

## Current Research

## Feeding Infants and Toddlers Study: The Types of Foods Fed to Hispanic Infants and Toddlers

JULIE A. MENNELLA, PhD; PAULA ZIEGLER, PhD, RD; RONETTE BRIEFEL, DrPH, RD; TIMOTHY NOVAK, MBA

**ABSTRACT**

**Objective** To assess the prevalence of breastfeeding and formula feeding, the age of introduction to specific foods, and the types of foods and beverages consumed by Hispanic infants and toddlers compared with similarly aged non-Hispanic infants and toddlers living in the United States.

**Design** Descriptive and comparative analysis of dietary recall data and responses to specific interview questions, which were collected in the 2002 Feeding Infants and Toddlers Study. Breastfeeding status, timing of introduction of complementary foods, percentage consuming foods from specific food groups, and the most frequently consumed fruits and vegetables by Hispanic and non-Hispanic children by age group (4-5 months, 6-11 months, 12-24 months).

**Subjects** A national random sample of 371 Hispanic and 2,637 non-Hispanic infants and toddlers between the ages of 4 and 24 months.

**Statistical analysis:** To test for differences between Hispanic and non-Hispanic children in the percentage who consumed a particular food item, we calculated percentages and standard errors in SUDAAN and 95% and 99% confidence intervals. The most frequently consumed fruits and vegetables were determined by tallying the percentage of infants and toddlers who consumed each specific fruit or vegetable on a given day.

**Results** Although there were some similarities, the early flavor and food experiences of Hispanic infants were different from similarly aged non-Hispanic infants in several ways. Hispanic infants younger than 1 year of age were more likely to have ever been breastfed and those

who were 4 to 5 months were more likely than non-Hispanics to be eating pureed baby foods on a daily basis. Although less likely to be eating noninfant cereals and baby food vegetables, 6- to 11-month-old Hispanics were more likely to be eating fresh fruits, fruit-flavored drinks, baby cookies, and foods such as soups, rice, and beans that are common in many Hispanic cultures. When fruits were introduced into the Hispanic child's diet, they were most commonly consumed fresh. This higher prevalence of being fed soups, rice, beans, and sweetened fruit-flavored drinks as well as tortillas was also observed among the 12- to 24-month-old toddlers.

**Conclusions** Dietetics professionals should be aware of the cultural differences in the foods fed to infants and toddlers that may contribute to the development of long-term food preferences and impact on nutrition. Understanding the factors that underlie food preferences is important if we are to develop evidence-based strategies to improve children's eating habits and lower their risks factors associated with obesity and other chronic diseases.

*J Am Diet Assoc. 2006;106:S96-S106.*

Hispanic individuals comprise the largest minority group in the United States (1). Hispanic children, in turn, comprise more than 20% of the nation's kindergarten through 12th-grade student population (2). As their population increases, more health professionals are called upon to address the high incidence of obesity, which is fueling an epidemic of type 2 diabetes and metabolic disorders in Hispanic youth as well as adults (3,4).

Among children enrolled in a New York City Special Supplemental Nutrition Program for Women, Infants, and Children, Hispanics were three times more likely to be overweight or in danger of becoming so compared with white children. Two-year-olds were less likely to be overweight than 3- to 4-year-olds (5). The increase in overweight after the age of 2 years suggests that there is a window of opportunity to initiate healthful eating habits and prevent overweight, and target nutritional messages to these families before obesity becomes a problem.

Because food preferences established during the first few years of life may track into later childhood and adolescence (6-8), developing strategies to eliminate health disparities and enhance acceptance of healthful foods early in life is important for long-term health (9,10). Such strategies may help eliminate health disparities between Hispanic and non-Hispanic children. However, any strategy needs to consider the social and cultural factors that interact with food availability and impact the development of dietary habits during childhood (11).

*J. A. Mennella is a member and director of education outreach, Monell Chemical Senses Center, Philadelphia, PA. P. Ziegler is an adjunct, assistant professor, Department of Foods and Nutrition, College of Saint Elizabeth, Morristown, NJ; at the time of the study, she was a principal scientist, Gerber Products Co, Parsippany, NJ. R. Briefel is a senior fellow, Mathematica Policy Research, Inc, Washington, DC. T. Novak is a systems analyst, Mathematica Policy Research, Inc, Princeton, NJ.*

*Address correspondence to: Julie A. Mennella, PhD, Monell Chemical Senses Center, 3500 Market St, Philadelphia, PA 19104-3308. E-mail: mennella@monell.org*

*Copyright © 2006 by the American Dietetic Association.*

*0002-8223/06/10601-1006\$32.00/0*

*doi: 10.1016/j.jada.2005.09.038*

The 2002 Feeding Infants and Toddlers Study (FITS) was designed to update our knowledge about food and nutrient intake and the feeding patterns of American infants and toddlers between the ages of 4 and 24 months (12,13). The present article uses the 2002 FITS data to describe the prevalence of breastfeeding and formula feeding, the age of introduction to certain foods, and the types of foods and beverages consumed by Hispanic, when compared with non-Hispanic, infants and toddlers. This information, in turn, will be valuable in the design and implementation of intervention strategies.

## METHODS

### Study Design and Population

The FITS includes a stratified random sample of 371 Hispanic and 2,637 non-Hispanic infants and toddlers between the age of 4 and 24 months. On average, the Hispanic 4- to 11.9-month-old infants were the same age as the non-Hispanics (mean age  $7.3 \pm 0.2$  months for Hispanic and  $7.2 \pm 0.1$  months for non-Hispanic infants; 95% confidence interval 6.9 to 7.7 and 7.0 to 7.4, respectively) as were the 12- to 24-month-old toddlers (mean age,  $18.2 \pm 0.4$  months for Hispanic and  $17.8 \pm 0.1$  months for non-Hispanic toddlers; 95% confidence interval 17.4 to 19.0 and 17.5 to 17.9, respectively).

Parents or primary caregivers were interviewed via telephone by trained interviewers between March and July 2002.

Data are presented for three age groups of infants and toddlers: 4-5 months (defined as 4.0 to 5.9 months), 6-11 months (defined as 6.0 to 11.9 months), and 12-24 months. The sample sizes by age group were 4-5 months ( $n=84$ ); 6-11 months ( $n=163$ ); and 12-24 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. Additional details about the FITS sample and data collection protocol (12,14) as well as more details on characteristics of the Hispanic population in general (14) are provided elsewhere.

All data collection instruments and procedures were reviewed and approved by the institutional review board compliance officer and Quality Assurance system at Mathematica Policy Research, Inc (Washington, DC).

### Dietary Data

Trained interviewers used the Nutrition Data System for Research (NDS-R, version 4.03, 2001, University of Minnesota Nutrition Coordinating Center, Minneapolis) to collect dietary recalls (12). Parents or primary caregivers provided a 24-hour dietary recall of all foods and beverages consumed by the child during the previous day and were asked specific questions regarding the age at which their infants were first fed infant formula, infant cereals, cow's milk, and pureed foods "on a daily basis." Pureed foods here could include commercial or homemade baby foods. The data on the age of introducing complementary foods are based on these specific interview questions, whereas the data on the consumption of specific foods and beverages are based on the 24-hour dietary recall. For this study, exclusive breastfeeding was defined as consuming only breast milk and no supplemental infant for-

mula, cow's milk, or other foods (except water), as reported by the parent or primary caretaker and verified with the 24-hour dietary recall. "Ever breastfed" was defined as a positive response to the question "Was (child) ever breastfed or fed breast milk?"

### Classification of Foods within Food Groups

The food classification/food grouping scheme developed for the FITS study allows flexibility in reporting foods and food groups at various levels of detail. As described previously (13), individual foods and beverages reported in the 24-hour recall were assigned to major and minor food groups similar to those used in the most recent Continuing Survey of Food Intakes by Individuals (15). The percentage of infants and toddlers who consumed any amount of a given food or beverage in one day was tabulated within each age/ethnicity group. The data tables show the "percentage consuming" any amount of a specific food or beverage within the major food groups (milk and milk products; grains and grain products; fruits; vegetables; meat and other protein sources; desserts, sweets, and sweetened beverages; and other foods such as salty snacks). The following briefly describes the foods included in the major food groups and subcategories:

- **Milk** includes breast milk, all kinds of infant formula, cow's milk with varying fat content, and soy and goat's milk.
- **Grains and grain products** includes breads, rolls, biscuits, bagels, and tortillas; cereals and granola bars; infant and noninfant ready-to-eat or cooked cereals; crackers, pretzels, and rice cakes; pasta and rice; pancakes, waffles, and French toast; and other grains.
- **Fruits** include the subcategories of 100% fruit juice, baby food fruits, and non-baby food fruits. Within these subcategories, fruits are categorized by how the fruit was prepared (ie, baby food fruits and canned, fresh and dried non-baby food fruits) and type (eg, bananas, pears, peaches, berries). Baby food fruits include single fruits (majority of fruits reported) as well as mixtures with the named fruit as the predominant fruit, eg, applesauce-blueberry mixture, bananas with apples and pears. Baby food fruits with tapioca and other baby food dessert fruits were counted as desserts. Consistent with categories used by food-labeling regulations (16), the 100% juice category included infant and adult fruit juices that were 100% juices, including juices fortified with calcium and/or other nutrients.
- **Vegetables** include 100% vegetable juice, baby/toddler vegetables, and cooked or raw (non-baby food) vegetables. Baby food vegetables include single vegetables (majority of vegetables reported) as well as mixtures with the named vegetable as the predominant vegetable, eg, broccoli and cauliflower or broccoli and carrots. Vegetables are further subcategorized into how vegetables were prepared (eg, baby food, cooked, and raw) and to distinguish color and flavor profile: dark green (eg, broccoli, spinach) vegetables which are typically bitter tasting (17) and deep yellow (eg, carrots, acorn squash); starchy vegetables (eg, potatoes, corn, green beans, peas) and nonstarchy vegetables (eg, tomatoes), all of

which are typically less bitter and sweeter tasting than dark green vegetables. The classifications for dark green and deep yellow vegetables are consistent with recommendations in the dietary guidelines (18).

- **Meat and other protein sources** include the subcategories of baby food and non-baby food meats; beans and peas; eggs; peanut butter, nuts, and seeds; cheese and yogurt. Meats are further categorized by type of meat, such as chicken, pork, beef, fish, shellfish, hot-dogs, sausages, and cold cuts.
- **Mixed dishes** includes a variety of foods that typically combine a grain with a protein source (meat, cheese, or beans), and sometimes also a vegetable (tomato sauce). Subcategories of mixed dishes include: sandwiches; soups; spaghetti, ravioli, and lasagna; baby food dinners; beans and rice; egg dishes (eg, omelets and quiche); macaroni and cheese; pizza; and burrito, taco, enchilada, and nachos.
- **Sweets, sweetened beverages, and desserts** is a broad food group that includes sweet-tasting foods. Sweets include desserts and candy, and sugar, syrups, preserves. Desserts include jarred baby food desserts; cakes, cookies, pies, and pastries; candy; and ice cream, frozen yogurt, and pudding. Sweetened beverages include soda, lemonade, and fruit-flavored and other sweetened drinks. Fruit drinks as defined in this study included beverages with less than 100% juice, many of which had added sugars (eg, 10% fruit drinks, fruit-flavored drinks, and lemonade), and some of which were fortified. Carbonated beverages included carbonated mineral waters and “diet” and “regular” products that may or may not have contained sugars and caffeine.
- The **salty snack** group includes potato chips, popcorn, cheese curls/puffs, tortilla chips, corn chips, and other types of chips and salty snacks.

### Data Analysis

For most of the major food groups, we report the percentage of the age/ethnicity subgroup who consumed the major food group (eg, any fruit) as well as the percentage who consumed various subcategories within the food groups on a given day. For simplicity and data reliability, we generally report data for foods that were consumed by 10% or more of an age/ethnicity subgroup, and for the most important categories of foods, based on consumption patterns, contributions to nutrient intake, and/or cultural preferences.

Because mixed dishes often contain a grain product such as pasta or bread, we report the data for commonly consumed mixed dishes along with the consumption of grains. We do not double-count foods in the data tables. For example, if a parent or caregiver reported the child ate a sandwich containing bread, meat, and cheese and could describe each food in detail, each food item was counted in its respective food category of grains, meats, or milk and milk products. However, if a generic fast-food hamburger or grilled cheese sandwich was reported, this is counted in the sandwich category.

The most frequently consumed fruits and vegetables were determined by tallying the percentage of infants and toddlers who consumed each specific fruit or vegetable, regardless of the preparation method. Vegetable es-

timates reflect vegetables consumed as distinct food items, and do not include vegetables contained in mixed dishes such as stews or pizza. To illustrate this, peaches included baby food, canned, dried, and fresh peaches, and peas included baby food, cooked, and raw peas. These foods are then reported in rank order of the most frequently consumed on any given day for each age/ethnicity subgroup.

Sample weights were calculated to account for nonresponses and to weight the sample to known population demographic characteristics. Estimates were calculated using the Statistical Analysis System (version 8.2, 2001, SAS Institute, Inc, Cary, NC), SUDAAN (release 9.0, 2004, Research Triangle Institute, Research Triangle Park, NC), and the appropriate sample weights. To test for differences between Hispanic and non-Hispanic groups in the percentage who consumed a particular food item, we calculated percentages and standard errors in SUDAAN and 95% and 99% confidence intervals. If confidence intervals overlapped, there were no significant differences in the percentage of Hispanics and non-Hispanics who consumed a particular food item (within an age group). The tables display the level of significance when confidence intervals did not overlap, indicating a significant difference between Hispanics and non-Hispanics.

We also followed accepted reporting guidelines for nutrition data with respect to the reliability of point estimates (19). The data presented in the tables meet minimum sample size requirements and have been reviewed for reliability. We flagged estimates with a † where the coefficient of variation (calculated as standard error ÷ mean) exceeds 30% because they may be potentially unreliable due to a high coefficient of variation. This is most problematic within the 4- to 5-month age group, for which the consumption of the food item 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 more caution due to a high coefficient of variation.

## RESULTS

### Breast Milk, Formula, Cow's Milk, and Baby Foods

Table 1 presents the prevalence of breastfeeding and introduction of infant formula, cow's milk, and baby foods such as cereal and pureed foods among infants and toddlers, as determined from the specific interview questions of the caregivers. Hispanic infants in the youngest age category (4-5 months) were significantly more likely to have been breastfed and to have consumed pureed foods than non-Hispanic infants. This higher prevalence of ever having been breastfed was also evident in the 6- to 11-month-old group, but not in the 12- to 24-month-old Hispanics. No differences were observed between Hispanics and non-Hispanics in the prevalence of exclusive breastfeeding or the feeding of formula, cow's milk, and infant cereals at the time of the study, however.

The majority of infants and toddlers consumed some form of milk on a given day and nearly half (49% Hispanic, 43% non-Hispanic) of the 4- to 5-month-old infants consumed some breast milk (Table 2). Thirteen 4- to 5-month-old Hispanic infants (out of 84; 15.5%) and 96

**Table 1.** Breastfeeding status and use of formula, cow's milk, infant cereal, and pureed foods among Hispanic and non-Hispanic infants and toddlers<sup>a</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)
	← %±SE <sup>b</sup> →					
Ever breastfed	93±2.8**	79±1.9	87±2.8*	77±1.4	77±4.7	74±1.8
Currently breastfed	49±6.0	43±2.3	31±4.4	23±1.4	12±3.9	6±0.8
Currently exclusively breastfeeding <sup>c</sup>	14±4.0	18±1.8	0.5±0.5†	0.3±0.2†	—	—
Ever fed infant formula	82±4.4	79±1.9	91±3.0	92±0.9	94±2.5	92±1.1
Ever fed cow's milk	3±2.6†	1±0.4†	18±3.6	19±1.3	89±3.2	95±0.9
Ever fed infant cereal	76±5.5	76±2.2	96±1.5	97±0.6	97±1.4	99±0.5
Ever fed pureed food	62±6.3*	51±2.6	97±1.5	97±0.5	100±0.4	99±0.4

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study, Hispanic and non-Hispanic subgroups. Based on information obtained in the parent/caregiver interview.  
<sup>b</sup>SE=standard error of the mean  
<sup>c</sup>Defined as consuming no other foods or beverages except water.  
\*Significantly different from non-Hispanics at the  $P<.05$ .  
\*\*Significantly different from non-Hispanics at the  $P<.01$ .  
†Indicates a statistic that is potentially unreliable because of a high coefficient of variation.

similarly aged non-Hispanic infants (out of 538; 17.8%) were exclusively breastfeeding at the time of the interview. Infant formula was used to supplement breastfeeding for some infants and was the primary source of nutrition for others. About three fourths of the 4- to 5-month-old as well as the 6- to 11-month-old infants were fed infant formula on a given day. Cow's milk was not a part of the diet of the majority of children until they were 12 to 24 months of age; one quarter of these infants were fed reduced fat or nonfat milk.

To determine whether there were significant differences in the age when infant formula, infant cereal, pureed foods, and cow's milk were introduced to the child's diet on a daily basis, we limited the analysis to toddlers who were 12 months of age and older to ensure that nearly all were past the age when these foods were introduced. Figure 1 shows that there were no significant differences between Hispanic and non-Hispanic infants in the mean age of introduction of these foods, although there were large individual differences. For example, pureed foods were introduced as early as the second or as late as the 18th month of life. However, it is interesting to note that the interview, during which caregivers were asked specific questions about whether the child was ever fed various milks or foods, revealed that 4- to 5-month-old Hispanic infants were more likely to have ever been fed pureed foods when compared with similarly aged non-Hispanic infants (Table 1).

### Grains and Grain Products

By 6 months of age, most infants consumed a grain or grain product on a given day (Table 2). Infant cereals were the predominant grain-based food in both Hispanic and non-Hispanic children's diet during the first year of life. However, by 12 to 24 months, the majority was no longer eating infant cereals and appreciable numbers were consuming other grain-based foods such as noninfant cereals, bread, crackers, pretzels, and rice cakes.

There were differences in the types of grains consumed in the older infants. Hispanic infants were less likely to eat noninfant cereals, but were more likely to be eating rice when 6 to 11 months of age. This higher prevalence of eating rice as well as tortillas was also evident in 12- to 24-month-old Hispanic toddlers. Hispanic toddlers were less likely to eat presweetened cereals and refined grains in mixed dishes, especially pizza, when compared with non-Hispanic toddlers.

### Fruits

Fruits or 100% fruit juices were being fed to about 45% of the 4- to 5-month-old Hispanic infants but only 36% of similarly aged non-Hispanic infants (Table 2). Although the vast majority (>80%) of the 6- to 24-month-old children were eating fruits on a given day, there were age-related changes in how the fruit was prepared for the child. Overall consumption rates of baby food fruits decreased, whereas the consumption rates of non-baby food fruits increased during the second year of life. Six- to 11-month-old Hispanic infants were less likely to be eating baby food fruits, and more likely to be eating fresh fruits, when compared with similarly aged non-Hispanics. The higher prevalence of eating fresh fruits was also evident in the younger age group of infants. Similarly, Hispanic toddlers were less likely to be eating canned fruit when compared with non-Hispanics.

Of the 6- to 11-month-old infants who were consuming apples at the time of the interview, 29% of the Hispanics, but only 6% of the non-Hispanics, were eating fresh apples ( $P<.01$ ). Figure 2 lists the top five fruits across all age groups. Although the types of fruits were similar between the ethnic groups, bananas were the most popular fruit choice among Hispanic infants and toddlers and non-Hispanic toddlers, whereas apples were the most popular fruit among non-Hispanic infants. Across all age groups, melons were more likely to be one of the top five fruits consumed by Hispanic infants and toddlers than

**Table 2.** Percentage of Hispanic and non-Hispanic infants and toddlers consuming different types of milk, grain products, fruits, vegetables, meats or other protein sources on a given day<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)
	← % →					
<b>Food group: Milk</b>						
Fed any milk	100.0	100.0	100.0	99.8	93.8	95.2
Breast milk	48.7	42.8	31.4	23.4	11.5†	5.7
Formula	74.6	70.7	79.3	78.6	9.3	7.1
Cow's or goat milk	—	—	7.5†	11.3	85.6	87.7
Fed cow's milk						
Whole	—	—	5.6†	8.3	61.7	66.3
Reduced fat or nonfat	—	—	2.2†	3.0	29.0	27.0
<b>Food group: Grain products</b>						
Any grain or grain product	56.5	56.9	95.0	93.5	97.1	98.9
Infant cereal	55.2	56.5	74.1	73.6	15.9	9.3
Noninfant cereal	—	—	18.5*	29.2	45.3	57.8
Breads <sup>c</sup>	1.4†	—	18.2	15.1	44.0	52.9
Tortillas	1.4†	—	4.0†	—	6.7†*	0.6†
Crackers, pretzels, rice cakes	1.3†	—	27.8	22.5	35.6	46.9
Pancakes, waffles, French toast	—	—	1.4†	4.3	13.0	16.0
Rice and pasta <sup>d</sup>	—	—	20.1*	10.3	44.3	32.9
Rice	—	—	15.9**	4.7	26.9*	13.0
Grains in mixed dishes	—	—	15.9	13.0	38.8*	54.4
Sandwiches	—	—	4.0†	4.6	24.2	24.9
Burrito, taco, enchilada, nachos	—	—	1.3†	—	2.1†	3.0
Macaroni and cheese	—	—	3.0†	3.1	10.1†	15.5
Pizza	—	—	—	1.4	1.0**†	9.7
Spaghetti, ravioli, lasagna	—	—	8.3†	4.6	9.3†	12.1
<b>Food group: Fruits</b>						
Any fruit or 100% fruit juice	45.0	35.9	86.2	86.8	84.6	87.2
Any fruit <sup>e</sup>	39.4	28.8	68.1	76.0	67.6	71.5
100% Fruit juice	19.3	15.3	57.8	47.7	64.1	58.9
Fruit preparation						
Baby food fruit	32.6	28.4	42.9*	58.1	5.6†	6.3
Non-baby food fruit	9.1†	1.3†	35.8	27.4	64.2	68.0
Canned fruit	2.3†	—	8.8	13.7	12.1**	26.2
Fresh fruit	9.1*†	—	30.0**	17.7	59.3	53.1
<b>Food group: Vegetables</b>						
Any vegetable or 100% vegetable juice <sup>f</sup>	30.0	27.3	66.2	70.3	76.0	80.5
Type of preparation						
Baby food vegetables	25.7	25.4	34.4*	47.6	4.1†	4.9
Cooked vegetables	4.2†	2.4†	33.2	29.4	71.4	72.9
Raw vegetables	2.3†	—	8.3†	2.6	25.0	13.1
Types of vegetables <sup>f</sup>						
Dark green vegetables <sup>g</sup>	—	—	3.3†	3.1	11.4†	7.5
Deep yellow vegetables <sup>h</sup>	21.0	18.2	32.2	25.9	20.0	15.4
Starchy vegetable:						
White potatoes	1.4†	2.3†	20.7	17.4	43.5	39.0
French fries/fried potatoes	—	—	5.7†	5.3	23.4	20.3
Baked/mashed	—	—	14.4†	10.7	19.8	17.7
Other starchy vegetables <sup>i</sup>	5.0†	4.0	6.7**	15.1	16.6	22.2
Other nonstarchy vegetables <sup>j</sup>	8.1†	8.0	28.5	29.0	42.0	43.4

(continued)

**Table 2.** Percentage of Hispanic and non-Hispanic infants and toddlers consuming different types of milk, grain products, fruits, vegetables, meats or other protein sources on a given day<sup>ab</sup> (continued)

	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)
	← % →					
<b>Food group: Meat or other protein sources</b>						
Any meat or protein source <sup>k</sup>	9.7†	5.3	71.6	62.0	90.3	94.7
Non-baby food meat	—	—	22.5	19.2	72.3	76.0
Other protein sources	1.4†	—	26.5	21.2	70.1	65.3
Beans and peas	1.4†	—	5.8†	1.8	19.1*	6.5
Eggs	—	—	9.5	4.2	26.4	22.5
Cheese	—	—	11.2	9.4	29.3	40.2
Yogurt	—	—	7.7	9.8	15.7	17.0
Protein sources in mixed dishes	7.5†	4.4	44.8	41.6	33.3	22.7
Baby food dinners	6.9†	3.9	24.7*	35.3	3.5†	3.9
Soup <sup>l</sup>	—	—	16.3**	5.1	23.4*	10.7
<b>Types of meat<sup>k</sup></b>						
Beef	—	—	5.0†	4.6	25.2	16.0
Chicken and turkey	—	—	11.2	11.9	46.5	43.6
Hotdogs, sausages, and cold cuts	—	—	7.2†	3.4	14.8	23.3
Pork/ham	—	—	3.8†	1.7	11.7	12.1

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study, Hispanic and non-Hispanic subgroups; 24-hour dietary recall data.

<sup>b</sup>Dashes indicate that less than 1% of the group consumed this food on a given day.

<sup>c</sup>Does not include bread in sandwiches. Sandwiches are included in mixed dishes. Includes tortillas, also shown separately.

<sup>d</sup>Does not include rice or pasta in mixed dishes. Includes rice (eg, white, brown, wild, and Spanish rice without meat) and pasta (eg, spaghetti, macaroni, and egg noodles). Rice is also shown separately.

<sup>e</sup>Total includes all baby food and non-baby food fruits and excludes 100% fruit juices and juice drinks.

<sup>f</sup>Total includes commercial baby food, cooked vegetables, raw vegetables, and 100% vegetable juices.

<sup>g</sup>Reported dark green vegetables include broccoli, spinach, romaine lettuce and other greens such as kale.

<sup>h</sup>Reported deep yellow vegetables include carrots, pumpkin, sweet potatoes, and winter squash.

<sup>i</sup>Reported starchy vegetables include corn, green peas, immature lima beans, black-eyed peas (not dried), cassava, and rutabaga. Corn is also shown as a subcategory of other starchy vegetables.

<sup>j</sup>Reported non-starchy vegetables include asparagus, cauliflower, cabbage, onions, green beans, mixed vegetables, peppers, and tomatoes.

<sup>k</sup>Includes baby food and non-baby food sources.

<sup>l</sup>The amount of protein actually provided by soups varies. Soups could not be sorted reliably into different food groups because many food descriptions lacked detail about major soup ingredients.

\*Significantly different from non-Hispanics at the  $P < .05$ .

\*\*Significantly different from non-Hispanics at the  $P < .01$ .

†Indicates a statistic that is potentially unreliable because of a high coefficient of variation.

non-Hispanics. Across all age/ethnicity subgroups, overall fruit consumption was greater than that observed for overall vegetable consumption.

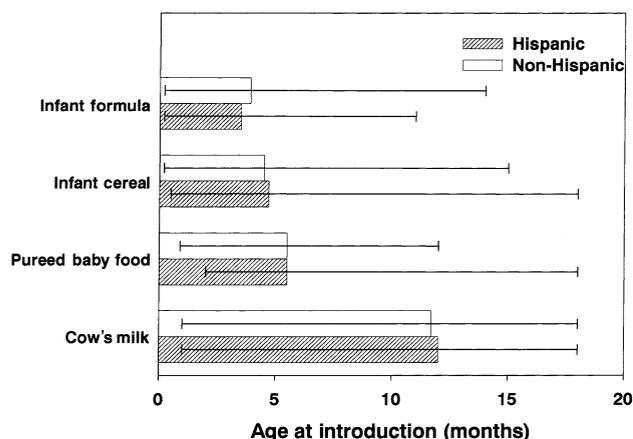
### Vegetables

The percentage of infants who consumed vegetables as distinct foods increased with age such that three fourths of the 6- to 11-month olds (67% Hispanic, 70% non-Hispanic) as well as 12- to 24-month-olds (76% Hispanic, 81% non-Hispanic) were eating vegetables on a given day (Table 2). In other words, between the ages of 6 and 24 months, there were significant numbers of both Hispanic and non-Hispanic infants who were not consuming any vegetables on a given day.

There were few differences in the types of vegetables consumed by Hispanic and non-Hispanic infants. The

consumption of dark green, leafy vegetables was low (<11%) across all age groups, whereas consumption of starchy vegetables such as potatoes, corn, and peas and other types of nonstarchy vegetables such as tomatoes became increasingly common with age. The percentage of infants consuming french fries quadrupled from 6-11 to 12-24 months such that 23% of the Hispanic and 20% of non-Hispanic toddlers were likely to consume this food on a given day. None of the top five vegetables for both Hispanic and non-Hispanic infants and toddlers was a dark-green vegetable (Figure 2).

Differences were observed in vegetable preparation. That is, 6- to 11-month-old Hispanic infants were less likely to eat baby food vegetables when compared with similarly aged non-Hispanic infants. For those toddlers who were consuming carrots at the time of the interview,



**Figure 1.** The mean age in months at which Hispanic and non-Hispanic infants were first fed infant formula, infant cereals, cow's milk, and pureed foods "on a daily basis." Horizontal lines denote minimum to maximum values. Pureed foods could include commercial or homemade baby foods. Data are from 2002 Feeding Infants and Toddlers Study based on responses to specific questions during the parent/caregiver interviews.

non-Hispanics were more likely to be eating cooked carrots than raw (61% and 28%,  $P < .01$ ), whereas Hispanic toddlers were as likely to eat them raw as cooked (48% and 43%, respectively). Similarly, for those eating tomatoes, 6- to 11-month-old Hispanics consumed fresh and cooked tomatoes at approximately the same frequency (60% and 40%, respectively), whereas non-Hispanics were significantly more likely to consume cooked tomatoes rather than in their fresh form (72% and 31%,  $P < .05$ ).

#### Meats or Other Protein Sources

Meats and other foods high in proteins (eg, eggs, cheese, beans, and peas; does not include meats consumed in sandwiches and other grain-based mixtures; see Table 2) appeared in the infants' diets after 6 months of age. At this time, both Hispanics and non-Hispanics were more likely to be eating non-baby food meat, and poultry was the most common type of meat consumed. By 12 months of age, beef was the second most commonly consumed meat among Hispanic toddlers, whereas hotdogs, sausages, and cold cuts were the second most commonly consumed meat source among non-Hispanics. Cheese and eggs were the most consumed nonmeat protein sources in both groups at this age. Infants were also consuming protein in mixed dishes. However, Hispanic infants were more likely to eat soups and less likely to eat baby food dinners when 6 to 11 months of age as compared with non-Hispanics. Hispanic toddlers were also more likely to be eating soups as well as beans and peas.

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

Consumption of sweet-tasting foods or beverages was evident among the 4- to 5-month-old infants and then increased steadily with age such that almost all of the

toddlers were eating such foods in a day (Table 3). Hispanic infants between the ages of 6 to 11 months were significantly more likely to be eating cookies and fruit-flavored drinks. This greater likelihood of consuming sweetened beverages, including fruit-flavored drinks, was also evident among Hispanic toddlers. Salty snacks, on the other hand, were not generally a part of the diet until after 12 months of age. One of five toddlers consumed a salty snack such as potato chips, popcorn, cheese curls, tortilla chips, or corn chips on a given day.

#### DISCUSSION

The early food experiences of Hispanics were different from similarly aged non-Hispanics in several ways. Hispanics infants who were younger than 1 year of age were more likely to have been breastfed. Six- to 11-month-old Hispanic infants were more likely to be eating fresh fruits, fruit-flavored drinks, and baby cookies, and to be introduced to cultural foods such as soups, rice, and beans. They were less likely to be eating noninfant cereals and baby food vegetables, however. When fruits were introduced into the Hispanic child's diet, they were commonly consumed fresh. Certain vegetables, such as carrots and tomatoes, were consumed raw and cooked at about the same frequency by Hispanic infants, whereas non-Hispanics were significantly more likely to consume these vegetables cooked. This higher prevalence of eating soups, rice, beans, and fruit-flavored beverages as well as tortillas among Hispanic infants 6 to 11 months of age was also observed among the 12- to 24-month-old Hispanic toddlers.

---

**Dietetics professionals should be aware of the cultural differences in the foods fed to infants and toddlers and to ensure that foods chosen contain the needed nutrients.**

---

These differences in food consumption patterns of Hispanic infants and toddlers may reflect cultural beliefs and practices that contribute to the development of food preferences and impact nutrition. Foods such as rice, soups, tortillas, and beans are characteristic of many Hispanic cultures and were introduced into the child's diet as early as the second half of the first year of life (20). The finding that Hispanic infants were more likely to be eating fruits at an earlier age and drinking fruit-flavored beverages from 6 to 24 months of age is consistent with previous reports that fruit was the predominant choice for first foods for infants living in several regions in Mexico and that sweetened drinks were routinely fed to the their infants to prevent or treat infant colic (21). Although heightened preferences for sweet-tasting foods is a hallmark of infancy (22), individuals of certain ethnicities, because of both genetic and experiential factors (23,24), may prefer even higher levels of sweet tastes. Ethnographic studies conducted in Mexico suggested heightened sweet preferences across all age groups and revealed that liberal feeding of sweetened beverages, processed

	Ethnicity	
	Hispanic	Non-Hispanic
<b>Top fruits by age group</b>		
4-5 mo	Bananas (16.3%) Apples (14.7%) Peaches (10.9%) Melons (3.5%) Pears (2.5%)	Apples (12.5%) Bananas (10.0%) Pears (5.9%) Peaches (5.8%) Prunes (1.6%)
6-11 mo	Bananas (35.9%) Apples (29.7%) Pears (15.2%) Peaches (11.7%) Melons (4.7%)	Apples (32.9%) Bananas (31.5%) Pears (17.5%) Peaches (13.9%) Apricots (3.7%)
12-24 mo	Bananas (41.5%) Apples (25.7%) Berries (8.5%) Melons (7.6%) Pears (7.3%)	Bananas (30.9%) Apples (22.0%) Grapes (12.3%) Peaches (9.6%) Berries (8.7%)
<b>Top vegetables by age group</b>		
4-5 mo	Carrots (9.9%) Sweet potatoes (6.8%) Green beans (5.8%) Peas (5.0%) Squash (4.3%)	Sweet potatoes (7.5%) Carrots (6.6%) Green beans (5.9%) Squash (5.4%) Peas (3.8%)
6-11 mo	Potatoes (20.7%) Carrots (19.0%) Mixed vegetables (11.1%) Green beans (11.0%) Sweet potatoes (8.7%)	Carrots (17.5%) Potatoes (16.4%) Green beans (15.9%) Squash (11.8%) Sweet potatoes (11.4%)
12-24 mo	Potatoes (43.5%) Tomatoes (23.1%) Carrots (18.6%) Onions (11.8%) Corn (10.2%)	Potatoes (39.0%) Green Beans (19.6%) Peas (12.8%) Carrots (12.3%) Tomatoes (11.9%)

**Figure 2.** Top five fruits and vegetables consumed by Hispanic and non-Hispanic infants and toddlers per age group. Percentage consuming at least one in a day is in parentheses. Data from the 2002 Feeding Infants and Toddlers Study, Hispanic, and non-Hispanic subgroups; 24-hour dietary recall data.

gelatins, canned fruits, soft drinks, and juices was an integral part of feeding children in this culture (25). Such experience with sweet-tasting liquids and foods has been shown to result in heightened sweet preferences during childhood (23).

Although the present study revealed no difference between Hispanics and non-Hispanics infants (all of whom were younger than 2 years of age) in the likelihood of being fed fruits on a given day, both the older Hispanic infants (6-11 months) and toddlers (12-24 months) were significantly more likely to be consuming a sweetened fruit drink. Data from national surveys (26) and the 5-A-Day campaign (27) suggest that Hispanic children may be eating fewer daily servings of fruits than non-Hispanic children and that more than one third of their fruits servings are obtained from fruit juices.

The ways in which such dietary habits established early in life contribute to the incidence type 2 diabetes

and metabolic syndrome among Hispanic youth are not fully understood. Ninety percent of overweight Hispanic children have at least one feature of the metabolic syndrome that makes them more susceptible to these diseases (28). Of interest is the recent finding among adults that drinking beverages containing fructose, a naturally occurring sugar commonly used to sweeten soft drinks and other beverages, induces a pattern of hormonal responses that may favor the development of obesity (29). Fructose consumption resulted in a metabolic profile of hormones (eg, decreased levels of circulating insulin and leptin and increased ghrelin concentrations), which would be predicted to increase food intake, thereby contributing to obesity in susceptible populations. Additional research is needed to investigate the long-term impact of consuming large amounts of fructose, particularly among individuals who are at increased risk for metabolic diseases.

**Table 3.** Percentage of Hispanic and non-Hispanic infants and toddlers consuming desserts, sweets, sweetened beverages, and salty snacks on a given day<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=87)
	←————— % —————→					
<b>Any type of dessert, sweet, or sweetened beverage</b>	13.2†	5.9	57.0	47.1	88.8	86.8
<b>Desserts and candy</b>	8.3†	3.5	50.9	40.7	62.1	68.9
Baby food desserts	7.0†	2.0†	17.4	15.5	3.2†	2.1
Cakes, pies, cookies and pastries	1.3†	1.1†	38.7	28.3	51.0	54.1
Baby cookies	1.3†	1.1†	24.8*	14.5	9.1†	13.4
Other cookies	—	—	11.6	12.5	36.9	35.2
Ice cream	—	—	3.2†	4.4	13.0	15.4
<b>Other sweets</b>	4.1†	1.8†	4.8†	7.6	33.9	32.3
Sugar, syrups, preserves	3.5†	1.8†	4.5†	5.0	17.8	25.6
<b>Sweetened beverages</b>	—	—	13.9	6.7	53.5*	35.8
Carbonated sodas	—	—	1.7†	—	17.0	8.1
Fruit flavored drinks	—	—	13.2*	5.4	47.0*	29.5
<b>Any type of salty snack<sup>c</sup></b>	—	—	3.1†	3.5	18.9	22.7

<sup>a</sup>Data from the 2002 Feeding Infants and Toddlers Study, Hispanic and non-Hispanic subgroups; 24-hour dietary recall data.

<sup>b</sup>Dashes indicate that less than 1% of the group ate this food on a given day.

<sup>c</sup>Includes potato chips, popcorn, cheese curls or puffs, tortilla chips, corn chips, and other types of chips and salty snacks.

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

†Indicates a statistic that is potentially unreliable because of a high coefficient of variation.

Although the FITS data provide a snapshot of food consumption patterns among Hispanic infants younger than 2 years of age, limitations to this study should be noted (14). First, the socioeconomic differences between the Hispanic and non-Hispanic sample (14) may contribute to the differences in the food types and preparations (eg, commercially prepared baby food) proffered to the child. Demographic and economic factors can play a role on food availability and contribute to consumer food choices because sugars, as well as fats, constitute one of the most palatable and low-priced nutrients (30). Second, although the FITS study is a nationally representative and random sample, it was not designed to produce Hispanic population estimates and therefore the size of the Hispanic sample is relatively small when compared with the non-Hispanic sample. Third, the Hispanic population in this sample (as well as in the United States) is not monolithic and represents ancestries from many different countries. Specific ethnic subgroups (eg, Mexican, Cuban, Puerto Rican) of Hispanic Americans have their own food traditions and practices that may contribute to the types of foods and flavors fed to their children, an area of research that warrants additional study.

Despite the differences, Hispanics and non-Hispanics were more similar than different in their early foods and flavor experiences. Across all age/ethnicity subgroups, children were eating more fruits than vegetables (27) and one in four toddlers was not consuming a vegetable on a given day. They were more likely to be eating sweet-tasting fruits, fatty foods such as french fries, and the less

bitter-tasting starchy vegetables. They were less likely to be eating bitter-tasting dark green vegetables (eg, broccoli, spinach). In fact, none of the top five vegetables was a dark green vegetable.

From the perspective of the ontogeny of taste development, these data are not surprising. Preferences for sweet foods (22,23) and rejection of bitter foods (31) is innate and present throughout infancy and childhood. It has been hypothesized that the small number of taste qualities evolved because of the functional importance of the primary stimuli (eg, sugars, sodium chloride, acids, bitter toxins) in nutrient selection, especially among children. Bitter taste sensitivity evolved, in part, to protect against poisoning (32,33), because many toxic substances by their nature are bitter and distasteful.

Clearly, more basic research is needed to determine how preferences develop for flavors (eg, bitter flavor of green vegetables) so that we may develop evidence-based strategies to enhance acceptance of foods such as fruits and vegetables by infants and toddlers. Research has shown that the transition from an exclusive milk diet to a mixed diet consisting of milk and solid foods can be facilitated by feeding infants a particular food for 8 to 9 days (34,35). Over time, preferences develop for the exposed foods. An appreciation of the complexity of early feeding and a greater understanding of the cultural and physiological mechanisms underlying the development of food preferences will aid in our development of evidence-based strategies and programs to facilitate fruit and vegetable acceptance by children.

## CONCLUSIONS

Dietetics professionals should be aware of the cultural differences in the foods fed to infants and toddlers and to ensure that foods chosen contain the needed nutrients. Because Hispanics are the single largest ethnic group in the United States, health practitioners should be aware of their food beliefs and practices.

Nutrition during the first years of life is a major determinant of growth and prevention of diseases. Because experiences early in life may program preferences and track into adolescence, understanding the factors that underlie cultural feeding practices and the formation of food preferences is important if we are to improve children's eating habits and reduce their risk factors associated with obesity and other chronic diseases.

Although certain foods such as green vegetables may not be accepted as readily as other foods, parents and caregivers should be not be discouraged but should continue offer these foods, in a positive context.

---

This research project was funded by Gerber Products Company. This research project was a collaborative effort among Mathematica Policy Research, Inc staff (authors Briefel and Novak), author Mennella at Monell Chemical Senses Center, and staff (author Ziegler) for the Gerber Products Company.

The opinions or views expressed in this supplement are those of the authors and do not necessarily reflect the opinions or recommendations of Gerber.

---

## References

1. Ramirez RR, de la Cruz GP. The Hispanic population in the United States: March 2002-June 2003. Available at: <http://www.census.gov/prod/2003pubs/p20-545.pdf>. Accessed April 23, 2005.
2. US Census Bureau. Table 1.1 Population by sex, age, Hispanic Origin and Race: March 2002. US Census Bureau, June 18, 2003. Available at: <http://www.census.gov/population/www/socdemo/compraceho.html>. Accessed April 23, 2005.
3. Cruz ML, Weigensberg MJ, Huang TT, Ball G, Shaibi GQ, Goran MI. The metabolic syndrome in overweight Hispanic youth and the role of insulin sensitivity. *J Clin Endocrinol Metab.* 2004;89:108-113.
4. Idrogo M, Mazze R. Diabetes in the Hispanic population. High risk warrants targeted screening and treatment. *Postgrad Med.* 2004;116:26-32,35-36.
5. Nelson JA, Chiasson MA, Ford V. Childhood overweight in a New York City WIC population. *Am J Publ Health.* 2004;94:458-462.
6. Skinner JD, Carruth BR, Bounds W, Ziegler P, Reidy K. Do food-related experiences in the first 2 years of life predict dietary variety in school-aged children? *J Nutr Educ Behav.* 2002;34:310-315.
7. Nicklaus S, Boggio V, Chabanet C, Issanchou S. A prospective study on food variety seeking in childhood, adolescence and early adult life. *Appetite.* 2005;44:289-297.
8. Cooke LJ, Wardle J, Gibson EL, Sapochnik M, Sheiham A, Lawson M. Demographic, familial and trait predictors of fruit and vegetable consumption by pre-school children. *Public Health Nutr.* 2004;7:295-302.
9. Lederman SA, Akabas SR, Moore BJ, Bentley ME, Devaney B, Gillman MW, Kramer MS, Mennella JA, Ness A, Wardle J. Summary of the Presentations at the Conference on Preventing Childhood Obesity, December 8, 2003. *Pediatrics.* 2004;114:1146-1173.
10. Krebs NF, Jacobson MS; American Academy of Pediatrics Committee on Nutrition. Prevention of pediatric overweight and obesity. *Pediatrics.* 2003;112:424-430.
11. Cultural considerations in feeding children. In: Kleinman RE, ed. *Pediatric Nutrition Handbook*. 5th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2004:137-148.
12. Devaney B, Kalb L, Briefel R, Zavitsky-Novak T, Clusen N, Ziegler P. Feeding infants and toddlers study: Overview of the study design. *J Am Diet Assoc.* 2004;104(suppl 1):S8-S13.
13. Fox MK, Pac S, Devaney B, Jankowski L. Feeding Infants and Toddlers Study: What foods are infants and toddlers eating? *J Am Diet Assoc.* 2004;104(suppl 1):S22-S30.
14. Briefel R, Ziegler P, Novak T, Ponza M. Feeding Infants and Toddlers Study: Characteristics and usual nutrient intake of Hispanic and non-Hispanic infants and toddlers. *J Am Diet Assoc.* 2006;106(suppl 1):S84-S95.
15. US Department of Agriculture. Continuing Survey of Food Intakes by Individuals 1994-1996, 1998. CD-ROM. Beltsville, MD: Agricultural Research Service; 1998.
16. Food and Drug Administration. Food Labeling: Warning and notice statement: Labeling of juice products: Final Rule. *Federal Register*. Vol 63, No. 130, July 8, 1998.
17. Barratt-Fornell A, Drewnowski A. The taste of health: Nature's bitter gifts. *Nutr Today.* 2002;37:114-150.
18. US Department of Health and Human Services, US Department of Agriculture. *Dietary Guidelines for Americans 2005*. 6th ed. Washington, DC: US Government Printing Office; January 2005.
19. Life Sciences Research Office, Federation of American Societies for Experimental Biology. Third report on nutrition monitoring in the United States: Volumes 1 and 2. Washington, DC: US Government Printing Office; 1995.
20. Block G, Norris JC, Mandel RM, DiSogra C. Sources of energy and six nutrients in diets of low-income Hispanic American women and their children: Quantitative data from HHANES, 1982-1984. *J Am Diet Assoc.* 1995;95:195-208.
21. Mennella JA, Turnbull B, Ziegler PJ, Martinez H. Infant feeding practices and early flavor experiences in Mexican infants: An intra-cultural study. *J Am Diet Assoc.* 2005;105:908-915.
22. Desor JA, Maller O, Greene LS. Preference for sweet in humans: Infants, children and adults. In: Weiffenbach JM, ed. *Taste and development: The genesis of sweet preference*. Washington, DC: US Government Printing Office; 1977:161-172.
23. Pepino MY, Mennella JA. Factors contributing to individual differences in sucrose preference. *Chem Senses.* 2005;30:319-320.

24. Mennella JA, Pepino MY, Reed DR. Genetic and environmental determinants of bitter perception and sweet preferences in children and adults. *Pediatrics*. 2005;115:E216-E222.
25. Messer E. Some like it sweet: Estimating sweetness preferences and sucrose intakes from ethnographic and experimental data. *Am Anthropol*. 1986;88:637-647.
26. The Hispanic Health and Nutrition Examination Survey. *Nutr Rev*. 1991;49:156-158.
27. Basch CE, Zybert P, Shea S. 5-A-Day: Dietary behavior and the fruits and vegetable intake of Latino children. *Am J Public Health*. 1994;84:814-818.
28. Cruz ML, Weigensberg MJ, Huang TT, Ball G, Shaibi GQ, Goran MI. The metabolic syndrome in overweight Hispanic youth and the role of insulin sensitivity. *J Clin Endocrinol Metab*. 2004;89:108-113.
29. Teff KL, Elliott SS, Tschop M, Kieffer TJ, Rader D, Heiman M, Townsend RR, Keim NL, D'Alessio D, Havel PJ. Dietary fructose reduces circulating insulin and leptin, attenuates postprandial suppression of ghrelin, and increases triglycerides in women. *J Clin Endocrinol Metab*. 2004;89:2963-2972.
30. Drewnowski A. Fat and sugar: An economic analysis. *J Nutr*. 2003;133(3):S838-S840.
31. Kajiura H, Cowart BJ, Beauchamp GK. Early developmental change in bitter taste responses in human infants. *Dev Psychobiol*. 1992;25:375-386.
32. Glendinning JI. Is the bitter rejection response always adaptive? *Physiol Behav*. 1994;56:1217-1227.
33. Steiner JE, Glaser D, Hawilo ME, Berridge KC. Comparative expression of hedonic impact: affective reactions to taste by human infants and other primates. *Neurosci Biobehav Rev*. 2001;25:53-57.
34. Gerrish CJ, Mennella JA. Strategies to enhance food acceptance in infants. *Am J Clin Nutr*. 2001;73:1080-1085.
35. Sullivan S, Birch LL. Infant dietary experience and acceptance of solid foods. *Pediatrics*. 1994;93:271-277.