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DIVERSE FOODS ARE SIMILARLY CATEGORIZED BY 8 – 13-YEAR-OLD CHILDREN

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Abstract

OBJECTIVE—Assess how 8–13-year-old children categorized and labeled foods for possible use as part of a food search strategy in a computerized 24-hour dietary recall.

DESIGN—A set of 62 cards with pictures and names of foods from 18 professionally defined food groups was sorted by each child into piles of similar foods.

SETTING—Participants attended the Research Center in the summer 2006.

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PARTICIPANTS—148 8–13- year-old children (132 English speaking, 16 primarily Spanish speaking).

MAIN OUTCOME MEASURES—Sorting of food items into common groupings and their names.

ANALYSES—Robinson matrices for identification of clusters of food items.

RESULTS—Children created on average 11.1 ($\pm$ 4.4) piles with 5.4 ($\pm$ 4.9) cards per pile. Robinson matrix clusters captured 92.4% of the variance in the sorting of food cards. No substantial differences in Robinson clustering were detected across subcategories for each of the demographic characteristics. The label names provided by the children were most frequently categorized as “Taxonomic-Professional” (42.5%), such as meat, fruit and drinks, or “Script” (26.4%), like breakfast food, desserts and snacks.

CONCLUSION AND IMPLICATIONS—Children categorized foods into similar clusters, but used diverse names to label them. These categories may be used to facilitate food search for researchers in a computerized 24-hour dietary recall for children in this age group.

Keywords

Food categorization; children; card sort; 24; hour dietary recall

INTRODUCTION/BACKGROUND

There is a need for an easily administered, inexpensive, yet accurate, diet assessment instrument for children and adolescents (1). The 24-hour dietary recall is usually considered the preferred method (2), because it provides a way of measuring actual intake over a specified time period, by eliciting specific foods and assessing quantity consumed. Conducting 24-hour dietary recalls, however, can be cost-prohibitive for large studies. To minimize these costs a prototype computerized 24-hour dietary recall for children was developed and validated among school children with the purpose of estimating fruit and vegetable intake (3). This method needs to be expanded to include all food groups. A key issue in refining this method is developing a self-administered food search strategy that children find intuitive (not requiring extensive thought) and transparent (clear procedures). Knowing how children categorize foods, and the names they use to label these food categories, should help identify how to group and name food categories in a computerized 24-hour dietary recall that facilitates accurate and rapid search for foods eaten.

The age at which children can accurately report dietary intake is not clear. The large national dietary surveys use parent proxies through 8 years of age; parent and child combined recall through 10 years; and child alone recall from 11 years onward (4). Some studies have obtained reasonable 24-hour dietary recalls from 8-year-old girls (5), while food frequencies have elicited data similar to that from adults only with children 13 years and older (6). There has been some concern that girls are more reliable than boys (7); that differences might be associated with ethnic group (8); and that underreporting might be associated with obesity (9).

To identify how cognitive level influences the way children think about food, 5 to 11-year-old children were asked to sort food pictures into piles of similar foods and to name those piles (10). “Pre-operational” thinkers (the younger children, closer to 5-years-old) generated categories that were different from those provided by older children, who were in transition through the stages of concrete-operational and formal thought. Other studies have found that the types of categories into which foods can be grouped vary from simple ego focused categories (e.g. like, dislike), to more complex ones that require a knowledge of the role of the food in a culture, like the script category (e.g. breakfast foods, lunch foods, or birthday foods),

to those implying a value or judgment about the food (e.g. healthy, unhealthy), or requiring an understanding of the similarity or shared properties of certain foods (e.g. professional food group categories, such as beverages, fruit, vegetables, or dairy foods) (11). Children as young as 4 through 7 years of age were able to classify the same foods across multiple categories (11). It is not known, however, which food categories children ordinarily use in the age range where they could be expected to self report diet, ie. 8 to 13-year-old, or if these categories differ by demographic characteristics.

This exploratory study assessed how 8 to 13-year-old categorized and labeled foods from 18 nutrition professionally defined categories of foods, and how these child categories and labels were influenced by gender, age, body mass index (BMI), ethnicity and socioeconomic status.

METHODS

This research was conducted at the USDA-supported Children's Nutrition Research Center (CNRC) at the Baylor College of Medicine and approved by its Institutional Review Board. Our target sample was 150 children, based on funds available. Attempts were made to recruit a sample with comparable numbers in each ethnic (White, Hispanic, and African American) and age category. A special attempt was made to recruit a cohort of primarily Spanish speaking children in anticipation of a Spanish language version of the computerized 24-hour dietary recall. The sample consisted of 152 8 to 13-year-old children, recruited via telephone from the CNRC volunteer participant database, during the summer of 2006, but 4 had missing data. This data base included 1,390 children living in the city of Houston and vicinity. Recruitment stopped after 330 children from 8 to 13-year-old were called; no distinctions by gender or socioeconomic status were made while recruiting. Of the 330 children called to participate, 54 were lost in the follow-up (i.e. contact was not established before the desired sample was reached); of the 276 contacted, 210 agreed to participate, but only 148 participants met the criteria and provided complete data for this card sort. Written informed consent was mailed or brought in person when attending the CNRC. Children were asked to do 5 different card sorts (each with different foods) taking about 30 minutes each, one of which was analyzed for this manuscript.

Children were scheduled to do the card sort activities for 2 days unless they had an early morning appointment and had time to finish all the activities in 1 day. Participant's demographic data (age, gender, ethnicity, parents' highest educational attainment and family income) were obtained by parent report. On the first day, height and weight were measured to calculate BMI. Height was measured using a stadiometer (PE-AIM-101 from Perspective Enterprises) according to a standardized protocol. Weight was measured using an electronic scale (SECA Alpha 882) according to a standardized protocol. Standard BMI equations were used ($\text{weight [kg]} / \text{height [m}^2\text{]}$) and the Centers for Disease Control and Prevention (CDC) percentiles were obtained (12).

All research staff were thoroughly trained on the protocol in all the card sort activities. The sequence of these card sorts was randomly assigned to minimize or equalize possible sequence and fatigue effects.

Card Sorting

The food items selected to appear on the cards were among those most frequently reported by 8–13-year-old children in previous studies conducted by our group. The foods were chosen to represent each of the 18 food categories (see Table 1) created by nutrition professionals to facilitate the search and selection of foods in a self-administered 24-hour dietary recall for adults (13).

A set of 62 4 ¼" × 5 ½" cards was used, each containing a colored photograph on a white background with the name of the selected food item (Table 1). The food photographs were previously generated for use in a computerized 24-hour dietary recall (13). The child was asked to sort the cards into piles of similar foods. Children were allowed to make as many or as few piles as they wanted. In response to pilot testing where some children used simplistic binary classification categories that only reflected preference or healthfulness of the foods, participants in the main study were instructed not to separate foods into healthy/unhealthy nor like/don't like categories which may have reflected what they thought we wanted, but would not be useful in a hierarchical food search strategy. However, these binary categories were accepted in the main study, since at this point we believed it reflected their level of cognitive complexity in regard to the foods, and not an experimental task demand characteristic. If there was a food they didn't know, a "Don't Know" pile was permitted; and if they weren't sure where to place a food, a "Not Sure" pile was suggested. At the end of sorting, the research staff went through the "don't know" and "not sure" food items and asked the child to try to place the cards in one of the existing piles. At the completion of sorting the child was asked to name each pile and then explain why he/she had selected that particular name. The research staff recorded the name on a sticky note and attached it to the top of each pile. At the end of each child's participation, they received monetary compensation, a nutrition education brochure on healthier diet and physical activity practices, and had any questions answered about healthier diet and physical activity practices. To minimize data entry errors, each food card contained a distinct bar code on the back. The data were entered at the end of each morning's data collection. For each pile, the name given by the child was first typed in (as recorded on the sticky note labels, hand-printed by the research staff), and food items included in the pile were scanned with a bar code reader.

Data Processing and Analyses

Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to describe the sample by their demographic and anthropometric characteristics. Participants were divided into normal (BMI <85th percentile), at risk of overweight (85th percentile ≤ BMI% < 95th percentile) and overweight (BMI ≥ 95th percentile) categories based on CDC growth charts (14). Differences in the mean number of card sort piles were tested across demographic and other variable categories using one way analysis of variance and pairwise comparisons.

Two types of data were coded from the card sort naming process: 1) Creation of level 2 names; and 2) Creation of level 3 names. 1) Level 2 names consisted of modifying names provided by children for consistency while maintaining the basic integrity of the name given by the child, e.g. first level pile names such as "bread", "bread group", "breads", were uniformly labeled into the second level: "bread"; first level names "fruit", "fruit foods", "fruit group", "fruit stuff", "all have or are fruit" were uniformly labeled into the second level: "fruit"; first level names: "fats and oils", "fatty food", and "greasy foods" were uniformly labeled into the second level: "fatty food". Each child pile name was coded by 2 dietitians and decisions on disagreements were based on group consensus (among all the authors). 2) The creation of level 3 names was conducted by sorting the second level names into eleven third level categories: some of these third level categories were identified from studies reflecting cognitive development, ranging from simpler ego oriented categories (evaluative-preferences: like/don't like), to categories requiring and imposing a cognitive framework reflecting knowledge of nutrition (see Table 2). Frequencies and percentages of the placement of the food items into the conceptual food categories (Table 2) were used to assess which child concepts were used more frequently and to determine if the frequency varied by the category (Table 1). Due to the large number of zeros and small cell frequencies in conjunction with the unaccounted variability of the multiple measures within child (several food items within each professional category), cross-tabulation was used for descriptive purposes only.

To understand the clustering among food items in the piles created by the children, proximity matrices were created using a study specific program written in FORTRAN programming language. The proximity matrix for the 62 food items was a symmetric 62×62 matrix of co-occurrence inputs. For example, the value of 124 in column (C) 1, row (R) 2 indicated that 124 of 148 total children put chocolate cupcake (C1) and cake (R2) in the same pile. In contrast, the value of 1 in C1 and R13 indicated only one of 148 children put cupcake (C1) and water (R13) in the same pile, suggesting that nearly all children perceived cupcake and water as not similar. Robinson matrices provide a clustering procedure in which the restrictions are general. A similarity matrix is said to be in Robinson form, if the values decrease as they move away from the diagonal; a matrix is in anti-Robinson form if the values in a dissimilarity matrix increase as they move away from the diagonal (15,16).

The Robinson (similarity) matrix was converted to a dissimilarity (anti-Robinson) matrix by subtracting the number of paired food items from the total number of children and then analyzed for anti-Robinson matrices (Matlab 7.0.1 m-files, The MathWorks Inc, Natick, MA. 2004) (17). The output matrix was converted back to a similarity file and subsequently standardized. The following cut off points (15,16) were used to define the levels that were from most similar to the least similar: (a) highly similar food items (values ≥ 3), square icon in figure 1; (b) moderately similar food items ($2 \leq \text{values} < 3$), circle icon; (c) modestly similar food items ($1 \geq \text{values} < 2$), triangle icon; and (d) least similar foods (values < 1), i.e. blank cells. A more complete discussion of (anti) Robinson matrices may be found elsewhere (15,16). The clusters resulting from the Robinson matrix analyses were named using the most common name that the children used to name the corresponding food piles.

RESULTS

Although the original sample included 152 children, only data from 148 children were included in the analyses. Three children were missing the card sort data and one child created too many (37) piles. The 4 children were English speaking and had a normal BMI percentile. Three were African American, one was Hispanic, and half (50%) were male. The 148 children included in the analyses (see Table 3) were predominantly English speaking (89%), female (57%), Hispanic (44%), normal BMI (55%), above $> \$60,000/\text{year}$ family income (52%), had a college graduate or higher in the home (53%), and were approximately equally distributed by age (8–13-years-old). On average children created $11.1 (\pm 4.4)$ piles with $5.4 (\pm 4.9)$ cards per pile. There were no differences in number of piles across gender, age, ethnic or BMI groups (Table 3). Spanish speaking children generated significantly ($F(1,146) = 4.23, p=0.042$) more piles ($\bar{x} = 13.3 \pm 5.6$) than English speaking ($\bar{x} = 10.9 \pm 4.2$) children. A main effect for race/ethnicity was significant across the four groups, but pairwise comparisons showed no significant differences. Children with the lowest household income created significantly more piles ($\bar{x} = 14.8 \pm 5.5$) than the medium ($\bar{x} = 10.6 \pm 3.9$) or highest ($\bar{x} = 11.1 \pm 3.8$) household income children ($F(2,126) = 7.61, p=0.001$). Children with a parent who was a high school graduate or less created significantly more piles ($\bar{x} = 13.5 \pm 5.5$) than those who had a college graduate ($\bar{x} = 10.9 \pm 3.6$) ($F(2,129) = 4.74, p=0.012$).

Figure 1 presents the Robinson matrix for all students combined. Because this matrix accounted for 92.4% of the variance (very high), no additional analyses of the residual matrices were performed. The letter and number preceding each food identifies the professional category (from Table 1). The first cluster was C.5 Bottled water to C.4 Smoothies, and was labeled “drinks”. The largest cluster in figure 1 was from P.2 fruit snack to O.4 snack crackers. The children most commonly referred to those foods as “snacks”. The clusters in figure 1 were sequentially labeled drinks, add-ons, snacks, partially overlapping healthy snacks, cheese by itself, fruit, breakfast foods, meal (lunch or dinner) and meat. There were no substantial differences in clustering of foods when conducted across demographic categories.

Food cards were the unit of analysis in Table 4. There were 592 level 1 pile names given by the children. The 592 level 1 names were collapsed by the first type of coding into 146 level 2 names. These 146 level 2 names were categorized into the 11 conceptual food categories. The professional categories (Table 1) were cross tabulated with the 11 conceptual categories (Table 2). Children categorized most of the cards into “Taxonomic-Professional” (tax-prof) (42.5%) and “Script-scheme” (script) (26.4%) categories (bottom row in Table 4). Foods from the professional categories that were most commonly (modal response) categorized into the “tax-prof” conceptual category were Beverages (79.2%); Breads, Rolls, Tortillas (43.6%); Condiments, Salsa, Sauces (37.2%); Fish, Shellfish (70%); Fruit (44.8%); Meat (63.3%); Poultry (75.2%); and Vegetables, Vegetable Juices (28.1%). The foods from the professional categories that were most commonly categorized into the “script” conceptual categories included cereal, energy bars (54.7%); eggs (44.0%); pancakes and waffles (51.3%); salty snacks (41.0%); and sweets, sweeteners (36.1%). Foods in some professional food categories were almost equally distributed (within 10 percentage points) between conceptual categories: Baked Goods (39.5% script, 35.8% tax-prof.), Beans, Peas, Nuts, Soy products (35.7% script, 26.3% tax-prof.), Dairy (34.1% tax-prof., 27.2% script), Fats, Oils, Dressings, Spread (29.8% goal, 26.2% tax-prof.), Pasta, Noodles, Spaghetti (35.2% tax-prof., 38.5% script), Sweets, Sweeteners (36.1% script, 34.6% tax-prof.) and Vegetables, Vegetable Juices (28.1% tax-prof., 26.4% script).

Differences in the third level conceptual categories by demographic characteristics are presented in Table 5 (cell percents with child as the unit of analysis). To determine whether the child conceptual categorization scheme was associated with demographic characteristics, cross tabulation of the conceptual categories by demographic characteristics was performed. The cells in this table represent the percentage of available children who used the particular conceptual categorization scheme. For example, only 6 of 132 (4.5%) English speaking children used an evaluative scheme to name a pile. Because the frequencies were not mutually exclusive, meaning a child could use any or all names, chi-square tests were not appropriate. Instead, any difference of at least 25% signified a practical significant difference and warranted further discussion. Due to a lack of any published cut-point in this area, a difference between two percentages of 25% was selected as a means of detecting a moderate, and in some cases large, effect (18). The majority of children (146) used the “tax-prof” category, followed by the “script” (117) conceptual category. Spanish speaking children used the “Food Characteristics” (food char.) (43.8%), and the “Thematic-complementary” (thematic) (75.0%) categories more than English speaking children (17.4%, 37.9%). Spanish speaking children used less frequently the Evaluative-Health perception category (0.0%) compared to the English speaking (25.8%). Eight year old children were more likely than the older children to use the “Specific-food item” (specific) (61.9%) (i.e. the name of the food in the picture) and “food preparation” (61.9%) type categories. Nine to 13-years-old children used “Goal-have a function” (goal) (44%, 36.4%, 61.5%, 56.3%, 63.0%) more frequently than 8-year-old children (9.5%). Nine year old children used the “Evaluative-health perception” category (36.0%) more than the 13-years-old group (7.4%). The “Don’t know, Not Sure, Not matched” categories were mostly used by 8-year-old children (100%). Hispanic children mostly used the “specific” category (50.8%). Children in the lower household income (61.9%), and lowest educational attainment (61.3%) groups used the “specific” category more than the children in the other categories.

DISCUSSION

This study assessed the categorization and labeling of 62 foods from 18 nutrition professionally defined categories among 8 to 13-year-old children. The Robinson matrix procedure identified eight clusters across the 62 foods (figure 1) accounting for 92.4% of the variance in categorization. No substantial differences were detected in the clustering of foods by any of

the demographic characteristics, including a wide age range (8–13-years-old). This suggests that children of different ages, genders, ethnic and other demographic characteristics categorize and thereby think about the foods in a similar way. Similar clustering was detected among children aged 5 to 11 years old who grouped foods into sweets, desserts, cakes, candy, and breakfast food among other categories (10).

Alternatively, there was substantial variability in the way children named the piles or groupings they generated (i.e., 146 level 2 names). While substantial numbers of foods were placed in the “don’t know”, “not sure”, or “not matched” categories, this should not be a problem for a computerized 24-hour dietary recall, since children will be searching for foods they’ve eaten. Most children placed foods in Taxonomic-Professional or Script categories. These findings are consistent with other research that found that younger children, 4 and 7 years old, and undergraduates (10,11,15) used mostly Script and Taxonomic categories when classifying foods.

Methods similar to those used in this study were applied to different groups of food items: mixed foods (19), fruit and vegetables (20), and grain foods (21). Inter study comparisons revealed Script and Taxonomic categories were also the most used in the other reports, but in the case of the Mixed dishes study, Specific Foods was the second most commonly used category (19). Children classified and labeled foods depending on the context of other foods in the set. For example, corn was categorized under Meal (lunch or dinner) in this card sort and under Vegetables when grouped in a Mixed Dishes (19) card sort, and in a vegetable sub category in a Vegetable card sort(20). Milk was categorized in Drinks in this card sort, but Dairy in the Mix Dishes card sort (19). Context specific classification was called cross-classification and flexibility in classifying foods in other studies (11,15).

More qualitative research indicated that adults used similar types of third level categories (e.g. their “meal time” and our “meal”, their “food group” and our “taxonomic” categories, their nutrient composition and our “nutrient composition” (22), and also classified foods differently based on context (22). Use of more consistent methods, however, would facilitate comparisons of food categorization between children and adults.

A cultural consensus on what foods are commonly eaten at specific meals (which is often in stark contrast with meal specific foods in other countries) is suggested in this data, e.g. the meal specific “Script” categories. However, the variability even within the Taxonomic and Script categories suggest that children do not have a detailed knowledge of nutrition or dietary guidelines concepts, but use an inductive inference to classify foods similar to the dietary guideline type food categories. More consistency in use of food category labels would be expected among groups of children receiving more nutrition education.

A food category system that places foods in mostly taxonomic-professional and script categories, with some redundant placement of foods in multiple categories as per the findings in Table 4, should facilitate the rapid and accurate findings of foods a child ate the previous day. For example, categorizing some of the foods by the meal time or script categories breakfast foods (orange juice, milk, pancakes, fruit), snacks (granola, candy, chocolate), lunch foods (sandwich, salad, cheese), dinner foods (rice, spaghetti, mashed potato); and other foods by taxonomic-professional categories: beverages, grains, dairy, meat (a combination of chicken, red meat and fish), and sweets, appears promising. Sub classification of the categories appears necessary, such as snacks, where there might be separate sweet snacks and salty snacks. Some food items, e.g. milk, may have to appear in breakfast, dairy and drinks categories; or cookies could be in the sweets and desserts categories. Further research is needed, however, to assess the accuracy and speed of categorization by children using this empirically derived, versus other, food categories.

The limitations of this research include the small sample size for some subgroups which may have led to not finding differences in categorization by demographics. Also, this was not a representative sampling of children. The sample was limited to 8 – 13-years-old children; it is not clear how the categorization of these foods would differ among younger or older children.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Children from 8 to 13-years-old categorized foods in consistent ways. Using these categories in a computerized 24-hour dietary recall should provide an easier framework that children can use, thereby leading to quicker and more accurate dietary assessment. Further research is needed to assess whether using these categories has the expected effects. Children would appear to more consistently label food categories with more school nutrition education.

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Figure 1.
Robinson Matrix from Sorting Food Items into Piles of Similar Foods.

Table 1
Food Items Used in The Card Sort Distributed Across 18 Professional Food Categories.

Professional Category	Food name
A. Baked Goods	
A1	Chocolate cupcake
A2	Cake
A3	Brownie
A4	Cookies
A5	Bagel
A6	<i>Pan dulce</i>
B. Beans, Peas, Nuts, Soy Products	
B1	Mixed nuts
B2	Pinto beans
C. Beverages	
C1	100% Orange juice
C2	Juice drinks
C3	Sports drinks
C4	Smoothies
C5	Bottled water
C6	Soda
D. Breads, rolls and tortillas	
D1	Bread
D2	Tortilla
E. Cereal, energy bars	
E1	Cereal
E2	Granola bar
F. Condiments, salsa, sauces	
F1	Jelly
F2	Catsup/ketchup
F3	Salsa
F4	Ranch dressing
G. Dairy	
G1	Milk
G2	Cheese
G3	Ice cream
G4	Yogurt
G5	Pudding
H. Eggs	
H1	Scrambled eggs
H2	Fried egg
I. Fats, oils, dressings, spreads	
I1	Butter/margarine
I2	Peanut butter 3
I3	Mayonnaise
J. Fish, shellfish	
J1	Fish stick
J2	Fish
J3	Fried shrimp
K. Fruit	
K1	Applesauce
K2	Banana
K3	Fruit cocktail
L. Poultry	

Professional Category	Food name
L1	Chicken nugget
L2	Buffalo wing
L3	Fried chicken leg/drumstick
M. Meat	
M1	Sausage
M2	Lunch meats
M3	Pork chop
N. Pasta, noodles, spaghetti	
N1	Rice
N2	Spaghetti
O. Salty snacks	
O1	Potato chips
O2	Cheese puffs
O3	Popcorn
O4	Snack crackers
P. Sweets, sweeteners	
P1	Chocolate
P2	Fruit snack
P3	Gummy candy
P4	Pancake syrup
P5	Popsicle
P6	Doughnut
Q. Vegetables, vegetable juice	
Q1	Corn
Q2	Tossed salad
Q3	Mashed potatoes
Q4	French fries
R. Pancakes, waffles	
R1	Pancake
R2	Waffle

Table 2

Third Level Conceptual Food Categories Varying from Simplest to Most Complex.

Cognitive development levels	Conceptual Categories	Example
A. Characteristics of me	1. Evaluative—preferences	Like/don't like
B. Concrete characterization of the food	2. Specific-food item (specific)	Name of the picture
C. Requires some knowledge of a common culture.	3. Food characteristics (food charact.)	Colors, texture, taste, shape (flat, round, etc)
	4. Script-scheme (script)	Scheme for a routine or event: lunch, snack, birthday.
	5. Food preparation	Baked, cooked, frozen, packaged
	6. Thematic-complementary (thematic)	Groups of objects that are associated or have a comple
D. A purpose for the food	7. Taxonomic—Ethnic/Places	Ethnic food and places (e.g. Mexican, Chinese, restau
E. Requires some knowledge or perception of the health effects of foods	8. Goal-have a function (goal)	Foods that have a function: e.g. extras, add ons
F. Requires knowledge of professional groupings	9. Evaluative-Health Perception	Good/bad, healthy/unhealthy/junk food
	10. Taxonomic-professional (tax-prof.)	Based on common properties or similarities among th
	11. Nutrient Composition	Macro and micro nutrients

Table 3

Sample Size and Number of Piles by Demographic Characteristics.

Characteristic	n (%)	Number of Piles M (SD)
Total	148 (100.0)	11.1 (4.4)
Language Spoken *		
English	132 (89.2)	10.9 (4.2) ^b
Spanish	16 (10.8)	13.3 (5.6) ^a
Gender		
Male	64 (43.2)	11.1 (4.7)
Female	84 (56.8)	11.2 (4.1)
Age (years)		
8	21 (14.2)	11.7 (5.2)
9	25 (16.9)	11.0 (4.9)
10	33 (22.3)	10.9 (4.6)
11	26 (17.6)	11.3 (4.5)
12	16 (10.8)	12.1 (4.8)
13	27 (18.2)	10.5 (2.6)
Race/ethnicity **		
White	47 (31.8)	10.8 (3.3)
African American	34 (23.0)	9.9 (4.9)
Hispanic	65 (43.9)	12.1 (4.7)
Other	2 (1.4)	9.0 (2.8)
Obesity Index		
Normal (BMI% <85%)	82 (55.4)	11.1 (3.9)
At Risk (85% < BMI% < 95%)	28 (18.9)	11.9 (4.6)
Overweight (BMI% > 95%)	37 (25.0)	10.8 (5.2)
Missing	1 (0.7)	8.0 (n/a)
Household Income ***		
<\$20,000	21 (14.2)	14.8 (5.5) ^a
\$20,000–\$59,000	31 (20.9)	10.6 (3.9) ^b
>=\$60,000	77 (52.0)	11.1 (3.8) ^b
Missing	19 (12.8)	8.2 (3.5)
Highest Household Education ****		
High School Graduate or less	31 (20.9)	13.5 (5.5) ^a
Some college/technical school	23 (15.5)	10.7 (4.3)
College graduate	78 (52.7)	10.9 (3.6) ^b
Missing	16 (10.8)	8.6 (3.6)

Notes: Missing category not included in testing differences among number of piles; For significant main effects-- mean "a" > mean "b"

* Significant effect [F(1,146)=4.23, p=.042] for language spoken

** Significant main effect (p=.046) for race/ethnicity; no significant pairwise comparisons. However, when Hispanic was split into English & Spanish, no significant differences were observed.

*** Significant effect [F(2,126)=7.61, p=.001] for household income

**** Significant effect [F(2,129)=4.74, p=.012] for highest household education

Table 4
Frequencies (and Row Percentages) of Foods in Professional Categories by Child Conceptual Children Categories.

Professional Categories	Child Conceptual Categories											
	Evaluative Like/Don't Like	Specific-Food item	Food Characteristics: Color, texture, shape	Script-scheme: Lunch, birthday	Food Preparation: Baked, cooked, frozen	Thematic-complementary relationship:cereal+milk	Taxonomic-Ethnic or places	Goal-have a function: Add-ons, extras, etc.	Evaluative-Health Perception: Good/bad, junk, etc.	Taxonomic-Professional: common properties/ similarities (grains, dairy)	Nutrient Composition: Vitamins, minerals, etc.	Don't Know, Not Sure, Not matched
Baked Goods	3.0 (0.3)	8.0 (0.9)	5.0 (0.6)	352.0 (39.5)	0.0 (0.0)	9.0 (1.0)	1.0 (0.1)	6.0 (0.7)	73.0 (8.2)	319.0 (35.8)	39.0 (4.4)	77.0 (8.6)
Beans,Peas,Nuts,Soy Products	3.0 (1.0)	12.0 (4.0)	1.0 (0.3)	106.0 (35.7)	0.0 (0.0)	2.0 (0.7)	3.0 (1.0)	4.0 (1.3)	13.0 (4.4)	78.0 (26.3)	12.0 (4.0)	63.0 (21.2)
Beverages	8 (0.9)	9 (1.0)	12 (1.3)	53 (5.9)	0 (0.0)	8 (0.9)	0 (0.0)	6 (0.7)	57 (6.4)	708 (79.2)	9 (1.0)	24 (2.7)
Breads,Rolls,Tortillas	3.0 (1.0)	10.0 (3.4)	0.0 (0.0)	62.0 (20.9)	0.0 (0.0)	21.0 (7.1)	4.0 (1.4)	14.0 (4.7)	2.0 (0.7)	129.0 (43.6)	10.0 (3.4)	41.0 (13.9)
Cereal,Energy Bars	2.0 (0.7)	2.0 (0.7)	5.0 (1.7)	163.0 (54.7)	1.0 (0.3)	8.0 (2.7)	1.0 (0.3)	2.0 (0.7)	14.0 (4.7)	61.0 (20.5)	7.0 (2.3)	32.0 (10.7)
Condiments, Salsa, Sauces	8 (1.4)	0 (0.0)	2 (0.3)	53 (9.0)	0 (0.0)	21 (3.6)	5 (0.9)	142 (24.1)	9 (1.5)	219 (37.2)	11 (1.9)	118 (20.1)
Dairy	4.0 (0.5)	53.0 (7.1)	25.0 (3.4)	203.0 (27.2)	3.0 (0.4)	22.0 (3.0)	1.0 (0.1)	17.0 (2.3)	51.0 (6.8)	254.0 (34.1)	14.0 (1.9)	98.0 (13.2)
Eggs	1.0 (0.3)	18.0 (6.0)	0.0 (0.0)	131.0 (44.0)	0.0 (0.0)	0.0 (0.0)	4.0 (1.3)	2.0 (0.7)	6.0 (2.0)	90.0 (30.2)	13.0 (4.4)	33.0 (11.1)
Fats, Oils, Dressings, Spreads	7.0 (1.6)	2.0 (0.4)	0.0 (0.0)	43.0 (9.6)	1.0 (0.2)	44.0 (9.9)	2.0 (0.4)	133.0 (29.8)	5.0 (1.1)	117.0 (26.2)	17.0 (3.8)	75.0 (16.8)
Fish, Shellfish	6.0 (1.3)	1.0 (0.2)	1.0 (0.2)	60.0 (13.5)	1.0 (0.2)	1.0 (0.2)	4.0 (0.9)	1.0 (0.2)	10.0 (2.2)	312.0 (70.0)	24.0 (5.4)	25.0 (5.6)
Fruit	3.0 (0.7)	1.0 (0.2)	9.0 (2.0)	111.0 (25.0)	5.0 (1.1)	12.0 (2.7)	1.0 (0.2)	4.0 (0.9)	37.0 (8.3)	199.0 (44.8)	3.0 (0.7)	59.0 (13.3)
Meat	4.0 (0.9)	2.0 (0.4)	0.0 (0.0)	75.0 (16.8)	0.0 (0.0)	14.0 (3.1)	6.0 (1.3)	6.0 (1.3)	11.0 (2.5)	283.0 (63.3)	20.0 (4.5)	26.0 (5.8)
Pancakes, Waffles	1.0 (0.3)	8.0 (2.7)	1.0 (0.3)	153.0 (51.3)	0.0 (0.0)	10.0 (3.4)	3.0 (1.0)	3.0 (1.0)	6.0 (2.0)	95.0 (31.9)	6.0 (2.0)	12.0 (4.0)
Pasta, Noodles, Spaghetti	2.0 (0.7)	4.0 (1.3)	0.0 (0.0)	85.0 (28.5)	3.0 (1.0)	5.0 (1.7)	5.0 (1.7)	2.0 (0.7)	5.0 (1.7)	105.0 (35.2)	17.0 (5.7)	65.0 (21.8)
Poultry	6.0 (1.3)	0.0 (0.0)	0.0 (0.0)	57.0 (12.8)	0.0 (0.0)	1.0 (0.2)	5.0 (1.1)	0.0 (0.0)	15.0 (3.4)	336.0 (75.2)	21.0 (4.7)	6.0 (1.3)
Salty Snacks	10.0 (1.7)	22.0 (3.7)	5.0 (0.8)	243.0 (41.0)	0.0 (0.0)	1.0 (0.2)	20.0 (3.4)	3.0 (0.5)	58.0 (9.8)	133.0 (22.5)	22.0 (3.7)	75.0 (12.7)
Sweets, Sweeteners	5.0 (0.6)	8.0 (0.9)	13.0 (1.5)	323.0 (36.1)	0.0 (0.0)	10.0 (1.1)	11.0 (1.2)	46.0 (5.1)	81.0 (9.1)	309.0 (34.6)	29.0 (3.2)	59.0 (6.6)
Vegetables, Vegetable Juice	7.0 (1.2)	69.0 (11.6)	3.0 (0.5)	157.0 (26.4)	0.0 (0.0)	4.0 (0.7)	6.0 (1.0)	18.0 (3.0)	29.0 (4.9)	167.0 (28.1)	23.0 (3.9)	111.0 (18.7)
Total	83.0 (0.9)	229.0 (2.5)	82.0 (0.9)	2430.0 (26.4)	14.0 (0.2)	193.0 (2.1)	82.0 (0.9)	409.0 (4.4)	482.0 (5.2)	3914.0 (42.5)	297.0 (3.2)	999.0 (10.8)

Table 5
Percent of Children within Cells Reflecting Cross Tabulation of Conceptual Categories by Demographic Characteristics.

Characteristics	n (%)	Evaluative Like/ Don't Like	Specific- Food item	Food Characteristics: Color, texture, shape	Script- scheme: Lunch, birthday	Food Preparation: Baked, cooked, frozen	Thematic- complementary relationship: cereal-milk	Taxonomic- Ethnic or places	Goal- have a function: Add-ons, extras, etc.	Evaluative- Health Perception: Good/bad, junk, etc.	Taxonomic- Professional: common properties/ similarities (grains, dairy)	Nutrient Composition: Vitamins, minerals, etc.	Don't Know, Not Sure, Not matched
Number of children *	148 (100.0)	6	56	30	117	62	6	11	67	34	146	16	126
Language Spoken													
English	132 (89.2)	4.5	31.8 ^b	17.4 ^b	80.3	37.9 ^b	4.5	7.6	45.5	25.8 ^a	98.5	12.1	84.1
Spanish	16 (10.8)	0.0	87.5 ^a	43.8 ^a	68.8	75.0 ^a	0.0	6.3	43.8	0.0 ^b	100.0	0.0	93.8
Age													
8	21 (14.2)	9.5	61.9 ^a	33.3 ^a	76.2	61.9 ^a	4.8	4.8	9.5 ^b	23.8	95.2	4.8	100.0 ^a
9	25 (16.9)	4.0	28.0 ^b	32.0	68.0	32.0 ^b	8.0	12.0	44.0 ^a	36.0 ^a	100.0	8.0	84.0
10	33 (22.3)	3.0	30.3 ^b	12.1	81.8	42.4	0.0	9.1	36.4 ^{a,d}	21.2	100.0	9.1	81.8
11	26 (17.6)	3.8	42.3	23.1	84.6	42.3	0.0	0.0	61.5 ^{a,c}	30.8	96.2	11.5	69.2 ^b
12	16 (10.8)	0.0	43.8	18.8	87.5	31.3 ^b	12.5	6.3	56.3 ^a	18.8	100.0	12.5	75.0 ^b
13	27 (18.2)	3.7	29.6 ^b	7.4 ^b	77.8	40.7	3.7	11.1	63.0 ^{a,c}	7.4 ^b	100.0	18.5	96.3
Race/Ethnicity													
White	47 (31.8)	4.3	25.5 ^b	14.9 ^b	85.1 ^a	34.0	4.3 ^b	6.4	51.1 ^a	14.9	100.0	10.6	74.5 ^b
African American	34 (23.0)	8.8	32.4 ^c	14.7 ^b	73.5 ^a	29.4	2.9 ^b	11.8	44.1 ^a	32.4 ^a	97.1	20.6	88.2
Hispanic	65 (43.9)	1.5	50.8 ^a	26.2	80.0 ^a	53.8	3.1 ^b	6.2	43.1 ^a	24.6	98.5	6.2	90.8
Other	2 (1.4)	0.0	0.0 ^{b,d}	50.0 ^a	0.0 ^b	50.0	50.0 ^a	0.0	0.0 ^b	0.0 ^b	100.0	0.0	100.0 ^a
Household Income													
<\$20K	21 (14.2)	9.5	61.9 ^a	38.1	71.4	47.6	4.8	14.3	47.6	28.6	104.8	9.5	100.0
\$20K-\$59K	31 (20.9)	0.0	38.7	22.6	77.4	58.1	6.5	12.9	38.7	9.7	100.0	0.0	93.5
>=\$60K	77 (52.0)	2.6	32.5 ^b	15.6	85.7	37.7	3.9	5.2	49.4	24.7	97.4	11.7	80.5
Missing **	19 (12.8)	10.5	31.6	15.8	63.2	26.3	0.0	0.0	36.8	31.6	94.7	26.3	73.7

Note: Practical significance (% difference > 25%) is noted with subscripts: % a meaningfully significantly higher than % b; % c meaningfully significantly higher than % d

Number of children is not mutually exclusive; children may have used any number (one, some, or all) of classification schemes.

* Missing category not used for comparisons.