

# WIC Infant and Toddler Feeding Practices Study-2: Third Year Report

## Executive Summary

### Authors

Nancy Weinfield, Ph.D.  
Christine Borger, Ph.D.  
Thea Zimmerman, M.S., R.D.  
Jill DeMatteis, Ph.D.  
Crystal MacAllum, Ph.D.  
Shannon Whaley, Ph.D.

Lorrene Ritchie, Ph.D., R.D.  
Lauren Au, Ph.D., R.D.  
Linnea Sallack, M.P.H, R.D.  
Laurie May, Ph.D.



**August 2019**

Prepared for:  
Danielle Berman, Ph.D.  
Office of Policy Support  
Food and Nutrition Service, USDA  
3101 Park Center Drive  
Alexandria, VA 22302  
(703) 305-2098

Prepared by:  
Westat  
*An Employee-Owned Research Corporation*<sup>®</sup>  
1600 Research Boulevard  
Rockville, Maryland 20850-3129  
(301) 251-1500

# **WIC Infant and Toddler Feeding Practices Study-2: Third Year Report**

August 2019

Task Order Number: AG-3198-K-14-0031

## **Authors:**

Nancy Weinfield, Ph.D., Westat  
Christine Borger, Ph.D., Westat  
Thea Zimmerman, M.S., R.D., Westat  
Jill DeMatteis, Ph.D., Westat  
Crystal MacAllum, Ph.D., Westat  
Shannon Whaley, Ph.D., PHFE WIC  
Lorrene Ritchie, Ph.D., R.D., Nutrition Policy Institute, Division of Agriculture and Natural Resources,  
University of California  
Lauren Au, Ph.D., R.D., Nutrition Policy Institute, Division of Agriculture and Natural Resources,  
University of California  
Linnea Sallack, M.P.H., R.D., Altarum Institute  
Laurie May, Ph.D., Westat

**Submitted by:**  
Westat  
1600 Research Blvd.  
Rockville, MD 20850 -3129

**Submitted to:**  
Danielle Berman, Ph.D.  
Office of Policy Support  
Food and Nutrition Service, USDA  
3101 Park Center Drive  
Alexandria, VA 22302

# Acknowledgement

The WIC Infant and Toddler Feeding Practices Study (ITFPS-2) is being conducted under the direction of the Office of Policy Support in the Food and Nutrition Service, USDA. We would like to thank Jay Hirschman, Melissa Abelev, Reneé Arroyo-Lee Sing, Tameka Owens, Allison Magness, Courtney Paolicelli, Danielle Berman, Kelley Scanlon, Anne Bartholomew, Valery Soto, Lisa Southworth, and Patricia MacNeil for their guidance and support of the study.

Study recruitment would not have been possible without the generous support of the 27 WIC State Agencies and the 80 WIC sites within those states and territories. Their cooperation and collaboration with the Westat team resulted in a highly successful recruitment phase and high response rates for the subsequent interviews.

Suzanne McNutt, who led the study at Westat from its inception until 2015, is the source of many of the study's strengths and innovations. Her leadership and its lasting effects allow the study to continue to flow and reach its goals. We are also grateful to Dr. Gail Harrison (University of California, Los Angeles) for her insightful contributions to the study during her tenure as Principal Investigator of the study from its inception in 2011 until 2015.

The Peer Advisory Panel offered valuable guidance on study design and analysis issues. The Advisory Panel members, experts in the fields of child development, infant feeding, and WIC research, included Maureen Black (Department of Pediatrics and Epidemiology, University of Maryland); Sally Findley (Columbia University Population Center); Larry Grummer-Strawn (formerly of the Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention); Suzanne Murphy (Cancer Research Center of Hawaii, University of Hawaii); Zoë Neuberger (Center on Budget and Policy Priorities); Peggy Trouba (State WIC Director, Nebraska Department of Health and Human Services); and Pat Crawford (Nutrition Policy Institute, Division of Agriculture and Natural Resources, University of California).

At Westat, Beth Mittl played a key role in coordinating the systems development and data management activities. Brenda Sun, a statistical programmer, supported the analytic work. Bibi Gollapudi managed the day-to-day recruitment activities. Chris Manglitz assisted with analysis. Through the Westat Telephone Research Center several staff members led computer-assisted telephone interview (CATI) activities, including Kendall Butler (CATI instrument design), Shannon Evans (CATI instrument development), and Peggy Corp (CATI training and operations).

Human subjects' protections for the study are overseen by 17 Institutional Review Boards (IRBs), including: Westat; state Department of Health IRBs in CA, CT, FL, GA, LA, MD, MI, NY, OH, OK, PA, SC, TN, and TX; and local IRBs at Arrowhead Regional Medical Center in San Bernardino, CA, and Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center, CA. We appreciate the effort these IRBs have made in overseeing human subjects' protections. We also appreciate the cooperation of all participating State Departments of Health in providing WIC administrative data for the study. Use of these data does not imply that the IRBs, State Departments of Health, or WIC State Agencies and sites agree or disagree with any presentations, analyses, interpretations or conclusions in this report.

## Table of Contents

	<u>Page</u>
WIC ITFPS-2 Third Year Report Executive Summary.....	1
Overview of Study Goals and Methods.....	1
Environmental Engagement of WIC ITFPS-2 Families .....	3
Work and School.....	3
Child Care Use.....	4
Participation in Federal Food Benefit Programs.....	4
Medical Care .....	5
Feeding Beliefs and Practices.....	6
Access to Fresh Fruits and Vegetables .....	6
Feeding Beliefs and Practices .....	6
Changes Made Due to WIC .....	9
Food Intake and Diet Quality.....	9
Fruits, Vegetables, Dairy, Grains, Meats and Other Protein Sources .....	9
Desserts and Sweets, Sugar Sweetened Beverages, and Salty Snacks.....	11
Indicators of Diet Quality.....	11
Energy and Nutrient Intake .....	12
Energy Intake .....	13
Macronutrient and Micronutrient Intake.....	13
Weight and Growth.....	15
BMI Percentile Group Distributions in the Third Year.....	16
Characteristics Associated with Child BMI Percentile Group .....	16
Associations between WIC Participation and Key Outcomes .....	17

	<u>Page</u>
Summary, Limitations, and Next Steps .....	18
Summary of Findings .....	18
Interpreting Study Findings .....	19
Next Steps .....	20

**Tables**

1	Median micronutrient intake of study children compared to recommendations (month 36) .....	14
2	Median micronutrient intakes of study children that exceed the tolerable upper intake level (month 36).....	15

**Figures**

1	The percentage of WIC ITFPS-2 mothers working and going to school (month 30) .....	3
2	Among study children in regular child care, current type of child care (Month 30).....	4
3	The percentage of WIC ITFPS-2 families who participate in WIC, SNAP, or School Meals or Summer Food Programs (months 30 and 36).....	4
4	Percentage of study mothers agreeing with select barriers to consumption of fresh fruits and vegetables (month 30).....	6
5	Percentage of study mothers engaging in select feeding practices (month 30) .....	7
6	Percentage of study mothers who consider their children to be picky eaters (month 30) .....	7
7	Percentage of study mothers reporting how often the television is on during meals (month 30).....	8
8	Frequency of families sitting down for meals together in the past week (month 30) .....	8

<b>Figures</b>		<b>Page</b>
9	Percentage of study mothers reporting making a change due to something learned at WIC (month 30).....	9
10	Percentage of study children consuming select food groups on a given day as compared to FITS 2016 .....	10
11	Percentage of study children consuming desserts and candy, sugar-sweetened beverages, and salty snacks on a given day (month 36) .....	11
12	Average Healthy Eating Index (HEI-2015) score for study children (month 36).....	11
13	Consumption of DGA recommended servings for food groups by study children (month 36).....	12
14	Study children’s median energy intake by gender (month 36) .....	13
15	The percentage of study children by third year BMI percentile groups .....	16

# WIC ITFPS-2 Third Year Report Executive Summary

## *Key Findings:*

- **WIC ITFPS-2 mothers are working and going to school.** Fifty-five percent of study mothers with 30-month old children have work and/or school commitments. At 30 months, 49 percent of study mothers are working, 15 percent are in school, and 9 percent of these women are combining work and school. Mothers of children not receiving WIC at 24 months are more likely than those receiving WIC to be working and/or going to school, or using child care.
- **WIC ITFPS-2 families are making use of nutrition- and health-promoting resources.** More than half of study children and/or mothers are still receiving WIC at 30 and 36 months (63 and 59 percent, respectively). Approximately half of study families participate in SNAP, about a third have a child participating in the National School Lunch Program, School Breakfast Program, or Summer Food Service Program. Mothers of children receiving WIC at 24 months are more likely than those not receiving WIC to be participating in SNAP, school and summer food programs, and Medicaid. More than 90 percent of study children have a medical home, and more than 90 percent went to a doctor for a well-child visit around the time of their second birthday. Almost 70 percent of study mothers say they have made a change in how they feed themselves or their families due to something they learned from WIC.
- **WIC ITFPS-2 families are engaging in some health-promoting feeding practices.** At 30 months, only 1 in 7 study mothers reports that her child is a very picky eater, and nearly 65 percent of families are eating at least 5 meals together during the week. However, televisions are on during meals at least some of the time in over half of study households. Children receiving WIC at 24 months are less likely than those off WIC at 24 months to be identified as picky eaters, or to have the television on during meals at 30 months.
- **WIC ITFPS-2 children are consuming a varied diet at 36-months old.** This includes fruits, vegetables, dairy, grains, and meats and other proteins. They are also, however, consuming desserts, candy, sugar-sweetened beverages, and salty snacks. Diet quality of study children leaves room for improvement, but is consistent with findings from other studies of young children. However, children have high levels of inadequate intakes of vitamin D, vitamin E, and potassium and median intakes of niacin, magnesium, folate, vitamin A, zinc, and sodium exceeds tolerable upper intake levels.
- **Child BMI in the third year is in line with national trends.** At age 3 years, 65 percent of study children are in the normal/healthy range of BMI-for-age percentiles. Few (4 percent) fall into the underweight range, but 14 percent fall into the overweight BMI percentile range, and 17 percent fall into the obese range. The high rates of overweight and obesity at age 3 are of public health concern, but are in line with trends seen for preschool-aged children in the national population.

## Overview of Study Goals and Methods

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) was established to safeguard the health of low-income pregnant women, infants, and children who are at

nutritional risk. The program was established by Congress as a pilot in 1972 under Public Law 92-433, Section 17 of the Child Nutrition Act of 1966, and made permanent in 1974.<sup>1</sup> The program, administered by the Food and Nutrition Services (FNS) of the U.S. Department of Agriculture (USDA), provides supplemental foods, nutrition education, including breastfeeding promotion and support, and health care referrals for low-income pregnant and postpartum women, and their infants and children up to age 5.

This report describes socio-demographic and environmental characteristics, feeding beliefs and practices, nutrition, and weight status of children currently or previously enrolled in WIC, at 30 and 36 months old, as part of the longitudinal WIC Infant and Toddler Feeding Practices Study (WIC ITFPS-2). By capturing data on mothers<sup>2</sup> and their children who were initially enrolled in WIC over the first 6 years of the child's life, the study informs a series of research questions regarding family circumstances, feeding practices, the associations between WIC services and those practices, and the health and nutrition outcomes of children receiving WIC. The study updates information about the population WIC serves. Additionally, the study draws comparisons to other national infant and toddler feeding studies that include both WIC and non-WIC participants.

WIC ITFPS-2 incorporates a core longitudinal sample (with up to 18 caregiver interviews occurring over the course of 72 months) and a supplemental sample with less frequent interviews to ensure cross-sectional precision in estimates at key points in time. Study mothers were recruited in person as they enrolled in selected eligible WIC sites<sup>3</sup> during the summer or fall of 2013 (either prenatally or before their infant was 2.5 months old). They were recruited from 80 sampled WIC sites, located in 27 states and territories nationwide. Interviews are conducted by telephone in English or Spanish. In addition, the study team periodically obtains data on child weight and height from WIC administrative records or from child health care providers. This report on the third year of life uses data from the 1-, 3-, 5-, 7-, 9-, 11-, 13-, 15-, 18-, 24-, 30-, and 36-month interviews, timed to child age. Participants are retained in the study regardless of their WIC participation status after enrollment. The participant surveys that are the primary focus for this report are those during the third year of life, the 30- and 36-month participant interviews, as well as the WIC administrative or

---

<sup>1</sup> U.S. Department of Agriculture, Food and Nutrition Service. About WIC's Mission. <http://www.fns.usda.gov/wic/about-wic-wics-mission>. Accessed September 27, 2017.

<sup>2</sup> Over 98 percent of respondents are biological mothers. Throughout the report the terms "mother" and "caregiver" are used interchangeably.

<sup>3</sup> Sites were excluded for operational and design reasons, including geographic location (American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and U.S. Virgin Islands), and small sites that were expected, on average, to enroll less than 30 new pregnant women/newborns per month.

health care provider data on child weight and height around the time of the third birthday. Whereas the 30-month interview focuses broadly on health, lifestyle, feeding practices and experiences, and childrearing practices, the 36-month interview focuses more specifically on the child’s dietary intake.

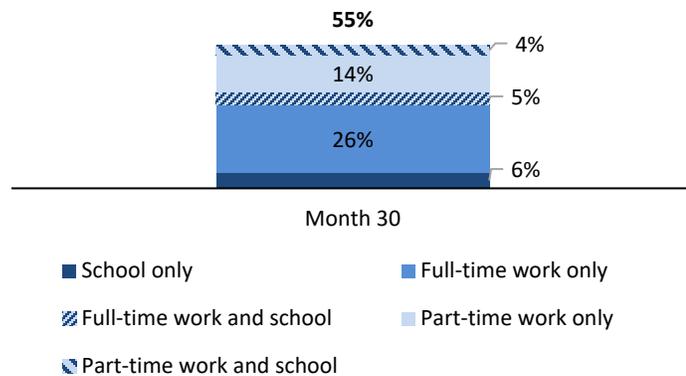
The data in this report are based on the 3,777 caregivers who completed at least a 1- or 3-month interview, although the unweighted number of cases may be smaller due to interview or item nonresponse, and analyses sometimes utilize specific subsets of the data to address subgroups of interest. The data are weighted to represent the national population of study-eligible infants enrolled in WIC at an eligible WIC site for the first time during the study’s 20-week recruitment period in 2013,<sup>4</sup> and to account for interview nonresponse. Study findings represent the characteristics, views, behaviors, and experiences of this national population.

## Environmental Engagement of WIC ITFPS-2 Families

### Work and School

More than half (55%) of study mothers with 30-month old children have work and/or school commitments. At 30 months, 49 percent of study mothers are working for pay, 15 percent are in school, and 9 percent of these women are combining work and school. Figure 1 shows the total percentages of mothers in school, working full-time or part-time, or in school while working 30 months. Mothers of children not receiving WIC at 24 months are more likely to be working and/or going to school at 30 months than mothers of children receiving WIC.

**Figure 1. The percentage of WIC ITFPS-2 mothers working and going to school (month 30)**

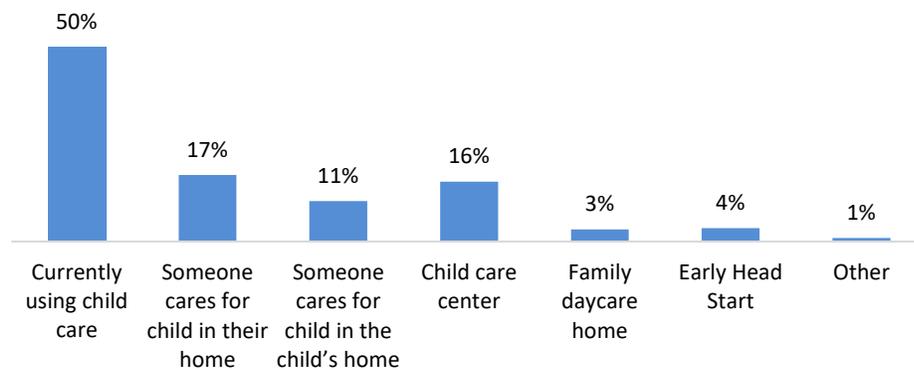


<sup>4</sup> Eligible mothers were either pregnant, or their infants were less than 3 months old. Mothers were at least 16 years old at the time of enrollment, and spoke either English or Spanish.

## Child Care Use

Regular child care is defined for WIC ITFPS-2 as an arrangement in which someone other than the child’s primary caregiver or the other parent cares for the child on a regular basis. The use of regular non-parental child care arrangements is increasing as children get older. Half of WIC ITFPS-2 children (50 percent) are currently in child care at age 30 months, which is a slight increase over the 44 percent who were in child care at age 24-months. At 30 months the most common type of arrangement is having a provider care for the child in the provider’s own home (Figure 2).

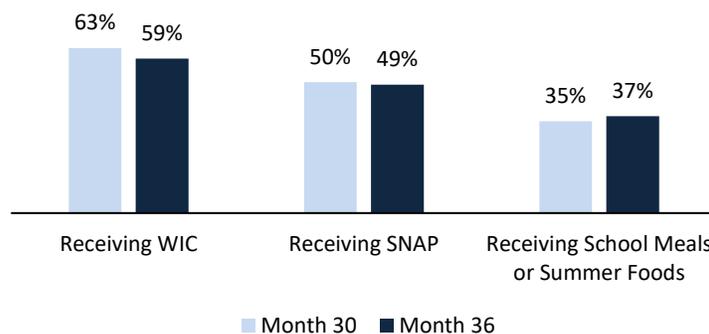
**Figure 2. Among study children in regular child care, current type of child care (Month 30)**



## Participation in Federal Food Benefit Programs

The study explores whether families are making use of federal food benefit programs such as continued participation in WIC by the study child or mother, participation in WIC for another child in the household other than the study child, and participation of household members in the Supplemental Nutrition Assistance Program (SNAP), and the National School Lunch Program (NSLP), School Breakfast Program (SBP),

**Figure 3. The percentage of WIC ITFPS-2 families who participate in WIC, SNAP, or School Meals or Summer Food Programs (months 30 and 36)**



or Summer Food Service Program (SFSP). Program participation questions are asked during interviews at both 30 and 36 months, thus results are reported for both months. Of note is that these reports of program participation, and of household income, are self-reported by the study respondents. Neither income nor program participation is independently verified by the study.

At both 30 and 36 months, more than half (63 and 59 percent, respectively) of study children and/or mothers are still receiving WIC, and in approximately a quarter of families, another child is receiving WIC. Study families are also receiving benefits from other federal food benefit programs, as half the families participate in SNAP, and approximately a third have a child who participates in NSLP, SBP, or SFSP (Figure 3).

## **Medical Care**

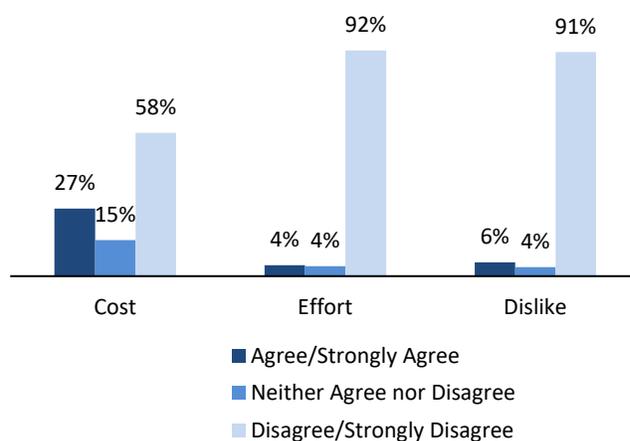
Nearly all study children are receiving health care. More than 90 percent of study mothers report that their children have a medical home, and had a well-visit around the second birthday. Their households are also engaged with systems that promote health care receipt, as 3 in 4 mothers report that someone in the household is receiving Medicaid.

## Feeding Beliefs and Practices

### Access to Fresh Fruits and Vegetables

Nearly 90 percent of study mothers report that fresh fruits and vegetables are available and plentiful in their communities, and about 75 percent are positive about the quality of the produce available to them. No clear barriers to consumption of fresh fruits and vegetable are reported, as mothers indicate that neither the effort required to prepare fresh fruits and vegetables, nor dislike for them, are reasons why it is difficult for them to include them in their diets. Cost emerges as an issue for some mothers, but over half of study mothers disagree or strongly disagree that cost is a deterrent (Figure 4).

**Figure 4. Percentage of study mothers agreeing with select barriers to consumption of fresh fruits and vegetables (month 30)**



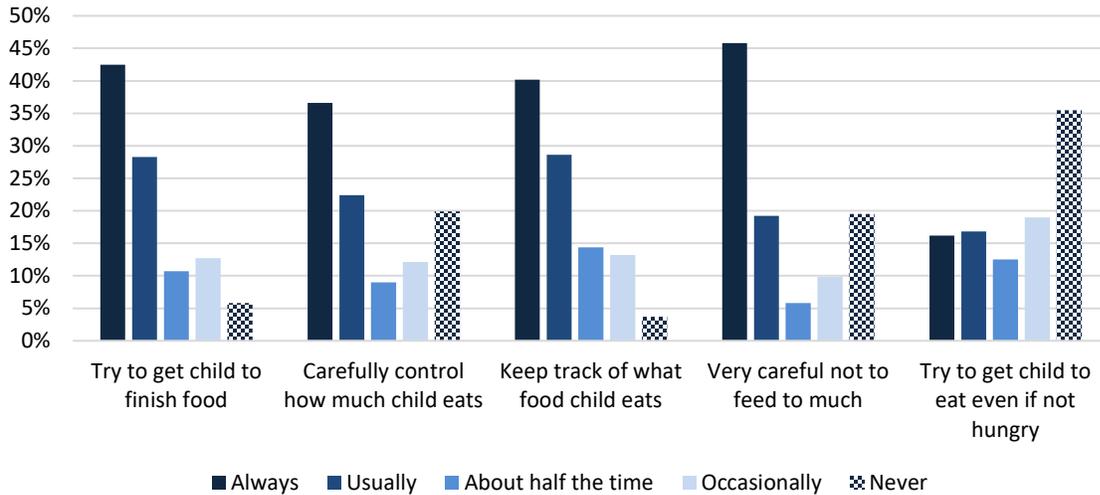
### Feeding Beliefs and Practices

WIC ITFPS-2 mothers were asked at the 30 month interview about their beliefs and practices for feeding young children. Feeding beliefs that emphasize parental control over child food consumption are held by many study mothers, particularly with regard to how much children should eat. Forty percent of mothers agree or strongly agree that it is important for children to finish all the food on their plates, and 58 percent believe it is important for parents to decide how much children eat.

Feeding practices, like beliefs, tend to emphasize parental control over child consumption (Figure 5). Most mothers (72%) report always or usually trying to get the child to finish food, and 59 percent report that they always or usually carefully control how much the child eats. Sixty-nine percent of mothers report that they always or usually keep track of what the child eats, and 65 percent are always or usually careful not to feed the child too much. Thirty-three percent of mothers report

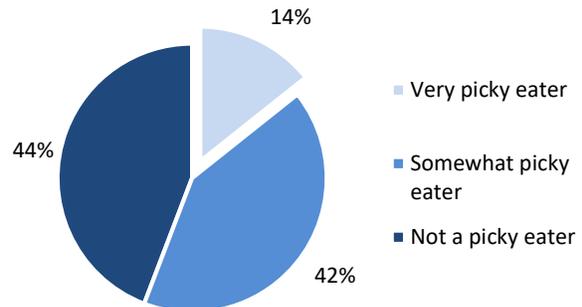
always or usually trying to get the child to eat even if he or she is not hungry, and 36 percent report never doing so.

**Figure 5. Percentage of study mothers engaging in select feeding practices (month 30)**



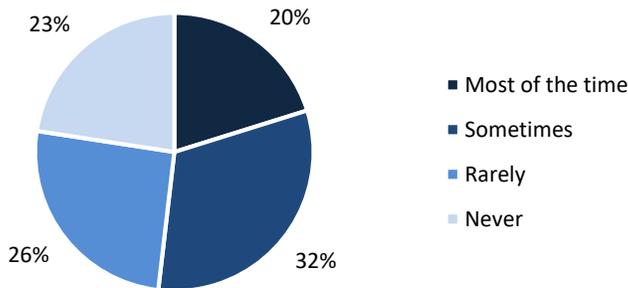
Picky eating is a common issue in the third year of life. Nonetheless, only 1 in 7 WIC ITFPS-2 mothers reports that her 30-month old child is a very picky eater, and 71 percent report introducing a new food 3 or more times before deciding that the child does not like it (Figure 6).

**Figure 6. Percentage of study mothers who consider their children to be picky eaters (month 30)**



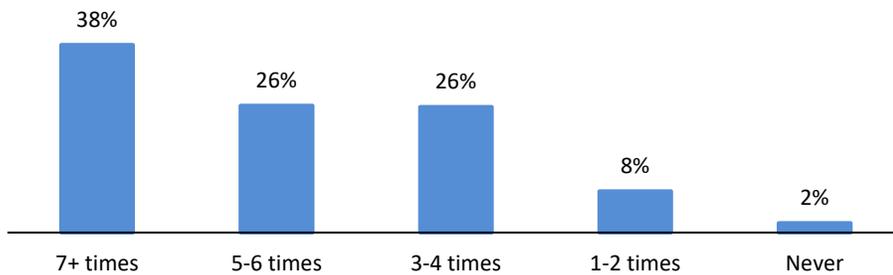
At 30 months the study asks about mealtime practices, such as limiting TV and other screens at meals, and regularly eating family meals. Nearly half of study mothers report that the television is rarely or never on during mealtimes, although 20 percent of study mothers report that the television is on during most mealtimes (Figure 7).

**Figure 7. Percentage of study mothers reporting how often the television is on during meals (month 30)**



Families are eating meals together regularly, with nearly 65 percent of study mothers reporting that their families ate at least 5 meals together during the week. Nonetheless, 10 percent of families eat together less than 3 times in a week (Figure 8).

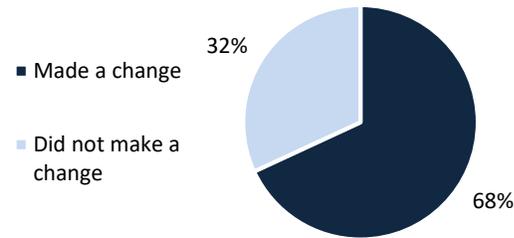
**Figure 8. Frequency of families sitting down for meals together in the past week (month 30)**



## Changes Made Due to WIC

Mothers report that WIC nutrition education is having an impact on their feeding practices. Almost 70 percent of study mothers report having made at least one change due to something they learned at WIC, including choosing more healthy foods, eating more fruits and vegetables, and offering appropriate portion sizes (Figure 9).

**Figure 9.** Percentage of study mothers reporting making a change due to something learned at WIC (month 30)



## Food Intake and Diet Quality

WIC ITFPS-2 study children are consuming a varied diet at 36 months old, including fruits, vegetables, dairy, grains, and meats and other proteins. However, many of the children are also consuming energy-dense, nutrient poor foods such as desserts, candy, sugar-sweetened beverages, and salty snacks.

### Fruits, Vegetables, Dairy, Grains, Meats and Other Protein Sources

At 36 months, 72 percent of WIC ITFPS-2 children are consuming a fruit other than juice on a given day, and 69 percent are consuming 100 percent fruit juice on a given day. Vegetable consumption among WIC ITFPS-2 remains lower, with 63 percent of the children consuming a vegetable on a given day at 36 months.

At 36 months, most of the children (85%) are consuming cow's milk on a given day. The most commonly consumed type of cow's milk is whole milk (32%); whereas, 31 percent consume either low-fat milk or skim milk, the types of milk provided by WIC to children over 24 months of age. Consumption of protein foods remains high, with 97 percent of children consuming a meat or another protein on a given day at 36 months.

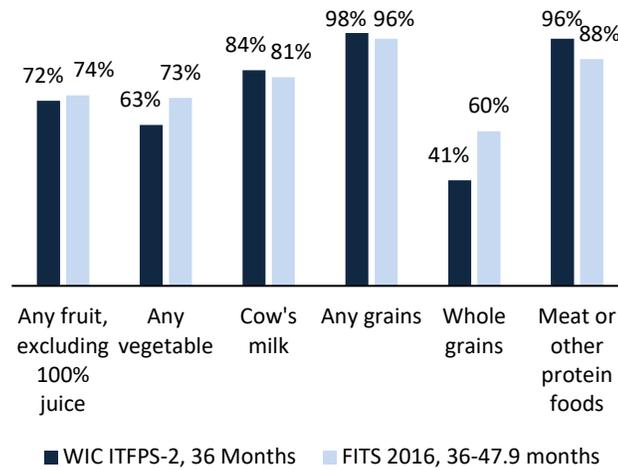
As was the case at 24 months, nearly all WIC ITFPS-2 children are consuming grains on a given day at 36 months (98%). Forty-one percent of study children are consuming a whole grain on a given

day at 36 months. Many of the whole grains are coming from whole grain breakfast cereals (available through the WIC food package), as 38 percent of study children are consuming whole grain breakfast cereals, yet only 1 percent are consuming whole grain bread and rolls.

These consumption patterns follow the same basic trends seen in the 2016 Feeding

Infants and Toddlers Study (FITS 2016), the latest in a well-known series of national studies of infant and toddler feeding practices.<sup>5</sup> At age 3 the consumption rates of fruits, vegetables, grains, cow’s milk, and meat or other protein foods are similar across the two studies. A lower percentage of WIC ITFPS-2 children than FITS 2016 children, however, are consuming whole grains (41% and 60%, respectively)(Figure 10).

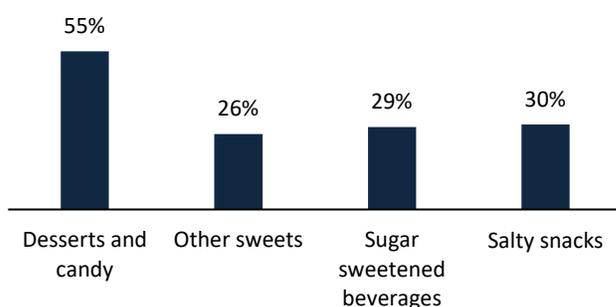
**Figure 10. Percentage of study children consuming select food groups on a given day as compared to FITS 2016**



<sup>5</sup> Welker, E., Jacquier, E., Catellier, D., Anater, A., & Story, M. (2018). Room for improvement remains in food consumption patterns of young children aged 2–4 years. *Journal of Nutrition*, 148, 1-11.

## Desserts and Sweets, Sugar Sweetened Beverages, and Salty Snacks

**Figure 11.** Percentage of study children consuming desserts and candy, sugar-sweetened beverages, and salty snacks on a given day (month 36)



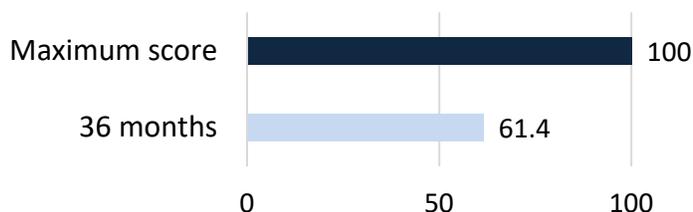
By 36 months, slightly more than half (55 percent) of study children are consuming a dessert or candy on a given day, 29 percent of the children are consuming a sugar sweetened beverage such as fruit drinks or carbonated sodas, and 30 percent are consuming a salty snack on a given day (Figure 11).

## Indicators of Diet Quality

Diet quality of WIC ITFPS-2 children was assessed both through the Healthy Eating Index 2015<sup>6</sup> and through the US Department of Agriculture’s (USDA) and Department of Health and Human Services Dietary Guidelines for Americans (DGAs) recommendations for food group intake for 3-year-old children.<sup>7</sup>

The Healthy Eating Index-2015 (HEI) is a standard measure of diet quality for age 2 years and above that conforms to the DGA. Using data from the 24-hour dietary recall, with a usual intake adjustment, the HEI produces both scores for dietary components and a total score. Total scores of 100 on the HEI indicate that the individual is fully meeting the DGA. The average total score on the HEI-2015 for 36-month

**Figure 12.** Average Healthy Eating Index (HEI-2015) score for study children (month 36)

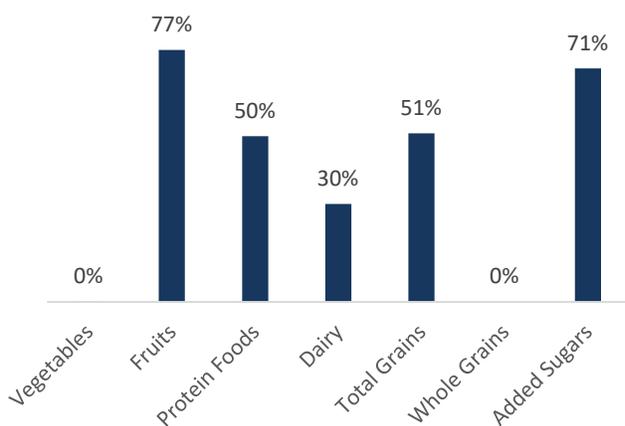


<sup>6</sup> National Cancer Institute (2018). Developing the Healthy Eating Index. February 12, 2018. <https://epi.grants.cancer.gov/hei/developing.html#2015> Accessed September 15, 2018.

<sup>7</sup> U.S. Department of Health and Human Services and U.S. Department of Agriculture (2015). 2015–2020 Dietary Guidelines for Americans. 8th Edition. Available at <http://health.gov/dietaryguidelines/2015/guidelines/>. Accessed September 15, 2018.

old WIC ITFPS-2 children is 61.4 (Figure 12), far below the optimal range of 81 or above,<sup>8</sup> but consistent with the score of 62.1 from previous research on young children from low-income families, and somewhat higher than the 59.9 average score of the age-matched national population<sup>9</sup>.

**Figure 13. Consumption of DGA recommended servings for food groups by study children (month 36)**



Another way to examine the quality of children’s diets is to look at whether the WIC ITFPS-2 children are meeting the DGAs by consuming the recommended amounts of select food groups (Figure 13). Analysis of consumption of DGA recommended food group servings shows that while high percentages of WIC ITFPS-2 children meet the DGAs for consumption of fruits (including 100% juice) (77%) and consume less than the recommended maximum for added sugars (71%), improvement is particularly needed with regard to the DGAs for consumption

of vegetables (0.1%) and whole grains (0.0%).

## Energy and Nutrient Intake

To examine dietary intake comprehensively, the total energy (as measured in kilocalories), macronutrient, and micronutrient contents of individuals’ diets are typically calculated, and nutrient intake is compared to existing standards or references such as the Dietary Reference Intakes (DRI). DRIs are nutrient standards, developed by the Institute of Medicine of the National Academy of Sciences,<sup>10</sup> that can be used as a point of comparison to estimate the prevalence of inadequate intakes.

<sup>8</sup> Carlson, A., Lino, M., Gerrior, S., & Basiotis, P. (2001). Report card on the diet quality of children ages two to nine. Washington (DC): United States Department of Agriculture. *Center for Policy and Promotion*.

<sup>9</sup> Page, J. D., Crixell, S. H., Beidiger-Friedman, L., Markides, B., & Bishop, N. D. (2017). Comparison of Healthy Eating Index-2010 Scores of Preschool-Aged Children in a High Risk Community to Those of an Age-Matched National Sample (NHANES 2009–2012). *The FASEB Journal*, 31(1\_supplement), 169-3.

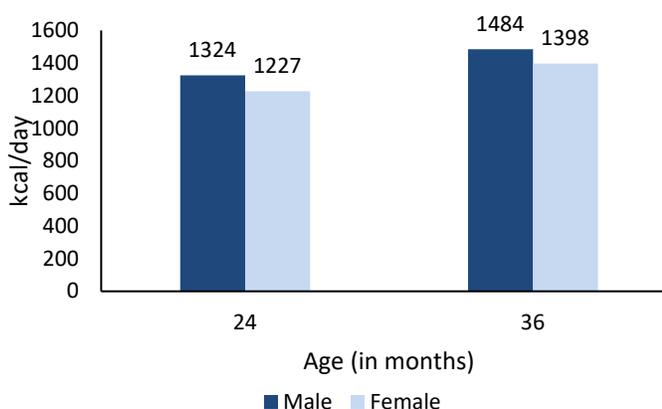
<sup>10</sup> Institute of Medicine (IOM). (2000). *Dietary Reference Intakes: Applications in Dietary Assessment*. Washington, DC: The National Academies Press.

## Energy Intake

Data from WIC ITFPS-2 suggest that young children’s median energy intakes continue to increase as the children age (Figure 14). Between ages 24 and 36 months, median energy intake increases by 12 percent for male children, and by 14 percent for female children. At both time points, males have higher median energy intakes than females; this is expected given that energy requirements for male children between ages 1-3 is slightly higher than that of female children.

According to the DRIs, the recommended daily caloric intake ranges from 1,162 kcal/day for sedentary three-year-old boys to 1,485 kcal/day for active three-year-old boys, and from 1,080 kcal/day for sedentary three-year-old girls to 1,395 kcal/day for active three-year-old girls.<sup>11</sup> Although no relevant measure of activity level is available for WIC ITFPS-2 children, and measurements on the day of the dietary intake are not available, median energy intakes for study children may be exceeding recommendations.

**Figure 14. Study children’s median energy intake by gender (month 36)**



## Macronutrient and Micronutrient Intake

Essential macronutrients (i.e., protein, carbohydrate, and fat) are needed in relatively large quantities to provide energy and promote growth, whereas micronutrients (i.e., vitamins and minerals) are needed in smaller amounts, but are still essential for various physiological and metabolic processes.

Median carbohydrate and protein intakes of study children meet or exceed recommended levels at 36 months. Additionally, median fat, carbohydrate, and protein intakes all fall within acceptable

---

<sup>11</sup> Dietary Reference Intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids (2002/2005). Dietary Reference Intakes (DRIs) for age 3 years are based on reference weight and height for boys of 31.5 pounds and 37.4 inches, and reference weight and height for girls of 30.6 pounds and 37 inches. Retrieved from <http://www.nationalacademies.org/hmd/~media/Files/Activity%20Files/Nutrition/DRI-Tables/5Summary%20TableTables%2014.pdf?la=en> on September 7.

levels as percentages of total daily energy intake at 36 months, which are based on the ideal range necessary to reduce chronic disease risk.

With the exception of vitamin D,<sup>12</sup> potassium, and vitamin E, the median intake levels of WIC ITFPS-2 study children both meet or exceed recommended levels, and have low estimates of inadequate intake at 36 months (Table 1).

The estimate of the prevalence of inadequate intakes for vitamin D is 82.1 percent at 36 months, and for vitamin E is 27.1 percent at 36 months. Median intake of potassium at 36 months is below the recommended level, suggesting inadequate intake in the population; however, there is no estimated average requirement from which to estimate the exact prevalence of inadequate intake.

**Table 1. Median micronutrient intake of study children compared to recommendations (month 36)**

Micronutrients	Adequate Intake or Estimated Average Requirement	Month 36	
		Median intake	Percent Inadequate intakes <sup>c</sup>
<b>Antioxidants</b>			
Vitamin C (mg/d)	13 <sup>b</sup>	94.2	0.0%
Vitamin E (mg/d)	5 <sup>b</sup>	6.0	27.1
<b>B vitamins</b>			
Thiamin (mg/d)	0.4 <sup>b</sup>	1.4	0.0
Riboflavin (mg/d)	0.4 <sup>b</sup>	2.0	0.0
Niacin (mg/d)	5 <sup>b</sup>	18.3	0.0
Vitamin B-6 (mg/d)	0.4 <sup>b</sup>	1.8	0.0
Folate (µg/d)	120 <sup>b</sup>	370.3	0.0
Vitamin B-12 (µg/d)	0.7 <sup>b</sup>	5.0	0.0
<b>Bone-related nutrients</b>			
Calcium (mg/d)	500 <sup>b</sup>	981.5	0.7%
Phosphorus (mg/d)	380 <sup>b</sup>	1090	0.0
<b>Bone-related nutrients (Continued)</b>			
Magnesium (mg/d)	65 <sup>b</sup>	208.8	0.0
Vitamin D (µg/d)	10 <sup>b</sup>	7.8	82.1%
<b>Other micronutrients</b>			
Vitamin A (µg RAE/d)	210 <sup>b</sup>	663.3	0.0
Vitamin K (µg/d)	30 <sup>a</sup>	42.8	NA
Iron (mg/d)	3.0 <sup>b</sup>	13.1	0.0
Zinc (mg/d)	2.5 <sup>b</sup>	8.9	0.0
Sodium (mg/d)	1000 <sup>a</sup>	2220	NA
Potassium (mg/d)	3000 <sup>a</sup>	2125	NA

<sup>12</sup> DRIs for vitamin D are based on an assumption of little or no sun exposure, although individuals' vitamin D levels are increased by exposure to sunlight. Consequently, DRIs for vitamin D have been a subject of disagreement in the scientific literature (Ross et al., 2011).

Micronutrients	Adequate Intake or Estimated Average Requirement	Month 36	
		Median Intake	Percent inadequate intakes <sup>c</sup>
Unweighted n		2,586	
Weighted n		438,319	

<sup>a</sup> Adequate Intake (AI)

<sup>b</sup> Estimated Average Requirement (EAR)

<sup>c</sup> Prevalence of inadequate intakes is estimated as the percentage of the group falling below the EAR, NA indicates no EAR is available. For iron, which is not normally distributed in the population, the full probability method for determining average risk of inadequate intake was used.

At the other end of the spectrum, median intakes of several micronutrients are above the tolerable upper intake level (UL) at 36 months, which is the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects (Table 2). Median intake of niacin, folate, magnesium, vitamin A, zinc are all above their ULs. Median sodium intake is 1.5 times the UL of 1500 mg/d at 36 months.

**Table 2. Median micronutrient intakes of study children that exceed the tolerable upper intake level (month 36)**

Micronutrients	UL	Median Intake Month 36
Niacin (mg/d)	10	18.3
Folate (µg/d)	300	370.3
Magnesium (mg/d)	65	208.8
Vitamin A (µg RAE/d)	600	663.3
Zinc (mg/d)	7	8.9
Sodium (mg/d)	1500	2220
Unweighted n		2,586
Weighted n		438,319

## Weight and Growth

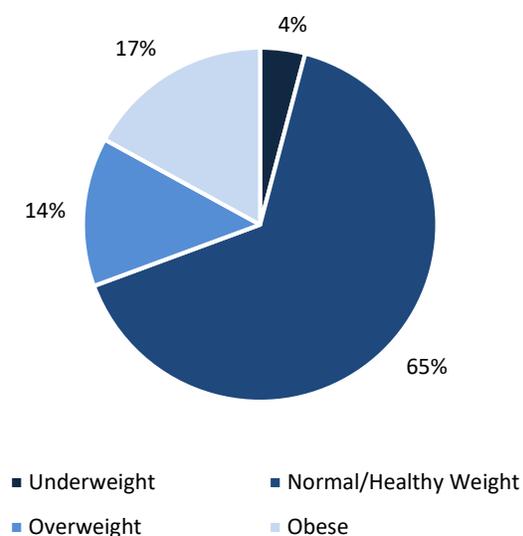
Study children are weighed and their height is measured, either by WIC site staff or by a health care provider, around the time of their third birthday (32-40 months old). Study children's weight and growth outcomes are categorized into the U.S. Centers for Disease Control and Prevention recommended body mass index (BMI)-for-age classifications: underweight (less than the 5<sup>th</sup> percentile), normal/healthy weight (5<sup>th</sup> to <85<sup>th</sup> percentile), overweight (85<sup>th</sup> to <95<sup>th</sup> percentile), or obese (95<sup>th</sup> percentile and above)<sup>13</sup>

<sup>13</sup> Centers for Disease Control and Prevention (CDC) (2018). National Center for Health Statistics [Web page]. [https://www.cdc.gov/growthcharts/growthchart\\_faq.html](https://www.cdc.gov/growthcharts/growthchart_faq.html). Accessed May 13, 2018.

## BMI Percentile Group Distributions in the Third Year

Figure 15 presents the percentage distribution of study children into third year BMI-for-age percentile groups. Most study children (65%) have a BMI in the normal/healthy percentile range (5<sup>th</sup> to <85<sup>th</sup> percentile). Few (4%) are in the underweight range (less than 5<sup>th</sup> percentile). Fourteen percent are in the overweight range (85<sup>th</sup> to <95<sup>th</sup> percentile), and 17 percent are categorized as obese (95<sup>th</sup> percentile and above).

**Figure 15. The percentage of study children by third year BMI percentile groups**



The percentage of study children falling into the overweight (14%) and obese (17%) categories is of public health concern, similar to the higher than expected rates reported from other research on this age group. Data from the national estimates for the entire U.S. population from the 2015-2016 National Health and Nutrition Examination Study show that 10 percent of 2-5 year old children have BMIs in the overweight range, and 16 percent have BMIs in the obese range.<sup>14</sup> Research specifically with WIC children in southern California found that among 3-year old children, the obesity rate in 2014 was 17.9 percent.<sup>15</sup>

## Characteristics Associated with Child BMI Percentile Group

In multivariate logistic regression analyses, maternal BMI in the obese range at the 24 month interview, and feeding beliefs and practices at 30 months such as restricting snack foods and being very careful not to feed the child too much, significantly increase the odds of the child being in the overweight or obese BMI percentile group at age 3 (as compared to the healthy BMI percentile group). Breastfeeding at 1 month postpartum, and the mother self-identifying as in a racial group

<sup>14</sup> Skinner, A. C., Ravanbakht, S. N., Skelton, J. A., Perrin, E. M., & Armstrong, S. C. (2018). Prevalence of obesity and severe obesity in US children, 1999–2016. *Pediatrics*, e20173459.

<sup>15</sup> Nobari, T. Z., Whaley, S. E., Prelip, M. L., Crespi, C. M., & Wang, M. C. (2018). Trends in socioeconomic disparities in obesity prevalence among low-income children aged 2–4 years in Los Angeles County, 2003–2014. *Childhood Obesity*.

other than African-American or White (as compared to self-identifying in the White racial group) each decreases the odds of the child being in the overweight or obese BMI percentile group at age 3.

## **Associations between WIC Participation and Key Outcomes**

The study explores WIC program participation status at 24 months and its association with key outcomes at child age 30 and 36 months. WIC Program participation at 24 months was selected as the participation marker rather than concurrent participation at 30 or 36 months, as leaving the WIC program would likely have a gradual effect on most outcomes that become evident over time, rather than immediate effects.

There are several findings that may indicate that mothers of children not receiving WIC at 24 months have improved financial circumstances at 30 or 36 months. Improved financial circumstances may have prompted them to discontinue WIC participation. Mothers of children not receiving WIC at 24 months are more likely than those receiving WIC to be working and/or going to school, or using child care, and less likely to be participating in SNAP, school and summer food programs, and Medicaid.

Families of children receiving WIC at 24 months seem to be engaging in feeding practices at 30 months that are consistent with the content of WIC nutrition education. As compared to children not receiving WIC at 24 months, children receiving WIC at 24 months are less likely to be identified as picky eaters at 30 months, and mothers whose children were receiving WIC at 24 months are less likely than their counterparts to report that the television is on most of the time during meals at 30 months.

There are several food group consumption differences at 36 months between children who were receiving WIC at 24 months and those who were not. Children receiving WIC at 24 months are more likely to consume 100 percent fruit juice on a given day than their counterparts, although there are no differences in the consumption of whole fruit (excluding juice). WIC participation is also significantly associated with vegetable consumption, with children receiving WIC at 24 months less likely to consume any vegetable on a given day at 36 months than their counterparts who do not receive WIC.

Children who are receiving WIC at 24 months are less likely to consume whole milk or reduced fat milk, and more likely to consume low fat milk at 36 months than are children who are not receiving WIC at 24 months. This is in line with the 2014 final rule for the contents of children’s food package for WIC, which typically provides low fat milk, and with the Dietary Guidelines for Americans (DGAs) (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015).

Looking at daily portions instead of any consumption on a given day, children receiving WIC at 24 months are also more likely to meet the DGAs for added sugars (i.e., consume less than the recommended maximum), but less likely to meet the DGAs for total grains, than children not receiving WIC at 24 months.

## Summary, Limitations, and Next Steps

### Summary of Findings

Results from the third year demonstrate that WIC ITFPS-2 families are actively engaged with their environments, and showing some health promoting behaviors:

- At 30 months, 49% of study mothers are working, and 15% are in school. Nine percent are doing both.
- More than half of study children and/or mothers are still receiving WIC at 30 and 36 months (63% and 59%, respectively).
- More than 90% of study children have a medical home, and more than 90% went to a doctor for a well-child visit around the time of their second birthday.
- 72% of the children consume a non-juice fruit, 69% consume 100 percent fruit juice, and 63% consume a vegetable on a given day.
- Most children are meeting the Dietary Guidelines for Americans (DGA) for servings of fruits (77%) and added sugars (71%).
- Median macronutrient intakes meet or exceed recommended levels at 36 months, and fall within acceptable levels as percentages of total daily energy intake.

- The median intakes of most, but not all, micronutrients meet or exceed recommended levels at 36 months.
- Almost 70% of study mothers say they have made a change in how they feed themselves or their families due to something they learned from WIC.

Some practices and outcomes reflect less healthy behaviors, and warrant monitoring as WIC ITFPS-2 continues:

- Televisions are on during meals at least some of the time in over 50% of study households.
- 82% of children are consuming a dessert, candy, other sweets, or sugar-sweetened beverage on a given day.
- Low percentages of children are meeting the DGA for servings of dairy (30%), vegetables (0.1%), or whole grains (0.0%).
- Dietary intakes of vitamin D and potassium are still falling below recommended levels. Intake of vitamin E exceeds recommended levels, but still has a prevalence of inadequate intake of 27 percent.
- Median sodium intake exceeds the recommended upper limit (UL) at 36 months, reaching 1.5 times the UL.
- At 3 years, although 65 percent of study children are in the normal/healthy range of BMI percentiles, 4 percent are underweight, 14 percent are overweight, and 17 percent are obese. The high rates of overweight and obesity at age 3 are of public health concern, but are in line with trends seen for preschool-aged children in the national population.

## Interpreting Study Findings

As with all research studies, design decisions and study-specific goals for WIC ITFPS-2 result in limitations to the conclusions that the study team can draw, both now and in future analyses. These limitations are most evident with regard to establishing causal relations, generalizing beyond the population represented by our probability sample, and disentangling caregiver perceptions from objective experiences.

This is an observational study, which is a design well-suited to studying the influences of ongoing public programs. Because of this observational study design, however, the study team can only infer causality between program predictors and outcomes rather than establishing it with certainty. The data are also limited in generalizability of the findings by the study eligibility rules and sample design.

Eligible mothers were either pregnant, or their infants were less than 3 months old, and they were enrolling in WIC for the first time for that pregnancy or child during our 20-week enrollment period in 2013. Mothers were at least 16 years old at the time of enrollment, and spoke either English or Spanish. WIC sites expected to serve small numbers of new participants each month were excluded from the sampling frame for operational purposes. There may be characteristics or feeding patterns not captured that pertain to mothers who are very young, who speak a language other than English or Spanish, who enroll in WIC for the first time after 3 months postpartum, or who receive services at smaller WIC sites.

Most of the study data about individual experiences and practices come from caregiver report during telephone interviews. Primary caregivers are the most knowledgeable informants about dietary intake and their feeding practices with their children, however, busy caregivers may at times be imperfect informants. Similarly, ongoing program participation is not verified through external records. Data reflect the perceptions and memories of the children's caregivers. Finally, not all issues related to childhood weight and health outcomes are apparent by age 3, and may not even be apparent by the time the study is completed at age 6. Factors beyond those explored in this study may influence, and continue to influence, eating and health as obesity risk continues into middle childhood and beyond.

## **Next Steps**

This is the fourth in a series of reports from the ongoing WIC ITFPS-2. Subsequent reports from the study will cover ages 4, 5, and 6 years, examining dietary intake, health outcomes, and family feeding practices of children initially enrolled in WIC. The data from WIC ITFPS-2, which the Food and Nutrition Service makes available, will also provide scientific researchers and the public with a landmark platform of data from which to pursue further analyses on nutrition and health in children of low-income families enrolled in WIC during pregnancy or early infancy.

There are many research topics from this report that will be carried forward and explored further in subsequent WIC ITFPS-2 reports. Three that are particularly notable are:

- WIC ITFPS-2 will continue to track median energy and nutrient intake among children beyond the first 3 years of life. Given WIC’s goal of safeguarding the health of low-income children by providing nutritious supplemental foods, it will be important to continue to examine the children’s dietary intakes.
- WIC ITFPS-2 will continue to follow the weight and height of WIC children through age 6 years, to understand the future trajectory of overweight and obese children in this population. Around the time of the third birthday, 14 percent of study children are overweight, and 17 percent are obese. Future reports will determine how weight status at age 3 relates to subsequent overweight or obesity status.
- As more WIC ITFPS-2 children discontinue WIC participation, future reports will examine the relationship between continued WIC participation and key outcomes in greater depth.