Resolution No. 06-2001-152

RESOLUTION OF THE WHITE MOUNTAIN APACHE TRIBE OF THE FORT APACHE INDIAN RESERVATION

WHEREAS, Becky Ethelbah on behalf of Johns Hopkins University, Pathways, has approached the Tribal Council this date with a request that the Tribal Council approve for publication the Pathways manuscript entitled; *"Validity of Self Reported Dietary Intake by American Indian Children: the Pathways Study";* and

WHEREAS, this report examines the validity of a modified diet-record-assisted 24 hours recall, for third grade American Indian children ensuring that American Indian children are able to accurately report the macronutrient proportions of their total energy intake, compared favorably with other ethnic groups of children of similar age; and

WHEREAS, the Tribal Council concludes that it is in the best interests of the White Mountain Apache Tribe to approve publication of this manuscript.

BE IT RESOLVED by the Tribal Council of the White Mountain Apache Tribe that it hereby approves publication of the Pathways Manuscript entitled; *"Validity of Self Report Dietary Intake by American Indian Children: The Pathways Study."*

The foregoing resolution was on June 7, 2001, duly adopted by a vote of EIGHT for and ZERO against by the Tribal Council of the White Mountain Apache Tribe, pursuant to authority vested in it by Article IV, Section 1 (a), (g), (s), (t) and (u) of the Constitution of the Tribe, ratified by the Tribe on September 30, 1993, and approved by the Secretary of the Interior on November 12, 1993, pursuant to Section 16 of the Act of June 18, 1934 (48 Stat. 984).

Dallas Massey, Sr.
Chairman of the Tribal Council

Cyndy Harvey-Burnette
Secretary of the Tribal Council

Validity of self-reported dietary intake by American Indian children: The Pathways Study

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Abstract

Objective To examine the validity of a modified diet-record-assisted 24-hour recall in third grade American Indian children.

Design The children were trained to record their food intake for 24 hours, then interviewed by trained staff using the Minnesota Nutrition Data System (NDS, version 2.6). The modified diet record method included training in portion size estimation. Direct observation of the children's intakes during school meals was used to validate the accuracy of their self-reported recalls.

Subjects Eighty third grade children recruited from schools from four American Indian Nations participating in the feasibility and pilot-testing phase of the Pathways study.

Statistical Analyses Pearson correlations were used to compare observed and reported nutrient level data. Food level data were obtained from the NDS Record Reports. Reported foods were compared with observed foods and food groups for matches, and percent differences in food quantities were calculated.

Results Recalled energy intake was overestimated by 13% for all school meals combined, and by 7% and 23% for school lunch and breakfast alone, respectively, although none of the differences were statistically significant. Percent of energy intake from fat, protein and carbohydrate from recalls were not significantly different from observed intake for the combined school meals. Pearson correlations between observed and recalled total energy and nutrients ranged from .52-.86 for both meals, from .55-.86 for school lunch, and from .61-.81 for school breakfast. Agreement between recalled and observed food items was 75.1%. Children recalled 57% of food quantities within ±10% of observed quantities.

Applications American Indian children were able to accurately report the macronutrient proportions of their total energy intake, and their reporting of total energy intake (+13% of criterion) compares favorably with other ethnic groups of children of similar age. They were able to accurately recall the majority of foods observed during school meals.

Validity of self-reported dietary intake by American Indian children: The Pathways Study

Introduction

The prevalence of obesity among school-age children is increasing in the United States (1,2). A comparison of data from a 1990 national survey of 9,464 American Indian school children (ages 5-18) with the Second National Health and Nutrition Examination Survey (NHANES II) and the Mexican-American population of the Hispanic Health and Nutrition Examination Survey (HHANES-MA) showed that American Indian children had significantly higher BMIs in nearly every age and sex group compared to the reference populations (3). The overall prevalence of overweight (BMI >85th percentile) in the American Indian children was 39% compared with 15% in NHANES II all-races combined and with 29% for the HHANES-MA population. In order to study the diet-related etiology of obesity in American Indian children, and to evaluate the effectiveness of nutrition interventions, a valid and acceptable diet assessment method is needed. While some self-report diet assessment tools have been developed and validated in children, we know of no studies that have validated dietary methods in American Indian children.

In validation studies of self-report dietary methods in non-American Indians, 7-11 year-old children have produced estimates for total energy intake of -3% to +11% using diet records, 24-hour recalls, and diet histories compared with observed intake or energy expenditure measured by doubly labeled water (4-8). Older children and adolescents (12-18 years) however, have demonstrated dietary reporting patterns more closely resembling adults, specifically

underreporting of total energy intake (5,9). Reporting errors of 0 to -27% have been reported for lean 12-18 year olds , compared with errors of -11% to -46% for obese adolescents in the same studies (5,9). Maffeis et al. (6) found that obese 9-year-old children also underreported their total energy intake using both the diet record (-29%) and diet history (-15%) methods compared with more accurate reporting (-1% to +6% error) by non-obese children. In addition to weight status, ethnicity may play a role in determining accuracy of dietary self-reporting. Using weighed school meals as the criterion, Todd et al. (7) reported that 8-11 year old Hispanic and Chinese children only slightly underreported their total energy intake by 24-hour recall by 6% and 10%, respectively. However in the same study, Cambodian children underreported their total energy intake by 24% and Filipino children overreported by 46%. In a study by Baranowski et al. (10) 8-12 year old Caucasian children underreported their total energy intake by 15% compared with Black children who underreported by 20% using a food frequency questionnaire. The criterion method used in that study was two consecutive twelve-hour days of observation. Champagne and colleagues (11) found similar reporting differences for Caucasian and Black children using the diet record method, with doubly labeled water as the criterion.

The purpose of the present study was to develop and validate a method to accurately measure 24-hour dietary intake in third grade American Indian children participating in the feasibility phase of the Pathways Study. The Pathways Study was a primary prevention intervention study designed to reduce the prevalence of obesity in American Indian elementary school children (12). The present study was conducted as a pilot test of the diet assessment methodology planned for the main intervention trial. Given the relatively consistent finding of accurate reporting (within –6% to +11% of the criterion) in 7-11 year old Caucasian, Hispanic

and Chinese children using the diet record, 24-hour recall or diet history methods (5-8,10), we tested the validity of a combined diet record assisted 24-hour recall method, similar to the one used in the Child and Adolescent Trial for Cardiovascular Health (CATCH) study (4), in American Indian children. We modified this basic CATCH method to include training the children in portion size estimation skills to enhance food quantity reporting accuracy. Observation of food intake during school meals was used as the criterion (4).

Methods

Subjects. One elementary school from each of four American Indian Nations participated in the study. Each school was partnered with one research institution, and the subsequent nation/institution match was referred to as a "site". The subjects were third-grade boys and girls, aged 8-10 years, randomly selected (stratified by site) from all children with parental consent. Institutional Review Board approvals were obtained from each of the four participating universities, and appropriate tribal and school board approvals were obtained for all testing and intervention activities in Pathways.

Dietary Reporting Method. The combined diet record-assisted 24-hour recall method included three components: 1) training the children, 2) recording of food intake (by the children) for the subsequent 24-hours, and 3) interviewing the children. The children were trained in groups of 8-12 for 45-60 minutes before school lunch, plus an additional 15-20 minute "booster" session immediately after lunch (21). The training consisted of instruction and practice in how to complete the diet record form. Unique to this study, the children were also trained in how to estimate and measure portion sizes of foods. Details regarding the portion size training procedure can be found elsewhere (21). At the end of the training session, each child was given a

large zipper-lock plastic bag with their blank diet record form, a completed sample form, measurement utensils (1c, ½c, 1/3c, 1/4c, 1 tablespoon, 1 teaspoon, 12" ruler), and a letter to the parents with instructions on how to assist their children in completing the diet record form.

The recording period commenced with school lunch, immediately following the 45 minute training session, and was completed after school breakfast the next day. For each food item a child listed on his/her diet record, he/she provided a brief description of the food, measured or estimated the amount of the food and listed that amount on the diet record, and checked a box indicating where the food was consumed. Staff who were not involved in the observation procedure (described below) assisted the children with the meal recording procedures if asked. The children's parents (or other appropriate adults) were encouraged (by letter, as mentioned above) to assist the children with the process of measuring and recording foods consumed at home (or other outside of school locations).

Following school breakfast the second day, each child received a 30-40 minute individual interview regarding their food intake over the previous 24 hours using the interactive Minnesota Nutrition Data System (NDS; version 2.6). The children brought their completed diet records to the interviews to use as a memory prompt for the 24-hour recall procedure. Additionally, food models and all serving utensils and other materials used during the training were available at the interviews to assist each child with portion size verification. The data entered into the NDS program, from the diet record-assisted interview, served as the final data set for each child. The interviewers were trained and certified to use the NDS program by the Nutrition Coordinating Center at the University of Minnesota (standard NDS-user training program). Interviewers were also trained and certified in study-specific interviewing protocol, and included both university

faculty and staff and American Indian community members.

Criterion Method. Accuracy of the children's reporting was evaluated by direct observation of school breakfast and lunch meals, which together potentially reflect approximately two thirds of a child's total daily dietary intake. While generally more costly and time consuming to administer, direct observation provides accurate estimates of food intake and permits the recording of associated behaviors (13-15). No weekend days were included in the sample due to the training and recording protocol. Ten days of school breakfast and lunch menus were obtained from each of the four study sites. Even though a full 24 hours of data were collected for each child, only the school meals were analyzed for reporting accuracy, because it was culturally unacceptable to observe children in the home environment in the communities represented in this study.

Training to collect data by the observation method included didactic training sessions on the purpose and technique of direct observation, instruction in the use of the forms for recording observational data, and practice in visual portion size estimation. A series of practice observations in school cafeterias was also conducted. Trainees were certified on the basis of: 1) the accuracy of their portion size estimates (maximum of 20% mean absolute error in estimating the portion size of 20 different foods typically offered in school meals), and 2) on having a high level of agreement between their practice observations of dietary intake in schools and that of a "gold standard" observer (maximum of 5 errors between the trainee and the gold standard observer for each child observed). The "gold standard" observers were individuals with a dietetics background, and usually an advanced degree in nutrition, and a high level of accuracy in portion size estimation.

Prior to the observation period each day, sample school breakfast and lunch trays were obtained from the kitchen and food descriptions and quantities were noted on the observation forms. Children were given identification tags to wear on their shirts prior to entering the cafeteria so that observers could identify them easily from a distance. Each observer was subsequently assigned to no more than three children to observe at one time. Children sat in the same area of the cafeteria during the meals. The observers did not interfere with the course of the meals, and did not interact with the children. After each child completed his/her meal, he/she left the tray on the table with their identification tag attached and left the cafeteria. Following the observation period, leftover foods were measured and recorded on the observation form.

Data Analyses. For nutrient level data, the recalled and observed intakes for each child were matched on child and meal, with 54 matched pairs for breakfast and 80 matched pairs for lunch. Meal intakes were computed as sums over each child and meal for energy, total fat, carbohydrate and protein. Percent of total energy was calculated by multiplying the total fat intake by 9, and the protein and carbohydrate by 4, and dividing each of them by the total calories for that child and meal. Mean and variance estimates were calculated for total energy, fat, carbohydrate and protein and for percent of total energy from fat, carbohydrate and protein. These values were estimated separately for recall and observation data and Pearson correlations between the two were calculated. A model, with no fixed effects and site as a random effect, was used to predict the difference between recalled and observed intakes. We tested the null hypothesis that thedifference between recalled and observed intakes was zero (H_o: $\beta_o = 0$) for each variable. The estimates and tests were predicted using SAS:STAT software version 6.12 (SAS Institute, Inc., copyright 1989-96. SAS Campus Drive, Cary, NC 27513). Food level data were obtained from

the NDS Record Reports. Observed foods were listed as actual food intake for each child, then recalled foods were compared to observed foods to determine: 1) if individual foods were a match, 2) if the food groups were a match, and 3) what the percent difference was for the food quantity consumed vs. observed. For example, if a child was observed to have eaten one whole apple, and that child reported eating one whole apple, then all three match criteria would be met. If, however, the child reported eating half an orange, then the food would be a "no match", the food group would be a match, and the percent agreement would be -50%. The formula used to determine percent difference was:

Percent Difference = (Recalled Quantity - Observed Quantity) ≡ Observed Quantity x 100.

The percent difference was calculated for each food for each child, and the results reported by five categories of percent error (plus one category for "correct" responses). The observed vs. recalled food and food group matches were added across all children for each food group, then a percent match was calculated for each food group as a percentage of the total number of foods observed for that group. The food groups were determined by the frequency and distribution of foods appearing in the NDS Record Reports. For example, fruits and fruit juices appeared enough times as specific items in the Record Reports that they were each justified for inclusion as a separate food group, rather than being collapsed into one group called Fruits/Juices.

Results

A total of 99 children were trained in the dietary reporting method; of those, 83 children returned diet records either partially or fully completed (Table 1). Children were interviewed

regardless of whether their diet records were completed. Eighty matched sets of observed and recalled food intake for school lunch, and 54 matched sets for school breakfast were available for analysis. Matched sets of breakfast and lunch recalls and observations were not available for all 99 children trained due to absences on the interview days and some children not participating in school breakfast.

Comparisons of observed vs. recalled total energy intake were not significantly different for the school meals combined, or for either meal individually, although the difference for school breakfast was nearly significant ($p=.06$; Table 2). The children overestimated recalled energy intake by 13% for both meals, and by 7% and 23% for school lunch and breakfast, respectively. Percent of energy intake from fat, carbohydrate and protein from the recalls were not significantly different from corresponding percentages from observation for any meal. However, significant differences between recalled and observed total carbohydrate and total protein in grams were found for school breakfast, and for total carbohydrate (G) for the combined school meals. Pearson correlations between observed and recalled nutrients ranged from .52-.86 for both meals, from .55-.86 for school lunch, and from .61-.81 for school breakfast.

When analyzed by site, the difference between observed and recalled total energy intake appeared much larger in one site than in the other three sites (Figure 1). Recalled energy intake was slightly overestimated by 4%, 5% and 7% for sites 1, 2, and 3, respectively. Energy intake was overestimated by 26% by site 4. No additional analyses by site were performed due to the small sample size from one site.

Table 3 shows the agreement between observed and recalled foods and food groups. All observed foods were categorized into 15 food groups, which were determined based on the

frequency and types of these foods in the data set. A total of 702 foods were observed across the four sites for the two school meals combined; of those, 527 foods were correctly recalled by the children. The children correctly recalled >70% of observed foods for 9 of the 15 food groups. Food groups which were the least accurately recalled were "added" foods, including condiments, butter/margarine and salad dressing, and also sweets and desserts. Children at site 1 correctly recalled 64-74.7% of observed foods; children from site 2 correctly recalled 89.9% of observed foods, children at site 3 correctly recalled 77.2-80.1% of observed foods, and children from site 4 correctly recalled 69.8-84.9% of observed foods. For sites 2 and 3, foods in three food groups were recalled 100% correctly.

Table 4 shows the agreement between observed and recalled food quantities. Of the 702 total foods observed, 581 foods had values for both observation and recall. Seventy-three foods (10.4%) were observed for which there were no corresponding recalls, and 48 foods (6.8%) were recalled for which there were no corresponding observations ("phantom foods"). Of the 581 food quantity pairs, 57% were correctly recalled by the children within 10% of the observed quantity. Fourteen percent of overestimations ranged from 11-99% greater than observed quantities, and 15.7% of overestimations were greater than 100% of observed quantities. Only 13.4% of all foods were underestimated.

Discussion

There are four primary findings from this study. First, for assessment of dietary variables at the group level, our data show that American Indian children are able to accurately report their dietary intake in terms of total energy intake and percentage of total energy from fat, carbohydrate and protein. This is particularly important with respect to the assessment of dietary

fat intake, a target nutrient in the Pathways Study. Similar findings were reported for third grade children in the CATCH Study using a diet record-assisted 24-hour recall method without portion size training (4). Higher Pearson correlations were found in this study compared with CATCH: for percent of energy from fat (.75 vs. .69), for percent of energy from carbohydrate (.86 vs. .68), and for percent of energy from protein (.86 vs. .68). A lower correlation was found for total energy (.52 vs. .59), however, unlike CATCH, we found no significant difference between recalled and observed total energy intake in our study. Eck et al. reported correlations between observation and recall of .75 for total energy, .52 for percent of energy from fat, .57 for percent of energy from carbohydrate, and .83 for percent of energy from protein for consensus recalls of 4 to 9-year old children and their parents (16). Emmons and Hayes reported correlations between observed and recalled total energy intake of .49 and .77 for third and fourth graders, respectively (17).

Second, for three of the four sites, the children were able to accurately report their total energy intake (+4 to 7% of observed intake). These results compare favorably with other ethnic groups and other children of similar age (5-8,10). The 26% overestimation of total energy reported by site 4 is not different in magnitude from other groups of obese children of similar age, however it is different in direction of error. Maffeis et al. reported an underestimation of 14% for total energy from obese 9-year-olds using the diet history method (6). Underestimations of obese children and adolescents ranged from 29% to 46% in studies by Maffeis et al. and Bandini et al., respectively (6,9). Since more accurate reporting of total energy was found for the other three sites in this study, it may be that differences in training conditions or other environmental factors may have been present at site 4 that were not present at the other three

sites.

Third, the children were able to correctly recall 75.1% of the foods they were observed consuming, and correctly recalled 82% of foods by food group. The children in CATCH correctly recalled 77.9% of observed foods. Baranowski et al. reported an 82.9% agreement between observed and recalled foods for third to sixth grade children using a combined diet record and food frequency method (10). Comparisons between observed and recalled foods by third and fourth graders were 67.3% and 80.6%, respectively, for school lunch meals in the study by Emmons and Hayes (17). Across studies, it appears that children were able to accurately recall food items consumed during periods of 24 hours or less.

Finally, for the Pathways Study, the primary modification to the combined diet record-assisted 24-hour recall method was the addition of one hour of training in portion size estimation for the participating children. Although this study was not designed to test whether training in portion size estimation improves overall dietary reporting accuracy, the agreement (+/- 10%) between observed and recalled food portion sizes in this study was 57% compared with 35.3% in the CATCH Study. Similar to CATCH, overestimation occurred more frequently than underestimation, and overestimations of greater than 100% occurred in all food groups. However, correct estimations also occurred in all but one food group, and for 8 of the 15 food groups, >50% of foods were estimated correctly. Food quantities reported with the greatest accuracy were juices, breads and crackers, desserts, milk, cereals and mixed dishes. Many of the same foods were also the most accurately reported in terms of food quantities in CATCH: desserts, milk, beverages, cookies and crackers, and breads. Food quantities reported with the least accuracy were salad dressings, butter and margarine, rice and macaroni, and condiments.

Similarities to CATCH were not found for these foods.

Many studies have used one or more parents as a proxy for reporting their children's food intake, or a combined child and parent reporting protocol, especially for children under 10 years of age (16,18-20). Frank reported that mothers' recalls of their elementary school children's food intakes were acceptable for grouping children by energy and nutrient intakes, but that the recalls did not accurately reflect actual food portions, types of foods and nutrients consumed (20). Similar findings were reported for mothers' recalls of 4-7-year-old Latino children's diets (19). Baranowski et al. reported substantial disagreement between foods observed as consumed by 3-4-year-old children and their mother's recall of their food intake (18). In our study, only 27% of parents across sites assisted their children with the diet record recording process. Accordingly, the children's training was designed to prepare them to report competently on their own.

While it appears that third grade American Indian children are able to recall their dietary intake accurately enough for use at the group level, these findings are limited to the specific communities participating in Pathways. It does not appear that the results can be generalized to other American Indian communities, since different results were obtained for one of the Pathways sites. Cross-validation of these results in other subsamples from these populations should be conducted, as well as replication studies in non-Indian populations. Further, this study did not address children's ability to accurately recall food intake outside of school. It is, however, encouraging that, with training, children as young as 8 years old can recall the majority of foods they have consumed during a 24-hour time period. Additionally, improvements in the accuracy of food quantity reporting, compared with other studies, were found.

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Table 1. Diet Record Return and Completion Rates

	Site 1	Site 2	Site 3	Site 4	Total	% of Total or Returned
Trained	33	26	19	21	99	---
Received Diet Record	33	26	19	20	98	99%
Returned Diet Record	27	23	16	17	83	85%
Complete	9	17	4	7	37	45%
School Lunch Only	2	0	7	0	9	11%
School Breakfast Only	9	5	0	5	19	23%
Parental Help	7	9	4	2	22	27%

Table 2. Energy and Nutrient Analysis (mean +/- standard deviation) of Observed vs. Recalled Intakes

	School Breakfast (n=54)				School Lunch (n=80)				Combined (n=54)			
Energy and Nutrients	Observed	Recalled	*p*	Pearson r^1	Observed	Recalled	*p*	Pearson r^1	Observed	Recalled	*p*	Pearson r^1
Energy (kcal)	279(108)	343(131)	.06	.64	482(144)	517(179)	.41	.55	761(159)	862(204)	.12	.52
Total Fat	8.6(6.9)	11.6(8.7)	.17	.70	17.1(7.3)	17.9(10.0)	.69	.59	25.5(9.6)	28.9(11.3)	.31	.57
Total Carbohydrate (g)	40.0(16.8)	46.2(20.0)	.03	.81	59.2(19.6)	65.6(21.8)	.17	.58	100.2(27.6)	110.8(32.4)	.05	.74
Total Protein (g)	11.1(6.3)	14.4(7.5)	.03	.66	24.3(8.8)	25.0(7.5)	.65	.57	34.8(11.5)	39.4(10.8)	.09	.68
% Energy from Fat	24.5(14.8)%	27.5(14.9)%	.18	.79	30.9(7.5)%	29.6(7.2)%	.70	.58	29.7(7.6)%	29.5(7.4)%	.96	.75
% Energy from Carbohydrate	61.4(20.1)%	56.7(19.0)%	.08	.78	50.0(10.7)%	51.8(9.4)%	.47	.75	53.3(11.3)%	50.1(10.4)%	.88	.86
% Energy from Protein	15.4(5.5)%	16.9(4.8)%	.12	.61	20.3(5.6)%	20.1(6.1)%	.79	.86	18.3(4.4)%	18.7(4.5)%	.61	.86

[1] p = 0.0001 for all *r* values

Table 3. Agreement Between Observed and Recalled Foods and Food Groups

Food Group	Total Sample				Site 1				Site 2				Site 3				Site 4			
	Match Food		Match Group		Match Food		Match Group		Match Food		Match Group		Match Food		Match Group		Match Food		Match Group	
	n[1]	%[2]	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Condiments	18	50.0	18	55.6	9	22.2	9	33.3	.	.	.	.	4	100.0	4	100.0	5	60.0	5	60.0
Butter/Margarine	18	66.7	18	66.7	1	0.0	1	0.0	6	100.0	6	100.0	11	54.5	11	54.5	.	.	.	.
Salad Dressing	9	22.2	9	33.3	9	22.2	9	33.3	.	.	.	.	.	.	.	.	.	.	.	.
Desserts	20	65.0	20	65.0	.	.	.	.	.	.	.	.	.	.	.	.	20	65.5	20	65.0
Milk	133	80.5	133	94.7	34	79.4	34	97.1	40	92.5	40	92.5	23	87.0	23	91.3	36	63.9	36	97.2
Mixed Dishes	63	92.1	63	95.2	23	95.7	23	95.7	17	94.1	17	94.1	15	100.0	15	100.0	8	62.5	8	87.5
Sugar/Sweets	25	68.0	25	68.0	.	.	.	.	4	0.0	4	0.0	5	60.0	5	60.0	16	87.5	16	87.5
Bread/Crackers	97	72.2	97	75.3	26	50.0	26	57.7	32	84.4	32	84.4	20	70.0	20	75.0	19	84.2	19	84.2
Cereals	30	83.3	30	93.3	18	88.9	18	94.4	6	100.0	6	100.0	6	50.0	6	83.3	.	.	.	.
Rice/Macaroni	13	84.6	13	84.6	.	.	.	.	.	.	.	.	.	.	.	.	13	84.6	13	84.6
Vegetables	105	71.4	105	75.3	31	58.1	31	58.1	23	95.7	23	95.7	23	69.6	23	69.6	28	67.9	28	75.0
Meat	45	88.9	45	88.9	2	0.0	2	0.0	19	94.7	19	94.7	7	100.0	7	100.0	17	88.2	17	88.2
Eggs	5	100.0	5	100.0	.	.	.	.	5	100.0	5	100.0	.	.	.	.	.	.	.	.
Fruit	78	79.5	78	85.9	19	57.9	19	84.2	24	91.7	24	91.7	21	81.0	21	81.0	14	85.7	14	85.7
Juices	43	48.8	43	88.4	14	57.1	14	85.7	12	83.3	12	83.3	1	0.0	1	0.0	16	18.8	16	100.0
All Foods	702	75.1	702	82.6	186	64.0	186	74.7	188	88.9	188	89.9	136	77.2	136	80.1	192	69.8	192	84.9

[1]1=Total number of foods observed for each food group and for all foods for the total sample and by site.
[2]2=Percent of observed foods correctly recalled for each food group and for all foods for the total sample and by site.

Table 4. Agreement Between Observed and Recalled Food Quantities by Food Group

Food Group	n[1]	% correct +/- 10%	Overestimated 11% - 49	Overestimated 50% - 49	Overestimated 100% +	Underestimated 11% - 49%	Underestimated 50% - 99%
Condiments	10	20.0	10.0	20.0	30.0	10.0	10.0
Butter/Margarine	12	16.7	.	8.3	75.0	.	.
Salad Dressing	3	.	.	.	33.3	33.3	33.3
Desserts	13	69.2	.	.	15.4	15.4	.
Milk	126	62.7	6.3	2.4	18.3	2.4	7.9
Mixed Dishes	60	60.0	3.3	5.0	13.3	6.7	11.7
Sugar/Sweets	17	58.8	5.9	11.8	11.8	6.9	5.9
Bread/Crackers	73	72.6	4.1	1.4	13.7	2.7	5.5
Cereals	28	64.3	14.3	.	7.1	10.7	3.6
Rice/Macaroni	11	18.2	27.3	9.1	27.3	18.2	.
Vegetables	77	41.6	10.4	18.2	18.2	5.2	6.5
Meat	41	56.1	12.2	2.4	14.6	12.2	2.4
Eggs	5	40.0	.	.	20.0	40.0	.
Fruit	67	49.3	16.4	3.0	9.0	16.4	6.0
Juices	38	78.9	13.2	.	2.6	5.3	.
All Foods	581	57.0	8.8	5.2	15.7	7.4	6.0

[1]n = number of paired observations and recalls

Figure 1: Observed vs Recalled Energy Intake for School Breakfast and Lunch Combined, by Site