Validation of Mothers' Reports of Dietary Intake by Four to Seven Year-Old Children

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Abstract: The validity of mothers' recall of four to seven year-old children's diet was assessed among 46 first generation Latino immigrant families from the Dominican Republic by comparing intake recalled by the mother to unobtrusive home observations of children. Correlations were moderate to high for calories and for most nutrients. There were no differences in mean intake of total calories or in intake of most macronutrients and micronutrients assessed. At least two-thirds of the children in the lowest (or highest) quintile based on home observation were correctly classified into the lowest or second lowest (or highest) quintiles based on mother's reports for calories and most nutrients. For all food items that were both observed and reported, 51 percent of reported portion sizes were equivalent to observed portion sizes, 15.5 percent were smaller, and 33.5 percent were larger. There was fair to good agreement on the number of food items eaten, with the exception of vegetables. Mothers' recall appears to be useful for classifying children by intake of calories, macronutrients and micronutrients, but provides a somewhat less accurate measure of actual foods eaten, portion sizes, and nutrient levels consumed. (*Am J Public Health* 1990; 80:1314–1317.)

Introduction

Valid measurement of diet is essential to improve understanding of the role of diet in the etiology of diseases and for evaluating dietary interventions. The 24-hour dietary recall is probably the most widely used instrument in surveys and studies of food intake in the United States,[1–7] and its validity has been investigated in adults by comparison with weighed intakes,[8,9] direct observation,[10–12] and other dietary measurement methods.[13–15] Two recently published studies[16,17] have reported on the validity of recall by adults who cook and serve children's meals, usually mothers. No studies of this kind have been conducted in Latino families with young children or have used unobtrusive observation of children in their homes as a validation criterion. Nor have any previous studies assessed the validity of parental recall of children's nutrient intake using regression methods to adjust for caloric intake, permitting estimation of nutrient values that remove the effect of caloric intake.

We assessed the validity of mothers' recall of four to seven year-old children's dietary intake of total calories and 17 nutrients and of portion sizes and food items aggregated within food groups among first generation Latino immigrant families from the Dominican Republic by comparing intake recalled by the mother to unobtrusive home observations of children.

Methods

Subjects and Setting

Subjects were drawn from a sample of four to seven year-old children and their mothers participating in the Columbia University Study of Childhood Activity and Nutrition, a longitudinal study of young children. The total sample comprises families residing in a primarily Latino, densely populated, low-income neighborhood in northern Manhattan, New York City. Eligibility required that children be generally healthy with no special dietary prescriptions or restrictions.

A total of 46 Dominican families (mean age of children = 5.4 years, S.D. = 0.8) participated in the validation study. There were 18 males (mean age = 5.0 years, S.D. = 0.78 years) and 28 females (mean age = 5.7 years, S.D. = 0.78 years). All parents in the validation study were mothers (mean age = 33.8 years, S.D. = 4.6). Thirty-one of the children lived in single parent families.

Measurements

Home observation: Home observations were conducted between May 1987 and May 1989 by trained observers, fluent in Spanish, on the day before a regularly scheduled study visit in which the mother was to report her child's dietary intake for the preceding 24-hour period. The time period of the home observation ensured observation of the main meal (usually 4:00pm to 8:00pm). Parents were told that the observer was interested in the child's activities but were not informed about the specific aims of the study.

The observer followed the child and recorded the foods the child ate, the amounts, and the time. When necessary the observer asked the child's mother what the child was eating. Prior to data collection, observers were trained and tested in visually estimating portion sizes. Data were recorded on an instrument adapted from the Health and Nutrition Examination Survey.[7]

Twenty-four hour dietary recall: Different individuals conducted the interviews and home observations. On the day following the home observation the mother was asked to describe the food items eaten by the child during each eating occasion, the time of day, and portion sizes. Three dimensional food models, food packages, glasses, cups, spoons, and other utensils, and questions about food preparation methods and brand names of foods were used to increase accuracy. The sections of the recall corresponding to the time when the observer was present in the home were excerpted for analysis. For both observed dietary intake and 24-hour recall data, foods and portion sizes were converted to nutrient intakes using a dietary analysis program,[18] which used published nutrient data from the United States Depart-

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ment of Agriculture.[19,20] Supplemental nutrient values were obtained from other sources.[21]

Statistical Analysis

Nutrient intake values were adjusted for average caloric intake using regression techniques.[22] The natural logarithm transformation was used to improve normality for intake of nutrients but untransformed values are reported in the tables. Nutrient analyses were also performed using unadjusted values. Results were the same and only adjusted values are reported. Pearson product-moment correlation coefficients were used to estimate consistency between observed and reported calorie and nutrient intake. Paired t-tests were used to evaluate differences between means. We also examined the proportion of children correctly classified into quintiles of nutrient intake.[22] Consistency between observed and reported portion size was calculated within nine food groups comprising the 200 food items that were both observed and reported. Portion sizes were defined as equivalent if they were within one and one-half times the smaller amounts. The proportions of mothers who reported fewer, the same, or more items than observed within food groups were calculated, and the Z test[23] was used to assess differences in proportions.

Results

Correlations were moderate to high for most nutrients, although mean nutrient intakes derived from mothers' reports tended to be higher than those derived from observations (Table 1). Paired t-tests indicated no significant differences for total calories or macronutrients, except protein. For micronutrients, there were differences for cholesterol, calcium, iron, thiamine, riboflavin, and niacin. At least two-thirds of the children in the lowest quintile based on home observation were correctly classified into the lowest or second lowest quintiles based on mother's reports for all 17 nutrients except carbohydrates, calcium, and riboflavin (Table 2). Fewer children were correctly classified into the highest two quintiles for fats and cholesterol. For micronutrients, mother's reports were about as good as or better at high levels of intake than they were at low levels of intake. For all nutrients, mean observed intake in the highest quintile was at least three times as high as that in the lowest quintile, so that correct classification has practical significance.

Overall, for all 200 food items that were both observed and reported, 51 percent of reported portion sizes were equivalent to observed portion sizes, 15.5 percent were smaller, and 33.5 percent were larger (Table 3). When mothers made errors in reporting portion sizes they tended to overestimate for all food groups except butter/fats/oils. For all foods combined the proportion underestimated was significantly lower than the proportion over-estimated. The small numbers of dairy products (n = 4) and eggs consumed (n = 1) precluded meaningful analysis for these food groups.

There was fair to good agreement on the number of food items eaten, with the exception of vegetables (Table 4). In all nine food groups mothers tended to report fewer items eaten than observed. The practical significance of the percent agreement depends in part on the overall frequency of consumption. The proportion of mothers who agreed with the observer that items were not eaten is thus included in Table 4. For nine out of 10 of the most frequently eaten foods, observed and reported frequencies were identical (data not shown).

Discussion

Ability to measure children's absolute nutrient intake (e.g., 300 milligrams of cholesterol per day) as well as macronutrient intake as a proportion of absolute calories is important since some nutritional guidelines are stated in these terms.[24–26] Adjustment for caloric intake is necessary when assessing the association between particular nutrients and disease risk or the causal role of nutrients in disease processes.[27–29] The regression method of adjustment recommended by Willett and used in this study[22] permits the estimation of nutrient values while removing the effect of total caloric intake. This is not achieved by dividing nutrient values by total caloric intake.[30]

TABLE 1—Means, standard deviations (SD), Pearson correlation coefficients, and 95 percent confidence intervals for observed and reported nutrients and calories (data based on reports from 46 Dominican mothers residing in Northern Manhattan and corresponding home observations of children's diet, 1987–1989)*

	Observed mean		Reported mean			
	Mean	(SD)	Mean	(SD)	r	95% CI
Fat (g)	12.2	(5.4)	12.9	(7.1)	.52	(.27–.70)
Saturated fat (g)	3.0	(2.5)	3.3	(2.1)	.38	(.10–.60)
Monounsaturated fat (g)	4.1	(2.6)	4.0	(2.3)	.41	(.14–.63)
Polyunsaturated fat (g)	3.9	(2.6)	4.1	(3.0)	.58	(.35–.75)
Cholesterol (mg)	53.6	(84.6)	83.2	(230.5)	.65	(.44–.79)
Protein (g)	16.1	(7.1)	19.7	(8.0)	.50	(.25–.69)
Carbohydrates (g)	59.9	(14.3)	59.8	(16.0)	.48	(.22–.68)
Sodium (mg)	335.9	(302.0)	396.6	(698.4)	.27	(−.02–.52)
Potassium (mg)	566.5	(280.4)	656.9	(546.7)	.54	(.30–.72)
Calcium (mg)	63.0	(57.2)	90.6	(110.7)	.28	(−.02–.52)
Phosphorus (mg)	185.5	(64.9)	230.8	(108.3)	−.10	(−.38–.20)
Iron (mg)	3.0	(1.1)	3.6	(1.3)	.82	(.70–.90)
Vitamin A (IU)	1121.6	(1561.2)	2354.4	(5933.5)	.66	(.45–.80)
Thiamine (mg)	0.28	(0.11)	0.32	(0.12)	.68	(.48–.81)
Riboflavin (mg)	0.22	(0.10)	0.36	(0.43)	.52	(.26–.70)
Niacin (mg)	4.1	(2.2)	4.7	(2.3)	.72	(.55–.84)
Vitamin C (mg)	33.0	(37.3)	29.2	(29.3)	.50	(.25–.69)
Calories	465.0	(229.5)	507.0	(258.9)	.71	(.53–.83)

*Nutrient intakes were adjusted using residuals from regression models with caloric intake as the independent variable and nutrient intakes as the dependent variables (22).

TABLE 2—Comparisons of observed and reported nutrient and caloric intake based on joint classification by quintiles (data based on reports from 46 Dominican mothers residing in Northern Manhattan and corresponding home observations of children's diet, 1987–1989)*

	Joint classification by quintiles					
	Lowest quintile on observation			Highest quintile on observation		
	Lowest quintile on recall (%)	Lowest 2 quintiles on recall (%)	Highest quintile on recall (%)	Highest quintile on recall (%)	Highest 2 quintiles on recall (%)	Lowest quintile on recall (%)
Fat (g)	56	89	0	78	89	11
Saturated fat (g)	33	67	0	63	63	13
Monounsaturated fat (g)	67	100	0	50	63	0
Polyunsaturated fat (g)	44	100	0	44	67	11
Cholesterol (mg)	67	100	0	11	44	22
Protein (g)	44	67	11	67	89	0
Carbohydrates (g)	44	56	11	56	100	0
Sodium (mg)	33	67	0	56	89	11
Potassium (mg)	44	78	0	44	67	0
Calcium (mg)	44	56	22	67	78	11
Phosphorus (mg)	56	67	11	56	78	0
Iron (mg)	80	90	0	56	89	0
Vitamin A (IU)	44	89	0	56	100	0
Thiamine (mg)	56	89	0	44	78	0
Riboflavin (mg)	44	56	11	56	78	0
Niacin (mg)	67	100	0	44	89	0
Vitamin C (mg)	56	78	0	56	67	11
Calories	67	100	0	44	89	0

*Nutrient intakes were adjusted using residuals from regression models with caloric intake as the independent variable and nutrient intakes as the dependent variables (22).

TABLE 3—Portion size reported versus observed for the 200 food items both observed and reported by food group (data based on reports from 46 Dominican mothers residing in Northern Manhattan and corresponding home observations of children's diet, 1987–1989)*

Food Group	Number of Foods	% Observed > Reported	% Observed = Reported	% Observed < Reported
Eggs	1	0	0	100.0
Dairy products	4	0	75.0	25.0
Butter/fat/oil	13	46.2	30.8	23.1
Sugar	17	11.8	58.8	29.5
Meat/fish/poultry	23	13.0	52.2	34.8
Fruits	22	9.1	59.1	31.8
Beans/nuts	36	16.7	38.9	44.4
Bread/grains/rice/cereal	40	15.0	52.5	32.5
Vegetables	44	13.6	56.8	29.5
Total**	200	15.5	51.0	33.5

*Portion sizes were defined as equivalent if they were within one and one-half times the smaller amount.

**Difference in proportions overreported − underreported = .18 (95% confidence intervals .08–.27)

TABLE 4—Percent of respondents reporting fewer, the same or more food items (vs observed) by food group (data based on reports from 46 Dominican mothers residing in Northern Manhattan and corresponding home observations of children's diet, 1987–1989)

	Items Reported (vs Observed)			
Food Group	% Fewer	% Same	% More	% Agree not Eaten
Eggs	4.3	95.7	0	93.5
Dairy products	8.7	84.8	6.5	76.1
Butter/fat/oil	21.7	71.7	6.5	39.1
Sugar	17.4	69.6	13.0	37.0
Meat/fish/poultry	15.2	73.9	10.9	34.8
Fruits	19.6	69.6	10.9	45.7
Beans/nuts	15.2	73.9	10.9	28.3
Bread/grains/rice/ cereal	10.9	80.4	8.7	15.2
Vegetables	30.4	41.3	28.3	17.4

Our findings support the utility of mother's recall of children's diet for research needing accurate classification of subjects' nutrient intake according to an ordinal or interval level of measurement. The differences in mean levels of intake for protein and several of the micronutrient values raise concerns about the use of parental recall for testing differences in mean nutrient intake between groups. Our results also indicate substantial errors in estimating portion sizes of foods, particularly over-estimation, as well as overreporting and underreporting of specific food items, and thus raise questions about the use of mother's recall as a method of measuring these aspects of children's eating behavior. Studies that require precise and accurate estimates of mean nutrient intake within groups or descriptions of food items and portion sizes consumed may need to rely on direct observation.

The dietary variable of interest in chronic disease epidemiology is typical diet. Eating patterns vary by time of week and year,[31–33] so that a single 24-hour dietary recall will not represent typical diet. Mothers' recall of children's evening meal may differ from that of other meals, and the presence of the observer may influence mothers' menu for the day or her likelihood of remembering what she served. The main evening meal is important, however, as evidenced by the observed consumption of calories, fat and saturated fat, as well as other nutrients.

Results from this study are consistent in some respects with other reports of the utility of surrogate-reported dietary information. The studies in adults, which reached guarded conclusions about the utility of this strategy, assumed that subjects' reports were accurate and these reports were the criterion against which the surrogates' reports were tested.[34–36] A trained observer provided the criterion mea-

sure in our study. Klesges, *et al,*[16] performed home observations of 30 children ranging in age from 24 to 48 months in which the observer weighed and recorded all food eaten by the child during the day. Dietary recalls were taken from the parent later that same day. At the nutrient level findings were similar to those in our study. At the food level, Klesges, *et al,* found that parents made errors in estimating portion sizes but correctly recalled 96 percent of the food items the child ate, a level of accuracy higher than in our study. Collecting recall data from the parents on the same day as the observation, rather than on the day following the home observation (which is how the recall method is generally used), or having the observer weigh food prior to consumption by the child may have enhanced the accuracy of reporting.

Eck, *et al,*[17] conducted unobtrusive observations of 34 children four to nine years of age eating a single meal in a cafeteria with both of their parents. Dietary recalls were taken from family members individually and as a group on the following day. There were no significant differences between observed and reported mean intake of total calories, calories from total fat, protein, carbohydrates, or sugar, or in intake of cholesterol, sodium, iron or calcium. The mean correlation for these nutrients was 0.77 for fathers, 0.63 for mothers, and 0.86 for the mother, father and child as a group. Eck, *et al,* also examined overreporting and underreporting of nutrients by food groups and reported that while general agreement was high, over- and underreporting varied greatly. The correlations between reported and observed nutrient intakes were, in general, higher than in our study. This study was based on a single meal in a cafeteria setting eaten by middle to high socioeconomic status families,[17] while our study was done in the home of Latino subjects of lower educational attainment.

Our study, together with the investigations by Klesges, *et al,* and Eck, *et al,* indicate that mothers' reports of children's diet appear to be useful to measure children's intake of calories, macronutrients, and micronutrients. The recall gives a somewhat less accurate measure of actual foods eaten, portion sizes, and nutrient levels consumed. Additional research is needed to verify our results in other Latino subgroups and non-Latino populations, to improve understanding about factors that improve and impede mother's reports about children's diet, and to test strategies to improve the validity of these measures.

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