RESEARCH
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Reliability and Validity of Food Frequency Questions to Assess Beverage and Food Group Intakes among Low-Income 2- to 4-Year-Old Children

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ABSTRACT

Background Fruits, vegetables, sweetened foods, and beverages have been found to have positive and negative associations with obesity in early childhood, yet no rapid assessment tools are available to measure intake of these foods among preschoolers.

Objective This study examines the test–retest reliability and validity of a 10-item Child Food and Beverage Intake Questionnaire designed to assess fruits, vegetables, and sweetened foods and beverages intake among 2- to 4-year-old children.

Methods The Child Food and Beverage Intake Questionnaire was developed for use in periodic phone surveys conducted with low-income families with preschool-aged children. Seventy primary caregivers of 2- to 4-year-old children completed two Child Food and Beverage Intake Questionnaires within a 2-week period for test–retest reliability. Participants also completed three 24-hour recalls to allow assessment of validity. Intraclass correlations were used to examine test–retest reliability. Spearman rank correlation coefficients, Bland–Altman plots, and linear regression analyses were used to examine validity of the Child Food and Beverage Intake Questionnaire compared with three 24-hour recalls.

Results Intraclass correlations between Child Food and Beverage Intake Questionnaire administrations ranged from 0.48 for sweetened drinks to 0.87 for regular sodas. Intraclass correlations for fruits, vegetables, and sweetened food were 0.56, 0.49, and 0.56, respectively. Spearman rank correlation coefficients ranged from 0.15 to 0.59 for beverages, with 0.46 for sugar-sweetened beverages. Spearman rank correlation coefficients for fruits, vegetables, and sweetened food were 0.30, 0.33, and 0.30, respectively. Although observation of the Bland–Altman plots and linear regression analyses showed a slight upward trend in mean differences, with increasing mean intake for five beverage groups, at least 90% of data plots fell within the limits of agreement for all food/beverage groups.

Conclusions The Child Food and Beverage Intake Questionnaire exhibited fair to substantial test–retest reliability and moderate to strong validity in ranking fruits, vegetables, sweetened food, and the majority of beverages consumed by children aged 2 to 4 years old. Although the Child Food and Beverage Intake Questionnaire might not be able to assess the absolute intake of foods and beverages, given the scarcity of an easily administered, valid, and reliable questionnaire to assess nutritional intake among 2- to 4-year-old low-income children, this tool is a useful means for measuring trends in dietary intake among low-income preschoolers.
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A HEALTHY DIET IS ESSENTIAL IN EARLY CHILDHOOD, and the diets of preschoolers have been found to be important not only for their growth and development, but also for their future health.[1]

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Studies have shown that diet is a major modifiable risk factor in the prevention of obesity and its consequences in adulthood.[2-6] Studies have also found that low-income children are disproportionately affected by obesity and face healthy lifestyle barriers.[7] Taken together, these issues increase the need to find ways to optimize the diet of low-income children. To do that, knowledge about their actual intake must be obtained. Therefore, there is an increasing need for reliable measurement methods of foods that are consumed as part of the usual diet of low-income preschoolers.

Assessing food intakes using existing measurement methods remains difficult and labor-intensive.[8] No single method is ideal under all conditions. The choice of method depends on a number of factors, including the aims of the study, the accuracy of the dietary data required, and the availability of resources.[9] Currently, the weighed food record method is considered one of the most recommended methods of dietary assessment.[10] However, this method is expensive and time-consuming.[11] Routine assessment of children's dietary intake requires a simple, quick, and reliable method. Food frequency questionnaires (FFQ) have been commonly used as a practical and efficient method to assess habitual diet over periods of time in large-scale dietary surveys, but very limited data are available on their reliability and validity among low-income preschool-aged children.[9,12] In fact, a dietary assessment validation study conducted in 1994 to validate two sets of FFQs (Harvard and Block) in a population made up of women and children eligible for the Special Supplemental Nutrition Program for Women, Infants and Children (WIC), found that neither FFQ could be recommended for use among children to estimate nutrient intake or to evaluate WIC eligibility.[13] The authors recommended the identification of a brief set of questions that can be tested for assessing appropriate dietary intake among children eligible for WIC. Obtaining reliable dietary intake data are important not only for monitoring the nutritional status of children eligible for WIC, but also for identifying dietary patterns among children and understanding the role of diet in health and disease disparities. Therefore, this study was designed to test the reliability and validity of a 10-item FFQ developed and utilized in the Los Angeles County WIC survey to estimate the fruits and vegetables, beverages, and sweets intake of preschool-aged children. The validity of the 10-item FFQ was tested using the 24-hour recall method, a dietary assessment method that has been used in numerous validation studies.[14] Although they are not without limitations; 24-hour recalls have been found to be suitable for comparison with questionnaires to establish validity.[14]

METHODS

Development of the Child Food and Beverage Intake Questionnaire

The Los Angeles (LA) County WIC Survey is a triennial telephone survey that provides in-depth information about key health indicators and health-related behaviors, as well as home and community indicators of support for families with young children. It is conducted among a randomly selected sample of pregnant and breastfeeding mothers and mothers of children up to their fifth birthday who are enrolled in the WIC Program. The survey, originally developed in 2005, was largely adapted from the 2005 Los Angeles County Health Survey,[15] with major input from California State WIC division and local WIC agency staff. The survey includes 127 total questions, 10 of which are dietary intake questions that ask primary caregivers (in most cases mothers) to report their child's beverage, fruit and vegetable, and sweets or sweetened food intake on a typical day. This 10-item Child Food and Beverage Intake Questionnaire was included to allow for assessment of dietary patterns and diet quality; however, its reliability and validity are still unknown.

Subject Recruitment

A convenience sample of 76 primary English and Spanish-speaking caregivers of 2- to 4-year-old children who were enrolled in WIC was recruited from a randomly selected WIC site run by the Public Health Foundation Enterprises Local Agency WIC program. Participants were recruited based on having a child between 2 and 4 years of age who was free of any disease that might influence nutritional status. In cases where caregivers had more than one child who qualified, the child with the most recent birthday was selected as the target child. The Ethical and Independent Review Services reviewed and approved the study protocol and all participants provided written informed consent before participating in this study. Data collection was conducted from July 10, 2012 to October 15, 2012.

At the Public Health Foundation Enterprises WIC site, caregivers of 2- to 4-year-old children were asked the following screening questions: "Do you know what your child ate yesterday?" and "Was yesterday a typical day in terms of what your child ate?" Participants who answered yes to both screening questions were invited into the study and provided written consent. All participants screened, regardless of study participation, received routine WIC services.

Before study enrollment, power analyses were computed to estimate the required sample size.[16] A sample size of 67 was estimated to give this study 80% power to detect a medium effect at α=.05. We conservatively expected to lose approximately 7 to 9 participants; therefore, we recruited 76 WIC participants for this study. A total of 6 children were excluded from the final dataset, as they had incomplete data. The final sample that was used in the analyses comprised 70 children. The six children lost to attrition were not different in terms of sociodemographic characteristics.

Study Protocol

In order to examine the reliability and validity of the 10-item Child Food and Beverage Intake Questionnaire that is embedded in the LA County WIC Survey (see Figure 1), data were collected at three time points. The three interviews included the completion of two Child Food and Beverage Intake Questionnaires and three 24-hour recalls (2 weekdays and 1 weekend day) within a 2-week period. In all interviews, the Child Food and Beverage Intake Questionnaire was administered before the 24-hour recall. All Child Food and Beverage Intake Questionnaire and recalls were administered by one research assistant who participated in a 1-day training session led by the lead author and WIC staff. During this training session, the research assistant was familiarized with the study protocol and trained on how to conduct over-the-phone and in-person 24-hour recalls using food props. The research assistant was also trained on how to enter 24-hour recall and questionnaire data in Microsoft Office Excel (version 14, 2010, Microsoft). The training session was followed by two practice sessions in which the research assistant practiced conducting 24-hour recalls and collecting data using the Child Food and Beverage Intake Questionnaire with the lead author and WIC staff. On the day of recruitment in the WIC site, the research assistant interviewed each participant with the 10-item Child Food and Beverage Intake Questionnaire and completed one 24-hour recall based on the child's food intake the previous day. In addition to asking