

## Current Research

# Feeding Infants and Toddlers Study: Characteristics and Usual Nutrient Intake of Hispanic and Non-Hispanic Infants and Toddlers

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*Editor's note: The Appendix that accompanies this article is available online at [www.adajournal.org](http://www.adajournal.org).*

### ABSTRACT

**Objective** To compare demographic and maternal characteristics and usual nutrient intakes of Hispanic and non-Hispanic infants and toddlers 4 to 24 months of age in the United States.

**Design** We conducted three interviews by telephone to collect information on sociodemographic and maternal characteristics, feeding practices, and dietary intake in the 2002 Feeding Infants and Toddlers Study. We collected 24-hour dietary recalls, including a second day's intake on a subsample, using the Nutrition Data System for Research. We used the Personal Computer version of the Software for Intake Distribution Estimation to estimate usual nutrient intake and nutrient adequacy and excess for three age subgroups—infants 4-5 months, infants 6-11 months, and toddlers 12-24 months—and Hispanic or non-Hispanic ethnicity.

**Subjects** A national sample of 3,022 infants and toddlers age 4-24 months, including 371 Hispanic and 2,637 non-Hispanic subjects.

**Statistical analysis** We compared means, percentile distributions, and percentages by age/Hispanic ethnicity subgroup, and applied the Dietary Reference Intakes to assess nutrient intakes.

**Results** Mothers of Hispanic infants and toddlers were younger, less likely to be married, and had lower education

levels than mothers of non-Hispanic infants and toddlers ( $P < .01$ ). Hispanic infants and toddlers had significantly higher rates of participation in the Special Supplemental Nutrition Program for Women, Infants, and Children than non-Hispanic infants and toddlers (42% to 23%) and were more likely to reside in urban areas and have lower annual household income levels ( $P < .01$ ). There were no significant differences in usual energy intake between Hispanic and non-Hispanic infants and toddlers, and mean usual energy intake exceeded the mean estimated energy requirement for all age/ethnicity subgroups. Hispanic toddlers consumed a significantly higher proportion of energy from carbohydrate (56% to 53%,  $P < .01$ ) and a significantly lower percentage of energy from fat (31% to 33%,  $P < .01$ ) than non-Hispanics. Comparing usual mean intakes, Hispanic infants age 6 to 11 months had a significantly lower intake of calcium than non-Hispanics (means of 574 mg and 626 mg per day, respectively,  $P < .05$ ) and a significantly higher intake of sodium compared with non-Hispanics of the same age (means of 647 mg to 476 mg per day,  $P < .01$ ). For infants, mean usual intakes were adequate for all nutrients. For toddlers, the prevalence of nutrient inadequacy was low ( $< 1\%$ ) with the exception of vitamin E, which was inadequate for 39% of Hispanic toddlers and 50% of non-Hispanic toddlers. For nutrients with defined Tolerable Upper Intake Levels, more than one third to almost half of toddlers exceeded the Tolerable Upper Intake Levels for vitamin A and zinc, and more than half (53% and 58% for Hispanics and non-Hispanic toddlers, respectively) exceeded the Tolerable Upper Intake Level for sodium. Usual mean intakes of vitamins A, C, and E and folate, potassium, and fiber were significantly higher among Hispanic toddlers compared with non-Hispanic toddlers.

**Conclusions** The Feeding Infants and Toddlers Study data provide information that is useful to practitioners, Special Supplemental Nutrition Program for Women, Infants, and Children program staff, and parents for delivering nutrition education messages that are consistent with dietary guidance for infants and toddlers as well as compatible with cultural preferences.

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**H**ispanics are a growing subgroup of the US population. People of Hispanic origin (which may be of any race) are expected to nearly double their share of the US population—from 13% to 24% between 2000 and 2050, and triple in number (1). In 2002, 20% of the preschool population (0 to 5 years) was Hispanic (2).

Among preschoolers age 2 to 5 years, 26% of Mexican Americans, the largest subgroup of Hispanics, were overweight or at risk of overweight in the 1999-2002 National Health and Nutrition Examination Survey (NHANES), and this proportion increased with age (3). Among older Mexican-American children and adolescents, 40% were overweight or at risk of overweight compared with non-Hispanic whites (28%) and non-Hispanic blacks (35%) ( $P < .05$ ) (3).

The toddler and preschool years are a critical time for the development of healthful eating patterns, which are influenced by parents and dietary practices associated with culture (4-8). In a study of more than 1,093 mother-infant pairs (of children 8 to 16 months of age), maternal diet and acculturation were found to affect infants' and toddlers' diets, especially the consumption of certain foods (9). Longitudinal studies of children's diets have also shown that nutrient intakes tracked as early as 3 to 4 years of age (8,10,11). Children who had a greater energy intake for their age group at baseline continued to maintain higher intakes than other participants their age throughout follow-up.

In the past 2 decades, the two largest national nutrition surveys—NHANES and the Continuing Survey of Food Intakes by Individuals (CSFII)—have provided some information about the diets of Hispanics, but the reports have generally focused on older children, adults, or Mexican Americans, and have not yet been frequently updated (12,13). For example, using CSFII 1994-1996 data, Aldrich and Variyam reported that adult Hispanics who were less acculturated and spoke Spanish rather than English had somewhat more healthful diets than acculturated Hispanics who spoke English (14).

Smaller studies of the diets of the Hispanic preschool population have often focused on participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) or the effects of food insecurity and poverty on dietary intake and nutritional status (15,16). Kaiser and colleagues found that Spanish-speaking or less acculturated families had lower income levels, higher rates of food insecurity, and poorer dietary quality as assessed according to the Food Guide Pyramid guidelines (15,17).

Designed to update our knowledge of food and nutrient intake, growth and motor development, and the feeding patterns of American infants and toddlers age 4 to 24 months (18,19), the 2002 Feeding Infants and Toddlers Study (FITS) provides a unique opportunity to assess the sociodemographic characteristics and dietary patterns of Hispanic and non-Hispanic infants and toddlers in the United States. The purpose of this article is to compare the demographic characteristics and usual nutrient intakes among Hispanic and non-Hispanic infants and toddlers and their mothers. To understand the food choices that underlie nutrient intake, we also assess the contribution of beverages and major food groups to daily energy intake.

This article provides background information for other articles in this series that describe the infant feeding practices and food consumption patterns of Hispanic and non-Hispanic infants and toddlers (20,21).

## METHODS

### Sample Design and Subjects

FITS was based on a stratified random sample drawn from the New Parent Database (Experian's New Parents Database, February-May 2002, Experian, Lincoln, NE), a commercial frame of parents of children from birth to 3 years of age. A number of commercial frames were evaluated, and Experian's Database was judged to have the greatest coverage of infants and toddlers in comparison to US statistics (22). Two age groups, 4-6 months and 9-11 months, were oversampled due to the transitions in infant feeding that occur at these ages. To be eligible, a household contacted from the sample frame needed to have a child in the age range of 2 to 22 months of age (18). Previous reports described the study design, data collection methods, and characteristics and usual nutrient intake of the full sample by age group (18,22,23). Sample weights adjust for the oversampling, nonresponse, and undercoverage of some subgroups of children not included in the sample frame.

All data collection instruments and procedures were reviewed and approved by Mathematica Policy Research, Inc's (Princeton, NJ) Institutional Review Board compliance officer and quality assurance system (22). All participants received written information about the study, understood that participation in the study was voluntary, and were assured of the confidentiality of the data. We obtained consent from each respondent before proceeding with the study interviews.

Consistent with guidelines from the US Census Bureau, we collected information about the child's race and ethnicity as separate and distinct categories and explored the possibility of creating mutually exclusive subgroups of non-Hispanic white, non-Hispanic black, and Hispanic participants (24). However, 54% of Hispanic parents/primary caretakers in our study reported their child's race as "other" or "Latino," which limited our ability to report data for combined race/ethnicity subgroups. Therefore, we report the FITS data by Hispanic or non-Hispanic origin to study the relationship between Hispanic or Latino ethnicity and dietary intake.

This article focuses on Hispanic or non-Hispanic ethnicities and three age groups—infants 4-5 months, infants 6-11 months, and toddlers 12-24 months—which correspond to the age groups specified by the Dietary Reference Intakes (DRIs) (25-31). (The DRIs for infants 4 to 6 months translates to a working definition of age 4.0 to 5.9 months, and the 6- to 11-month age group translates to 6.0 to 11.9 months.) The study population of 3,022 included 14 cases with missing ethnicity. We report findings for 3,008 cases with 24-hour dietary recall data (371 Hispanics and 2,637 non-Hispanics). The sample sizes by age group were: 4-5 months ( $n=84$ ), 6-11 months ( $n=163$ ), and 12 months ( $n=124$ ) for Hispanics, and 4-5 months ( $n=538$ ), 6-11 months ( $n=1,228$ ), and 12-24 months ( $n=871$ ) for non-Hispanics.

### Data Collection Methods

FITS consisted of as many as three separate interviews, all conducted by telephone from March to July 2002. First, a household survey was conducted with the parent or primary caretaker (usually the mother) to establish

eligibility, recruit participation, and collect information on sociodemographic characteristics (eg, household composition and income; and the parent's age, education level, marital status, and employment status). We located and contacted 6,585 of the sampled households, of which 3,855 were eligible to participate. Among eligible households, 3,224 completed the recruitment interview, for a recruitment completion rate of 73%.

Second, an interviewer called the household again to conduct the 24-hour dietary recall and to ask additional questions on infant feeding practices, growth, and developmental milestones. Respondents were mailed an instructional booklet that included portion size aids prior to the interview. Trained interviewers, fluent in both English and Spanish, used the University of Minnesota's Nutrition Data System for Research (NDS-R, version 4.03, 2001, University of Minnesota Nutrition Coordinating Center, Minneapolis) to collect dietary intakes (18,21,22,24). Of the 3,224 households recruited for the study, 3,022 completed a 24-hour dietary recall for the eligible sample child. The 24-hour dietary recall protocol included probes for amounts of foods and beverages consumed by the infant or child (ie, not what was offered), as well as foods that were consumed together (eg, cereal added to formula).

Third, a random subsample of respondents ( $n=702$  comprised of 93 Hispanics and 609 non-Hispanics) completed a second 24-hour dietary recall 3 to 10 days after the first recall. This second dietary recall was conducted on a different day of the week than the first recall and was used to calculate "usual" nutrient intake and to support assessments of nutrient adequacy and excess. Information about the use of dietary supplements was also collected during the 24-hour dietary recall interview.

### Nutrient Database

Nutrient calculations were performed using the NDS-R software (Nutrition Data System for Research; version 4.03, 2001, University of Minnesota Nutrition Coordinating Center). Nutrient intake included intake from foods, beverages, breast milk, and dietary supplements. Additional details about the FITS dietary data collection, coding, and analysis were reported by Devaney and colleagues (18) and Ziegler and colleagues (22).

### Statistical Methods

To account for the day-to-day variation in nutrient intake, we used the personal computer version of the Software of Intake Distribution Estimation (PC-SIDE, version 1.02, 2001, Iowa State University, Ames). We used methods recommended by the Institute of Medicine to assess the usual nutrient intakes of infants and toddlers (25). Where applicable, we estimated the percentage of infants and toddlers with usual intakes below the Estimated Average Requirement (EAR), compared the means of usual nutrient intake distributions with Adequate Intake (AI) levels, and compared the usual intake distributions with Tolerable Upper Intake Levels (ULs). For nutrients with an EAR and Recommended Dietary Allowance (RDA), and a symmetrical requirement distribution, the proportion of the population with usual in-

takes less than the EAR is an estimate of the proportion of the group with inadequate intakes—intakes that do not meet nutrient requirements (25). In some cases, particularly infants age 4 to 5 months, nutrient distributions were too skewed to adjust the distribution; for these cases, we report only the mean usual intake.

For infants and toddlers, requirements for many nutrients are expressed in terms of an AI, which cannot be used to determine the proportion of individuals in a group with inadequate nutrient intakes (25-29,31). For such nutrients, we calculate estimates of the percentiles of the usual intake distributions and compare the AI with the mean of the usual intake distribution. Population subgroups with mean intakes at or more than the AI can be assumed to have nutritionally adequate diets. Three nutrients—iron, protein, and zinc—do have an EAR and RDA for older infants (29,30). In these cases, we used the EAR cutpoint method to assess nutrient adequacy. We analyzed the entire data set (energy, macronutrients, micronutrients, and fiber) by age group and Hispanic ethnicity, but only report data for energy and selected nutrients of interest for this population group: vitamins A, C, D, E, B-12, and folate; calcium, iron, phosphorus, potassium, sodium, and zinc; and fiber.

Energy intakes were assessed in relation to the estimated energy requirements, which account for the child's age, weight, and physical activity level (30). Macronutrient intakes (fat, carbohydrate, and protein) were assessed in relationship to the AI for infants age 6 to 11 months and to the EAR and the acceptable macronutrient distribution range for toddlers age 12 to 24 months (30). We examined the proportion of toddlers with usual intakes that were outside the acceptable macronutrient distribution ranges.

Sample weights were calculated to account for nonresponse and to weight the sample to known population demographic characteristics. Statistical Analysis System (version 8.2, 2001, SAS Institute, Inc, Cary, NC) was used to create data files and analytic variables. Estimates were calculated using SUDAAN (version 9.0, 2004, Research Triangle Institute, Research Triangle Park, NC), which correctly incorporates the complex design and sample weights. We calculated confidence intervals for tests of significant differences between mean values for Hispanics and non-Hispanics at the 95th and 99th probability levels. Estimates of the proportion of the population at or below various poverty levels were based on reported household income, household size, and 2002 Census poverty data (32).

We also followed accepted reporting guidelines for nutrition data with respect to the reliability of point estimates (33). The data presented in the tables meet minimum sample size requirements ( $n>25$ ). We have flagged estimates with a † where the coefficient of variation (calculated as  $\text{standard error} \div \text{mean} \times 100\%$ ) is 30% or more because they may be potentially unreliable due to a high coefficient of variation. This is most problematic in cases in which the proportion of the group with a particular characteristic or food consumption level is very low ( $<10\%$ ) and there is high variability within the group. In these cases, the estimate is based on an adequate sample size, but should be interpreted with caution due to a high coefficient of variation.

**Table 1.** Characteristics of Hispanic and Non-Hispanic infants and toddlers and their mothers, age 4-24 months<sup>a</sup>

Characteristic	Hispanic (n=371)	Non-Hispanic (n=2,637)
	← <i>mean ± SEM</i> <sup>b</sup> →	
<b>Infant/toddler</b>		
Age (mo)	13.5 ± 0.5	13.3 ± 0.2
First-born (%)	50 ± 3.5	58 ± 1.3
Ever breastfed (%)	82 ± 2.9	76 ± 1.1
Black (%)	4.3* ± 1.2	8.5 ± 0.7
Receiving WIC <sup>c</sup> (%)	43** ± 3.4	23 ± 1.1
Using vitamin/mineral supplement(s) (%)	18 ± 2.9	18 ± 1.1
Reported to be a "picky eater" <sup>d</sup>	35 ± 3.7	37 ± 1.3
<b>Mother</b>		
Age (y)	28** ± 0.5	30 ± 0.2
11th grade education or less (%)	17** ± 2.8	5 ± 0.6
Completed college (%)	22** ± 2.9	42 ± 1.3
Married (%)	68** ± 3.4	84 ± 0.9
Employed outside the home (%)	53 ± 3.5	58 ± 1.3
Spanish-speaking <sup>e</sup> (%)	34** ± 3.4	0.3† ± 0.1
<b>Household</b>		
At/below 130% poverty <sup>f,g</sup> (%)	18* ± 3.1	9 ± 0.8
At/below 185% poverty <sup>f,g</sup> (%)	40** ± 3.9	22 ± 1.2
Annual household income <sup>g</sup> (\$)	45,972** ± 1,771	55,513 ± 764
Urban (%)	60** ± 3.4	45 ± 1.3
Rural (%)	8** ± 1.7	21 ± 1.0

<sup>a</sup>Data from the 2002 Infants and Toddlers Feeding Study, Hispanic and non-Hispanic subgroups.

<sup>b</sup>SEM=standard error of the mean.

<sup>c</sup>WIC=Special Supplemental Nutrition Program for Women, Infants, and Children.

<sup>d</sup>Reported by the primary caretaker to be a "very picky" or "sometimes picky" eater.

<sup>e</sup>Includes "Spanish only" and "both Spanish and English equally" as the languages spoken to the child. Approximately 68% of Spanish-speaking cases were "Spanish only," or 23% of Hispanics overall.

<sup>f</sup>Poverty status is calculated using the annual household income and family size in comparison to federal poverty thresholds for 2002. In 2002, the poverty threshold for a family of four was \$18,392.

<sup>g</sup>Excludes those with missing income levels.

\*Significantly different from non-Hispanics, *P*<.05.

\*\*Significantly different from non-Hispanics, *P*<.01.

†Indicates a statistic with a coefficient of variation of 30% or higher.

## RESULTS

### Sociodemographic and Nutrition-Related Characteristics

Table 1 shows descriptive information about demographic, maternal, and nutrition-related characteristics of the Hispanic and the non-Hispanic subgroups. (The Appendix [available online at [www.adajournal.org](http://www.adajournal.org)] provides sample sizes and unweighted characteristics for Hispanic and non-Hispanic infants and toddlers by age group and for the full sample.) There was no significant difference in the age distribution or the mean age of infants and toddlers by ethnicity. There were no significant

differences between Hispanic and non-Hispanic infants and toddlers in the full sample of 4- to 24-month-olds in the initiation of breastfeeding. Further investigation revealed that breastfeeding initiation was significantly higher among Hispanic infants age 4 to 5 months and 6 to 11 months compared with their non-Hispanic counterparts (20). A little more than half of the mothers were employed outside of the home in both subgroups.

On average, mothers of Hispanic infants and toddlers were significantly younger, had fewer years of education, and were less likely to be black or married than mothers of non-Hispanic infants and toddlers (Table 1). Approximately one third of Hispanic infants and toddlers had Spanish-speaking mothers or caretakers. Among Spanish-speaking mothers and caretakers of Hispanic infants and toddlers, approximately two thirds spoke only Spanish to their children and one third spoke both Spanish and English.

Hispanic infants and toddlers had significantly higher rates of participation in WIC than non-Hispanic infants and toddlers (43% to 23%, *P*<.01), consistent with the percentage with income eligibility for WIC (40% to 22%, respectively, *P*<.01) (ie, at or less than 185% of the poverty level). A higher percentage of Hispanic infants and toddlers lived in urban rather than rural areas compared with their non-Hispanic counterparts (60% to 45%, respectively, *P*<.01).

### Energy

The mean and median usual intakes of energy, as well as the estimated percentiles of the usual energy intake distribution, were greater than the estimated energy requirements for both Hispanics and non-Hispanics (Table 2). For Hispanic and non-Hispanic infants 4 to 5 months of age, mean usual energy intake was approximately 9% more than the mean estimated energy requirement; for infants 6 to 11 months, mean usual energy intake was 17% more than the mean estimated energy requirement for Hispanics and 22% more for non-Hispanics; and for toddlers 12 to 24 months of age, mean usual energy intake was 36% more than the mean estimated energy requirement for Hispanics, and 31% more for non-Hispanics. There were no significant differences between the usual mean intake of energy between Hispanic and non-Hispanic infants and toddlers.

We calculated the percentage of daily energy from major categories of beverages: breast milk, infant formula, milk (including cow's, goat, and soy milk), 100% fruit juices, and sweetened beverages (including fruit-flavored drinks, ades, and carbonated beverages); and solid foods [grains and grain products (including cereals, pasta, and rice), fruits, vegetables, meat and protein sources (including cheese, eggs, and peanut butter), desserts and sweets, and other foods such as fats and salty snacks] (Table 3). At 4 to 5 months of age, infant formula and breast milk account for roughly 90% of energy, and approximately 65% at 6 to 11 months of age. Solid foods gradually increase as a percentage of energy as infants transition from a milk diet to the toddler diet, which reflects the family fare.

There were no statistically significant differences between Hispanic and non-Hispanic infants and toddlers in

**Table 2.** Usual intake of food energy and estimated energy requirements, Hispanic and non-Hispanic infants and toddlers<sup>ab</sup>

Age group	Percentiles of Usual Intake and Requirement Distributions (kcal) <sup>b</sup>															
	5th		10th		25th		50th		75th		90th		95th		Mean (kJ)	
	H <sup>c</sup>	NH <sup>d</sup>	H	NH	H	NH	H	NH	H	NH	H	NH	H	NH	H	NH
Infants 4-5 mo																
Usual Intake	463	536	507	555	562	578	628	636	748	723	889	803	971	860	665 (2,784)	660 (2,763)
EER <sup>e</sup>	440	461	501	481	562	541	600	602	660	662	763	723	804	763	610 (2,553)	605 (2,533)
Infants 6-11 mo																
Usual Intake	609	607	659	660	749	746	860	852	983	986	1,104	1,145	1,182	1,263	873 (3,654)	883 (3,696)
EER	562	548	588	582	649	649	729	723	830	810	931	885	1,012	911	746 (3,123)	723 (3,026)
Toddlers 12-24 mo																
Usual Intake	758	829	849	911	1,018	1,052	1,228	1,217	1,481	1,402	1,798	1,593	2,060	1,723	1,294 (5,417)	1,239 (5,186)
EER	647	707	727	729	828	828	909	949	1,050	1,050	1,131	1,171	1,333	1,212	949 (3,973)	949 (4,705)

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study, Hispanic (n=371) and non-Hispanic (n=2,637) subgroups.

<sup>b</sup>Intakes are from foods and supplements. To convert kilocalories (kcal) to kilojoules (kJ), 1 kcal=4.186 kJ.

<sup>c</sup>H=Hispanic.

<sup>d</sup>NH=non-Hispanic.

<sup>e</sup>EER=Estimated Energy Requirement (30).

their mean percentage of daily energy intake from specific beverages or specific food groups. Among toddlers, sweetened beverages accounted for approximately 6% and 4% of energy among Hispanics and non-Hispanics, respectively.

### Macronutrients

We calculated the usual intake of macronutrients—fat, carbohydrate, and protein—in grams and as a percentage of daily energy intake. There were no significant differences in the usual mean intake (in grams) of fat, carbohydrate, or protein between Hispanic and non-Hispanic infants at age 6 to 11 months (data not shown) or as a percentage of energy (Figure). Among toddlers age 12 to 24 months, the usual intake of energy from fat was 31.4% among Hispanic toddlers compared with 33.2% among non-Hispanic toddlers (Figure;  $P<.01$ ). Whereas differences in mean values are not dramatically different, the usual intake of energy from carbohydrate was significantly greater among Hispanics (55.6%) compared with non-Hispanics (53.0%) ( $P<.01$ ). Protein accounted for 15% of energy among both subgroups of toddlers.

Approximately 46% of Hispanic toddlers and 36% of non-Hispanic toddlers had a usual intake of fat outside the acceptable macronutrient distribution range of 30% to 40% of energy (data not shown). Approximately 15% of Hispanic toddlers and 11% of non-Hispanic toddlers had a usual intake of carbohydrate outside the acceptable macronutrient distribution range of 45% to 65% of energy from carbohydrate. Less than 5% of both subgroups had usual intakes outside the acceptable macronutrient distribution range of 5% to 20% of energy from protein.

### Micronutrients

For all nutrients, the mean usual intake for Hispanic and non-Hispanic infants in both age groups exceeded the AI (Tables 4 and 5). Comparing the mean usual intake to the AI, Hispanic and non-Hispanic infants' diets are ade-

quate for vitamins and minerals. There were no significant differences in mean usual intake between Hispanic and non-Hispanic infants at 4 to 5 months of age (Table 4). For most nutrients (except iron), the 10th percentile of the usual intake distribution either equaled or exceeded the AI for both Hispanic and non-Hispanic infants at age 6 to 11 months (Table 5). For iron, the estimated prevalence of inadequacy was 4.7% for Hispanic and 7.5% for non-Hispanic infants. Approximately 5% of both subgroups had an inadequate zinc intake. Comparing usual mean intakes, Hispanic infants age 6 to 11 months have significantly lower intakes of calcium ( $P<.05$ ) and vitamin E ( $P<.01$ ) and a significantly higher intake of sodium compared with non-Hispanic infants of the same age (mean of 647 mg to 476 mg per day,  $P<.01$ ).

Table 6 shows estimated usual intake distributions of micronutrients for Hispanic toddlers and non-Hispanic toddlers age 12 to 24 months, respectively. Hispanic toddlers had significantly higher usual mean intakes of vitamins A, C, and E; folate; potassium; and fiber and significantly lower usual mean intake of vitamin D. The table also indicates the estimated percentage with inadequate intake and the risk of excessive intake levels, where applicable. Among both Hispanic and non-Hispanic toddlers, the prevalence of nutrient inadequacy was low—less than 1% for most nutrients in both subgroups, and 2% for phosphorus and zinc in Hispanic toddlers, and 3% for folate in non-Hispanic toddlers. For vitamin E, the estimated proportion with inadequate intakes was 39% among Hispanic toddlers and 50% among non-Hispanic toddlers (Table 6). Mean intakes for vitamin D, calcium, potassium, and sodium exceeded the AI in both toddler subgroups. Mean usual intake of fiber was 9 g per day for Hispanic toddlers and 8 g per day for non-Hispanic toddlers ( $P<.01$ ). Even the 90th percentile of usual fiber intake was less than the AI of 17 g of fiber per day (adjusted for median energy intakes).

For nutrients with ULs, the percentage with usual nutrient intakes exceeding the UL was less than 1% for

**Table 3.** Percentage of total daily energy from beverages and food groups among Hispanic and non-Hispanic infants and toddlers<sup>ab</sup>

	Age 4-5 Months		Age 6-11 Months		Age 12-24 Months	
	Hispanic (n=84)	Non-Hispanic (n=538)	Hispanic (n=163)	Non-Hispanic (n=1,228)	Hispanic (n=124)	Non-Hispanic (n=871)
	← <i>mean ± SEM</i> →					
<b>Beverages</b>						
Total <sup>d</sup>	88.9±2.10	91.1±0.50	63.9±1.50	64.6±0.50	41.1±1.50	38.5±0.60
Breast milk	36.4±5.20	35.2±2.00	13.5±2.20	12.4±0.80	3.1†±1.20	1.6±0.30
Infant formula	50.8±4.50	54.4±1.90	41.4±2.60	44.7±0.90	2.4†±0.80	2.2±0.30
Milk <sup>e</sup>	0.1†±0.10	0.0±0.00	2.6†±0.90	3.0±0.40	23.0±1.70	24.2±0.60
100% fruit juices	1.4±0.40	1.4±0.20	5.1±0.60	4.0±0.20	6.7±0.90	6.5±0.30
Sweetened beverages <sup>f</sup>	0.2*†±0.10	0.0±0.00	1.2†±0.40	0.5±0.10	5.7±0.80	4.0±0.30
<b>Solids</b>						
Total <sup>g</sup>	11.1±2.10	8.9±0.50	36.1±1.50	35.3±0.50	58.9±1.50	61.4±0.60
Grains/grain products <sup>h</sup>	4.7±0.80	4.8±0.30	11.3±0.70	11.3±0.30	15.5±0.90	16.9±0.40
Infant cereal	4.4±0.70	4.8±0.30	5.9±0.50	6.8±0.20	1.1±0.30	0.5±0.10
Noninfant cereal	0.0±0.00	0.0±0.00	1.0†±0.30	1.3±0.10	3.0±0.50	4.2±0.20
Pasta/rice	0.1†±0.10	0.0±0.00	1.8±0.40	0.9±0.10	4.9±0.70	3.4±0.20
Fruits	3.4±0.80	2.1±0.20	6.5±0.70	7.6±0.20	6.7±0.90	5.8±0.20
Vegetables	1.0±0.20	1.2±0.10	3.6±0.40	3.7±0.10	4.5±0.50	3.6±0.10
Meat/protein sources	0.8†±0.50	0.4±0.10	8.0±0.80	7.2±0.30	16.9±1.10	18.8±0.50
Meats <sup>i</sup>	0.8†±0.50	0.4±0.10	4.5±0.50	5.0±0.20	9.1±0.90	10.1±0.40
Protein sources <sup>j</sup>	0.0±0.00	0.0±0.00	3.6±0.60	2.2±0.20	7.7±0.70	8.7±0.30
Desserts/sweets <sup>k</sup>	1.0†±0.40	0.3†±0.10	4.3±0.60	4.1±0.20	7.4±0.90	8.5±0.30
Other foods	0.1†±0.10	0.0±0.00	2.3±0.60	1.4±0.10	7.9±0.90	7.9±0.30
Fats <sup>l</sup>	0.1†±0.10	0.0±0.00	1.0±0.20	0.9±0.10	4.3±0.50	3.9±0.10
Salty snacks	0.0±0.00	0.0±0.00	0.2†±0.10	0.1±0.00	1.1±0.30	1.3±0.10
<b>Total</b>	100	100	100	100	100	100

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study, Hispanic and non-Hispanic subgroups.<sup>b</sup>Percentages may not add to 100 due to rounding.<sup>c</sup>SEM=standard error of the mean.<sup>d</sup>Includes all beverages shown separately and other beverages such as bottled water and unsweetened tea.<sup>e</sup>Includes cow's milk, goat's milk, and soy milk.<sup>f</sup>Includes carbonated soda, fruit drinks, ades, and other sweetened drinks.<sup>g</sup>Includes solid foods and non-beverage liquid foods such as soup and ice cream.<sup>h</sup>Includes other grains not shown separately such as breads, rolls, tortillas, crackers, and pancakes.<sup>i</sup>Includes meat, fish, poultry, and baby-food dinners.<sup>j</sup>Includes cheese, yogurt, eggs, dried beans and peas, and peanut butter.<sup>k</sup>Includes cakes, cookies, pies, pudding, ice cream, and candy.<sup>l</sup>Includes butter, margarine, salad dressings, gravies, and sauces.\*Significantly different from non-Hispanics, *P*<.05.

†Indicates a statistic with a coefficient of variation of 30% or higher.

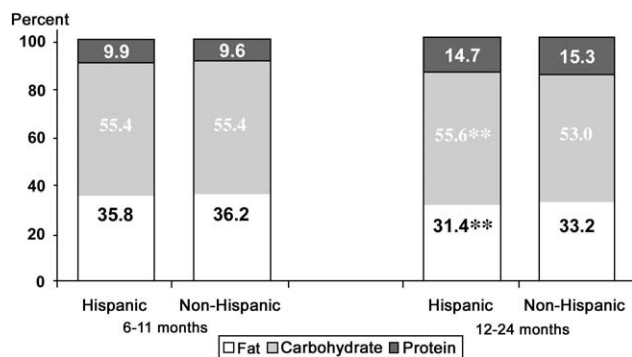
most nutrients, except for vitamin A, sodium, and zinc. Approximately 46% of Hispanic toddlers and 35% of non-Hispanic toddlers had usual intakes exceeding the UL for vitamin A. For zinc, the respective values were 47% of Hispanic toddlers and 40% of non-Hispanic toddlers. A little more than half of both toddler subgroups exceeded the UL for sodium, 53% and 58%, for Hispanics and non-Hispanics, respectively.

## DISCUSSION

The 2002 FITS provides new and important information about the influence of Hispanic ethnicity on the energy, macronutrient, and micronutrient intakes of infants and toddlers. In 2002, when the FITS was conducted, Hispanics comprised 13% of the US population and were more likely to live in central cities, less likely to have gradu-

ated from high school, and more likely to live in poverty than non-Hispanics (34). The FITS mothers of Hispanic infants and toddlers were less educated, had lower annual household incomes, were more likely to live in urban areas, and were younger than mothers of non-Hispanic infants and toddlers.

There are three important population characteristics to keep in mind when interpreting the FITS findings on Hispanic ethnicity and dietary intake. First, the study was not designed to be a representative sample of Hispanic infants and toddlers in the United States, and therefore the results are not generalizable to the entire Hispanic infant and toddler population in the United States. Second, as in the United States, the FITS sample of Hispanic infants and toddlers had a significantly higher percentage of the group with low household in-



**Figure.** Usual intake of macronutrients as a percentage of energy by ethnicity. Percentages may not add to 100 due to rounding. \*\*Significantly different from non-Hispanics,  $P < .01$ . Data from the 2002 Feeding Infants and Toddlers Study.

comes (at or below 130% of the federal poverty threshold) and a high rate of participation in WIC (43%) (2,34,35). Third, although the mean annual household income of Hispanics in FITS (\$44,887) was consistent with the mean annual income of Hispanics (any race) in the United States in 2002 (\$45,972) (34), the FITS sample had a lower percentage of very low income, and a higher percentage of middle income, compared with national distributions (18). The Hispanic sample in FITS may have higher household income levels compared with other studies of WIC and Latino participants, particularly those that focused on food insecurity among the very lowest income groups (15). Nevertheless, FITS provides a large sample of Hispanic and non-Hispanic infants and toddlers to study infant feeding practices and food consumption (20), meal patterns (21), and energy and nutrient intake.

It is important to consider differences in survey methods and sample designs in comparing FITS data to data collected in national nutrition surveys such as NHANES and CSFII. Both NHANES and CSFII exclude breastfeeding infants and toddlers from reported nutrient estimates, and CSFII (and sometimes NHANES) exclude the contribution of dietary supplements to total nutrient intakes. NHANES 1988-1994 and NHANES 1999-2005 oversampled Mexican Americans, whereas CSFII 1994-1996, 1998 oversampled low-income people, but not Hispanics, although selected CSFII dietary data are reported by Hispanic ethnicity. Differences in dietary methods in terms of mode, data collection software, food composition databases, and the use of statistical procedures to adjust nutrient intakes must also be considered in comparing dietary findings across studies.

### Energy Intake and Risk of Overweight

There are few published reports about dietary intakes among Hispanic individuals based on national survey data, and data from the Hispanic HANES are now more than 20 years old. Briefel and Johnson reviewed trends in energy and nutrient intake among the US population ages 1 year and older (36). Based on 1-day NHANES' dietary data, mean energy intake among nonbreastfeed-

**Table 4.** Usual intake of selected micronutrients of Hispanic and non-Hispanic infants age 4 to 5 months<sup>ab</sup>

Nutrient	AI <sup>c</sup>	Hispanic	Non-Hispanic
		(n=84)	(n=538)
← mean ± SEM <sup>d</sup> →			
<b>Vitamins</b>			
Vitamin A (μg/d, RAE <sup>e</sup> )	400	675 ± 39.6	635 ± 9.7
Vitamin C (mg/d)	40	78 ± 6.1	69 ± 1.5
Vitamin D (μg/d)	5	6.8 ± 0.73	6.1 ± 0.21
Vitamin E (mg/d)	4	9.4 ± 0.47	9.7 ± 0.17
Folate (μg/d)	65	112 ± 7.8	111 ± 4.6
Vitamin B-12 (μg/d)	0.4	1.3 ± 0.12	1.3 ± 0.04
<b>Minerals</b>			
Calcium (mg/d)	210	460 ± 27.4	487 ± 10.3
Iron (mg/d)	0.27	10.0 ± 0.99	10.7 ± 0.45
Phosphorus (mg/d)	100	295 ± 20.2	314 ± 8.4
Potassium (mg/d)	400	742 ± 42.9	726 ± 14.2
Sodium (mg/d)	120	179 ± 9.4	189 ± 5.0
Zinc (mg/d)	2	4 ± 0.3	4 ± 0.1
Fiber (g/d)	NA <sup>f</sup>	1.4 ± 0.30	1.1 ± 0.09

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study, Hispanic and non-Hispanic subgroups.

<sup>b</sup>Intakes are from foods and supplements.

<sup>c</sup>AI=Adequate Intake (25-31).

<sup>d</sup>SEM=standard error of the mean.

<sup>e</sup>RAE=retinol activity equivalent.

<sup>f</sup>NA=not applicable.

ing toddlers age 12 to 36 months increased 161 kcal (674 kJ) (from 1,350 kcal [5,651 kJ] in 1971-1974 to 1,511 kcal [6,325 kJ] in 1999-2000), representing a 12% increase in mean energy intake (36). Although we cannot directly compare energy intake between NHANES and FITS due to different age cutoffs and the exclusion of breastfeeding children in the NHANES nutrient estimates, the usual mean energy intake of Hispanic and non-Hispanic toddlers age 12 to 24 months in FITS (1,294 kcal [5,417 kJ] and 1,239 kcal [5,186 kJ] respectively) is closer to the 1-day mean intake of children age 12 to 36 months in the United States in the 1970s and 1980s (36).

Based on FITS data, Devaney and colleagues, in a report published in 2004, found that mean energy intake for all toddlers exceeded energy requirements by 31% (22). Possible limitations of the data collection include the lack of measured body weight and parents' overreporting of foods and/or amounts of foods, which would lead to errors in calculating the estimated energy requirements. These issues are discussed by Devaney and colleagues in detail (22) and apply to the current findings as well as future studies using 24-hour dietary recalls. In the current analysis, Hispanic toddlers' usual energy intake exceeded their energy requirements by 36% (non-Hispanics exceeded energy requirements by 31%). Further, Hispanic toddlers consumed a higher proportion of their energy from carbohydrate (56%) compared with non-Hispanics (53%) ( $P < .01$ ).

Although mean energy intakes from beverages and specific food groups were not statistically different and sample sizes do not support more detailed analysis, the FITS data suggest that energy intake related to sweetened

**Table 5.** Usual intake of selected micronutrients of older infants (6-11 months) by Hispanic ethnicity<sup>ab</sup>

Nutrient	AI <sup>c</sup>	Usual Intake Percentiles											
		10th		25th		Median		Mean		75th		90th	
		H <sup>d</sup>	NH <sup>e</sup>	H	NH	H	NH	H	NH	H	NH	H	NH
<b>Vitamins</b>													
Vitamin A ( $\mu\text{g/d}$ , RAE <sup>f</sup> )	500	498	515	585	607	727	730	766	768	914	889	1,101	1,070
Vitamin C (mg/d)	50	61	61	79	77	101	96	106	101	128	121	156	147
Vitamin D ( $\mu\text{g/d}$ )	5	2	ND <sup>g</sup>	4	ND	7	ND	8	8	10	ND	14	ND
Vitamin E (mg/d)	5	6	7	7	8	9	10	9**	10	11	12	13	15
Folate ( $\mu\text{g/d}$ )	80	98	96	131	132	175	171	191	198	233	218	303	298
Vitamin B-12 ( $\mu\text{g/d}$ )	0.5	0.8	0.7	1.1	1.2	1.6	1.7	1.8	1.9	2.3	2.3	2.9	3.1
<b>Minerals</b>													
Calcium (mg/d)	270	357	396	435	484	544	596	574*	626	679	732	830	890
Iron (mg/d)	11 (6.9) <sup>h</sup>	8.4	7.7	11.1	11.3	14.4	15.3	14.8	15.9	18.1	19.7	21.8	24.6
Phosphorus (mg/d)	275	270	293	345	382	450	482	481	511	583	605	731	756
Potassium (mg/d)	700	742	799	916	967	1,147	1,175	1,199	1,230	1,425	1,427	1,721	1,721
Sodium (mg/d)	370	288	171	384	227	544	344	647**	476	789	577	1,123	949
Zinc (mg/d)	3 (2.5) <sup>h</sup>	3.0	3.0	4.0	4.2	5.3	5.4	5.4	5.6	6.7	6.6	8.1	8.1
Fiber (g/d)	NA <sup>i</sup>	3	3	4	4	5	6	5	6	7	7	9	9

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study, Hispanic (n=163) and non-Hispanic (n=1,228) subgroups.  
<sup>b</sup>Intakes are from food and supplements.  
<sup>c</sup>AI=Adequate Intake (25-31).  
<sup>d</sup>H=Hispanic.  
<sup>e</sup>NH=non-Hispanic.  
<sup>f</sup>RAE=retinol activity equivalent.  
<sup>g</sup>ND=not determined due to skewness of the data.  
<sup>h</sup>Recommended Dietary Allowance (Estimated Average Requirement).  
<sup>i</sup>NA=not applicable.  
\*Significantly different from non-Hispanics,  $P<.05$ .  
\*\*Significantly different from non-Hispanics,  $P<.01$ .

beverages and carbohydrate intake need to be studied further in relationship to Hispanic ethnicity and cultural preferences. We know from other data sources that Hispanic preschoolers are at increased risk of overweight (3,37). Sweetened beverages are one source of energy that can be targeted for nutrition education and improved dietary patterns. An article by Mennella and colleagues (20) investigates food consumption patterns for Hispanic and non-Hispanic infants and toddlers and sheds light on some important differences in food selection related to Hispanic ethnicity. For example, older Hispanic infants and toddlers were more likely to consume sweetened, fruit-flavored drinks compared with their non-Hispanic counterparts (20). This finding is consistent with consumption of a higher percentage of energy from carbohydrate among Hispanic toddlers shown in the Figure.

### Nutrient Intake

Population shifts in macronutrient distributions as a percentage of total energy intake are important to understand because they may relate to risk of overweight and patterns of food consumption, especially among the preschool population (36,38). Hispanic preschoolers may be at even greater risk due to lower household incomes, food insecurity, and observed patterns of energy intake and macronutrient distributions of energy intake.

Published reports from population-based national sur-

veys typically report mean dietary intake based on 1 day of intake, although this will change in the future with the application of the DRIs to the collection of 2 days of intake per person in NHANES. In NHANES III, Mexican-American toddlers age 1 to 2 years had a mean intake of 34% of energy from fat and 52% of energy from carbohydrate compared with the Hispanic toddlers in FITS, with 31% of energy from fat and 56% of energy from carbohydrate (39).

A more recent *Journal of the American Dietetic Association* article by Zive and colleagues found that Mexican-American children consumed less total energy than other children, but had a higher percentage of energy from fat (40). We found no difference in usual mean energy intakes, but a higher proportion of Hispanics with energy intakes greater than the estimated energy requirement and a higher percentage of energy from carbohydrate, perhaps attributable to different population characteristics or income levels compared with the Hispanics or Latinos in the smaller studies.

To evaluate the relationship between acculturation and diet, we also assessed usual mean energy and nutrient intake among Hispanic infants and toddlers of English-speaking and Spanish-speaking caretakers. Mean usual energy intake was not significantly different between the two groups at 6 to 11 months: 860 kcal (3,600 kJ) vs 817 (4,048 kJ); or at 12 to 24 months: 1,353 kcal (6,706 kJ) vs

**Table 6.** Usual intake of selected micronutrients among toddlers (12-24 months) by Hispanic ethnicity<sup>ab</sup>

Nutrient	Dietary Reference Intakes				Usual Intake Percentiles												Inadequate Intake		Excessive Intake	
					10th		25th		Median		Mean		75th		90th		% < EAR		% > UL	
	EAR <sup>c</sup>	RDA <sup>d</sup>	AI <sup>e</sup>	UL <sup>f</sup>	H <sup>g</sup>	NH <sup>h</sup>	H	NH	H	NH	H	NH	H	NH	H	NH	H	NH	H	NH
<b>Vitamins</b>																				
Vitamin A (µg/d, RAE <sup>i</sup> )	210	300		600 <sup>j</sup>	514	361	618	474	752	633	790**	679	917	832	1,110	1,050	<1	<1	46	35
Vitamin C (mg/d)	13	15		400	58	33	78	51	105	79	115**	88	139	114	187	153	<1	<1	<1	<1
Vitamin D (µg/d)			5	50	4	4	5	6	8	8	8*	9	11	11	14	15	NA <sup>k</sup>	NA	<1	<1
Vitamin E (mg/d)	5	6		200 <sup>lm</sup>	3	3	4	4	6	5	7*	6	9	7	12	10	39	50	<1 <sup>m</sup>	<1 <sup>m</sup>
Folate (µg/d)	120	150		300 <sup>m</sup>	189	159	243	206	324	276	360*	311	436	376	573	508	<1	3	<1 <sup>m</sup>	3 <sup>m</sup>
Vitamin B-12 (µg/d)	0.7	0.9		ND <sup>n</sup>	1.9	2.0	2.7	2.6	3.6	3.5	3.8	3.7	4.7	4.5	5.8	5.7	<1	<1	NA	NA
<b>Minerals</b>																				
Calcium (mg/d)			500	2,500	552	538	735	707	957	913	976	935	1,196	1,140	1,424	1,360	NA	NA	<1	<1
Iron (mg/d)	3.0	7.0		40	5.3	5.1	7.0	6.6	9.6	8.8	10.7	9.6	13.1	11.7	17.3	15.1	<1	<1	<1	<1
Phosphorus (mg/d)	380	460		3,000	602	625	765	773	963	950	982	966	1,179	1,143	1,388	1,327	2	<1	<1	<1
Potassium (mg/d)			3,000	ND	1,478	1,325	1,759	1,585	2,094	1,907	2,125**	1,946	2,459	2,264	2,812	2,618	NA	NA	NA	NA
Sodium (mg/d)			1,000	1,500	834	1,085	1,134	1,311	1,562	1,590	1,691	1,624	2,106	1,901	2,713	2,208	NA	NA	53	58
Zinc (mg/d)	2.5	3.0		7	3.8	4.5	5.0	5.4	6.8	6.6	7.6	6.8	9.3	7.9	12.4	9.4	2	<1	47	40
Fiber (g/d)			19/17 <sup>o</sup>	ND	7	5	8	6	9	7	9**	8	10	9	11	12	NA	NA	NA	NA

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study, Hispanic (n=124), and non-Hispanic (n=871) subgroups.  
<sup>b</sup>Intakes are from foods and supplements.  
<sup>c</sup>EAR=Estimated Average Requirement.  
<sup>d</sup>RDA=Recommended Dietary Allowance.  
<sup>e</sup>AI=Adequate Intake.  
<sup>f</sup>UL=Tolerable Upper Intake Level (25-31).  
<sup>g</sup>H=Hispanic.  
<sup>h</sup>NH=non-Hispanic.  
<sup>i</sup>RAE=retinol activity equivalent.  
<sup>j</sup>As preformed vitamin A only (29).  
<sup>k</sup>NA=not applicable.  
<sup>l</sup>As α-tocopherol; applies to any form of supplemental α-tocopherol (26).  
<sup>m</sup>The ULs for vitamin E and folate apply to synthetic forms obtained from supplements, fortified foods, or a combination of the two (26,28).  
<sup>n</sup>ND=not determined.  
<sup>o</sup>The AI for children age 1-3 is 19 g/d, based on a recommendation of 14 g fiber/1,000 kcal and a median intake of 1,372 kcal/d for 1-3 year olds in the Continuing Survey of Food Intake by Individuals. Adjusting for the lower median energy intake of the 12- to 24-month-old Feeding Infants and Toddlers Study toddlers leads to an adjusted AI of 17 g/d (30).  
\*Significantly different from non-Hispanics; P<.05.  
\*\*Significantly different from non-Hispanics; P<.01.

1,215 (6,024 kJ), for English-speaking vs Spanish-speaking caretakers, respectively. The findings suggest that more acculturated Hispanic toddlers (ie, in English-speaking homes) may consume diets that are higher in energy with a higher percentage of energy from carbohydrate (55.5% vs 51.6%) compared with Hispanic toddlers in Spanish-speaking homes. The FITS sample sizes did not permit more detailed analysis but do suggest that further research in this area is warranted.

A study based on 24-hour dietary recalls collected from mothers of 4- to 7-year-old Latino children found that 38% of toddlers had a usual fat intake that fell outside of the acceptable macronutrient distribution range of 30% to 40%; half of these consumed less than 30% of energy from fat and half consumed more than 40% (40). Our analysis of usual macronutrient intake suggests that Hispanic toddlers consume a higher percentage of energy from carbohydrates and fat outside the acceptable macronutrient distribution ranges than non-Hispanics. In FITS, a relatively higher proportion of Hispanic diets fell outside the acceptable macronutrient distribution range for fat and carbohydrate, indicating that nutrition education to improve food choices when infants transition to toddlerhood is especially important for Hispanic mothers and caretakers.

Our analysis of micronutrient intakes revealed that both Hispanic and non-Hispanic infants and toddlers consumed nutritionally adequate diets and were similar in the percentage using dietary supplements (18% in both groups). The relatively high micronutrient intakes correspond to the reported energy intakes, and to some extent to infant formula use. Among Hispanic toddlers, approximately half had intakes that exceeded the UL for vitamin A, zinc, and sodium. A smaller study of 3- to 4-year-olds also found that low- and middle-income Hispanic children had high intakes of sodium (41). These findings suggest that choices in table foods contribute to high sodium intake, and that further study of the infant and toddler DRIs for selected nutrients is needed (22,25,31).

### Hispanics and WIC

In 2002, Hispanics were the largest ethnic group participating in WIC, representing 38% of all WIC clients (35). A study of WIC participants in New York City found that Hispanic 2-year-olds were more than twice as likely to be overweight than other racial/ethnic groups (37), and a 2001 study of 274 WIC families in California found that increased food insecurity was associated with less intake of fruits and vegetables (42).

In FITS, WIC participation was significantly higher among Hispanics compared with non-Hispanics (43% vs 23%;  $P < .01$ ), and especially high among the older infants age 6 to 11 months (57% vs 27%, respectively) (Appendix). WIC participation is an important factor to consider in the interpretation of nutrient intakes and is higher among Hispanics, as reported in national program data (35). In a 2004 publication of FITS data, Ponza and colleagues reported on the nutrient intakes and food choices of infants and toddlers participating in WIC (43). They found that the mean usual intakes of nutrients targeted by WIC (eg, calcium, vitamins A and C) exceeded the AI among WIC participants, and that there were low levels of nutrient inadequacy (<1%, except for iron, intake of

which was inadequate in 10%). Reported mean energy intakes exceeded mean energy requirements, with the largest discrepancy observed for WIC participants (43).

### Future Research

The FITS data provide insights about the need for additional research of the DRIs and the assessment of the diets of diverse population subgroups. Our data on usual energy and nutrient intake suggest that there may be differences in parents' infant feeding practices and the introduction of complementary foods and table foods that contribute carbohydrate, fat, and sodium to the diet. Mennella and colleagues (20) investigated the infant feeding practices and food consumption patterns of Hispanic and non-Hispanic infants and toddlers, and Ziegler and colleagues reported on their meal and snack patterns (21). Additional research on cultural preferences and dietary habits related to food sources of carbohydrate, in particular the role of sweetened beverages, should be conducted in future studies with larger samples sizes to address differences among ethnic groups.

Longitudinal studies of infants, toddlers, and preschoolers would be invaluable as a source of information on the development of eating habits and cultural preferences and the risk of overweight. Information could be collected on breastfeeding initiation and duration, infant feeding practices, socioeconomic factors and ethnicity, parents' knowledge and attitudes about infant and toddler feeding, weight and length or height, and dietary intake. Longitudinal studies would provide information about the tracking of energy and nutrient intake and weight status in relation to environmental and family characteristics.

### CONCLUSIONS

Through dietary analyses, we compared the diets of Hispanic children and the diets of non-Hispanic children to better understand why Hispanic children are more overweight than non-Hispanic children, and to identify dietary practices that may be improved through nutrition education. National trends suggest that dietetics professionals, health care practitioners, and parents should be concerned about toddlers' energy intakes and food selection with respect to risk of overweight. The early introduction of sweetened beverages is one dietary practice that could be targeted for improvement by health professionals and practitioners.

Dietetics professionals have an important opportunity to educate parents and medical practitioners about cultural preferences in diet and to provide dietary guidance that is sensitive to cultural preferences. With a high proportion of Hispanic women of childbearing age and children from birth to 5 years participating in WIC, dietetics professionals providing counseling and nutrition education services in WIC should be aware of FITS findings among Hispanics and tailor education efforts accordingly. FITS findings and the results of other studies of Latinos indicate that dietetic professionals, health practitioners, and WIC nutritionists should consider acculturation in feeding practices and encourage the selection and consumption of nutritious traditional foods.

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**Appendix. Feeding Infants and Toddlers Study: Sample characteristics of Hispanic and non-Hispanic subgroups<sup>ab</sup>**

Hispanic ethnicity	Age 4-24 Months				Age 4-5 Months				Age 6-11 Months				Age 12-24 Months			
	H <sup>c</sup>		NH <sup>d</sup>		H		NH		H		NH		H		NH	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
<b>Sex</b>																
Male	199	54	1,340	51	48	58	274	51	95	58	621	51	56	45	445	51
Female	171	46	1,296	49	35	42	264	49	68	42	606	49	68	55	426	49
<b>Birth order</b>																
First-born	189	51	1,479	56	41	49	290	54	85	52	677	55	63	51	512	59
Second born or later	182	49	1,158	44	43	51	248	46	78	48	551	45	61	49	359	41
<b>Age of child (mo)</b>																
4 to 5	84	23	538	20	84	100	538	100	NA <sup>e</sup>		NA		NA		NA	
6 to 8	75	20	631	24	NA		NA		75	46	631	52	NA		NA	
9 to 11	88	24	597	23	NA		NA		88	54	592	48	NA		NA	
12 to 14	43	12	326	12	NA		NA		NA		NA		43	35	326	37
15 to 18	44	12	266	10	NA		NA		NA		NA		44	35	266	31
19 to 24	37	10	279	11	NA		NA		NA		NA		37	30	279	32
<b>Child's weight-for-age percentile</b>																
≤25th	88	25	658	26	17	21	117	22	42	27	329	28	29	25	212	25
25.01-50th	76	22	574	22	19	24	128	24	34	22	247	21	23	20	199	23
50.01-75th	77	22	585	23	17	21	112	21	30	19	270	23	30	26	203	24
75.01-100th	111	32	754	29	27	34	172	33	51	33	343	29	33	29	239	28
<b>Ever breastfed</b>																
Yes	309	83	2,021	77	77	92	427	79	137	84	941	77	95	77	653	75
No	62	17	614	23	7	8	111	21	26	16	287	23	29	23	216	25
<b>Vitamin/mineral supplement use</b>																
Yes	53	14	374	14	5	6	19	4	26	16	149	12	22	18	206	24
No	318	86	2,263	86	79	94	519	96	137	84	1,079	88	102	82	665	76
<b>Age of mother at birth (y)</b>																
<20	38	13	125	6	5	7	32	7	15	11	58	6	18	18	35	5
20 to 24	83	27	456	21	19	26	96	22	35	27	225	22	29	29	135	1
25 to 29	80	26	646	29	27	37	129	29	38	29	283	28	15	15	234	32
30 to 34	63	21	646	29	14	19	113	25	25	19	316	31	24	24	217	30
35 or older	40	13	338	15	8	11	77	17	19	14	147	14	13	13	114	16
<b>Mother's education</b>																
≤11th grade	55	15	135	5	14	17	32	6	22	14	59	5	19	16	44	5
Completed high school	118	33	631	24	26	31	118	22	50	32	312	26	42	35	201	23
Some postsecondary	107	30	744	28	25	30	152	29	47	30	349	29	35	29	243	28
Completed college	81	22	1,111	42	18	22	231	43	38	24	503	41	25	21	377	44
<b>Mother works</b>																
Yes	185	50	1,484	57	40	48	259	49	71	44	698	57	74	61	527	61
No	181	50	1,138	43	44	52	274	51	89	56	523	43	48	39	341	39
<b>Parents' marital status</b>																
Married	260	71	2,215	84	65	77	433	81	111	69	1,037	85	84	69	745	86
Not married	105	29	412	16	19	23	101	19	49	31	187	15	37	31	124	14
<b>Mother's language spoken to child</b>																
English	251	68	2,532	96	64	76	512	96	108	66	1,182	96	79	64	838	96
Spanish	114	31	6	<1	20	24	2	<1	50	31	2	<1	44	35	2	<1
Other	6	2	99	4	0	0	24	4	5	3	44	4	1	1	31	4
<b>Child receiving WIC<sup>f</sup></b>																
Yes	170	46	648	25	32	38	158	29	93	57	330	27	45	37	160	18
No	200	54	1,985	75	52	62	380	71	70	43	896	73	78	63	709	82

(continued)

**Appendix.** Feeding Infants and Toddlers Study: Sample characteristics of Hispanic and non-Hispanic subgroups<sup>ab</sup> (continued)

	Age 4-24 Months				Age 4-5 Months				Age 6-11 Months				Age 12-24 Months			
	H <sup>c</sup>		NH <sup>d</sup>		H		NH		H		NH		H		NH	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
<b>Hispanic ethnicity</b>																
<b>Race/ethnicity</b>																
Non-Hispanic black	NA		220	8	NA		41	8	NA		113	9	NA		66	8
Non-Hispanic white	NA		2,415	92	NA		497	92	NA		1,114	91	NA		804	92
Hispanic	371	100	NA		84	100	NA		163	100	NA		124	100	NA	
<b>Household income (\$)</b>																
<10,000	10	3	38	1	3	4	6	1	5	3	21	2	2	2	11	1
10,000-14,999	11	3	37	1	1	1	7	1	7	4	17	1	3	2	13	2
15,000-24,999	36	10	184	7	5	6	38	7	17	10	94	8	14	11	52	6
25,000-34,999	65	18	293	11	12	14	72	13	31	19	131	11	22	18	90	10
35,000-49,999	81	22	641	24	20	24	119	22	35	22	319	26	26	21	203	23
50,000-74,999	56	15	531	20	12	14	98	18	19	12	235	19	25	20	198	23
75,000-99,999	29	8	282	11	10	12	59	11	11	7	137	11	8	7	86	10
≥100,000	17	5	255	10	4	5	58	11	6	4	110	9	7	6	87	10
Missing	66 <sup>g</sup>	18	376 <sup>h</sup>	14	17	20	81	15	32	20	164	13	17	14	131	15
<b>Low income</b>																
≤130% poverty level <sup>i</sup>	53	14	209	8	9	11	42	8	28	17	107	9	16	13	60	7
≤185% poverty level <sup>j</sup>	118	32	489	19	18	21	112	21	57	35	227	19	43	35	150	72
<b>Urbanicity</b>																
Urban	219	59	1,166	45	51	61	254	48	97	60	528	44	71	57	384	45
Suburban	116	31	890	34	24	29	174	33	48	30	425	35	44	36	291	34
Rural	35	10	540	21	9	11	104	20	17	11	260	21	9	7	176	21
Sample size	371	100	2,637	100	84	100	538	100	163	100	1,228	100	124	100	871	100

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study.

<sup>b</sup>The table presents unweighted sample characteristics. Some percentages may not add to 100 due to rounding. Cases with missing data are excluded from percentages except for income.

<sup>c</sup>H=Hispanic.

<sup>d</sup>NH=non-Hispanic.

<sup>e</sup>NA=not applicable

<sup>f</sup>WIC=Special Supplemental Nutrition Program for Women, Infants, and Children.

<sup>g</sup>Includes 3 cases with annual income <\$35,000 and 2 cases with annual income of \$35,000 to \$99,999.

<sup>h</sup>Includes 10 cases with annual income <\$35,000 and 6 cases with annual income of \$35,000 to \$99,999.

<sup>i</sup>Income eligibility for the Food Stamp Program. Cases are also included in category of ≤185% poverty level. Percentages reported for those with income data only.

<sup>j</sup>Income eligibility for WIC. Percentages reported for those with income data only.