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Fourth-Grade Children are Less Accurate in Reporting School Breakfast than School Lunch during 24-Hour Dietary Recalls

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Abstract

Objective—To compare reporting accuracy for breakfast and lunch in two studies.

Design—Children were observed eating school meals and interviewed the following morning about the previous day. Study 1 – 104 children were each interviewed one to three times with ≥25 days separating any two interviews. Study 2 – 121 children were each interviewed once in forward (morning-to-evening) and once in reverse (evening-to-morning) order, separated by ≥29 days.

Setting—12 schools.

Participants—Fourth-grade children.

Main Outcome Measures—For each meal: food-item variables – observed number, reported number, omission rate, intrusion rate, total inaccuracy; kilocalorie variables – observed, reported, correspondence rate, inflation ratio.

Analysis—General linear mixed-models.

Results—For each study, observed and reported numbers of items and kilocalories, and correspondence rate (reporting accuracy), were greater for lunch than breakfast; omission rate, intrusion rate, and inflation ratio (measures of reporting error) were greater for breakfast than lunch. Study 1 – for each meal over interviews, total inaccuracy decreased and correspondence rate increased. Study 2 – for each meal for boys for reverse and girls for forward order, omission rate was lower and correspondence rate was higher.

Conclusions and Implications—Breakfast was reported less accurately than lunch. Despite improvement over interviews (Study 1) and differences for order × sex (Study 2), reporting accuracy was low for breakfast and lunch.

Keywords

children; dietary recalls; reporting accuracy; school breakfast; school lunch; observation; validation

INTRODUCTION

Breakfast consumption plays an important role in children's general health and well-being, and is associated with nutritional adequacy, body weight, and cognitive and academic

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performance.[1–3] School is a common source of breakfast for many children: In the United States, average daily participation in the School Breakfast Program exceeds 9 million children.[4] The accuracy of dietary recalls by elementary school children (without assistance from parents) has been investigated in validation studies by comparing parts of 24-hour recalls to school-meal observations of breakfast and lunch[5–9] alone or combined with weighed intake.[10] However, despite continuing interest in the importance of children's breakfast consumption,[1–3] few studies have compared the accuracy with which children report school breakfast and school lunch.

Todd and Kretsch[10] expected children to report school breakfast intake more accurately than school lunch intake because fewer items were served at breakfast. They calculated Pearson correlations for each meal between children's dietary recalls and school-meal observations combined with weighed intake. Although Todd and Kretsch did not present detailed results by meal, they stated that the correlations "…for selected nutrients at breakfast were higher for the most part than at lunch …",[10] which suggests higher reporting accuracy for breakfast than lunch.

In a validation study by Weber et al[11] with children, analyses by school meal indicated significant differences between reported and observed carbohydrate and protein (with $p = .06$ for energy) for school breakfast, but no significant differences for school lunch, which suggests higher reporting accuracy for lunch than breakfast. In contrast, Pearson correlations between reported and observed nutrients and energy ranged from 0.64 to 0.81 for school breakfast and 0.55 to 0.59 for school lunch, which suggests higher reporting accuracy for breakfast than lunch. However, some aspects of their study could have caused reactivity and altered children's intake and/or reporting, thus decreasing the generalizability of their results concerning *children's* reporting accuracy. Specifically, staff who did not conduct observations helped children record meals if asked. Instead of returning meal trays as usual, children were asked to leave trays (and name tags worn for the study) on tables after meals ended. Children received measurement utensils and training for a total of 60 to 80 minutes before and after the observed school lunch to estimate amounts and to complete a diet record to be used as a memory prompt during a 24-hour dietary recall conducted the next morning.[11]

The purpose of the current analysis was to compare children's reporting accuracy for school breakfast and school lunch by using data from two validation studies by our group. In Study 1, the consistency of children's reporting accuracy over multiple interviews was investigated.[8] In Study 2, the effect of order prompts (morning-to-evening [with breakfast coming earlier in the report] versus evening-to-morning [with breakfast coming later in the report]) on the accuracy of children's dietary recalls was investigated.[9] We did not previously compare reporting accuracy for school breakfast and school lunch. In each study, dietary recalls were obtained for an entire 24-hour period because previous research has shown that children's accuracy for reporting lunch during a 24-hour dietary recall is less than accuracy for reporting only lunch.[12]

METHODS

This section summarizes the sample and data collection methods for each study; additional details are described elsewhere.[8, 9] For each study, approval was obtained from the institutional ethics committee for research involving human subjects, and child assent and parental consent to participate were obtained in writing prior to data collection. Children were recruited from all fourth-grade classes from a total of 12 public schools in one school district in a southern state. The schools were selected based on high participation in school meals (breakfast, lunch). The sample for each study was stratified by sex and race to ensure equal representation of the sex/race groups; however, neither study was powered to detect sex or race differences.[8, 9] Table 1 provides important details concerning the sample, design, and methods for each study.

Observations

Only children who obtained meals at school were observed because unobtrusively identifying contents of meals brought from home is difficult.[13] Entire school meal periods were observed to note trading of foods.[14] One of three dietitians in Study 1, or one of four dietitians in Study 2, observed one to three children simultaneously and recorded, for each child, items and amounts eaten in servings. Children could see when an observer was present, but did not know who, specifically, was being observed or would be interviewed. Practice observations were conducted prior to data collection to familiarize children with an observer's presence.[15] Inter-observer reliability, assessed regularly through data collection, was satisfactory.[8, 9]

Interviews

One of three dietitians in Study 1, or one of four dietitians in Study 2, interviewed children individually after breakfast in the morning after each observation day about their intake on the previous day. A dietitian never interviewed a child that she had observed on the previous day. For Study 1, each of 104 children was interviewed once (n=12), twice (n=13), or three times (n=79); at least 25 days separated any two interviews for an individual child, and when possible, in subsequent interviews, different dietitians interviewed the child on different weekdays. For Study 2, 121 children were each interviewed twice, once in forward order (morning-to-evening) and once in reverse order (evening-to-morning), separated by ≥29 days; a child's two interviews were conducted by different dietitians, and, when possible, on different weekdays. Interviewers followed a multiple-pass protocol modeled after the Nutrition Data System for Research (NDS-R; version 4.03, Nutrition Coordinating Center, University of Minnesota, Minneapolis, 2000); however, interviewers wrote information reported by children onto paper forms instead of using the NDS-R computerized version. For Study 1, all interviews used forward-order prompts. For Study 2, half of the children in each sex/race group were randomly assigned to forward-order prompts during the first interview and reverse-order prompts during the second interview; the other half of each group received the complementary assignment. (Figure 1 in references [8] and [9] fully describes each interview protocol.) Each interview was audio-recorded and transcribed. Quality control for interviews, assessed regularly throughout data collection, indicated that interviewers adequately adhered to the protocols.[8, 9]

Analyses

Children were asked to report intake for the entire previous day during each interview, but analyses for each study were restricted to intake for school meals because the validation method of observation included only school breakfast and school lunch. As explained in detail elsewhere,[8, 9] to be considered as reports of school meals, children had to identify *school* as the location where meals were eaten, name meals appropriately, and report mealtimes to within an hour of observed mealtimes; these requirements were applied consistently to all reports. Each item *observed* eaten at a school meal was classified as a *match* if it was reported eaten, or as an *omission* if it was not reported eaten, at that school meal. Each item *reported* eaten at a school meal was classified as a *match* if it had been observed eaten, or as an *intrusion* if it had not been observed eaten, at that school meal. Because children can report foods many ways, items reported eaten were classified as matches unless it was clear that the children's reports did not describe items observed eaten; this may have overestimated children's reporting accuracy.[8, 9]

As in previous studies,[8, 16, 17] observed amounts and reported amounts were recorded using a qualitative scale and then assigned numeric values as *none*=0.00, *taste*=0.10, *little bit*=0.25, *half*=0.50, *most*=0.75, *all*=1.00, or the actual number of servings if >1 was observed or reported eaten. For each item observed eaten, and for each item reported eaten, standardized school-meal servings were used to obtain per serving information about kilocalories from the NDS-R database; for items not in NDS-R, kilocalorie information was obtained from the school district's nutrition program. Although the portion-size estimates may have been imprecise, the same approach was used to estimate kilocalories for observed items and for reported items.

For each interview for each child, we calculated nine variables for breakfast and lunch separately; there were five food-item variables (number of items observed eaten, number of items reported eaten, omission rate, intrusion rate, total inaccuracy) and four kilocalorie variables (observed, reported, correspondence rate, inflation ratio). The five food-item variables were calculated after assigning an importance weight to each item according to meal component, with combination entrée = 2.00, condiment = 0.33, and every remaining component = 1.00.[8, 9] *Higher* values for omission rate, intrusion rate, and total inaccuracy indicate *lower* reporting accuracy.[8, 9] *Higher* values for correspondence rate, and *lower* values for inflation ratio, indicate *higher* reporting accuracy.[18] The nine variables are defined in the Table 2 footnotes.

Study 1—Previously published food-item analyses (based on classifying each item as a match, omission, or intrusion) for both meals combined showed that total inaccuracy (which cumulated errors in servings for all items and amounts) decreased from the first to the third interview (*p* = .006), which indicated that children's reporting accuracy for the two meals combined improved over interviews.[8] For the current analysis, we conducted a general linear mixed-model analysis (with child as the sole random effect) for each of the nine variables to determine whether the consistency of reporting accuracy over interviews depended on meal (breakfast, lunch), interview (first, second, third), and meal × interview. The model included interview and meal × interview due to the design and previously-published effect of interview; the sex and race stratification variables were also included. Least squares means (LSMs) and standard errors (SEs) were calculated for each meal for each interview, for levels of variables involved in significant effects, and for combinations of levels of variables in significant interactions.

Study 2—Previously published food-item analyses for both meals combined showed an order-x-sex interaction on omission rates (*p* = 0.008): Boys had lower omission rates in reverse-order reports, but girls had lower omission rates in forward-order reports.[9] For the current analysis, we conducted a general linear mixed-model analysis (with child as the sole random effect) for each of the nine variables to determine whether reporting accuracy depended on meal, order (forward, reverse), sex, order × sex, meal × order, meal × sex, and meal × sex × order. Sequence (first or second interview) was in the model to investigate order. The main effects and interactions for order and sex were in the model due to the design and previously-published order-x-sex interaction; the race stratification variable was also in the model. We calculated LSMs and SEs for each order by meal and sex, for levels of variables involved in significant effects, and for combinations of levels of variables involved in significant interactions.

RESULTS

Table 2 shows LSMs and SEs from the general linear mixed-model analysis conducted for each of the nine variables, for Study 1 for each interview by meal, and for Study 2 for each order by meal and sex, along with F values and *p* values for significant effects and interactions.

For each study, all five food-item variables and four kilocalorie variables for observed consumption, reported consumption, and reporting accuracy differed significantly by meal. Specifically, more items (*p* < .0001 for each study) and kilocalories (*p* < .0001 for each study) were *observed* eaten for lunch than for breakfast, and more items (*p* < .0001 for each study) and kilocalories ($p < .0001$ for each study) were *reported* eaten for lunch than for breakfast. Correspondence rate, a measure of reporting *accuracy*, was greater for lunch than for breakfast ($p = .0002$ for each study). Three measures of reporting *error* – omission rate ($p = .0048$ for Study 1; $p = .0014$ for Study 2), intrusion rate ($p < .0001$ for each study), and inflation ratio ($p < .0001$ for Study 1; $p = .0017$ for Study 2) – were greater for breakfast than for lunch.

Another measure of reporting *error* – total inaccuracy – was greater for lunch than for breakfast ($p < .0001$ for each study). However, because total inaccuracy is a cumulative sum of reporting errors in servings for all items (matches, omissions, and intrusions) and amounts combined, it cannot be normalized for the number of items. Thus, the significant effect of meal for total inaccuracy in both studies can be attributed to the significant differences in the numbers of observed items and reported items for breakfast and lunch.

In Study 1, neither children's *observed* intake nor *reported* intake varied significantly over interviews for either school meal: The effect of interview was not significant for observed intake (number of items or kilocalories), or for reported intake (number of items or kilocalories) for either school meal. The meal-x-interview interaction was not significant for any variable. As shown in Table 2, for each meal over interviews, total inaccuracy decreased ($p = .0262$), and correspondence rate increased ($p = .0222$), which indicates that children's reporting accuracy improved over interviews for school breakfast and for school lunch.

In Study 2, the meal-x-order-x-sex interaction was not significant for any variable. However, reported kilocalories ($p = .0106$) and intrusion rate ($p = .0494$) were greater for forward- than for reverse-order prompts. The order-x-sex interaction was significant for reported kilocalories, which were similar for boys for both order prompts but lower for girls for reverse-than forward-order prompts ($p = .0394$); for omission rate, which was lower for boys for reverse-order prompts and for girls for forward-order prompts ($p = .0059$); and for correspondence rate, which was greater for boys for reverse-order prompts and for girls for forward-order prompts ($p = .0082$). The results for omission rate and correspondence rate in Table 2 indicate that children's reporting accuracy was low for school breakfast as well as for school lunch, but was higher for boys for reverse-order prompts and for girls for forward-order prompts.

More kilocalories were observed eaten by boys than by girls ($p = .0004$ for Study 1; $p = .0075$ for Study 2). In Study 1, more items ($p = .0378$) and kilocalories ($p = .0004$) were reported eaten by boys than by girls. In Study 2, at breakfast, boys were observed eating more items than girls, but at lunch, girls were observed eating more items than boys ($p = .0166$); furthermore, at breakfast, total inaccuracy was lower for girls than for boys, but at lunch, it was similar for girls and for boys ($p = .0497$). In Study 2, more items were reported eaten by black children than by white children ($p = .0240$). The Table 2 footnotes provide LSMs and SEs for significant effects of sex for Study 1 and for race for Study 2.

DISCUSSION

We analyzed data collected previously for two dietary validation studies with children to compare reporting accuracy for school breakfast and school lunch. We found that although fewer items and kilocalories were observed eaten and reported eaten at school breakfast than at school lunch, children were less accurate in reporting school breakfast than school lunch.

Our conclusions differ from those of Todd and Kretsch[10] and Weber et al[11] discussed in the introduction. The difference could be due to the approach used to compare observed information to reported information. Their approach did not consider errors in reported items or amounts; in contrast, our approach considered the accuracy of reported information because we classified items as matches or intrusions, and amounts as corresponding or overreported.[18]

Although neither Study 1 nor Study 2 was powered to detect sex or race differences, significant sex and race effects and interactions were found for several variables in each validation study. Several *non*-validation studies that have obtained 24-hour dietary recalls from children have found differences by race/ethnicity and/or sex in mean reported daily intakes of energy and nutrients, and/or the percent of children who met nutrition recommendations.[19–23] Whether differences by race/ethnicity and/or sex in children's dietary intake are due to actual differences in *intake*, or to variation in *reporting accuracy* by race/ethnicity and/or sex, is an area for which future dietary validation studies with children are needed.

These additional analyses are limited by specific aspects of the designs and methods of Studies 1 and 2. Analyses were restricted to school meals in children's 24-hour dietary recalls because observations included two school meals instead of an entire 24 hours. Qualitative terms converted to quantitative terms were used for amounts of standard servings. A lenient criterion was used to classify reported items as matches; this may have overestimated reporting accuracy.

The limitations are offset by several strengths. Observations were conducted in a setting and manner that minimized reactivity. Throughout data collection, quality control was assessed both for observations and for interviews. Reports were obtained from children *without* assistance from parents (who were not present at the observed school meals); thus, we investigated *children's* reporting accuracy.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Children were less accurate in reporting school breakfast than school lunch during 24-hour dietary recalls, even though fewer items and kilocalories were observed and reported eaten for school breakfast than for school lunch. These results have implications when dietary recalls are obtained from children, as might be done to evaluate nutrition education interventions, to assess the relative validity of food frequency questionnaires, or to determine the effects of the school breakfast program (eg, traditional versus universal-free) on children's dietary outcomes.

For Study 1, the improvement in children's reporting accuracy over interviews for school breakfast and for school lunch may have been due to children's maturation, to increased experience with the interview process, or to some other unknown factor. For Study 2, reporting accuracy was better for school breakfast, and for school lunch, for boys for reverse-order prompts and for girls for forward-order prompts. However, despite improvement over interviews for school breakfast and for school lunch in Study 1, and differences for the order-x-sex interaction in Study 2, reporting accuracy was low for school breakfast and for school lunch.

Children in both studies might have been less accurate in reporting school breakfast than school lunch because 1) another school breakfast intervened between the to-be-reported school breakfast and the interview, 2) more time intervened between eating school breakfast and the interview than between eating school lunch and the interview, and/or 3) fewer items at school breakfast than at school lunch made any reporting error proportionally greater. Insight concerning the first two possibilities could be gained by investigating reporting accuracy by meal in a validation study that had sufficient numbers of children and that varied both target period (prior 24 hours – from 24 hours before the interview until the time the interview began; previous day – midnight to midnight of the day before the interview) and interview time (morning, afternoon, evening). In such a study, one would expect children to be most accurate for reporting school breakfast during morning interviews about the prior 24-hours' intake because there would have been no school breakfast between the to-be-reported school breakfast and the interview, and because the time interval between eating school breakfast and the interview would be less than for any of the other target period × interview time conditions, and less than the time interval between eating school lunch and the interview.

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Table 1

Details concerning the sample, design, and methods for Study 1 and for Study 2

	Study 1	Study 2
School year of data collection	1999 – 2000	2000 – 2001
Number of schools *	6	11
Mean percent of children (range) across all grades who were eligible to receive free or reduced-price school meals during the school year of data collection	69% (36% to 91%)	60% (33% to 74%)
Number (%) of children who agreed to participate	382 (73%)	669 (73%)
Number of randomly-selected children observed and interviewed (Black girls, Black boys, White girls, White boys)	104 (27, 24, 28, 25)	121 (29, 31, 29, 32)
Number of interviews per child†	1 (n = 12), 2 (n = 13), 3 (n = 79)	2
Number of days between any two interviews for an individual child†	25 to 99 (median = 41)	29 to 127 (median = 63)

*A total of 12 schools participated; five schools participated in both studies.

†Each interview was conducted in the morning after school breakfast on the day after school meals (breakfast, lunch) were observed, and concerned the child's intake on the previous day.

Table 2

Least squares means (LSMs), standard errors (SEs), and statistics from mixed-model analyses for Study 1 and for Study 2

	---- LSM (SE) ----			Statistics from Mixed-Model Analyses		
Study 1	**Interview 1**	**Interview 2**	**Interview 3**	**Significant Effects**	**F value**	***p* value**
Food-Item Variables *						
Number of Items Observed Eaten †				meal	388.49	<.0001
Breakfast	*3.3 (0.1)*	*3.3 (0.1)*	*3.4 (0.1)*			
Lunch	*5.5 (0.1)*	*5.2 (0.1)*	*5.1 (0.1)*			
Number of Items Reported Eaten ‡				meal	107.23	<.0001
Breakfast	*2.9 (0.1)*	*2.9 (0.1)*	*3.0 (0.2)*	sex	4.43	.0378
Lunch	*4.1 (0.1)*	*4.2 (0.1)*	*3.9 (0.2)*			
Omission Rate (%) §				meal	8.31	.0048
Breakfast	*59 (3)*	*54 (4)*	*53 (4)*			
Lunch	*51 (3)*	*47 (4)*	*44 (4)*			
Intrusion Rate (%) **				meal	35.90	<.0001
Breakfast	*54 (4)*	*50 (4)*	*45 (4)*			
Lunch	*35 (3)*	*34 (4)*	*27 (4)*			
Total Inaccuracy (servings) †† ‡‡				meal	20.36	<.0001
Breakfast	*3.3 (0.2)*	*3.2 (0.2)*	*2.9 (0.2)*	interview	3.72	.0262
Lunch	*4.3 (0.2)*	*3.9 (0.2)*	*3.5 (0.2)*			
Kilocalorie Variables‡‡						
Observed§§				meal	397.46	<.0001
Breakfast	*276 (15)*	*297 (16)*	*288 (17)*	sex	12.94	.0004
Lunch	*552 (15)*	*541 (16)*	*543 (17)*			
Reported***				meal	147.87	<.0001
Breakfast	*233 (16)*	*243 (17)*	*238 (18)*	sex	12.93	.0004
Lunch	*413 (16)*	*401 (17)*	*409 (18)*			
Correspondence Rate (%)†††				meal	14.43	.0002
Breakfast	*36 (3)*	*41 (3)*	*44 (4)*	interview	3.83	.0222
Lunch	*46 (3)*	*50 (3)*	*57 (4)*			
Inflation Ratio (%)‡‡‡				meal	29.01	<.0001
Breakfast	*62 (7)*	*50 (7)*	*69 (8)*			
Lunch	*33 (7)*	*27 (7)*	*27 (8)*			
Study 2		Forward	Reverse	Significant Effects	F value	*p* value
Food-Item Variables*						
Number of Items Observed Eaten †				meal	394.32	<.0001
Breakfast	*Boys*	*3.5 (0.2)*	*3.3 (0.2)*	meal × sex	5.91	.0166
	Girls	*3.1 (0.2)*	*3.1 (0.2)*			
Lunch	*Boys*	*5.3 (0.2)*	*5.2 (0.2)*			
	Girls	*5.5 (0.2)*	*5.3 (0.2)*			
Number of Items Reported Eaten ‡				meal	115.21	<.0001
Breakfast	*Boys*	*2.9 (0.2)*	*2.9 (0.2)*	race	5.24	.0240
	Girls	*3.1 (0.2)*	*2.7 (0.2)*			
Lunch	*Boys*	*3.9 (0.2)*	*4.1 (0.2)*			
	Girls	*4.1 (0.2)*	*4.0 (0.2)*			
Omission Rate (%) §				meal	10.65	.0014

Study 1	Interview 1	- - - - LSM (SE) - - - - Interview 2	Interview 3	Statistics from Mixed-Model Analyses Significant Effects	F value	*p* value
Breakfast	*Boys*	*68 (4)*	*60 (4)*	order × sex	7.88	.0059
	Girls	*53 (5)*	*66 (5)*			
Lunch	*Boys*	*54 (4)*	*46 (4)*			
	Girls	*52 (5)*	*56 (5)*			
Intrusion Rate (%) **				meal	19.29	<.0001
Breakfast	*Boys*	*51 (5)*	*40 (5)*	order	3.95	.0494
	Girls	*46 (5)*	*35 (6)*			
Lunch	*Boys*	*31 (4)*	*22 (4)*			
	Girls	*28 (5)*	*32 (5)*			
Total Inaccuracy (servings) †† ‡‡				meal	36.34	<.0001
Breakfast	*Boys*	*3.4 (0.3)*	*2.8 (0.3)*	meal × sex	3.93	.0497
	Girls	*2.5 (0.3)*	*2.4 (0.3)*			
Lunch	*Boys*	*4.1 (0.3)*	*3.6 (0.3)*			
	Girls	*3.7 (0.3)*	*4.0 (0.3)*			
Kilocalorie Variables ‡‡						
Observed§§				meal	324.43	<.0001
Breakfast	*Boys*	*307 (22)*	*281 (22)*	sex	7.27	.0075
	Girls	*258 (23)*	*249 (23)*			
Lunch	*Boys*	*607 (22)*	*619 (22)*			
	Girls	*566 (23)*	*554 (23)*			
Reported***				meal	105.43	<.0001
Breakfast	*Boys*	*176 (24)*	*193 (24)*	order	6.64	.0106
	Girls	*190 (25)*	*125 (25)*	order × sex	4.29	.0394
Lunch	*Boys*	*408 (24)*	*376 (24)*			
	Girls	*389 (25)*	*317 (25)*			
Correspondence Rate (%)†††				meal	14.63	.0002
Breakfast	*Boys*	*28 (4)*	*37 (4)*	order × sex	7.10	.0082
	Girls	*40 (4)*	*30 (5)*			
Lunch	*Boys*	*46 (4)*	*50 (4)*			
	Girls	*48 (4)*	*41 (4)*			
Inflation Ratio (%)‡‡‡				meal	10.03	.0017
Breakfast	*Boys*	*36 (6)*	*33 (6)*			
	Girls	*36 (7)*	*33 (7)*			
Lunch	*Boys*	*28 (6)*	*11 (6)*			
	Girls	*20 (7)*	*15 (7)*			

* For each of the five food-item variables, an importance weight was assigned to each match (an item observed eaten and reported eaten), omission (an item observed eaten but not reported eaten), and intrusion (an item reported eaten but not observed eaten) by meal component with combination entrée = 2, condiment = 0.33, and every remaining component = 1. Thus, reporting errors counted more for combination entrées than for condiments and remaining meal components.

† Number of items observed eaten = sum of weighted number of items observed eaten per school meal per observation per child.

‡ Number of items reported eaten = sum of weighted number of items reported eaten per school meal per interview per child. Each interview concerned the previous day's intake. For Study 1, 104 children were each interviewed one to three times with ≥25 days separating any two interviews for a child. For Study 2, 121 children were each interviewed once per order (forward [morning-to-evening]; reverse [evening-to-morning]), separated by ≥29 days. For Study 1, the LSM (SE) for boys was 3.7 (0.1) and for girls was 3.3 (0.1). For Study 2, the LSM (SE) for Black children was 3.6 (0.1) and for White children was 3.3 (0.1).

[§]For school breakfast and school lunch separately, per interview per child, omission rate = (sum of weighted omissions / [sum of weighted omissions + sum of weighted matches]) * 100. Values may range from 0% to 100% with 0% considered perfect and 100% indicating that nothing observed eaten was reported eaten. The omission rate for a school meal was undefined if a child was observed to eat nothing for that meal (Study 1 – Interview 1: breakfast [1 boy], lunch [1 boy]; Interview 2: breakfast [1 girl]; Interview 3: none; Study 2 – 1 girl for breakfast for reverse-order prompts).

[**]For school breakfast and school lunch separately, per interview per child, intrusion rate = (sum of weighted intrusions/[sum of weighted intrusions + sum of weighted matches]) * 100. Values may range from 0% to 100% with 0% considered perfect and 100% indicating that nothing reported eaten was observed eaten. The intrusion rate for a school meal was undefined if a child was observed to eat something at the meal but reported eating nothing, or reported no meals that met the criteria to be consider a report of the school meal (Study 1 – Interview 1: breakfast [9 girls, 4 boys], lunch [1 girl, 1 boy]; Interview 2: breakfast [5 girls, 4 boys], lunch [1 girl, 2 boys]; Interview 3: breakfast [3 girls, 2 boys], lunch [2 girls]; Study 2 – reverse-order prompts [boys – 16 breakfasts, 10 lunches; girls – 23 breakfasts, 10 lunches]; forward-order prompts [boys – 17 breakfasts, 8 lunches; girls – 8 breakfasts, 6 lunches]).

[††]For school breakfast and school lunch separately, per interview per child, total inaccuracy = (absolute difference between amounts reported and observed for each match * weight) + (amount of each omission * weight) + (amount of each intrusion * weight) summed over all items at the meal. A total inaccuracy score of zero indicates a perfect recall relative to observation. Because total inaccuracy is a cumulative sum of reporting errors in servings for all items [matches, omissions, and intrusions] and amounts combined, it cannot be normalized for the number of items. Thus, the significant effect of meal for total inaccuracy in both studies can be attributed to the significant differences in the numbers of observed items and reported items for breakfast and lunch.

[‡‡]For total inaccuracy and the four kilocalorie variables, amounts observed and/or reported eaten in servings were converted as follows: *none*=0.00, *taste*=0.10, *little bit*=0.25, *half*=0.50, *most*=0.75, *all*=1.00, or the *actual number of servings* if >1 was observed or reported eaten. For each item observed and/or reported eaten, the standardized serving sizes provided for school meals by the school district's nutrition program were used to estimate per serving kilocalories from the NDS-R database; for items not in NDS-R, kilocalorie information from the school district's nutrition program was used. For each child, after classifying each item as a match, omission, or intrusion, serving size and kilocalories/serving information were used to estimate values of four kilocalorie variables – observed, reported, correspondence rate, and inflation ratio. Although the portion-size estimates may have been imprecise, the same approach was used for observed items and reported items.

[§§]For school breakfast and school lunch separately, per observation per child, observed kilocalories = sum of kilocalories from amounts of items observed eaten at the meal. For Study 1, the LSM (SE) for boys was 439 (9) and for girls was 393 (9).

[***]For school breakfast and school lunch separately, per interview per child, reported kilocalories = sum of kilocalories from amounts of items reported eaten at the meal. For Study 1, the LSM (SE) for boys was 348 (10) and for girls was 298 (10).

[†††]For school breakfast and school lunch separately, per interview per child, correspondence rate = (sum of corresponding amounts from matches/sum of observed amounts) × 100. [The corresponding amount from a match is the smaller of the reported and observed amounts, or the reported amount if it equals the observed amount.] The correspondence rate is a genuine measure of reporting accuracy. It has a lower bound of 0% (indicating that nothing observed was reported eaten) and an upper bound of 100% (indicating that all observed items and amounts were reported correctly). Higher correspondence rates reflect higher (better) reporting accuracy.

[‡‡‡]For school breakfast and school lunch separately, per interview per child, inflation ratio = [(sum of overreported amounts from matches) + (sum of overreported amounts from intrusions)/sum of observed amounts] × 100. The inflation ratio is a measure of reporting error. It has a lower bound of 0% (indicating no intrusions and no overreported amounts of matches), but no upper bound. Lower inflation ratios reflect higher reporting accuracy.