Burstein et al., 2000). The study used a nonrepresentative sample of children in 10 sites from families with incomes less than 100 percent of poverty. Families were asked whether their child usually consumed three types of WIC foods: milk, cheese, and juice. The study found that WIC children were significantly more likely than other low-income children to consume each of the three types of WIC foods at least once a day.

A more recent descriptive study of children ages 12-24 months compared WIC participants with all nonparticipants, regardless of nonparticipants' income (Ponza et al., 2004).<sup>8</sup> WIC participants were more likely than nonparticipants to consume 100-percent juice and cow's milk, as well as sweetened beverages and fruit-flavored drinks. Similar proportions of WIC participants and nonparticipants consumed presweetened and non-presweetened cereals, eggs, peanut butter (including nuts and seeds), and cheese. Although the mean intakes of food energy for both WIC participants and nonparticipants exceeded estimated energy requirements (EER), the difference between mean energy intake and the EER was greater for WIC participants than nonparticipants.

Although recent information about WIC's impact on children's consumption of WIC foods is limited to two descriptive studies, a number of national-level studies used analytical procedures to control for other factors and found positive associations between WIC participation and nutrient or dietary intake among WIC-age children. Although the present report focuses on food consumption, a brief review of the nutrient or dietary analysis of WIC provides helpful background.

Using data on children in households with income less than 130 percent of poverty from the 1989-91 CSFII, Rose et al. (1998) found that participation in the WIC program was associated with a significant increase in the intake of a number of nutrients, including iron and protein. In a study based on data from the 1994-96 CSFII of children who were income-eligible for WIC (proxied by annual household income less than 200 percent of poverty), Oliveira and Gundersen (2000) found that participation in WIC was associated with significantly increased intake of several WIC-targeted nutrients—iron, vitamin C, and vitamin A. After limiting the analysis to children living in a household with an infant or woman on WIC, the authors found that participation in WIC had a positive and significant effect on the intake of iron, folate, and vitamin B-6.

<sup>7</sup>This review focused on recent studies because results from studies based on data collected before the dramatic expansion of the child component of WIC may not be applicable to the current situation, in which WIC benefits are more widely available to children.

<sup>8</sup>In other words, the group of non-participants included both children eligible to participate in WIC and children who were ineligible.

Chandran (2003) used the 1994-96, 1998 CSFII data set to examine the effect of WIC participation on food consumption and diet quality of children 2-4 years of age. Diet quality was assessed using USDA's Healthy Eating Index (HEI), which incorporates 10 components of dietary guidelines. The study found that participation in WIC was associated with improved diet quality as measured by HEI and several of its components. The analysis also found that WIC participation was associated with reduced consumption by children of added sugars (i.e., those that do not occur naturally in the foods themselves).

Another study using the 1994-96, 1998 CSFII dataset found that among children in households with incomes less than 130 percent of poverty, WIC had a beneficial effect on the intake of fat, carbohydrates, added sugar, and fruit (Siega-Riz et al., 2004).<sup>9</sup> Among children in households with incomes from 130 percent to 185 percent of poverty, WIC had a beneficial effect on the intake of added sugar and fruit. No statistically significant differences were found in total energy intake by WIC status.

Although these studies found that participation in WIC is associated with improved diets or greater intake of WIC target nutrients, the outcomes may not necessarily occur from the increased consumption of WIC foods. They could occur, for example, if receipt of WIC benefits frees up food dollars that are spent on foods not provided in WIC food packages but that are still high in WIC target nutrients, or if the nutrition education provided through WIC leads to improved diets with increased consumption of non-WIC foods high in the target nutrients.<sup>10</sup>

## The Data

The source of data for this study was the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, 1998 conducted by USDA's Agricultural Research Service (USDA, ARS, 2000). The CSFII 1994-96 collected information from people of all ages. The Supplemental Children's Survey (or CSFII 1998), which only collected data from children less than 10 years of age, was designed so that the data could be combined with those from the 1994-96 survey.<sup>11</sup> Both surveys use a complex multi-stage area sample design to obtain nationally representative samples of people in U.S. households.

The CSFII 1994-96, 1998 contains information on the socioeconomic characteristics of individuals as well as on their food intake, specifically, the kinds and amounts of food consumed on each of 2 nonconsecutive days, using 24-hour dietary recalls. Day 1 data on children were collected in person with adult proxies—preferably the person responsible for preparing the child's meals—providing the food intake data for children. Most Day 2 data were also collected in person, although some of the interviews were conducted by telephone. Both the Day 1 and Day 2 questionnaires used a multiple-pass method to maximize the respondent's ability to remember what was consumed. Measuring guides were used to help the respondent estimate the amounts eaten. Descriptions of every food item consumed were obtained from the respondents and then matched to descriptions of foods in a food coding database.

<sup>9</sup>That is, WIC participation was associated with increased intake of carbohydrates and fruit and decreased intake of fat and added sugars.

<sup>10</sup>Self-selection bias is another potential factor in explaining previous results that found that WIC participation is associated with increased nutrient intake. People who participate in WIC may be more concerned about nutrition and more motivated to improve their own or their child's nutritional status than eligible persons who choose not to participate in the WIC program.

<sup>11</sup>The Supplemental Children's Survey was conducted in response to the Food Quality Protection Act of 1996, which required USDA to provide data from a larger sample of children for use by the Environmental Protection Agency in estimating exposure to pesticide residues in children's diets.



The CSFII 1994-96, 1998 contained information on 6,748 children, of whom 118 were being breastfed or did not have their WIC status listed and were thereby excluded from the analysis. An additional 1,111 children who did not have 2 days of consumption data were also excluded from the analysis, resulting in a sample of 5,519 children.<sup>12</sup>

## Classifying Children by WIC Status

To be eligible for WIC, family income must fall at or below 185 percent of the Federal poverty guidelines or the child must participate in the Food Stamp, Medicaid, or Temporary Assistance for Needy Families (TANF) programs (or have certain family members who participate in the Medicaid or TANF programs), and the child must also be individually determined to be at “nutritional risk” by a health professional. Because the CSFII data do not allow for the determination of nutritional risk, WIC eligibility for this study was proxied solely by income, as determined by the annual income of the household.<sup>13</sup> Past research suggests that WIC income eligibility estimates based on annual income may underestimate income eligibility for WIC as determined by local WIC agencies (Gordon et al., 1997).<sup>14</sup> In order to include all children who were likely to have met the WIC income-eligibility criteria at some point during the year, this report considered children in households with annual income at or below 200 percent of the poverty guidelines to be income-eligible for WIC. Children who were authorized to receive food stamps, or who lived in a household that received income from the Aid to Families with Dependent Children (AFDC) or TANF programs, were considered to be WIC-eligible regardless of income.<sup>15</sup> Although participation in Medicaid also makes a child income-eligible for WIC, the CSFII did not collect information on Medicaid participation. Children living in a household in which someone was participating in WIC were considered to be eligible for WIC regardless of income.

The 5,519 children included in the sample were assigned to one of four mutually exclusive groups determined by WIC status (table 2). These four groups included WIC participants (children who were participating in the WIC program at the time of survey) and two groups of eligible nonparticipants: children who resided in a household in which no one was participating in WIC and children who, while not participating in WIC, lived in a household in which some other member of the household was a participant. Children in WIC households were separated from other eligible nonparticipating children in order to control for possible spillover effects that could bias the results of the study. Spillover effects may occur if a person’s participation in WIC affects the consumption patterns of other people in the household. For example, this could happen if: (1) receipt of WIC benefits frees up food dollars that are spent on WIC-type foods for nonparticipating children; (2) the nutrition education received by WIC women (the primary meal preparers in most households) results in increased consumption of certain WIC-type foods by other household members; or (3) WIC foods are shared among non-WIC household members. Although the WIC food package is intended to be consumed solely by the individual participant and not by other family members, sharing of WIC foods may occur.<sup>16</sup>

<sup>12</sup>Of the 1,111 children with less than 2 days of data, 862 had no days of data and 249 had only 1 day of data.

<sup>13</sup>The inability to use the CSFII to determine whether an individual meets the nutritional risk criteria has no practical effect in determining WIC eligibility status for this study. WIC applicants are required to meet only one of a number of nutritional risk criteria to be eligible for WIC. Research has determined that “nearly all U.S. women and children” meet the criteria based on failure to meet Dietary Guidelines and thus are at nutritional risk (Institute of Medicine, 2002).

<sup>14</sup>WIC regulations state that local WIC agencies, in determining the income eligibility of an applicant, may consider either the income of the family during the past 12 months or their current income to determine which one more accurately reflects the family’s status (7CFR 246.7). More individuals may be eligible if the determination is based on monthly or biweekly rather than annual income (for example, during a period of unemployment).

<sup>15</sup>The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 replaced the AFDC program with the TANF program.

<sup>16</sup>The degree to which the sharing of WIC foods occurs is not known.



**Table 2—Number of children 1-4 years of age in the sample by WIC status**

Number of children	WIC status
1,108	<i>WIC participant</i> —children participating in WIC at time of interview
1,602	<i>Eligible nonparticipant (non-WIC household)</i> —nonparticipating child who is eligible for WIC based on income and resides in a non-WIC household
208	<i>Eligible nonparticipant (WIC household)</i> —nonparticipating child who is eligible for WIC based on income and resides in a WIC household
2,601	<i>Ineligible nonparticipant</i> —nonparticipating child who is ineligible for WIC based on income
5,519	Total children included in the analysis

Note: Of the 6,748 children in the CSFII 1994-96,1998 dataset, 1,229 were either breastfeeding or had less than 2 days of dietary intake data, or their WIC status could not be ascertained and they were subsequently dropped from the analysis.

The fourth group of children included in the analysis were ineligible nonparticipants (children not eligible for WIC as determined by high household income and nonparticipation in the Food Stamp and AFDC/TANF programs). There are fundamental differences in household resources, education levels, and nutrition knowledge between adults caring for children eligible for WIC and adults caring for children whose family income is too high to be eligible.<sup>17</sup> The differences may affect food consumption patterns. Therefore, the most relevant comparison of the effects of WIC will be between WIC participants and other low-income children. However, for completeness, the group of children ineligible to participate in WIC was also included in this analysis. The finding of consistent results in comparisons between WIC children and all three groups of nonparticipants, including those ineligible to participate, would suggest stronger, more credible results.<sup>18</sup>

## Determining WIC-Approved Foods

The CSFII food coding database consists of almost 7,500 unique food codes, each including a description of the food. The determination of which codes represent “WIC-approved” foods was inexact. Federal WIC regulations specify the types of supplemental foods that may be prescribed to WIC participants (7 CFR 246.10). However, each State WIC agency is responsible for identifying the specific foods authorized for use in that State from among those authorized by the Federal regulations.<sup>19</sup> For example, States can determine the physical form of the WIC food (for example, evaporated or fresh fluid milk), specific food brands, food packaging (cans, cartons, or bottles), flavors or varieties (e.g., orange or cranberry juice), and food container sizes. As a result, the specific types of foods included in WIC food packages vary across States.<sup>20</sup> The CSFII does not identify the State of residence of the survey respondent, nor does the description of the foods in the CSFII food coding database always provide enough information to determine whether that food exactly matched the types of foods approved for WIC.<sup>21</sup> ERS researchers identified the food codes that seemed to best

<sup>17</sup>At least some of these differences between WIC participants and ineligible children are unobservable and can not be controlled for by statistical procedures.

<sup>18</sup>For example, if WIC children were found to consume significantly more WIC foods than all three groups of nonparticipants, there is more confidence that participation in WIC leads to increased consumption of WIC foods.

<sup>19</sup>Factors that influence State decisions on what foods to allow include cost considerations, participant satisfaction, and ease of administration. In addition, States can impose more stringent nutritional standards than those specified in the Federal WIC regulations (Kirlin et al., 2003).

<sup>20</sup>For information on how the lists of WIC-approved foods varies by State, see Kirlin, et al., 2003

<sup>21</sup>For example, the food code did not indicate whether the frozen concentrate fruit juice contained at least 30 milligrams of vitamin C per 100 milliliters of reconstituted juice as required by Federal WIC regulations.

represent “WIC-approved” foods, based on Federal WIC program regulations and a review of selected State lists of WIC-allowed foods (see table 3 for a description of the foods designated as WIC-approved foods for this study). This report examines the consumption of the types of foods provided through WIC, regardless of whether the food was actually purchased through WIC.<sup>22</sup> Therefore, all WIC-type foods, even those purchased outside of WIC-authorized distribution systems (e.g., in a restaurant), are considered to be “WIC-approved” for this report.

This study focuses on the types of food provided in the WIC food package for children—cereal, juice, milk, cheese, eggs, peanut butter, and beans/peas. WIC foods are distributed to participants by quantity (i.e., a maximum of 36 ounces of dry cereal per month), and quantities vary across WIC foods. A weight-based measure, grams, was used to determine the amount of the individual WIC-approved food consumed. In general, WIC-approved foods that were one of several food items in a food dish were excluded from this analysis when the amount (in grams) of the WIC food consumed was not specified in the dataset. This is not an issue for WIC-approved foods, such as cereal and juice, that are rarely combined with other foods.<sup>23</sup> However, other WIC-approved foods, such as eggs or cheese, are more often combined in dishes with other foods.<sup>24</sup> This problem is lessened somewhat by the fact that young children are probably more likely than adults to consume single-item foods and less likely to consume dishes comprised of combinations of foods.

Since this study is also interested in whether WIC is contributing to overweight, the food energy content, measured in calories, was collected for the amount of WIC-foods consumed, the amount of non-WIC foods consumed, and the total amount of food consumed. Milk drunk by young children is often sweetened or flavored, which increases the calories consumed. Similarly, fat is often added to eggs and beans and peas during cooking, increasing total calories. In measuring the calories consumed from all WIC-approved foods, only the milk, eggs, and beans/peas were included for which the CSFII listed the calories separately from those of other ingredients added after purchase.<sup>25</sup>

## Descriptive Analysis

This section discusses the demographic and socioeconomic characteristics of children and their consumption levels of selected foods by their WIC status: WIC recipient, eligible nonparticipant in a non-WIC household, eligible nonparticipant in a WIC household, or ineligible nonparticipant. The estimates in the tables were computed using appropriate sample weights. However, statistical testing was not conducted because the estimates reported here are for descriptive purposes and for suggesting possible directions for the analytical procedures that follow.

WIC recipients are generally younger than children in the other three groups, reflecting the decline in children’s participation in WIC as they get older (table 4). WIC recipients, as well as eligible nonparticipants in WIC households, are more likely than the other two groups to receive food stamps and to be Black or Hispanic. As expected, ineligible nonparticipants

<sup>22</sup>The CSFII does not collect information on which foods were obtained through WIC. However, since one of the objectives of the WIC program is to improve food habits, it is important to examine the overall consumption of WIC-type foods, regardless of source.

<sup>23</sup>Although cereal is often eaten with milk, the CSFII reports the amounts of the cereal and milk consumed separately.

<sup>24</sup>Although milk consumed by young children is often sweetened or flavored after purchase, such milk, even when the amount of the flavoring or sweetener was not separated from the milk in the dataset, was included as WIC-approved milk since milk accounts for the vast majority of the beverage’s weight. Similarly, the milk added to pudding mix was included as WIC-approved milk.

<sup>25</sup>In other words, milk in which chocolate syrup was added after purchase or milk added to pudding mix were excluded from the total count of calories from WIC-approved milk when the added calories from the chocolate syrup or pudding mix were not reported separately in the dataset.

**Table 3—“WIC-approved” foods and other food categories as defined in this study**

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WIC-approved milk (weight-based)

*Includes:* fluid cow's milk (regardless of fat content), low-lactose milk, buttermilk, dry (powdered) milk, evaporated milk, acidophilus milk, goat's milk, milk flavored after purchase, milk added to cocoa mix, and the milk added in making pudding at home.

*Excludes:* human milk, calcium-fortified milk, condensed milk, soy or rice milk, imitation milk, milk beverages, milk drinks such as Yoo-Hoo, milk shakes, milk purchased already flavored, and milk that was one ingredient in a multi-ingredient dish other than pudding (such as soup) when the amount of milk consumed was not specified.<sup>1</sup>

WIC-approved milk (calorie-based)

Same varieties as for WIC-approved milk (weight-based) except that it excludes milk with flavorings added after purchase and milk added to puddings and cocoa, when the calories from the milk could not be separated from the calories from flavorings and pudding mix.

WIC-approved juices

*Includes:* all 100-percent (no added sugar) citrus, noncitrus, vegetable, and tomato juice, regardless of form (canned, bottle, carton, fresh).

*Excludes:* sweetened juices, juice or fruit drinks, juice cocktails, and ciders.

WIC-approved cereals

*Includes:* most hot or ready-to-eat national brands of cereal approved for WIC.

*Excludes:* most private or store brand cereals.<sup>2</sup>

Other cereals

All cereals except WIC-approved cereals.

WIC-approved cheese

*Includes:* the following natural or processed cheeses: cheddar, brick, american, colby, colby jack, monterey, mozzarella, muenster, provolone, and swiss, including lowfat and low-sodium versions.

*Excludes:* other kinds of cheese as well as cottage cheese, cheese spread, cream cheese, and imitation cheese. Cheese mixtures were also excluded, i.e., cheese that was one ingredient in a multi-ingredient dish (e.g., cheese soup or cheese sandwich), when the type or amount of cheese consumed was not specified.

WIC-approved eggs (weight-based)

*Includes:* all eggs, regardless of cooking method (scrambled, fried, boiled, etc.) and dried-egg mix.

*Excludes:* eggs that were one ingredient in a multi-ingredient dish (e.g., egg foo yung or omelet with cheese and ham), when the amount of eggs consumed was not specified.

WIC-approved eggs (calorie-based)

Same as WIC-approved eggs (weight-based) defined above, except excluding eggs with fat added during cooking.

WIC-approved peanut butter

*Includes:* low or reduced sodium.

*Excludes:* reduced fat peanut butter, vitamin- and mineral-fortified peanut butter, and peanut butter with added ingredients such as jelly.

WIC-approved beans or peas (weight-based)

*Includes:* dry beans (such as white, black, brown, bayo, fava, lima, pink, pinto, red kidney, and mung bean), dry peas (cowpeas, chickpeas, and split peas), and lentils.

*Excludes:* bean, pea, or lentil mixtures, i.e., beans or peas that were one ingredient in a multi-ingredient dish (e.g., pea or bean soup), when the amount of beans or peas consumed was not specified.

WIC-approved beans or peas (calorie-based)

Same as WIC-approved beans or peas (weight-based) defined above, except excluding dry beans, peas, and lentils with fat added during cooking.

Other beverages

*Includes:* soft drinks, juice drinks, lemonade, coffee, and tea.

*Excludes:* milk and milk drinks, fruit juice, and fluid replacement drinks (e.g., Pedialyte).

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<sup>1</sup>Although Federal WIC regulations do not specifically disallow flavored milk, examination of the WIC-allowable food lists from a sample of 14 States found that all of the States specifically excluded flavored milk.

<sup>2</sup>The CSFII dataset identified few store brands. Store brands were estimated to account for 10 percent of the WIC cereal market share in 1999 (Private Label Manufacturers Association, 2000).

**Table 4—Socioeconomic and demographic characteristics of children by WIC status**

	All children	WIC recipients	Eligible nonparticipants non-WIC household	Eligible nonparticipants WIC household	Ineligible nonparticipants
<i>Child characteristics:</i>					
Age:					
1 year	24.3%	32.3%	19.7%	23.6%	23.5%
2 years	25.0%	26.3%	24.5%	20.7%	25.1%
3 years	25.6%	21.8%	26.1%	25.2%	26.9%
4 years	25.1%	19.5%	29.7%	30.5%	24.5%
Mean age (years)	2.5	2.3	2.7	2.5	2.6
Sex:					
Male	50.8%	50.9%	51.4%	49.3%	50.6%
Female	49.2%	49.1%	48.6%	50.8%	49.4%
Race/ethnicity:					
White (non-Hispanic)	60.8%	38.3%	49.8%	27.7%	78.6%
Black (non-Hispanic)	16.9%	28.7%	22.7%	31.8%	7.7%
Hispanic	16.1%	26.7%	21.3%	33.7%	7.6%
Other (non-Hispanic)	6.2%	6.3%	6.2%	6.8%	6.2%
Food stamp recipient	18.5%	49.1%	25.5%	43.8%	0.0%
<i>Household characteristics:</i>					
Homeowner	55.3%	28.9%	35.6%	31.6%	78.8%
Assets over \$5,000	33.3%	5.9%	11.0%	6.2%	58.9%
Single-headed household	19.1%	36.3%	29.3%	36.0%	5.2%
Annual household income (\$)	39,870	18,255	20,305	20,925	60,968
Income as percent of poverty	195.4	102.5	117.1	107.1	283.4
Household size (persons)	4.4	4.8	4.6	5.5	4.1
Head's schooling (years)	12.8	11.1	11.7	11.8	14.3
<i>Geographic characteristics:</i>					
Region:					
Northeast	19.4%	17.7%	16.2%	10.6%	22.5%
Midwest	23.0%	23.2%	23.8%	10.2%	23.4%
South	33.1%	33.9%	33.3%	38.5%	32.3%
West	24.5%	25.2%	26.6%	40.6%	21.8%
Urbanization:					
Central city	33.3%	43.6%	36.5%	47.6%	26.2%
Suburbs	48.3%	33.7%	41.5%	38.1%	58.8%
Rural	18.4%	22.7%	22.0%	14.4%	15.0%

appear to be better off relative to the other three groups, as measured by socioeconomic characteristics such as annual household income, home ownership, assets, and head of household's years of schooling. They are also less likely to live in a single-headed household, in central cities, or in rural areas.

Within the two groups of eligible nonparticipating children, those who resided in a WIC household were less likely to be White and more likely to be Black or Hispanic, to receive food stamps, live in larger households, and reside in the West or in central cities.

Table 5 shows the average consumption (measured in either grams or calories) of the foods (including beverages) in the WIC food package for children, over the 2 days in which intake data were collected.<sup>26</sup> The WIC-approved cereal, juice, milk, eggs, cheese, and peanut butter refer to the specific types of these foods that are approved for the WIC program as defined in table 3. WIC-approved milk, eggs, cheese, peanut butter, and dry beans/peas account for practically all of these food items that are consumed by children. However, WIC-approved cereals account for only one-third (33.2 percent) of the total quantity of all cereals consumed by children and WIC-approved juices compete with other non-WIC beverages (such as soft drinks) in the diets of children.<sup>27</sup> Thus, the amounts of other cereal and other beverages (excluding milk) consumed by children are also presented in table 5. In terms of grams of food consumed, the data in table 5 indicate that WIC participants consumed more WIC-approved cereal, juice, and milk than the other three groups of participants. On average, calories from WIC-approved foods account for one-quarter (24.7 percent) of the total calories from food and beverages consumed by children.<sup>28</sup>

Approximations of the maximum amounts (in grams) of the foods provided in the WIC food packages over a 2-day period are shown in the last column of table 5. A comparison of the average amount of WIC-approved foods consumed by WIC participants with the prorated maximum 2-day amount of foods provided by the WIC food package indicates that WIC participants are consuming far less than the maximum amounts provided by WIC. For example, WIC children consumed an average 32.9 grams of WIC-approved cereal over the 2-day period compared with the prorated maximum 68 grams of cereal provided in the WIC food package. There are a number of possible reasons for this result, including that:

- (1) WIC recipients do not redeem the WIC voucher for their full amount;
- (2) Some of the WIC food purchased was either thrown out or consumed by other members of the household;
- (3) The survey respondents underreported the amount of food consumed by the child;
- (4) Due to imprecise means of measuring the amount of specific foods contained in some mixed dishes, some WIC-approved foods were probably omitted from the lists of approved foods constructed for this study, resulting in an underestimation of the amount of these foods consumed by WIC participants; and

<sup>26</sup>Standard errors for the estimates presented in table 5 are not shown because factors other than WIC status affect consumption. For example, the composition of the four groups differs by age, and differences in consumption patterns across the groups may be due largely to the fact that older children eat different foods and different quantities of food than younger children.

<sup>27</sup>Soft drinks accounted for over one-third (35.4 percent) of the total grams of other beverages.

<sup>28</sup>This analysis undercounts the percentage of calories it attributes to WIC-approved foods, since the calories attributed to WIC-approved foods here do not account for those WIC foods included in food mixtures when the dataset did not separate the calories of component foods.

**Table 5—Average 2-day consumption of WIC-approved foods, by WIC status**

Food group	All children	WIC recipients	Eligible nonparticipants non-WIC household	Eligible nonparticipants WIC household	Ineligible nonparticipants	Maximum quantity of food in WIC food package (2-day average)
WIC-approved cereals	24.2	32.9	23.3	27.3	20.8	68
Other cereals	48.6	49.2	53.9	56.8	44.8	NA
WIC-approved juices	283.5	322.0	213.0	248.1	308.8	544
Other beverages	413.5	383.2	507.8	514.9	366.8	NA
WIC-approved milk	734.9	764.2	718.0	652.0	738.3	1,451
WIC-approved cheeses	15.2	12.6	14.2	13.0	17.8	121
WIC-approved eggs	20.7	24.5	26.4	25.4	15.6	NA
WIC-approved peanut butter	5.8	5.0	5.9	6.2	6.0	34
WIC-approved beans/peas	7.5	12.3	10.9	16.5	3.0	30
All WIC-approved foods	709.5	792.5	677.5	688.4	694.2	NA
All non-WIC foods	2,169.4	2,099.9	2,282.2	2,316.0	2,125.4	NA
All foods and beverages	2,878.9	2,892.3	2,959.7	3,004.4	2,819.6	NA

NA=Not applicable.



(5) WIC recipients do not receive the maximum amounts of each WIC food, either because the local WIC agency tailors the individual's food package or because the child (i.e., the child's parent) refuses to accept all of the WIC foods offered. (Unpublished data from the Food and Nutrition Service (FNS), the agency responsible for administering the WIC program, indicates that States are prescribing less than the maximum amount of most WIC foods).<sup>29</sup> In addition, the maximum amounts of all WIC foods are not available to WIC participants. For example, cheese is not part of the basic food package for children—it is provided only as a substitute for milk. Similarly, WIC participants choose peanut butter or beans/peas (but not both) as part of their food package. Thus, WIC children can not receive the maximum amounts of both milk and cheese and beans/peas and peanut butter.

The calculations of the average quantities of food consumed, presented in table 5, are based on the amount of food consumed by all children in the study. However, some children did not eat some of the specific WIC-approved foods during the 2-day period in which information was collected. Table 6 shows the percentage of children who consumed specific WIC-approved foods during at least 1 of the 2 days of dietary recall. Almost all children (98.9 percent) consumed one or more of the WIC-approved foods during the 2-day period. However, the percentage of all children who consumed specific WIC-approved foods varied widely, from almost 93 percent for milk to less than 9 percent for beans/peas.

Within the specific WIC-approved food groups, the percentage of children consuming that food also varied by WIC status. For example, the percentage of children consuming WIC-approved cereal ranged from 33.5 percent (ineligible nonparticipants) to 53.0 percent (WIC recipients). WIC participants had the highest percentage of children who consumed a particular WIC-approved food for three of the seven WIC-approved foods.

## Regression Analysis of the Effects of WIC Participation

The results in table 5 suggest that WIC participants consume larger amounts of some WIC-approved foods than non-WIC children. However, factors other than WIC status may affect the consumption of WIC foods. For example, WIC children consume more milk than non-WIC children, but that difference may be due to age rather than to WIC. WIC children tend to be younger than other children, and studies show that milk consumption declines with children's age. Similarly, receipt of food stamps may lead to increased consumption of some WIC-approved foods and WIC children are more likely to receive food stamps than other children. In simple comparisons across groups, factors such as age and food stamp receipt can confound measurement of consumption effects due to WIC.

In order to isolate WIC-related effects, multivariate regression analysis was used to control for observed (i.e., measured) differences between the four groups of children. Regression analysis is a tool used to study the statistical dependence of a variable, called the dependent variable, on two or more other variables, called explanatory or independent variables. The technique yields a measure of the effect of an independent variable on the dependent

<sup>29</sup>Based on data from the 2002 WIC Participant and Program Characteristics Study.

**Table 6—Percentage of children in sample consuming WIC-approved foods during 2-day survey, by WIC status**

Food group	All children	WIC recipients	Eligible	Eligible	Ineligible nonparticipants
			nonparticipants non-WIC household	nonparticipants WIC household	
Percent					
WIC-approved cereal	37.3	53.0	31.7	45.7	33.5
WIC-approved juices	60.9	68.8	50.6	58.7	64.0
WIC-approved milk	92.9	93.8	93.0	91.4	92.7
WIC-approved cheese	42.6	38.7	40.1	35.6	46.3
WIC-approved eggs	29.1	36.0	35.3	41.4	21.4
WIC-approved peanut butter	26.0	24.0	23.7	26.0	28.3
WIC-approved beans/peas	8.8	14.2	11.3	17.3	4.2
Any WIC-approved food	98.9	99.0	98.8	100.0	98.8
Other cereal	54.9	45.9	59.4	47.6	56.6
Other beverages	74.5	73.6	82.0	81.7	69.7
Any non-WIC food	100.0	99.9	100.0	100.0	100.0
Any food	100.0	100.0	100.0	100.0	100.0

Note: unweighted data.

variable, given that other independent variables are in the model. This analysis has the benefit of simultaneously controlling for multiple factors that may influence the consumption of WIC-approved foods, such as child's age, race/ethnicity, and receipt of food stamps.

The dependent variable in nine models was the amount (in grams) of various foods consumed by children—WIC-approved cereal, juice, milk, cheese, eggs, peanut butter, and beans/peas, as well as other (i.e., non-WIC) cereal and beverages. Three additional regressions were conducted for the amount of energy (calories) consumed in all WIC-foods, in all non-WIC foods, and in all foods (i.e., total calories consumed).<sup>30</sup>

Table 7 lists the independent variables included in the models. The main independent variable of interest in this analysis—WIC status—was represented by the four categories defined previously: (1) WIC participant; (2) eligible nonparticipant in non-WIC household; (3) eligible nonparticipant in WIC household; and (4) ineligible nonparticipant.<sup>31</sup> In order to quantify the qualitative WIC status, indicator (or “dummy”) variables were used, one to represent each of the four categories. Statistically, the use of indicator variables requires that one of the indicator variables be dropped or omitted. In order to interpret the effect of an indicator variable on the dependent variable, it must be compared to the omitted variable. For example, in this analysis, the variable representing WIC participants was the omitted variable. The effect of the other three indicator variables representing WIC status are estimated by comparing them to the omitted category. Thus, the regression coefficients associated with each of the three groups of nonparticipants measure the effect of membership in that category compared with the effect of membership in the omitted category, WIC participants.

Since the consumption of specific foods is influenced by many factors other than WIC status, it is important to control for as many of these confounding factors as possible when assessing the quantitative relationship between WIC participation and the consumption of foods. Therefore, the model included a number of other independent variables, representing the characteristics of the children and their households, geographic locations, and other factors thought to influence the consumption of food, as follows:

*Child characteristics*—Variables representing the age, sex, and race/ethnicity of the child were included to account for their effect on food consumption patterns. A variable representing Food Stamp Program participation was included to account for that program's effect on food purchasing power.

*Household characteristics*—Since income influences the kinds and amount of food that can be purchased, a variable representing the annual income of the household, expressed as a percentage of the poverty threshold, was included. A household's assets may affect its ability to withstand unexpected decreases in income, so two measures of household wealth were included: homeownership and whether the household had cash assets of more than \$5,000. Size of household and whether the household was single-headed may influence the amount of time available for meal planning and preparation and related food choices. Number of other children 1-9

<sup>30</sup>The category “food” or “foods” in this analysis includes beverages.

<sup>31</sup>WIC status in this report is determined solely by current WIC participation. Previous participation in WIC may also affect food consumption habits, for example, through lessons learned by a parent in WIC education classes or from food preferences developed while receiving WIC food packages. However, this study does not account for previous WIC participation, since the CSFII dataset used for the study does not contain information on past participation in the program.

**Table 7—Independent variables in regression model**

Variable	Definition
<b>Child characteristics:</b>	
WIC status:	
WIC participant	Child participates in WIC (omitted category)
Eligible nonpart. (non-WIC household )	Eligible nonparticipating child who resides in a non-WIC household
Eligible nonpart. (WIC household)	Eligible nonparticipating child who resides in a WIC household
Ineligible nonparticipant	Nonparticipating child who is ineligible for WIC
Racial/ethnic:	
White	White child (omitted category)
Black	Black child
Hispanic	Hispanic child
Other race/ethnicity	Child of other race/ethnicity
Age of child:	
1 year	1-year-old child
2 years	2-year-old child
3 years	3-year-old child
4 years	4-year-old child (omitted category)
Sex of child:	
Male	Male child
Female	Female child (omitted category)
Food stamp status:	
Food stamp recipient	Child receives food stamps
Non-food stamp recipient	Child does not receive food stamps (omitted category)
<b>Household characteristics:</b>	
Household size	Number of household members
Head's schooling	Highest grade of school completed by household head
Other children	Number of other children age 1-9 in household
Percent of poverty	Annual household income as a percent of the poverty threshold
Household status:	
Single-headed household	Single-headed household
Dual-headed household	Dual-headed household (omitted category)
Home ownership:	
Home owner	Household member owns home
Not owned	Home is not owned by a household member (omitted category)
Household assets:	
Assets of \$5,000	Household has savings or cash assets of more than \$5,000
Assets less than \$5,000	Household has cash assets less than \$5,000 (omitted category)
<b>Geographic characteristics:</b>	
Census region:	
Northeast	Household is located in the Northeast (omitted category)
South	Household is located in the South
Midwest	Household is located in the Midwest
West	Household is located in the West
Metropolitan Statistical Area status:	
Central city	Household is located in a MSA, central city
Suburbs	Household is located in a MSA, outside central city (omitted)
Rural	Household is located in a non-MSA
<b>Other variables:</b>	
Year of survey	
1994	Survey was conducted in 1994
1995	Survey was conducted in 1995
1996	Survey was conducted in 1996
1998	Survey was conducted in 1998 (omitted category)
Weekend days	Number of weekend days of consumption data
Season:	
Summer	Survey was conducted during summer
Fall	Survey was conducted during fall
Winter	Survey was conducted during winter
Spring	Survey was conducted during spring (omitted category)

years of age was included in the model to account for the influence of other children on the eating patterns of the child of interest. Number of years of schooling completed by the household head was included as a proxy for nutritional knowledge.<sup>32</sup>

*Geographic characteristics*—Variables based on region of residence and metropolitan status were constructed to account for regional differences in food consumption practices and prices.

*Other variables*—Variables representing the year the survey was conducted, the number of days of the 2 days of intake data collection that were conducted on weekends, and the season in which the survey was conducted were included to account for their potential effect on consumption patterns.

In general, a single-equation model of demand for a specific food item can be formulated and written as:

$$Y_i = X_i \beta + \varepsilon_i \quad (1)$$

where  $Y_i$  represents a specific WIC-approved food item consumed by the child,  $X_i$  denotes a vector of socioeconomic and geographic characteristics, and  $\varepsilon_i$  represents a stochastic error term accounting for unexplained variation of the model. In many situations, the estimation of the model is conducted using the Ordinary Least Squares (OLS) procedure. But the OLS procedure is not valid if numerous zero values were reported for the dependent variable  $Y$ . As shown in table 6, many children in the study did not consume one of the types of WIC-approved food during the 2 days in which information was collected, resulting in a large number of observations of zero. The economic interpretation of ‘zero’ consumption is ambiguous, and consequently alternate modeling and estimation procedures are required to conduct the investigation. The regression model used under those circumstances is referred to as the ‘censored regression model,’ or the ‘Tobit’ model. The Tobit model is expressed mathematically by:

$$\begin{aligned} Y_i &= X_i \beta + \varepsilon_i & \text{if } X_i \beta + \varepsilon_i > 0 \\ Y_i &= 0 & \text{if } X_i \beta + \varepsilon_i \leq 0 \end{aligned} \quad (2)$$

The regression analysis was performed using STATA version 8, correcting for weighting and the complex survey sample designs of the CSFII.

## Regression Results

Separate regressions were run for each of the food groups of interest. The results of the analysis are presented in table 8.<sup>33</sup> Regression coefficients were considered to be significantly different from zero at  $p < 0.10$  (i.e., there was less than a 1-in-10 chance of these results occurring as a random event).<sup>34</sup>

<sup>32</sup>In households reporting both a male and female head of household, the years of schooling of the female head were used to represent the head’s education.

<sup>33</sup>Of the 5,519 children included in the descriptive analysis, 12 were dropped because they were missing data for at least one of the independent variables. Of the remaining 5,507 children included in the regression analyses, 1,105 were WIC participants, 1,599 were eligible nonparticipants (non-WIC households), 204 were eligible nonparticipants (WIC households), and 2,599 were ineligible non-participants.

<sup>34</sup>Due to day-to-day fluctuations in the dietary intake of individuals, estimates of intake based on only 2 days of data will be distributed less tightly around the mean than estimates based on more days of data. This will increase the width of the confidence intervals around the estimate of the mean, making it more difficult to obtain statistically significant differences between estimates. In other words, the presence of large intra-individual variation (day-to-day fluctuations in a sample member’s reported intake) makes it more difficult to determine inter-individual variation (variation in usual intake among sample members), which is the variation of interest (Fraker, 1990). For this reason a 10-percent threshold was chosen instead of a 5-percent threshold.

**Table 8—Regression results**

	WIC cereal		Other cereal		WIC juice		Other beverage		WIC milk		WIC eggs	
	Estimate	t value	Estimate	t value	Estimate	t value	Estimate	t value	Estimate	t value	Estimate	t value
Eligible nonpart. (non-WIC hh <sup>1</sup> )	-48.74	-4.87	23.28	2.91	-206.64	-6.33	145.56	5.48	-23.68	-0.93	13.68	1.96
Eligible nonpart. (WIC hh <sup>1</sup> )	-18.18	-1.41	8.09	0.57	-111.10	-1.9	148.37	2.52	-97.74	-1.93	2.80	0.3
Ineligible nonparticipant	-47.29	-3.24	-9.42	-0.72	-146.27	-2.84	95.55	2.36	-4.12	-0.08	12.55	1.46
Percent of poverty	-0.06	-0.93	0.26	4.2	0.26	0.92	-0.07	-0.31	-0.46	-2.11	-0.14	-2.96
Male	4.30	0.8	-4.80	-0.82	41.44	2.65	37.07	2.15	45.82	2.28	2.94	0.81
Age 1 year	-12.32	-1.61	-20.04	-2.45	30.16	1.21	-361.57	-13.21	271.72	7.75	11.02	1.95
Age 2 years	-2.91	-0.41	-1.44	-0.2	115.15	5.16	-154.41	-5.89	5.74	0.27	23.39	4.2
Age 3 years	2.25	0.34	8.63	1.94	30.01	1.27	-69.81	-2.96	-4.56	-0.28	5.05	1.07
Black	16.60	1.89	47.36	4.54	-17.57	-0.54	31.74	1	-147.38	-4.75	27.79	4.26
Hispanic	6.57	0.75	-20.54	-2.37	-35.97	-1.23	33.76	0.95	65.59	1.79	45.95	7.24
Other race/ethnicity	-21.18	-2.44	-15.30	-1.36	24.17	0.5	-125.40	-2.18	9.96	0.22	29.06	4.02
Food stamp recipient	-23.92	-2.5	10.46	0.97	7.84	0.25	40.05	1.31	-23.19	-0.71	1.74	0.25
Household size	-3.26	-1.67	2.03	0.84	-13.57	-1.78	-5.38	-0.83	-1.98	-0.29	2.31	1.32
Single-headed household	0.88	0.1	23.51	2.48	-15.39	-0.41	5.38	0.14	-78.37	-2.54	-16.51	-2.48
Home owner	3.77	0.53	-5.12	-0.63	38.00	1.69	-10.03	-0.38	12.10	0.57	-1.84	-0.34
Assets of \$5,000	-0.23	-0.04	-15.89	-2.7	0.31	0.01	-99.39	-4.62	43.03	1.69	-0.95	-0.16
Head's schooling	1.16	1.14	0.23	0.24	9.50	2.05	-16.16	-3.94	-5.41	-1.23	-2.46	-2.96
Other children	2.00	0.33	3.77	0.59	6.41	0.32	18.49	0.97	-25.13	-1.16	-13.97	-2.68
Midwest	-27.75	-3.65	3.92	0.56	-144.15	-3.43	107.09	2.5	8.06	0.29	-6.42	-0.77
South	-39.80	-6.69	19.34	2.38	-158.67	-4.08	125.07	3	-25.85	-1.06	9.98	1.2
West	-18.04	-2.16	-0.02	0	-143.21	-4.26	-19.13	-0.43	-27.01	-1.01	6.30	0.75
Central city	6.32	0.91	5.85	1.22	16.00	0.6	11.53	0.47	-46.98	-2.15	-7.05	-1.47
Rural	-9.02	-1.84	-2.23	-0.32	-34.13	-0.73	131.66	3.07	-27.53	-0.76	-3.08	-0.45
Survey year - 1994	22.60	2.8	-18.64	-2.89	1.52	0.05	-27.46	-0.79	-64.04	-2.73	-1.77	-0.3
Survey year - 1995	22.50	2.65	-28.01	-3.09	-18.80	-0.6	40.00	1.32	-38.63	-1.07	-3.42	-0.55
Survey year - 1996	12.05	1.39	-2.64	-0.25	15.27	0.48	-49.97	-1.63	14.13	0.41	-2.82	-0.4
Weekend days	-7.88	-1.66	-8.61	-1.84	-7.21	-0.4	46.98	2.65	-46.32	-2.34	5.99	1.55
Summer	-5.40	-0.79	8.86	1.52	10.74	0.35	36.44	1.4	39.38	1.38	-5.59	-1.15
Fall	-5.47	-0.74	10.54	1.4	15.52	0.49	-49.15	-1.26	92.58	3.6	-1.24	-0.17
Winter	11.07	1.38	-5.99	-0.84	4.06	0.12	-29.89	-0.98	-14.36	-0.47	2.66	0.47
Constant	10.11	0.47	-66.47	-2.8	197.40	2.03	503.73	5.54	878.57	9.57	-31.28	-1.4
Sigma	4.86	81.41	4.95	122.67	6.24	209.7	6.31	301.09	6.34	251	4.61	178.23

Continued—



Table 8—Regression results—continued

	WIC cheese		WIC peanut butter		WIC beans/peas		WIC energy		Non-WIC energy		Total energy	
	Estimate	t value	Estimate	t value	Estimate	t value	Estimate	t value	Estimate	t value	Estimate	t value
Eligible nonpart. (non-WIC hh <sup>1</sup> )	1.78	0.59	-2.27	-0.99	-6.62	-0.46	-100.28	-4.41	94.28	1.74	-5.69	-0.1
Eligible nonpart. (WIC hh <sup>1</sup> )	-1.95	-0.3	5.88	1.16	7.68	0.4	-82.64	-2.04	144.62	2.01	59.72	0.83
Ineligible nonparticipant	5.26	1.14	-4.20	-0.85	-52.49	-2.15	-79.17	-2.35	-50.83	-0.74	-131.15	-1.77
Percent of poverty	-0.01	-0.39	0.00	-0.13	-0.09	-0.67	-0.33	-1.99	0.42	1.38	0.11	0.32
Male	-3.30	-2.1	1.27	0.78	-19.98	-2.18	47.83	3.46	135.84	5.27	183.65	5.76
Age 1 year	-10.67	-4.31	-11.63	-4.65	-33.30	-2.36	146.00	6.65	-812.22	-20.70	-664.77	-15.32
Age 2 years	-6.10	-2.51	-6.23	-2.44	-2.59	-0.18	20.64	1.25	-421.91	-11.15	-399.98	-10.34
Age 3 years	-4.37	-1.97	0.07	0.04	-12.48	-0.82	4.93	0.3	-210.45	-6.59	-205.40	-5.65
Black	-12.60	-3.44	-9.32	-3.5	35.21	1.9	-67.35	-2.93	40.35	0.84	-27.59	-0.54
Hispanic	-7.77	-2.23	-23.85	-7.88	191.92	12.54	43.85	2.06	-51.33	-0.96	-8.18	-0.17
Other race/ethnicity	-23.30	-5.11	-19.19	-4.67	75.49	3.26	-13.50	-0.44	-169.36	2.61	-182.13	-2.62
Food stamp recipient	8.36	2.65	0.20	0.07	-12.38	-0.74	-20.49	-0.87	57.83	1.36	39.20	0.93
Household size	-1.09	-1.47	-0.26	-0.4	-2.79	-0.67	-4.30	-0.82	2.82	0.20	-1.25	-0.08
Single-headed household	2.14	0.63	1.25	0.41	-17.75	-1.01	-46.29	-1.8	53.93	1.20	7.71	0.15
Home owner	0.25	0.12	0.54	0.29	14.43	1.03	14.70	0.89	0.68	0.02	15.18	0.46
Assets of \$5,000	2.84	1.22	-1.16	-0.61	0.24	0.02	14.24	0.82	-39.93	0.97	-25.59	-0.56
Head's schooling	1.38	2.92	0.80	1.91	-1.24	-0.77	-2.70	-0.9	3.32	0.67	0.57	0.11
Other children	4.04	1.71	2.12	1.05	-12.41	-0.86	-18.19	-1.1	38.71	1.19	19.99	0.58
Midwest	-4.74	-0.93	-1.69	-0.43	-11.88	-0.55	-97.66	-4.21	117.28	2.02	21.02	0.35
South	-2.95	-0.73	-2.61	-0.72	49.21	2.53	-100.66	-5.17	-2.32	-0.04	-102.35	-1.96
West	4.07	0.93	1.71	0.45	6.62	0.33	-94.67	-5.47	-87.41	-1.46	-181.25	-3.11
Central city	-6.67	-2.52	1.19	0.61	20.14	1.97	-31.54	-2.17	23.66	0.65	-7.87	-0.18
Rural	0.68	0.15	-0.08	-0.02	32.92	1.8	-25.33	-0.84	62.13	1.39	38.65	0.81
Survey year - 1994	-5.66	-2.37	-2.24	-0.98	-10.17	-0.6	-47.76	-2.36	-125.48	-3.33	-171.62	-3.93
Survey year - 1995	-4.79	-1.42	2.55	1	-5.17	-0.34	-24.87	-1.16	-136.99	-3.67	-161.16	-3.72
Survey year - 1996	3.96	1.05	-0.57	-0.22	28.06	1.64	21.77	0.82	-195.85	-5.35	-174.13	-5.16
Weekend days	-2.55	-1.35	1.45	1.07	-16.63	-2.06	-34.99	-2.8	38.61	1.62	3.73	0.14
Summer	-1.18	-0.53	0.48	0.18	-8.52	-0.54	19.74	1.23	-5.58	-0.16	14.70	0.42
Fall	-8.38	-2.43	-1.27	-0.51	2.68	0.14	34.53	1.7	-101.64	-3.13	-66.01	-1.92
Winter	-5.35	-2.37	0.26	0.1	-9.50	-0.57	-15.72	-0.68	-68.92	-1.61	-83.66	-1.94
Constant	-11.21	-1.35	-23.23	-3.74	-225.07	-5.01	957.51	17.39	2367.46	17.64	3322.39	23.23
Sigma	3.95	134.24	3.62	95.99	5.12	120.83	5.99	405.63	6.65	333.20	6.74	378.23

<sup>1</sup>hh = household

Note: Red numbers represent regression coefficients that are statistically significant at p &lt; .10.

## ***WIC Status Variables***

Compared with eligible nonparticipants living in non-WIC households, WIC participants consumed significantly more WIC-approved cereal and juice and significantly less other cereal, other beverages, and WIC-approved eggs, holding other factors constant. Compared with eligible nonparticipants living in WIC households, WIC participants consumed significantly more WIC-approved juice and milk and significantly less of other beverages. Compared to ineligible nonparticipants, WIC participants consumed significantly more WIC-approved cereal, juice, and beans/peas and significantly less of other beverages.

WIC participants consumed significantly more calories from WIC-approved foods compared with each of the three groups of nonparticipants. They also consumed significantly fewer calories from non-WIC foods than the two groups of eligible nonparticipants. There was no significant difference in total calories consumed between WIC participants and the two groups of eligible nonparticipants. Compared with ineligible nonparticipants, however, WIC participants consumed more total calories from all foods.

## ***Other Variables***

Many of the other independent variables included in the regression models were also statistically significant. For example, male children consumed significantly more calories from WIC-approved foods, non-WIC foods, and from all foods and beverages than female children. They also drank more WIC-approved juice, milk, and other beverages and ate less WIC-approved cheese and beans/peas. Age of the child was also significant in several cases. For example, relative to 4-year-olds, 1-year-old children consumed more calories from WIC-approved foods but fewer calories from non-WIC foods and from all foods. They also consumed more grams of WIC-approved milk and eggs and fewer grams of WIC-approved cheese, peanut/butter, beans/peas, other cereal, and other beverages.

Participation in the Food Stamp Program was associated with increased consumption of WIC-approved cheese and decreased consumption of WIC-approved cereal. Weekend days were associated with fewer calories from all WIC-approved foods and larger quantities of other beverages, but smaller quantities of WIC-approved milk, beans/peas, and other cereal.

There were numerous differences in consumption of the food groups by race/ethnicity. For example, compared with Whites, Blacks consumed significantly fewer calories from WIC-approved foods, less WIC-approved milk, cheese, and peanut butter, and more WIC-approved cereal, eggs, beans/peas, and other cereal.<sup>35</sup> Hispanics, on the other hand, consumed significantly more calories from WIC-approved foods than Whites, more WIC-approved milk, eggs, and beans/peas, and less WIC-approved cheese, peanut butter, and other cereal. There were also numerous differences in consumption of the various food groups across geographic regions.

Compared with the earlier years in which the survey was conducted, the 1998 survey year was associated with a significant increase in calories both from non-WIC foods and all foods.

<sup>35</sup>Concerns about possible lactose intolerance may account for some of the relatively low consumption of milk and cheese among Black children.

## Effects Associated With WIC Participation

The regression analysis discussed above identified those cases in which WIC participants consumed significantly more or less of a type of food than one of the three nonparticipant comparison groups. Those results were then used to compute the marginal effect as a percent of average consumption of WIC participants. Results are presented for the types of foods found to be most affected by participation in WIC—grams of WIC cereal, WIC juice, and other (i.e., non-WIC) beverages consumed, as well as total calories from WIC-approved foods. The marginal effect associated with participation was decomposed into two separate effects. One of these—the probability effect—refers to WIC’s effect on the probability of consuming a particular type of food, that is, consuming a positive amount of the food during the 2-day period rather than none at all. As shown in table 6, during the 2-day reference period, WIC participants were more likely to consume some types of WIC foods than non-WIC children. The second effect is the magnitude effect, which is WIC’s effect on the *amount* of food consumed by children who ate a positive amount of the food.

WIC participants, when compared with either eligible children in non-WIC households or ineligible children, consumed on average about 75 percent more grams of WIC-approved cereal after other factors were held constant (fig. 2).<sup>36</sup> Most of this dramatic difference was due to the magnitude effect (that is, among those children who consumed WIC-approved cereals, WIC participants consumed larger quantities) rather than the probability effect (in which WIC participants are more likely to consume WIC cereals).

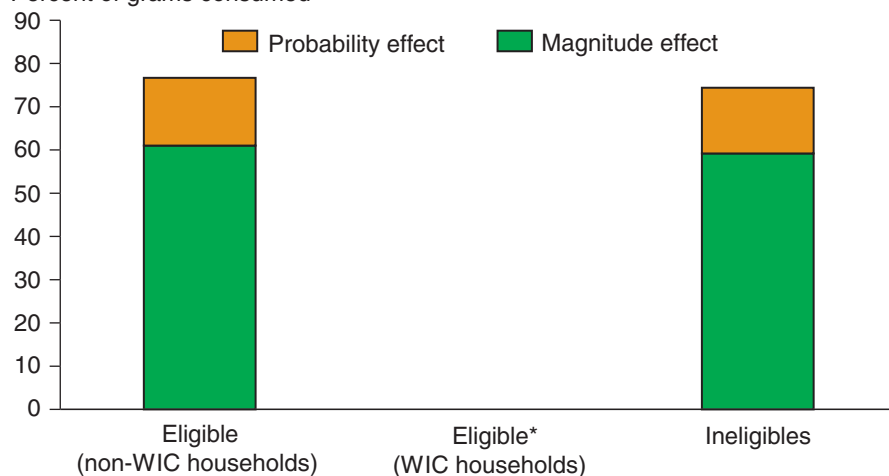
WIC participation was also associated with large increases (24 to 45 percent) in the WIC-approved juice consumed, depending on with which group of nonparticipants the WIC participants were compared (fig. 3). At

<sup>36</sup>Estimates of the change in consumption due to WIC participation measured in grams for a specific commodity can be approximated by using the figures for average consumption for a specific commodity as reported in table 5. For example, 75 percent (i.e. the marginal effect) of the average 24 grams of WIC-approved cereal consumed by all children, as shown in table 5, equals 18 grams.

Figure 2

### Estimated effects of WIC on consumption of WIC-approved cereal: WIC participation vs. three comparison groups

Percent of grams consumed



\* Marginal effects were not reported for eligible nonparticipants in WIC households because there was no statistical difference in the number of grams of WIC-approved cereal consumed between WIC participants and eligible nonparticipants.

the same time, WIC participants consumed 17 to 26 percent fewer grams of other beverages than the other groups of children (fig. 4).

With regard to calories from all WIC-approved foods, WIC participants consumed between 11 and 14 percent more calories than children in the other three groups (fig. 5). The probability effect was very small in all three cases, reflecting the fact that the vast majority of children in the study consumed some WIC-approved food during the reference period regardless of whether they participated in WIC. On the other hand, WIC participants consumed between 4 and 7 percent fewer calories from non-WIC foods compared with the two groups of eligible nonparticipants. All of this

Figure 3

**Estimated effects of WIC on the consumption of WIC-approved juice:  
WIC participation vs. three comparison groups**

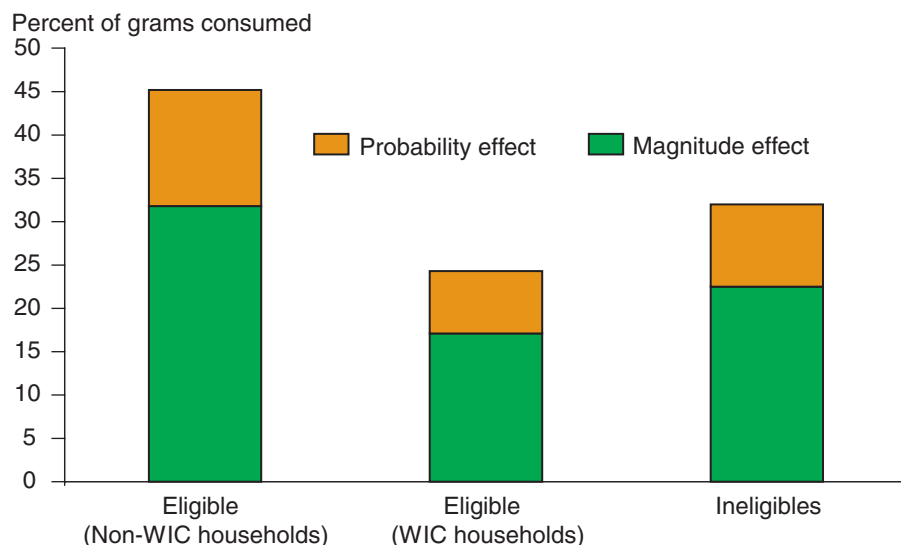


Figure 4

**Estimated effects of WIC on the consumption of other beverages:  
WIC participation vs. three comparison groups**

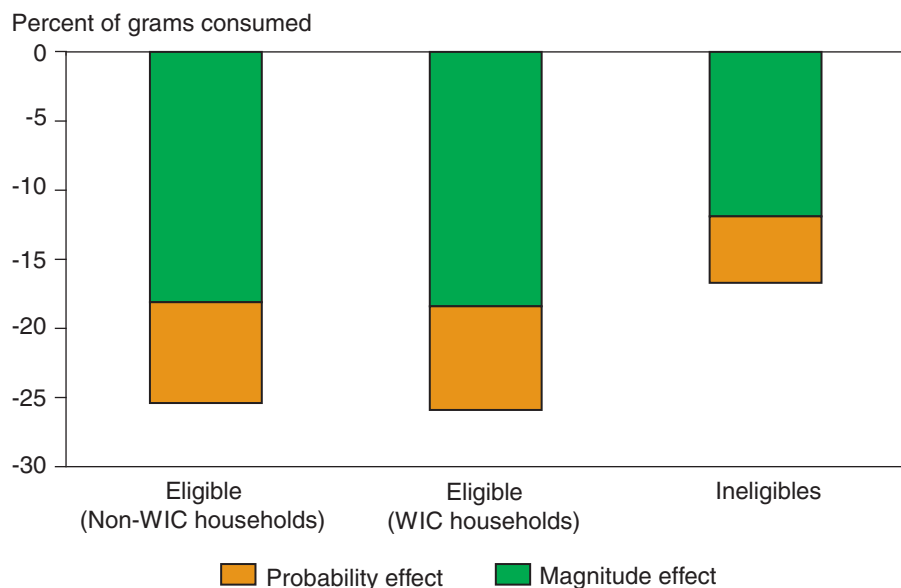
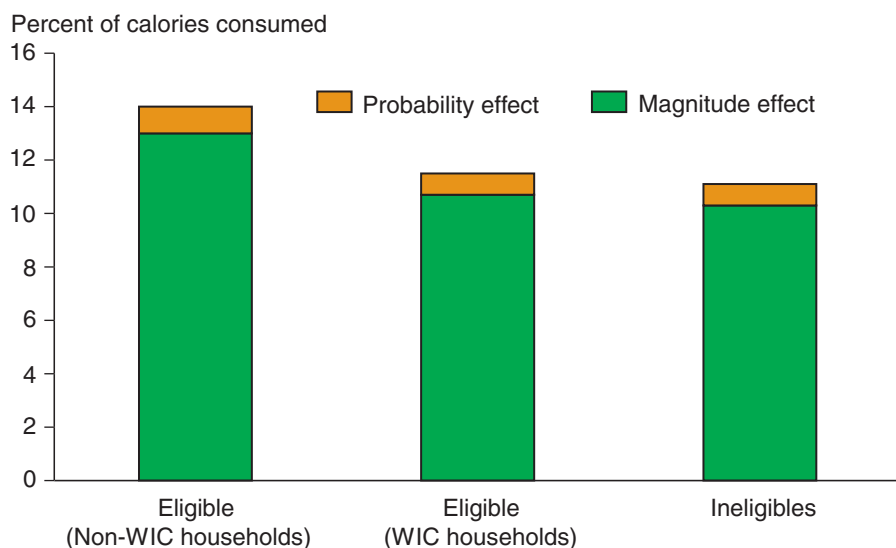


Figure 5

### Estimated effects of WIC on the caloric intake of WIC-approved foods: WIC participation vs. three comparison groups



decrease in calories was due to the magnitude effect, since virtually all the children in the study consumed some non-WIC food during the reference period.

## Discussion

This analysis compared the consumption of WIC-approved foods by WIC children with that of three groups of nonparticipating children—those eligible to participate who lived in a non-WIC household, those eligible to participate who lived in a WIC household, and those ineligible to participate. In an ideal setting, where both the observed and unobserved characteristics of WIC children differ on average from those of eligible nonparticipants only by WIC status, the most relevant comparison by which to isolate the effects of WIC participation is that between WIC participants and eligible nonparticipants living in a non-WIC household. In this analysis, that comparison showed that WIC participation was associated with increased consumption of WIC-approved cereal and juice and decreased consumption of other cereal, other beverages, and WIC-approved eggs. WIC participants consumed significantly more combined calories from all WIC-approved foods, but significantly fewer from all non-WIC foods.

Thus, the results of the regression analysis suggest that after controlling for observable differences between WIC recipients and eligible nonparticipating children in non-WIC households, participation in WIC increases the consumption of some WIC-approved foods while decreasing the consumption of some non-WIC foods.<sup>37</sup> However, problems of estimation and interpretation exist if WIC recipients differ in unobservable ways from income-eligible nonparticipants and if these differences influence nutrient intake. Such unobservable differences, the result of possible self-selection into the WIC program, may bias the regression estimates of WIC's effect on food consumption. Self-selection occurs because WIC is a voluntary

<sup>37</sup>The finding that WIC children consumed fewer grams of WIC-approved eggs is unexplained.

program: parents choose to enroll their child. Children participating in WIC may differ in unobservable ways from those eligible children whose parents choose not to participate.

Biases due to self-selection may be upward, that is, augmenting WIC's measured effects on the consumption of WIC foods, thereby overstating WIC's true impact. For example, upward selection bias may occur when eligible children do not participate in WIC because their parents are less knowledgeable about the importance of nutrition for a child's health, or less motivated to improve their child's nutrition than parents of children who actively seek sources of nutrition assistance. In such cases, a measured effect for WIC may be due, wholly or in part, to parental behavior rather than to WIC.

On the other hand, selection bias can also be downward, diminishing WIC's measured effects on nutrient intake, thereby understating WIC's true impact. This could happen if the parents of an eligible child choose not to participate because their child has low nutritional risk, with little to be gained from WIC. Thus, WIC participants may be more likely to be at greater nutritional risk than nonparticipants. If so, then comparisons between WIC children and children in other groups would result in a downwardly biased estimate of WIC's effect.

In an experimental study, the effects of WIC on children would be obtained by randomly selecting from a group of eligible children, with some of them to receive benefits and some not. On average, the characteristics (both observable and unobservable) of the two groups of children would not differ other than in whether they participated in the WIC program (assuming that all children selected to receive WIC benefits did so). Differences in consumption levels between the two groups could be attributed solely to the effects of WIC and not to self-selection bias. However, largely due to ethical concerns about withholding benefits from needy children, a WIC study with a random assignment design has not been conducted.

Although there are statistical techniques that attempt to control for selection bias, they require that the model include one or more variables that explain program participation but do not directly influence food consumption. Because of the lack of such variables in the CSFII, a statistical model that corrects for selection bias was not used in this study. However, a methodology was used that indirectly addresses possible selection bias to some degree, specifically, with regard to a parent's concern for a child's nutrition and motivation to improve it. A comparison was made between WIC participants and eligible nonparticipants living in a WIC household. Since the nonparticipating children live in a household in which some other member is in WIC, the household knows about WIC and is motivated enough to go through the application process for at least one household member. When comparing WIC participants and eligible nonparticipants in a WIC household, the study found that WIC participation was associated with increased consumption of combined calories from all WIC-approved foods, as well as larger quantities of WIC-approved juice and milk and decreased consumption of other beverages. This suggests once again that WIC does affect food consumption. This result was found despite the possibility of spillover



effects (whereby foods obtained through WIC are shared among non-WIC members of the household), which makes statistically significant results harder to find.

There is a caveat to this approach and its findings. The fact that some members of the household are in WIC but other supposedly eligible members are not raises questions as to why these non-WIC children are not participating. One possible reason is that the child may have applied for WIC but was prevented from participating due to the local WIC agency's lack of funds, in which case WIC rations participation to persons demonstrating the greatest nutritional risk.<sup>38</sup> Although anecdotal evidence suggests that in recent years nearly everyone who was eligible and applied for the WIC program has been able to participate, during the years of the CSFII survey some children may have been unable to participate due to limited funds. Another possible reason that some eligible children in WIC households may not participate is that they are unwilling to consume the WIC foods (or only consume limited quantities) due to food preferences, diminishing the parent's incentive to enroll the child. Since the household will already be receiving the benefits of WIC's nutrition education program via another member's participation, little else will be gained by enrolling a child who does not eat the WIC foods. In support of this second hypothesis, results of the regression analysis indicate that compared with WIC participants, nonparticipants in WIC households consumed significantly less WIC-approved milk, a major component of the WIC food package for children.<sup>39</sup> There were no significant differences in milk consumption between WIC participants and the other two groups of nonparticipants.

The use of the third comparison group—children ineligible to participate because their household income is too high—also addresses possible selection bias to some degree, specifically the issue that WIC participants may be more knowledgeable about the importance of good nutrition than eligible nonparticipants. Higher income households tend to have higher education levels (and presumably more nutrition knowledge) and better diets in general than lower income households. Thus, comparing WIC participants with a group of ineligible nonparticipants should underestimate WIC's effect and make it more difficult to find significant effects from WIC participation. However, the results of the analysis showed that when WIC participants were compared with ineligible nonparticipants, the WIC participants consumed significantly more combined calories from WIC-approved foods, with larger quantities of WIC-approved cereal, juice, and beans/peas and significantly smaller amounts of other beverages.

Thus, participation in WIC was associated with significant increases (or decreases) in the amount of food consumed, across the different comparison groups. Furthermore, the magnitudes of the effects associated with WIC participation were substantial for some types of food. After controlling for other factors, participation in WIC was associated with an increase of nearly 75 percent in the amount of WIC-approved cereal consumed compared with eligible nonparticipants in non-WIC households and ineligible nonparticipants. Depending on the comparison group, WIC participation was associated with a 24- to 45-percent increase in the amount of

<sup>38</sup>When the lack of funds do not allow WIC to serve all eligible persons, WIC uses a seven-point priority system to ensure that those at the greatest nutritional risk receive program benefits. In general, priority is given to persons demonstrating medically based nutritional risks over dietary-based nutritional risks, to pregnant and breastfeeding women, to infants over children, and to children over postpartum women.

<sup>39</sup>WIC children can receive up to 24 quarts of milk per month through WIC.

WIC-approved juice consumed and a 17- to 26-percent decrease in the amount of other beverages.

The finding that WIC participants consumed significantly more of WIC-approved juice and less of other beverages than all three groups of nonparticipants—as well as significantly more WIC-approved cereal than both eligible participants in non-WIC households and ineligible nonparticipants—supports the results from previous studies in which WIC participation was associated with significantly lower intake of added sugars by children (Siega-Riz et al., 2004; Chandran, 2003). WIC restricts juices to those with no added sugar and sets limits on the amount of sugar in the cereals provided through the program.

Although WIC was found to be associated with increased consumption of some WIC-approved foods, the analysis found no statistically significant difference in the consumption of other WIC-approved food groups such as cheese and peanut butter, and few significant differences in the consumption of WIC-approved milk, eggs, and beans/peas. Consumers probably have stronger brand loyalties and taste preferences in cereals (and, to a lesser degree, juices) than in the other WIC food groups (Kirlin et al., 2003). However, WIC participants can only use their WIC vouchers for specific brands of cereal that are iron-fortified and low-sugar. Cereals that do not meet WIC requirements comprise a considerable share of the market. WIC participants, if they want to take advantage of the free food provided by WIC, must purchase cereal that may be different from what they would choose if there were no restrictions. Juice may be similar in that WIC participants are required to use their WIC vouchers on products containing 100-percent juice, which compete with other beverages in the diets of children. On the other hand, WIC regulations place fewer restrictions on the other types of WIC foods participants can purchase with their WIC vouchers, and there is less product differentiation among brands of milk, eggs, dry beans/peas, etc. Thus, WIC probably constrains participant's choices of cereal and beverages more than choices of the other WIC foods. So WIC participants are likely to purchase the same types of milk, eggs, dry beans/peas, cheese, and peanut butter as non-WIC participants.<sup>40</sup>

The results clearly demonstrate that participation in WIC is statistically *associated* with increased consumption of some WIC-approved foods, such as cereal and juice. However, because of factors such as self-selection bias, it is not possible to definitely prove that WIC participation per se is the cause of the increased consumption of WIC foods. Even so, the finding of similar results across three different comparison groups—eligible nonparticipants in non-WIC households, eligible nonparticipants in WIC households, and ineligible nonparticipants—provides strong evidence that participation in WIC, and not some confounding factor, does increase the consumption of some WIC-approved foods.

Given the finding that WIC participation is associated with increased consumption of some WIC-approved foods, it is not surprising that WIC would be associated with an increase in the energy consumption (measured in calories) of WIC-approved foods. This study found that WIC participation was associated with an increase in the amount of total calories from all

<sup>40</sup>It should be noted that these food types were also the most problematic in terms of classifying specific foods as WIC-approved due to the problems associated with food combinations and mixtures.

WIC foods of 11 to 14 percent, depending on which of the three groups of nonparticipants they were compared with.

At the same time, among low-income children eligible for WIC, participation in WIC was associated with reduced consumption of calories from non-WIC foods (about 4 to 7 percent of the average calories from non-WIC foods consumed by children in the study). There was no significant difference in total calories consumed by WIC recipients and the two groups of eligible nonparticipants. This result suggests that WIC-approved foods replace other food items in the diets of WIC participants rather than adding to the total amount of food consumed.

WIC participants did consume significantly more total calories—an estimated 131 more calories over 2 days, which represents about 5 percent of the average caloric intake of children in the study—compared with ineligible nonparticipants.<sup>41</sup> However, this result does not necessarily mean that participation in WIC leads to increased caloric consumption. As stated earlier, these two groups—WIC participants and ineligible nonparticipants—systematically differ in many ways that cannot be controlled for and that may confound the relationship between WIC and caloric consumption. Thus, this report considers the more relevant comparison of the effects of WIC participation on calories consumed to be between WIC participants and other low-income children (i.e., the other two groups of eligible nonparticipants), a comparison that found no association between participation in WIC and total caloric consumption.<sup>42</sup>

WIC-approved foods account for a substantial portion of children's diets, on average, for at least a quarter of the total calories consumed from food and beverages. WIC accounts for an even more significant portion of younger children's diets—compared with 4-year-olds, 1-year-old children consumed significantly more calories from WIC-approved foods, but fewer total calories.

Among other notable findings, numerous differences in the consumption of the food groups by race/ethnicity and geographic regions were found, suggesting strong cultural and regional dietary patterns. Children's consumption of WIC-approved foods was also found to vary during the week. Weekend days were associated with fewer calories from all WIC-approved foods and smaller quantities of WIC-approved cereal, milk, cheese, beans/peas, and other cereal, but with more calories from non-WIC foods and larger quantities of other beverages and WIC-approved eggs.

Participation in the Food Stamp Program had a limited effect on the consumption of the individual foods included in the analysis—it was associated only with increased consumption of WIC-approved cheese, and decreased consumption of WIC-approved cereal. This result may be explained by the fact that food stamps can be used to purchase most foods and beverages, including non-WIC foods, while WIC benefits are targeted to specific types of foods (Chandran, 2003).<sup>43</sup>

An unexpected finding was that, compared with the earlier survey years of 1994-96, the 1998 survey year was associated with a significant increase in

<sup>41</sup>There was no statistical difference between WIC participants and ineligible nonparticipants in the amount of non-WIC foods consumed.

<sup>42</sup>Most previous examinations of WIC's effects on children's consumption of foods restricted the analysis to low-income children. For example, Burstein et al. (2000) limited their analysis to children from families with incomes less than 100 percent of poverty; Rose et al. (1998) looked at children from families with incomes less than 130 percent of poverty; Siega-Riz et al. (2004) looked at children with incomes of 185 percent of poverty or less; and Oliveira and Gundersen (2000) and Chandran (2003) used a cutoff of 200 percent of poverty. The one exception was the descriptive study by Ponza et al. (2004) that compared WIC participants with all nonparticipating children, regardless of income.

<sup>43</sup>Food stamps can be used to purchase most foods, except for hot foods, foods eaten in the store, and alcohol and tobacco.

calories both from non-WIC foods and from all foods. Although rates of obesity and overweight among children are increasing over time, it is unlikely that such an increase in calories would show up in such a short time. It is possible that procedures for collecting information on food energy consumed in the 1998 survey differed in some way from the earlier survey.

USDA is considering redesigning the WIC food packages and the results of this analysis could have important implications for their future composition. This study found that WIC has a very large impact on the consumption of some foods such as WIC-approved cereal and juice, foods in which WIC participants' choices are constrained to a large degree. Furthermore, WIC participation was found to affect the consumption of foods not included in the WIC food package, for example, other (non-WIC) beverages. WIC-approved juice competes with non-WIC beverages (such as soft drinks) in the diets of children.

On the other hand, WIC participation was found to have little effect on the consumption of types of food for which WIC participants' food choices were less constrained, such as milk, eggs, dry beans/peas, cheese, and peanut butter. Thus, the effect of the WIC food package on participants' food consumption differed by type of food. This highlights the importance of determining which foods the WIC packages should contain in order to affect change in the dietary patterns of participants.

Numerous differences in the consumption of WIC-approved foods were also found by race/ethnicity and geographic regions, suggesting strong cultural and regional dietary patterns. This supports the premise that changing the WIC food package to reflect cultural preferences may increase consumption of certain foods.

## Conclusions

WIC-approved foods are an important part of children's diets, whether or not the children participate in the program. On average, calories from WIC-approved foods account for at least one-quarter of the total calories from food and beverages consumed by children. To determine the effect that participation in WIC has on the consumption of WIC-approved foods, the consumption patterns of WIC participants were compared with those of eligible nonparticipants living in non-WIC households. Two additional comparison groups were constructed to account for the possibility of spillover effects whereby WIC foods are shared among non-WIC household members (eligible nonparticipants living in WIC households), and for the effect of higher household incomes (ineligible nonparticipants).

A Tobit multivariate regression analysis was conducted that took into account the fact that some children may not consume a particular type of food during a 2-day period. The results strongly suggest that participation in WIC affects the consumption patterns of children, at least for some types of foods. After controlling for other observed factors, WIC participants consumed 24-45 percent more WIC-approved juice and 17-26 percent less of other beverages such as soft drinks than each of the three comparison groups. WIC participants also consumed about 75 percent more WIC-approved cereal than both eligible nonparticipants living in non-WIC households and ineligible nonparticipants. The findings support results from previous studies in which WIC participation was associated with significantly lower intake of added sugars. The analysis found little or no association between participation in WIC and the consumption of other WIC-approved foods.

Participation in WIC was found to result in an 11- to 14-percent increase in the energy consumption (measured in calories) of WIC-approved foods. However, WIC participants consumed significantly fewer calories from non-WIC foods than the two groups of eligible nonparticipants. As a result, there was no significant difference in total calories consumed from all foods and beverages between WIC participants and the two groups of eligible nonparticipants. There is thus little evidence that participation in WIC contributes to increased caloric intake among children eligible to participate. However, relative to children ineligible to participate because their household income is too high (and who may differ from WIC participants in fundamental, but unobservable, ways), WIC participants consumed more total calories.

Because USDA is considering redesigning the WIC food packages, the results of this analysis could play a role in the future composition of the packages. This study found that although WIC participation had little effect on the consumption of some types of food, it had a substantial impact on the consumption of others. Numerous differences in the consumption of WIC-approved foods were also found by race/ethnicity and geographic regions, suggesting strong cultural and regional dietary patterns. This study highlights the importance of choosing the specific foods for WIC food packages that are most likely to affect change in the dietary patterns of participants in the program.



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## Appendix

### History of the WIC Food Packages

The 1972 legislation that created the WIC program defined the “supplemental foods” to be provided to program participants as “those foods containing nutrients known to be lacking in the diets of populations at nutritional risks and, in particular, those foods and food products containing high-quality protein, iron, calcium, vitamin A, and vitamin C” (P.L. 92-433). These five target nutrients were chosen based on studies that suggested they were lacking in the diets of the WIC target population. Legislation enacted in 1978 removed any reference to specific nutrients by defining supplemental foods as “those foods containing nutrients determined by nutritional research to be lacking in the diets of pregnant, breastfeeding, and postpartum women, infants, and children,” as determined by the Secretary of Agriculture (P.L. 95-627). Although mention of specific nutrients was removed, the WIC food packages continued to provide the original five target nutrients since “research had not provided evidence of changes in the dietary habits or economic situations of the target population” (44 FR 69255). The same legislation also directed the Secretary to ensure, to the degree possible, that the fat, sugar, and salt content of the supplemental foods is appropriate. It also allowed WIC State agencies, with the approval of the Secretary, to substitute different foods that are nutritionally equivalent to those in the WIC food packages, to allow for different cultural eating patterns. The original intent of this provision was to permit areas outside the continental United States to operate a WIC program that provides foods indigenous to the area (44 FR 69266). However, it has received increased attention in recent years as the WIC population has become more ethnically diverse.

The WIC food packages were designed to be supplemental. They were not intended to meet all the nutritional needs of the participants, but were meant to be used with a variety of other foods (44 FR 69255). The nutrition education component of WIC emphasizes the need for a varied diet. However, since USDA did not believe that nutrition education could compensate for insufficient income, the WIC food packages were constructed to provide high percentages of the Recommended Dietary Allowances (RDA) for the target nutrients. In addition to their nutritional contribution, the types of foods included in the WIC food packages were chosen based on the following principals: cost, broad cultural and ethnic appeal, commercial availability, versatility in preparation and use, feasibility of apportionment into daily servings over a month’s time, and administrative feasibility (USDA, Food and Nutrition Service, 1997). The foods in the packages are generally of domestic origin (in support of the nation’s agricultural economy) and have undergone minimal processing (FR 1994).

Although the foods contained in the WIC packages continue to be high in one or more of the original five target nutrients, the packages have undergone some changes. Prior to 1980, three food packages were specified for participants: one for infants; one for pregnant, breastfeeding and nonbreastfeeding postpartum women and children; and one for children with special dietary needs. The authorized foods contained in the packages included iron-fortified infant formula, infant cereal, milk, cheese, eggs, iron-fortified

breakfast cereal, and fruit or vegetable juice that contains vitamin C (44 FR 69255). The food packages were designed for group participant population categories that consume the same general kinds of foods, with the intent that local WIC agencies would tailor the packages to suit the nutritional needs of the individual. However, a 1979 study conducted by the U.S. General Accounting Office concluded that nearly all WIC participants were given the maximum allowable quantities of the WIC foods without any attempts to tailor the kinds and amounts of food to meet the nutritional needs of individuals (U.S. General Accounting Office, 1979). This lack of adjustment of the packages resulted in criticism that WIC was promoting overfeeding and encouraging waste (44 FR 69256).

In 1980, the number of food packages increased from three to six: infants 0 through 3 months, infants 4 through 12 months, children/women with special dietary needs, children 1-5 years, pregnant and breastfeeding women, and nonbreastfeeding postpartum women. The increase was made to take into account the different nutritional needs of participants and the belief that little tailoring was taking place (45 FR 74861). The food group “dried beans/peas/or peanut butter” was added to the food packages of children and pregnant and breastfeeding women to increase food variety and enhance the nutrient value. At the same time, the quantities of some other foods were revised; for example, limits were placed on the amount of cheese (to control costs as well as curb sodium levels), and a maximum level of 6 grams of sugar per dry ounce for adult cereals was established as a result of concern over sugar’s contribution to dental caries.

In 1992, a seventh package—an enhanced food package for breastfeeding women whose infants do not receive infant formula from WIC—was established to support and promote breastfeeding (57 FR 56231). The new package added two new food items—carrots and canned tuna—along with increased amounts of juice, cheese, and beans/peas and peanut butter, to the items provided in the food package for pregnant and breastfeeding women.