NIH Public Access
Author Manuscript
J Health Psychol. Author manuscript; available in PMC 2012 July 18.

Published in final edited form as:
J Health Psychol. 2010 May ; 15(4): 505–514. doi:10.1177/1359105309353814.

Fourth-grade children's dietary recall accuracy for energy intake at school meals differs by social desirability and body mass index percentile in a study concerning retention interval

Caroline H. Guinn, RD, LD[1], **Suzanne D. Baxter, PhD, RD, LD, FADA**[1], **Julie A. Royer, MSPH**[1], **James W. Hardin, PhD**[1,2], **Alyssa J. Mackelprang, BS**[1], and **Albert F. Smith, PhD, MS**[3]

[1] Institute for Families in Society, University of South Carolina, Columbia, SC, USA

[2] Department of Epidemiology and Biostatistics, University of South Carolina, Columbia, SC, USA

[3] Department of Psychology, Cleveland State University, Cleveland, OH, USA

Abstract

Data from a study concerning retention interval and school-meal observation on children's dietary recalls were used to investigate relationships of social desirability score (SDS) and body mass index percentile (BMI%) to recall accuracy for energy for observed (n=327) children, and to reported energy for observed and unobserved (n=152) children. Report rates (reported/observed) correlated negatively with SDS and BMI%. Correspondence rates (correctly reported/observed) correlated negatively with SDS. Inflation ratios (overreported/observed) correlated negatively with BMI%. The relationship between reported energy and each of SDS and BMI% did not depend on observation status. Studies utilizing children's dietary recalls should assess SDS and BMI%.

Keywords

Dietary Recall; Social Desirability; Body Mass Index Percentile; Children

Introduction

Over the last several decades, the incidence of childhood obesity has increased dramatically in the USA (Hedley et al., 2004) and worldwide (Wang & Lobstein, 2006). Although energy intake is related to obesity (US Department of Health and Human Services & US Department of Agriculture, 2005), inaccurately reported energy intake could mask the true relationship between intake and obesity. Concerns have increased about whether school meals contribute to childhood obesity (Ralston et al.); to investigate this, accurate information is needed about children's school-meal intake.

Children's self-reports are the most feasible method for obtaining information about school-meal intake. Children have provided 24-hour dietary recalls (24hDRs) or recalls of school-meal intake without parental assistance for various studies (e.g., Luepker et al., 1996; Receveur et al., 2008). Validated procedures for collecting dietary data from children are needed.

Address for correspondence and reprints: Caroline H. Guinn, RD, LD, 1600 Hampton Street, Suite 507, Columbia, SC 29208; 803-777-1824 extension 24 (phone); 803-777-1120 (fax); cguinn@mailbox.sc.edu.

In dietary-reporting validation studies, reported information about some time period (e.g., from a 24hDR) is compared to reference information (e.g., from direct observation) about that period, with reference information assumed as truth. When reporting accuracy is assessed at the food-item level, items in the reference set and/or reported set are classified as *matches* (items in both sets), *omissions* (items only in the reference set), and *intrusions* (items only in the reported set) (Smith, 1991; Smith et al., 1991). Table 1 defines italicized terms. Validation studies have identified errors, including omissions and intrusions (e.g., Baranowski et al., 2002), and sources of intrusions (e.g., Baxter et al., 2008), in children's dietary recalls.

Dietary recall accuracy may be related to such personality characteristics as the tendency to respond in a socially desirable way. Socially desirable responding is inferred when a person reports never performing a behavior that most people perform at least occasionally (e.g., gossiping), or reports always performing a behavior that most people perform usually but omit occasionally (e.g., admitting mistakes) (Paulhus, 1991). A person with a high social desirability score (SDS), indicating the tendency to respond in a socially desirable way, may err systematically when responding to a variety of questions, including questions about dietary intake (Baxter et al., 2004). A respondent with a high SDS might underreport intake of "bad" foods and overreport intake of "good" foods (Worsley et al., 1984). Some studies with adults, especially women, have found a negative correlation between social desirability and dietary reporting accuracy (e.g., Hebert et al., 2002). Assessment of social desirability in studies in which children self-report dietary intake has been recommended (Livingstone & Robson, 2000). In the one dietary-reporting validation study of which we know that examined children's social desirability (Baxter, Smith, Litaker et al., 2006), SDS was not a significant covariate for any accuracy variable concerning energy, although subsequent analyses found that SDS correlated negatively with number of school-breakfast items reported eaten (Guinn et al., 2008).

Dietary recall accuracy may be related to body weight or body composition. Some studies with adults have shown that as body fatness increased, energy underreporting increased (e.g., Johnson et al., 1998). Concerning studies with children aged six to 11 years, one study found that energy underreporting increased among children with higher relative weight and higher adiposity (Fisher et al., 2000), but two studies found no significant relationship between energy misreporting and children's body composition (Kaskoun et al., 1994; O'Connor et al., 2001). In these three studies, parents assisted children with dietary reports (Fisher et al., 2000; O'Connor et al., 2001) or provided reports for children (Kaskoun et al., 1994). We know of only two validation studies that examined the relationship of children's dietary recall accuracy and body mass index percentile (BMI%). In one (Baxter, Smith, Litaker et al., 2006), children with high BMI%s (≥85th percentile) omitted more energy than children with low BMI%s (≥5th and <50th percentiles). Also, girls with high BMI%s intruded less energy than boys with high BMI%s, but girls with low BMI%s intruded more energy than boys with low BMI%s; girls with high BMI%s intruded the least while girls with low BMI%s intruded the most. In the other study (Baxter, Smith, Nichols et al., 2006), over three successive interviews, both omission rate and intrusion rate decreased for children with healthy weights (≥5th and <85th percentiles), decreased then stabilized for children at risk of being overweight (≥85th and <95th percentiles), and increased then stabilized for children who were overweight (≥95th percentile).

Because school-age girls, more than boys, show concern with body size and restrain their eating (e.g., Phares et al., 2004), reporting accuracy may differ by sex. Thus, sex differences in studies of children's dietary recall accuracy should be examined.

For this article, we investigated the relationship of fourth-grade children's accuracy for reporting energy intake at school meals to each of SDS and BMI%. The children were participants in a study of the effect of retention interval (time between to-be-reported meals and interview) on recall accuracy (Baxter, Hardin, Guinn et al., 2009), and whether school-meal observations influenced children's 24hDRs (Baxter, Hardin, Smith et al., 2009). For this article's analyses, we hypothesized negative relationships between energy reporting accuracy and each of SDS and BMI%. Because most studies that use 24hDRs lack a validation method, recall accuracy for energy intake is unknown, and only reported energy is available. Thus, we also investigated the relationship between fourth-grade children's reported energy and each of SDS and BMI%. Because the study sample consisted of two observation-status groups—observed and unobserved children—we could determine whether these relationships depended on observation status.

Experimental Methods

Data collection was approved by the appropriate institutional review board for research involving humans. Written assent and consent were obtained. The sample, school-meal observations, interobserver reliability, dietary recalls, and quality control for interviews have been detailed elsewhere (Baxter, Hardin, Guinn et al., 2009; Baxter, Hardin, Smith et al., 2009).

Sample and design

During the 2004–05, 2005–06, and 2006–07 school years, researchers distributed assent and consent forms in fourth-grade classes in 17, 17, and 8 elementary schools, respectively. Children who returned forms (two to three days later) signed by parents received small prizes (e.g., rulers) irrespective of participation decisions. Of 2,391 children invited to participate, 1,780 agreed. From the center 95% of the age distribution of participating children each school year, children were randomly selected with the constraints that half were boys and all were usual school-meal eaters. "Usual school-meal eaters" were children who obtained school breakfast and school lunch during 1) at least four of five practice observations conducted at the beginning of the school year and 2) at least four of five previous observations as data collection progressed throughout the school year. In the final sample of 555 children (96% Black), 374 children were observed eating two school meals (breakfast, lunch) and interviewed to obtain a 24hDR, and 181 children were interviewed without having been observed. Assignment to observation-status group was random, subject to the constraint that two-thirds of children were observed; within observation-status groups, children were randomized to one of six conditions created by crossing two target periods (prior-24-hour; previous-day) with three interview times (morning; afternoon; evening). Data collection continued until each condition had 62 or 64 observed children (half boys) and 30 or 31 unobserved children (half boys) (Baxter, Hardin, Guinn et al., 2009; Baxter, Hardin, Smith et al., 2009).

Observations

To obtain reference information for observed children, researchers conducted school-meal observations according to written procedures used previously (e.g., Baxter, Smith, Litaker et al., 2006). Each observer watched one to three children simultaneously during entire meal periods; children sat according to their school's typical arrangement. Observers noted foods and amounts eaten in servings of standard school-meal portions.

Interobserver reliability (IOR) was assessed at least weekly throughout data collection. For an IOR assessment, a pair of observers independently watched the same child at breakfast or lunch. A child who was observed for IOR assessment was not interviewed to obtain a recall concerning that meal. Results from IOR indicated satisfactory agreement (mean agreement >90%) between pairs of observers to within one-fourth serving on amounts observed eaten (Baxter, Hardin, Guinn et al., 2009).

No school-meal observations were conducted in schools of children in the unobserved group during the target periods about which such children were to be interviewed.

Interviews

To obtain reported information, non-observing researchers (blinded to children's observation status) conducted interviews that followed written multiple-pass protocols described elsewhere (Baxter, Hardin, Guinn et al., 2009). The interviewer then administered 14 social desirability items (see Table 2, footnote b), a subset of the 46-item Children's Social Desirability scale (Crandall et al., 1965) identified by Baxter and colleagues (2004) as sufficiently measuring the same construct as the entire scale. Crandall and colleagues, in developing the Children's Social Desirability Scale, found Spearman-Brown-corrected split-half reliabilities ≥0.82 for third- to twelfth-grade children, and one-month test-retest reliabilities ≥0.85 (Crandall et al., 1965; Strickland, 1977).

Interviews were audio-recorded and transcribed. Each interviewed child was mailed a $20 check.

Quality control was assessed for each interview using established procedures (e.g., Baxter, Smith, Litaker et al., 2006). Only interviews that passed quality control were analyzed (Baxter, Hardin, Guinn et al., 2009; Baxter, Hardin, Smith et al., 2009).

Weight/height measurements

In the spring of each school year, researchers used established procedures (Lohman et al., 1988; Maternal and Child Health Bureau) to measure children's weight (to the nearest 0.10 pound) with digital scales and height (to the nearest 0.125 inch) with stadiometers in duplicate (after repositioning the child). If the two weights and/or heights were not within 0.25 pounds and/or 0.25 inches, respectively, a third measurement was taken. If two measurements were taken, their average was used for analyses; if three measurements were taken, the average of the closest two was used.

For all researcher pairs, inter-rater reliability was assessed daily on a random sample of ≥10% of children; intraclass correlations exceeded 0.99 for weight and for height.

Using age in months at time of measurement, sex-specific BMI-for-age growth charts for youth were used to determine each child's BMI% (Centers for Disease Control and Prevention, 2009; Kuczmarski et al., 2002).

Analyses

Analyses were restricted to reports of school meals. According to criteria used previously (e.g., Baxter, Smith, Litaker et al., 2006) and applied consistently to all recalls, meals in children's 24hDRs were treated as referring to school meals (see Table 2, footnote a).

As done previously (e.g., Baxter, Smith, Litaker et al., 2006), qualitative labels used to record observed and reported information were assigned numeric values as none=0.00, taste=0.10, little bit=0.25, half=0.50, most=0.75, all=1.00, or as the actual number of servings if >1.00 serving was observed and/or reported eaten. For reference and reported items, information about energy (in kilocalories) for standard school-meal portions was obtained from the Nutrition Data System for Research (Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN) or the school district's nutrition program. Quantified servings were multiplied by per-serving energy values.

To assess recall accuracy for energy intake for observed children, we calculated three measures: *report rate*, *correspondence rate*, and *inflation ratio* (Baxter, Guinn et al., 2009; Baxter et al., 2007a, 2007b; Smith et al., 2007). Recent analyses (Baxter, Guinn et al., 2009; Baxter et al., 2007a, 2007b; Smith et al., 2007) have shown that separating report rate into correspondence rate and inflation ratio provides insight into dietary recall accuracy.

For each of the three measures, a mixed-model analysis of variance was conducted with SDS and BMI% as explanatory variables. For each measure, the full model included adjustments for sex and for the SDS-x-sex, BMI%-x-sex, and SDS-x-BMI%-x-sex interactions. Because the original study showed that recall accuracy for items and energy consumed at school meals by observed children deteriorated as the retention interval increased (Baxter, Guinn et al., 2009; Baxter, Hardin, Guinn et al., 2009), results were adjusted for target period, interview time, and their interaction. Because none of these adjustments was significant, we estimated a model for each measure with only SDS and BMI% as explanatory.

To calculate reported energy for each child, we summed reported amounts for energy across the items the child reported having eaten for the target period's school meals.

The original study showed that the number of reported items and reported energy for school meals did not differ by observation status (Baxter, Hardin, Smith et al., 2009). For this article, a regression model for reported energy included observation-status group, SDS, and BMI% as explanatory, and adjustments for sex and for the SDS-x-BMI%, SDS-x-sex, BMI %-x-sex and SDS-x-BMI%-x-sex interactions, and for all two- and three-way interactions and the four-way interaction involving observation-status group, sex, SDS, and BMI%. Results also were adjusted for target period, interview time, and their interaction. After fitting this model, non-significant (P>0.05) terms were removed, and a final model with observation-status group, SDS, and BMI% was estimated. An equivalence test on adjusted means (Wellek, 2002) was then conducted to evaluate equivalence of observation-status groups. Analyses were conducted using Stata (10.0, Stata, Inc., College Station, TX) and SAS (9.0, SAS Institute, Inc., Cary, NC).

Results

Only data from children who met criteria for reporting both school meals and for whom we had SDS and weight/height measurements were analyzed. Thirty-nine observed and 22 unobserved children failed to meet criteria for reporting both school meals. Due to interviewer error, we had no SDS for 1 observed child. Seven observed children and 7 unobserved children were absent during weight/height measurements. Thus data were analyzed from 327 observed and 152 unobserved children.

Table 2 presents descriptive statistics for SDS and BMI% by observation-status group and sex.

None of the correlations between SDS and BMI% differed significantly from zero. For observed children, these correlations were −0.10 (P=0.079) overall, −0.11 (P=0.178) for girls, and −0.09 (P=0.276) for boys. For unobserved children, these correlations were 0.05 (P=0.559) overall, 0.06 (P=0.586) for girls, and 0.02 (P=0.839) for boys. For all children combined, these correlations were −0.05 (P=0.254) overall, −0.06 (P=0.371) for girls, and −0.05 (P=0.462) for boys.

Report rates were negatively related to SDS and BMI% (regression coefficient for SDS= −2.64, *P*=0.002; regression coefficient for BMI%= −0.36, *P*=0.001). Means in Table 3 illustrate these relationships. Larger report rates can be due to larger numerators (reported energy) or smaller denominators (observed energy) or both. Table 3 shows that SDS correlated negatively with reported energy (regression coefficient= −10.62, *P*=0.030) but did not correlate significantly with observed energy (regression coefficient=4.76, *P*=0.271), whereas BMI% correlated positively with observed energy (regression coefficient=2.08, *P*<0.001) but did not correlate significantly with reported energy (regression coefficient= −0.04, *P*=0.955).

Correspondence rates were negatively related to SDS (regression coefficient= −1.17; *P*=0.010; see Table 3). No significant relationship was found between BMI% and correspondence rates (regression coefficient=0.02; *P*=0.782).

Inflation ratios were negatively related to BMI% (regression coefficient= −0.38; *P*<0.001; see Table 3). No significant relationship was found between SDS and inflation ratios (regression coefficient= −1.47; *P*=0.079).

Analysis of reported energy showed no significant effect of observation-status group (*P*=0.396) or of BMI% (*P*=0.305); however, a significant relationship was found between reported energy and SDS (regression coefficient= −9.55, *P*=0.019). An equivalence test showed that relationships between reported energy and BMI%, and between reported energy and SDS, were statistically equivalent within a small effect size window (0.2 standard deviation) for the observation-status groups (*P*<0.0001).

Discussion

We investigated the relationship of children’s accuracy for reporting energy intake at school meals to SDS and BMI%. For report rates, results were as hypothesized for SDS and BMI%. For correspondence rates, results were consistent with our hypothesis concerning SDS—as SDS increased, children tended to report less of the observed school-meal energy intake, that is, their reporting accuracy for energy intake decreased; however, our hypothesis concerning BMI% was not substantiated. For inflation ratios, the finding that as BMI% increased, children’s falsely-reported energy intake for school meals decreased, was contrary to our hypothesis, and our hypothesis concerning SDS—was not substantiated.

The finding that inflation ratios correlated negatively with BMI% is similar to results for intruded energy from another validation study with fourth-grade children (Baxter, Smith, Litaker et al., 2006). Also, secondary analyses (Guinn et al., 2008) from that study found that, for school breakfast, items reported eaten were less likely to be intrusions for boys with low BMI%s (≥5th and <50th percentiles) than for boys with high BMI%s (≥85th percentile), girls with high BMI%s, and girls with low BMI%s. Additionally, for school breakfast, for amounts reported eaten for intrusions, there was an interaction of BMI%-group and sex, and an interaction of BMI%-group, sex, and SDS; compared to girls with low BMI%s, as SDS increased, amounts reported eaten for intrusions increased for boys with high BMI%s and decreased for girls with high BMI%s. For school lunch, amounts reported eaten for intrusions were smallest for girls with high BMI%s.

We found no correlation between SDS and BMI% that differed significantly from zero. This differs from findings from a non-validation study with 24hDRs by 8- to 10-year-old girls for which the correlation between SDS and BMI was large and negative (Klesges et al., 2004); however, that study apparently used BMI, not BMI%.

When the numerator and denominator of report rate for observed children were investigated separately, results indicated that observed energy (but not reported energy) at school meals correlated positively with BMI%. Although this is intuitively sensible, to our knowledge, a similar result has been published only by Baxter, Smith, Litaker et al. (2006) who found that more energy was observed eaten at school meals by children with high BMI%s than children with low BMI%s.

For children analyzed for this article, the relationships between reported energy and SDS, and between reported energy and BMI%, were not influenced by observation, so conclusions about these relationships from validation studies using school-meal observations should generalize to studies with comparable children but for whom school-meal observations are not conducted.

In a study of fourth-grade children (74% Black) in another school district (Baxter et al., 2004), the mean of the 14 social desirability items (administered as part of the 46-item Children’s Social Desirability Scale) was close to the mean of the 14 items administered as a stand-alone scale for this article. The mean BMI% for children analyzed for this article was similar to the mean BMI% of fourth-grade children (54% Black) in five previous studies in another school district (Guinn et al., 2007). As in three studies with fourth-grade children in another school district (Baxter et al., 2007a, 2007b; Smith et al., 2007), children analyzed for this article were observed to have consumed more energy at school meals than they reported.

Although full models in our analyses included adjustments for sex, it was not significant in any model.

The data analyzed for this article had some limitations. Weight and height were not measured on the interview day, so BMI% might have changed in the time span between the interview day and measurement day; this time span ranged from 0 to 155 days (mean [standard deviation]=78.5 [45.5]). Results concerning accuracy are for the school-meal parts of dietary recalls rather than an entire 24-hour period. Test-retest reliability for the 14 social-desirability items as a stand-alone scale is unknown. The sample was homogeneous with respect to age and race/ethnicity.

The data analyzed for this article had several strengths. Recalls were obtained without parental help, permitting investigation of relationships between children’s dietary recall accuracy, children’s SDS, and children’s BMI%. Reference information was obtained by direct observation, permitting differentiation of correctly and incorrectly reported items and amounts.

These results have implications for dietary research with children. First, because children’s SDS and BMI% may be related to dietary reporting accuracy, these variables should be measured in studies that utilize dietary recalls. Second, relationships between reported energy and SDS, and between reported energy and BMI%, were statistically equivalent in the two observation-status groups; thus, conclusions about these relationships from validation studies using school-meal observations are generalizable to comparable children who have not been observed. Finally, in validation studies, report rates do not permit adequate assessment of the relationship of dietary recall accuracy with other variables; correspondence rates and inflation ratios, which are distinct aspects of recall accuracy, should be used.

Acknowledgments

This research was supported by R01HL074358 and R21HL088617 (with S.D.B. as Principal Investigator for both grants) from the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH). This article's content is the authors' responsibility and does not necessarily represent the official views of NHLBI or NIH.

We thank the elementary schools and Student Nutrition Services of Richland One School District (Columbia, SC). We appreciate the contribution to this work of Amy F. Joye, MS, RD, who was Project Director for R01HL074358 until she suffered severe brain damage due to a medical tragedy. The Amy Joye Memorial Research Award has been established through the American Dietetic Association Foundation to award nutrition research grants in Amy's memory.

References

Baranowski T, Islam N, Baranowski J, Cullen KW, Myres D, Marsh T, et al. The Food Intake Recording Software System is valid among fourth-grade children. Journal of the American Dietetic Association. 2002; 102:380–385. [PubMed: 11902371]

Baxter SD, Guinn CH, Royer JA, Hardin JW, Mackelprang AJ, Smith AF. Shortening the retention interval of 24-hour dietary recalls increases fourth-grade children's accuracy for reporting energy and macronutrient intake at school meals. 2009 Manuscript submitted for publication.

Baxter SD, Hardin JW, Guinn CH, Royer JA, Mackelprang AJ, Smith AF. Fourth-grade children's dietary recall accuracy is influenced by retention interval (target period and interview time). Journal of the American Dietetic Association. 2009; 109:846–856. [PubMed: 19394471]

Baxter SD, Hardin JW, Royer JA, Smith AF, Guinn CH. Sources of intrusions in children's dietary recalls from a validation study of order prompts. Journal of Health Psychology. 2008; 13:1157–1162. [PubMed: 18987088]

Baxter SD, Hardin JW, Smith AF, Royer JA, Guinn CH, Mackelprang AJ. Twenty-four hour dietary recalls by fourth-grade children were not influenced by observations of school meals. Journal of Clinical Epidemiology. 2009; 62:878–885. [PubMed: 19230605]

Baxter SD, Smith AF, Hardin JW, Nichols MN. Conclusions about children's reporting accuracy for energy and macronutrients over multiple interviews depend on the analytic approach for comparing reported information to reference information. Journal of the American Dietetic Association. 2007a; 107:595–604. [PubMed: 17383265]

Baxter SD, Smith AF, Hardin JW, Nichols MN. Conventional energy and macronutrient variables distort the accuracy of children's dietary reports: Illustrative data from a validation study of effect of order prompts. Preventive Medicine. 2007b; 44:34–41. [PubMed: 16959308]

Baxter SD, Smith AF, Litaker MS, Baglio ML, Guinn CH, Shaffer NM. Children's social desirability and dietary reports. Journal of Nutrition Education and Behavior. 2004; 36:84–89. [PubMed: 15068757]

Baxter SD, Smith AF, Litaker MS, Guinn CH, Nichols MN, Miller PH, et al. Body mass index, sex, interview protocol, and children's accuracy for reporting kilocalories observed eaten at school meals. Journal of the American Dietetic Association. 2006; 106:1656–1662. [PubMed: 17000199]

Baxter SD, Smith AF, Nichols MN, Guinn CH, Hardin JW. Children's dietary reporting accuracy over multiple 24-hour recalls varies by body mass index category. Nutrition Research. 2006; 26:241–248. [PubMed: 17541449]

Centers for Disease Control and Prevention. BMI Percentile Calculator for Child and Teen: English Version. 2009 [accessed October 8, 2009]. http://apps.nccd.cdc.gov/dnpabmi/Calculator.aspx

Crandall VC, Crandall VJ, Katkovsky W. A children's social desirability questionnaire. Journal of Consulting Psychology. 1965; 29:27–36. [PubMed: 14277395]

Fisher JO, Johnson RK, Lindquist C, Birch LL, Goran MI. Influence of body composition on the accuracy of reported energy intake in children. Obesity Research. 2000; 8(8):597–603. [PubMed: 11156436]

Guinn CH, Baxter SD, Hardin JW, Royer JA, Smith AF. Intrusions in children's dietary recalls: The roles of BMI, sex, race, interview protocol, and social desirability. Obesity. 2008; 16:2169–2174. [PubMed: 18535542]

Guinn, CH.; Baxter, SD.; Litaker, MS.; Thompson, WO. Prevalence of overweight and at risk of overweight in fourth-grade children across five school-based studies conducted during four school years. Journal of Child Nutrition & Management. 2007 [accessed October 8, 2009]. http://docs.schoolnutrition.org/newsroom/jcnm/07spring/guinn/index.asp

Hebert JR, Ebbeling CB, Matthews CE, Hurley TG, Ma Y, Druker S, et al. Systematic errors in middle-aged women's estimates of energy intake: Comparing three self-report measures to total energy expenditure from doubly labeled water. Annals of Epidemiology. 2002; 12:577–586. [PubMed: 12495831]

Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999–2002. Journal of the American Medical Association. 2004; 291:2847–2850. [PubMed: 15199035]

Johnson RK, Soultanakis RP, Matthews DE. Literacy and body fatness are associated with underreporting of energy intake in US low-income women using the multiple-pass 24-hour recall: A doubly labeled water study. Journal of the American Dietetic Association. 1998; 98:1136–1140. [PubMed: 9787719]

Kaskoun MC, Johnson RK, Goran MI. Comparison of energy intake by semiquantitative food frequency questionnaire with total energy expenditure by the doubly labeled water method in young children. American Journal of Clinical Nutrition. 1994; 60:43–47. [PubMed: 8017336]

Klesges LM, Baranowski T, Beech B, Cullen K, Murray DM, Rochon J, et al. Social desirability bias in self-reported dietary, physical activity and weight concern measures in 8- to 10-year old African-American girls: Results from the Girls health Enrichment Multisite Studies (GEMS). Preventive Medicine. 2004; 38:S78–S87. [PubMed: 15072862]

Kuczmarski, RJ.; Ogden, CL.; Guo, SS.; Grummer-Strawn, LM.; Flegal, KM.; Mei, Z., et al. Vital Health Stat. Vol. 11. National Center for Health Statistics; 2002 [accessed October 8, 2009]. 2000 CDC Growth Charts for the United States: Methods and development. http://www.cdc.gov/nchs/data/series/sr_11/sr11_246.pdf

Livingstone MBE, Robson PJ. Measurement of dietary intake in children. Proceedings of the Nutrition Society. 2000; 57:279–293. [PubMed: 10946797]

Lohman, TG.; Roche, AF.; Martorell, R. Anthropometric Standardization Reference Manual. Champaign, IL: Human Kinetics Books; 1988.

Luepker RV, Perry CL, McKinlay SM, Nader PR, Parcel GS, Stone EJ, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity: The Child and Adolescent Trial for Cardiovascular Health (CATCH). Journal of the American Medical Association. 1996; 275(10): 768–776. [PubMed: 8598593]

Maternal and Child Health Bureau. Accurately weighing & measuring: Technique. [accessed October 8, 2009]. http://depts.washington.edu/growth/module5/text/intro.htm

O'Connor J, Ball EJ, Steinbeck KS, Davies PSW, Wishart C, Gaskin KJ, et al. Comparison of total energy expenditure and energy intake in children aged 6–9 y. American Journal of Clinical Nutrition. 2001; 74:643–649. [PubMed: 11684533]

Paulhus, DL. Measurement and control response bias. In: Robinson, JP.; Shaver, PR.; Wrightsman, LS., editors. Measures of Personality and Social Psychological Attitudes. San Diego, CA: Academic Press; 1991. p. 17-59.

Phares V, Steinberg AR, Thompson JK. Gender differences in peer and parental influences: Body image disturbance, self-worth, and psychological functioning in preadolescent children. Journal of Youth and Adolescence. 2004; 33:421–429.

Ralston, K.; Newman, C.; Clauson, A.; Guthrie, J.; Buzby, J. The National School Lunch Program: Background, Trends, and Issues. Economic Research Report No. EER-61. 2008 [accessed October 8, 2009]. http://www.ers.usda.gov/Publications/ERR61/

Receveur O, Morou K, Gray-Donald K, Macaulay AC. Consumption of key food items is associated with excess weight among elementary-school-aged children in a Canadian First Nations Community. Journal of the American Dietetic Association. 2008; 108:362–366. [PubMed: 18237583]

Smith, AF. Cognitive Processes in Long-term Dietary Recall. Hyattsville, MD: National Center for Health Statistics, Vital and Health Statistics; 1991. Series 6

Smith AF, Baxter SD, Hardin JW, Nichols MN. Conventional analyses of data from dietary validation studies may misestimate reporting accuracy: Illustration from a study of the effect of interview modality on children's reporting accuracy. Pub Health Nutr. 2007; 10:1247–1256. [PubMed: 17381899]

Smith AF, Jobe JB, Mingay DJ. Retrieval from memory of dietary information. Applied Cognitive Psychology. 1991; 5:269–296.

Strickland, BR. Approval motivation. In: Blass, T., editor. Personality Variables in Social Behavior. Hillsdale, NJ: Lawrence Erlbaum Associates; 1977. p. 315-356.

US Department of Health and Human Services, & US Department of Agriculture. Dietary Guidelines for Americans, 2005. 62005 [accessed October 8, 2009]. www.healthierus.gov/dietaryguidelines

Wang Y, Lobstein T. Worldwide trends in childhood overweight and obesity. International Journal of Pediatric Obesity. 2006; 1:11–25. [PubMed: 17902211]

Wellek, S. Testing Statistical Hypotheses of Equivalence. Boca Raton, FL: Chapman Hall/CRC Press; 2002.

Worsley A, Baghurst KI, Leitch DR. Social desirability response bias and dietary inventory responses. Human Nutrition: Applied Nutrition. 1984; 38A:29–35. [PubMed: 6706682]

Biographies

CAROLINE H. GUINN, RD, LD is a Research Dietitian in the Institute for Families in Society at the University of South Carolina in Columbia, South Carolina, USA.

SUZANNE DOMEL BAXTER, PhD, RD, LD, FADA is a Research Professor in the Institute for Families in Society, at the University of South Carolina in Columbia, South Carolina, USA.

JULIE A. ROYER, MSPH is a Research Associate in the Institute for Families in Society at the University of South Carolina in Columbia, South Carolina, USA.

JAMES W. HARDIN, PhD is a Research Associate Professor in the Department of Epidemiology and Biostatistics, and Director of the Biostatistics Collaborative Unit at the University of South Carolina in Columbia, South Carolina, USA.

ALYSSA J. MACKELPRANG, BS is a Research Specialist II in the Institute for Families in Society at the University of South Carolina in Columbia, South Carolina, USA.

ALBERT F. SMITH, PhD, MS is an Associate Professor in the Department of Psychology at Cleveland State University in Cleveland, Ohio, USA.

NIH-PA Author Manuscript

NIH-PA Author Manuscript

Table 1

Definitions of terms in alphabetical order (Baxter, Guinn et al.; Baxter et al., 2007a, 2007b; Smith et al., 2007)

Correspondence rate for energy: This is the percentage of total observed energy that was reported correctly. It was calculated for each child as: [(total corresponding energy from matches)/(total observed energy)] × 100. It is a genuine measure of reporting accuracy that is sensitive to reporting errors. It has a lower bound of 0% (indicating that no observed items were reported eaten). It has an upper bound of 100% (indicating that all observed items and amounts were reported correctly). Larger values indicate better reporting accuracy. Correspondence rate equals report rate minus inflation ratio.

Corresponding energy from matches: For each match, this is the smaller of reported and observed energy (or reported energy if it is equal to observed energy).

Inflation ratio for energy: This is a non-negative augmentation to correctly reported energy that is based on incorrect reporting. It was calculated for each child as: {[(total overreported energy from matches) + (total overreported energy from intrusions)]/(total observed energy)} × 100. It is a measure of reporting error. It has a lower bound of 0% (indicating that there were no intrusions and that no amounts of matches were overreported). It has no upper bound (because there is no limit on what a person can report). Smaller values indicate better reporting accuracy. Inflation ratio equals report rate minus correspondence rate.

Intrusion: This is a food item that was not observed eaten but was reported eaten in some nonzero amount for that meal.

Match: This is a food item that was observed eaten in some non-zero amount and was reported eaten in some non-zero amount for that meal.

Omission: This is a food item that was observed eaten in some non-zero amount but was not reported eaten for that meal.

Overreported energy from intrusions: For each intrusion, this is the entire amount of reported energy.

Overreported energy from matches: For each match, this is the amount of energy by which reported energy exceeds observed energy (or zero if reported energy is less than or equal to observed energy).

Report rate for energy: This is the reported percentage of observed energy. It was calculated for each child as: [(total reported energy)/(total observed energy)] × 100. It is a conventional measure of reporting accuracy which disregards reporting errors. It has a lower bound of 0% (indicating nothing was reported). It has no upper bound (because there is no limit on what a person can report). Traditional interpretation is that values close to 100% indicate high reporting accuracy, values greater than 100% indicate overreporting, and values less than 100% indicate underreporting. Report rate equals correspondence rate plus inflation ratio.

Total observed energy: For each child, this was the sum of (total corresponding energy from matches) + (total unreported energy from matches) + (total unreported energy from omissions).

Total reported energy: For each child, this was the sum of (total corresponding energy from matches) + (total overreported energy from matches) + (total overreported energy from intrusions).

Unreported energy from matches: For each match, this is the amount of energy by which observed energy exceeds reported energy (or zero if observed energy is less than or equal to reported energy).

Unreported energy from omissions: For each omission, this is the entire amount of observed energy.

Table 2

Descriptive statistics for fourth-grade children's social desirability scores (SDS) and body mass index percentiles (BMI%) by observation-status group (observed, unobserved) and sex [a]

	Observed children (n = 327)		Unobserved children (n = 152)	
	Boys (n = 164)	**Girls (n = 163)**	**Boys (n = 77)**	**Girls (n = 75)**
SDS [b]				
Mean [standard deviation]	7.6 [3.3]	8.0 [3.4]	8.0 [3.6]	8.4 [3.0]
Q1	5.0	5.0	5.0	6.0
Median	7.0	8.0	8.0	8.0
Q3	10.0	11.0	10.0	11.0
BMI% [c]				
Mean [standard deviation]	75.7 [25.3]	74.5 [26.8]	69.1 [28.5]	72.8 [26.8]
Q1	58.8	59.8	48.2	58.1
Median	85.2	84.4	76.9	82.6
Q3	97.4	96.8	94.0	95.4

[a]Results presented are for 327 observed and 152 unobserved children who met the criteria for reporting both school meals, and for whom we had SDS and height/weight measurements. Meals in children's 24-hour dietary recalls were treated as referring to school meals only if children identified "school" as the location, referred to breakfast as "school breakfast" or "breakfast", referred to lunch as "school lunch" or "lunch", and reported mealtimes to within one hour of scheduled mealtimes (Baxter, Hardin, Guinn et al., 2009; Baxter, Hardin, Smith et al., 2009).

[b]SDS could range from 0 to 14, with higher scores indicating a higher tendency toward socially desirable responding. The 14 items were scored by giving one point to each item where the child's answer matched the socially-desirable answer. The 14 social desirability items *(and socially desirable answer)* were (Baxter et al., 2004): 1. Have you ever felt like saying unkind things to a person? *(No)*
2. Are you always careful about keeping your clothing neat and your room picked up? *(Yes)*
3. Do you sometimes feel like staying home from school even if you are not sick? *(No)*
4. Do you ever say anything that makes somebody else feel bad? *(No)*
5. Are you always polite even to people who are not very nice? *(Yes)*
6. Sometimes, do you do things you've been told not to do? *(No)*
7. Do you always listen to your parents? *(Yes)*
8. Do you sometimes wish you could just play around instead of having to go to school? *(No)*
9. Have you ever broken a rule? *(No)*
10. Do you sometimes feel angry when you don't get your way? *(No)*
11. Do you sometimes feel like making fun of other people? *(No)*
12. Do you always do the right things? *(Yes)*
13. Are there sometimes when you don't like to do what your parents tell you? *(No)*
14. Do you sometimes get mad when people don't do what you want them to do? *(No)*

[c]Sex-specific BMI-for-age growth charts for youth ages two to 20 years were used to determine each child's BMI% (Centers for Disease Control and Prevention; Kuczmarski et al., 2002).

Table 3

Means [and standard deviations] for report rate for energy, reported energy, observed energy, correspondence rate for energy, and inflation ratio for energy for social desirability score (SDS) quartiles and body mass index percentile (BMI%) quartiles for observed children (n = 327) and for reported energy for unobserved children (n = 152) [a]

	n of children	Report rate for energy	Reported energy	Observed energy	Correspondence rate for energy	Inflation ratio for energy
Observed children						
SDS						
0 to 5	84	98 [62]	663 [273]	754 [271]	49 [26]	49 [68]
6 to 7	71	89 [48]	652 [294]	788 [259]	44 [28]	46 [43]
8 to 9	73	90 [39]	716 [295]	834 [231]	51 [28]	39 [33]
10 to 14	99	77 [51]	556 [299]	797 [270]	39 [26]	39 [50]
BMI%						
1.2 to 59.2	81	106 [73]	641 [280]	698 [250]	42 [30]	64 [74]
59.3 to 84.4	82	83 [47]	624 [324]	788 [252]	46 [28]	37 [46]
84.5 to 97.2	82	88 [36]	697 [314]	824 [258]	50 [26]	37 [34]
97.3 to 99.8	82	75 [37]	597 [254]	857 [257]	42 [26]	33 [34]
Unobserved children						
SDS						
0 to 5	40		650 [364]			
6 to 7	28		775 [338]			
8 to 9	29		667 [264]			
10 to 14	55		616 [248]			
BMI%						
1.2 to 59.2	47		687 [288]			
59.3 to 84.4	37		780 [340]			
84.5 to 97.2	44		588 [257]			
97.3 to 99.8	24		580 [312]			

[a]Table 1 defines report rate for energy, (total) reported energy, (total) observed energy, correspondence rate for energy, and inflation ratio for energy. Energy values are for kilocalories. Table 2, footnote b, explains SDS. Table 2, footnote c, explains BMI%. Endpoints for group intervals for SDS and BMI% were defined using quartiles from the observed children.