

Validation of 2 Brief Fruit and Vegetable Assessment Instruments Among Third-Grade Students

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ABSTRACT

Objective: To evaluate the validity of 2 brief instruments to estimate fruit and vegetable (FV) intake among third-grade children.

Methods: Children from an elementary school and a community center (n = 107) completed 2 retrospective questions for FV intake (fruit and vegetable questionnaire [FVQ]) and a food record (A Day in the Life Questionnaire [DILQ]) to estimate FV intake. Agreement between intake based on these instruments and 3 24-hour dietary recalls was determined.

Results: Disattenuated Pearson correlation coefficients ranged from 0.40 to 0.69 for FV intake; however, the low reliability of multiple 24-hour recalls may have inflated the strength of the correlations. Altman-Bland difference plots suggested that the FVQ overestimated FV intake whereas the DILQ overestimated fruit and underestimated vegetable intake. Limits of agreement were wide for both tools, indicating poor overall agreement.

Conclusions and Implications: The FVQ and DILQ were not valid instruments to evaluate FV consumption under current study conditions. Other assessment methods and instruments should be considered for young children.

Key Words: validation, fruit, vegetable, assessment, children (*J Nutr Educ Behav.* 2015; ■:1-6.)

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INTRODUCTION

Consumption of fruit and vegetables (FV) among children (aged 2–19 years) in the US is well below national recommendations.¹ Therefore, many community and school-based programs have been developed to encourage FV consumption among children by organizations, including those implementing Supplemental Nutrition Assistance Program–Education (SNAP–Ed). Evaluating the effectiveness of these programs within the constraints of

community settings using validated dietary assessment tools remains a challenge. Current assessment tools used with children include food records or diaries^{2,3} such as A Day in the Life Questionnaire (DILQ),⁴ 24-hour dietary recalls,⁵ food frequency questionnaires,^{6,7} and observational methods.⁸ Evidence documenting the validity of these tools is typically based on 24-dietary recalls or weighed food records as reference standards, but many potentially useful tools remain unvalidated.⁹

Nutrition education objectives of SNAP–Ed¹⁰ are consistent with the Dietary Guidelines for Americans¹¹ including improvement in FV intake among children. Measures to evaluate SNAP–Ed outcomes should be “valid, reliable, sensitive to change and practical for use.”¹² Two instruments used in Minnesota SNAP–Ed to evaluate the long-term impact of a school-based FV curriculum for third-grade children based on time and cost considerations included the DILQ⁴ and a 2-item fruit and vegetable questionnaire (FVQ) adapted from a Food Behavior Checklist¹³ used with adult SNAP–Ed participants. Because these simple and brief dietary intake measures (DILQ and FVQ) had not been validated for use in this program, the current study was conducted to determine whether they could capture the self-reported FV intake accurately in third-grade children while also acknowledging the challenges inherently associated with young children's recall capabilities.¹⁴

The DILQ is a 1-day chronological food diary developed for use with children aged 7–9 years.⁴ Daily activity questions are included to enhance recall and mask the intention of

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measuring FV intakes. Several questions vary from the original version⁴ based on modifications to suit the nomenclature of meal occasions in the US. The FVQ includes 2 questions asking about FV intake on most days and includes measuring cup pictures¹⁵ with response options ranging from 0 to 3 cups in half-cup increments. Pictured cups contain either fruit or vegetables at the designated cup level. Readability and validity were acceptable among adults¹⁶⁻¹⁸ but were not tested with children. Food Behavior Checklist questions regarding FV intake were reliable among children (aged 8-9 years) but were not tested for agreement with a reference measure.¹⁹

The DILQ and FVQ are practical assessment tools because they can be quickly administered to school-aged children in a group setting at low cost; however, analysis of the DILQ data may be challenging. Validation of the DILQ is necessary across an entire day and validation of the FVQ is necessary for convergent validity with children. Therefore, the objective of this study was to validate these 2 brief FV intake assessment tools among third-grade children using 24-hour dietary recalls as the reference method.

METHODS

Participants

Data were collected from third-grade students attending 1 elementary school ($n = 100$) and children participating in a community-based summer program during 2012-2013 ($n = 7$). Approximately 488 students were enrolled in the school, with 76% classified as racially and ethnically diverse.²⁰ The majority of children (84% and 88%, respectively) were eligible for free or reduced price school meals from the school²¹ and summer camp, respectively. Recruitment fliers were sent home to parents with children in any of 5 classrooms in the school ($n = 124$) and parents of third-grade children attending the summer camp ($n = 15$); this resulted in a response rate of approximately 77%. Children were given \$10 gift cards for participation and teachers were given \$50 gift cards for their assistance. The University of Minne-

sota Institutional Review Board, school principal, and community center director approved this study; the researchers obtained informed consent and assent from parents and youth, respectively.

Data Collection Procedures

On the morning of the first day, a trained researcher administered the FVQ and then the DILQ to children, providing minimal prompts. For the DILQ, the previous day's school breakfast and lunch menus were reviewed to remind children of the foods they were offered in school. For the FVQ, researchers asked whether children usually consumed FV on most days. Because the FVQ pictures did not include juice, researchers instructed children to include juice as a part of their usual intake. Researchers did not provide additional information to describe the difference between 100% fruit juice and fruit drinks.

An individual 24-hour recall interview was conducted with each child later in the day after administration of the DILQ and FVQ. Recalls were conducted in the school classroom or library, and in a private room in the summer camp setting. A standard multiple pass method was used based on the Nutrition Data System for Research 2012 software program (Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, 2012).²² Because combination dishes such as spaghetti with sauce contribute a substantial amount of vegetables to children's diets,²³ these foods were included in the vegetable category. French fries, potato chips, and baked products containing fruit were excluded.

Within the next 3 weeks, 2 food record-assisted 24-hour recalls were conducted. Children were instructed to complete a food record and reminded to return it the next day for their 24-hour recall interview. A letter was included for parents, asking them to assist in recording food consumed by their children at home immediately after consumption. One third completed and returned food records for both recalls. Recalls included 2 weekdays and 1 weekend day.

Comparison of FV Intake

To compare questionnaire intake data with dietary recall data, DILQ frequency data were transformed into cups using an algorithm developed for the Eating at America's Table Study (using National Health and Nutrition Examination Survey 2003-2006 data)²⁴ and the 24-hour recall data (servings)¹¹ from Nutrition Data System for Research 2012 output were converted to cups. The use of this algorithm was described by Thompson et al²⁵ to convert FV screener frequency data to quantities for adults. Data from children with only 1 24-hour recall and those whose recalls were deemed unreliable (eg, FV consumption > 10 cups) were excluded from analysis ($n = 5$). Results from children who completed 2 or 3 24-hour recalls were included in data analysis ($n = 102$).

Results from the first 24-hour recall were compared with the DILQ results because the DILQ measures reported intake on 1 day. Results from all of the recalls were compared with the FVQ results because the FVQ measures reported intake on most days.

Data Analysis

The authors used Pearson correlation, disattenuated Pearson correlation, and Bland-Altman analysis to assess agreement. The disattenuated Pearson correlation adjusted for measurement error in the 24-hour recall,²⁶ which was estimated with a linear mixed model.²⁷ Bland-Altman analyses are frequently used to assess the extent of agreement between 2 continuous measures. The primary advantage of a Bland-Altman analysis is the interpretation, which remains on the scale of the outcome of interest (eg, cups of fruit intake). Bland-Altman analysis provided the bias and limits of agreement. Bias represents the average difference between 2 measures. The agreement limits define the interval containing 95% of the differences.²⁸ Two instruments were considered in agreement to the extent that bias was close to 0 and the limits of agreement were narrow.²⁹ Analysis was done with SAS software (version 9.3, SAS Institute, Inc, Cary, NC, 2011) and R (version 3.1.2, R Foundation

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