



# Reliability of 24-Hour Dietary Recalls as a Measure of Diet in African-American Youth



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## ARTICLE INFORMATION

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## ABSTRACT

**Background** Although it is a common practice to estimate dietary intake using three random 24-hour dietary recalls, some studies have suggested up to nine may be necessary to reliably estimate usual intake in youth. Given the resulting increase in resources and participant burden, more research is needed to determine whether this method is reliable, particularly in African-American youth at increased risk for obesity and other chronic diseases.

**Objective** This study estimated the reliability with which 24-hour dietary recalls measure energy, fat, fruit, and vegetable intake in African-American youth and examined how reliability changes as a function of the number of recalls.

**Design** This study used cross-sectional data collection across three studies.

**Participants/setting** Participants were African-American youth ( $n=456$ , mean  $\pm$  standard deviation age  $13.28 \pm 1.86$  years, 64% were girls, mean  $\pm$  standard deviation body mass index [calculated as  $\text{kg}/\text{m}^2$ ]  $31.45 \pm 7.94$ ) who completed random 24-hour dietary recalls (67% completed three) conducted by research assistants using the Automated Self-Administered 24-Hour recall system ( $n=258$ ) or registered dietitian nutritionists using the Nutrition Data System for Research ( $n=198$ ).

**Main outcome measures/statistical analyses** Estimates provided by multilevel models were used to calculate the proportion of variance accounted for between individuals and the reliability of means within individuals as a function of the number of recalls.

**Results** Reliability estimates for assessing dietary outcomes using one to three recalls ranged from 11% to 62%. To achieve 80% reliability, the following number of recalls would need to be conducted: 8 for energy intake, 13 for fat intake, 21 to 32 for fruit intake, and 21 to 25 for vegetable intake.

**Conclusions** The common practice of assessing dietary intake with three recalls does so with low reliability in African-American youth. Until more objective methods for reliably estimating usual intake are developed, researchers who choose to use 24-hour dietary recalls are encouraged to include estimates of the measure's reliability in *a priori* power calculations for improved decision making regarding the number of observations and/or sample size.

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**D**IETARY INTAKE HAS BEEN LINKED TO IMPORTANT health outcomes, including several of the leading causes of death (eg, cardiovascular disease, cancer, diabetes).<sup>1</sup> For researchers aiming to promote the early establishment of healthy eating behaviors in populations at high risk for obesity and other chronic diseases,

the dietary patterns of African-American youth are of particular interest. Numerous randomized controlled trials have sought to improve dietary outcomes (eg, percent of energy from fat and fruit and vegetable intake) in racially and ethnically diverse children and adolescents and have relied on 24-hour dietary recalls to assess changes in diet.<sup>2-4</sup> Demonstrating meaningful changes in youth dietary patterns is challenging, however, with interventions often showing null or only marginally significant effects.<sup>5,6</sup> Low reliability of dietary measures contributes to measurement error and, in turn, reduces power to detect effects. The current study expands on past research by examining the reliability of random 24-hour dietary recall measures in African-American youth.

The use of self-reported, 24-hour dietary recalls for estimating dietary intake has received a great deal of attention.<sup>7-15</sup>

The Continuing Professional Education (CPE) quiz for this article may be taken at [www.eatrightPRO.org](http://www.eatrightPRO.org). Simply log in with your Academy of Nutrition and Dietetics or Commission on Dietetic Registration username and password, go to the My Account section of My Academy Toolbar, click the "Access Quiz" link, click "Journal Article Quiz" on the next page, then click the "Additional Journal CPE quizzes" button to view a list of available quizzes. Non-members may take CPE quizzes by sending a request to [journal@eatright.org](mailto:journal@eatright.org). There is a fee of \$45 per article for non-member Journal CPE. CPE quizzes are valid for 1 year after the issue date in which the articles are published.

Among the well-recognized methodological challenges associated with 24-hour recalls is the issue of reliability, defined here as the extent to which repeated 24-hour recalls estimate usual dietary intake without error.<sup>9</sup> Low reliability is due to both variations in diet across days and inaccuracy in reporting. Reliability is important for dietary assessment because less-reliable estimates have more errors and are therefore less likely to show effects of interventions or the influence of key important predictors. Further, reliability estimates can help determine the number of observations needed to account for daily variation in typical intake patterns.<sup>16,17</sup> While collecting three recalls from youth is a common practice in the field,<sup>2-4</sup> it has recently been suggested by Ollberding and colleagues<sup>17</sup> that as many as six to nine recalls might be needed to estimate usual intake in youth using 24-hour recalls with reasonably adequate reliability. The gap between what is currently done and this recent recommendation represents a large difference in terms of cost and participant burden, particularly for intervention and longitudinal studies that gather dietary data across repeated intervals. Using data across three different studies with low-income, African-American samples, and a similar analytic approach as that taken by Ollberding and colleagues, the current study assesses the reliability of 24-hour dietary recalls for estimating four dietary outcomes frequently assessed within randomized controlled trials (ie, energy, fat, vegetable, and fruit intake).

A number of statistical methods have been proposed to account for the unreliability of 24-hour dietary recalls.<sup>18,19</sup> While these methods require as few as two recalls collected on nonconsecutive days to model usual intake, they are most applicable for estimating group means at the population level and, thus, will not resolve the issue of lower power due to unreliability. These methods also require a high degree of technical expertise and are not widely used, particularly within the context of examining dietary changes in randomized controlled studies, which have largely relied on averaging across recalls.<sup>3</sup> It is therefore of great interest to examine the reliability of commonly used practices to make appropriate decisions regarding power and sample size calculations, as well as appropriate causal inferences from dietary intervention studies conducted with African-American youth. The aims of the present study were to determine the reliability with which 24-hour dietary recalls measure total energy, fat, vegetable, and fruit intake in African-American youth ages 10 to 17 years, and to examine how the reliability of 24-hour dietary recalls changes as a function of the number of recall days across three independent studies.

## METHODS

### Participants

Participants (n=456) were children and adolescents between the ages of 10 and 17 years who completed 24-hour dietary recalls as part of their participation in one of three studies: a cross-sectional health assessment study (study 1)<sup>20</sup>; a family-based, health-promotion intervention (study 2)<sup>21</sup>; or a family-based, weight-loss efficacy trial (study 3).<sup>22</sup> All studies were conducted in South Carolina. Participants across the three studies were recruited using numerous strategies, including printed materials (flyers, brochures) through

referrals from local pediatrician's offices, or at community events. Youth were eligible to participate in study 1 if they were between the ages of 10 and 17 years old; classified as overweight or obese (defined as having a body mass index  $\geq 85$ th percentile for age and sex); able to speak English; and without a chronic medical condition, psychiatric condition, or developmental delay. Eligible participants from study 1 who did not self-identify as African American (n=40) were removed from the present analyses. Youth were eligible to participate in study 2 if they were African American; between the ages of 11 and 15 years old; living with at least one parent or primary caregiver willing to participate; without a chronic medical condition, psychiatric condition, or developmental delay; and not already taking part in a health or weight-loss program. Finally, youth were eligible to participate in study 3 if they were African American; between the ages of 11 and 16 years old; classified as overweight or obese; living with at least one parent or primary caregiver willing to participate; living in a home with internet access; without a chronic medical condition, psychiatric condition, or developmental delay; not already taking part in a weight-loss program; and not taking medication that would interfere with weight loss. Recruitment and data collection took place between 2010 and 2012 for studies 1 and 2 and between 2013 and 2015 for study 3. See Figure 1 for a participant flow diagram for each of the three studies. Because studies 1 and 2 were conducted at the same time, some youth (n=27) participated in both studies, and data for these participants were shared across studies.

### Procedure

Protocols for the three studies were approved by the Institutional Review Board at the University of South Carolina. Before any measures were administered, parents and youth signed informed consent and assent documents, respectively. A team of trained measurement staff collected measures for all participants. Measures included demographics, anthropometric data (height, weight), and three random 24-hour dietary recalls. Participants received a monetary incentive for completing assessments. Cross-sectional data from study 1 and baseline data from studies 2 and 3 were included in the present analyses.

### Measures

**Anthropometric Measures.** Height was measured using a stadiometer (ShorrBoard Infant/Child/Adult Measuring Board, Weigh and Measure, LLC) and weight was measured with a digital scale (Digital Floor Scale 880; Seca). Two measures of height and weight were taken, and the mean score was used in anthropometric calculations. Body mass index (calculated as  $\text{kg}/\text{m}^2$ ) and body mass index percentiles were calculated using the Centers for Disease Control and Prevention 2000 growth reference curves.<sup>23</sup>

**Dietary Intake.** Three 24-hour dietary recalls were completed for each participant and used to estimate dietary outcomes, including total energy, fat, fruit, and vegetable intake. Recalls were conducted on randomly assigned days determined by study staff and not scheduled with participants in advance. Twenty-four-hour recalls calculate intake by taking into account detailed food descriptions, including brand names, ingredients, methods of food preparation, and

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