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Research report

Evaluation of a pictorial method to assess liking of familiar fruits and vegetables among preschool children

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ABSTRACT

Research suggests fruit and vegetable (FV) preferences greatly influence on FV intake. Methods for assessing children's FV preference in a reliable and valid manner are needed. The purpose of this study was to develop a practical, reliable, and valid method for evaluating FV liking among preschool-aged children using photographs. Authors formatively assessed a series of digital FV photographs and hedonic scales to develop content for the liking measure. The measure for assessment included 20 high-quality, digital photographs presenting 13 FVs. A non-gendered 5-point face scale (super yummy to super yucky) was chosen to determine level of liking. We used this measure to establish reliability (i.e., test re-test) and concurrent validity (i.e., photograph versus tasting experience) of the pictorial method. Data were analyzed using Spearman's Rho Correlation Coefficients and Wilcoxon signed-rank tests. The measure demonstrated varying levels of reliability/validity for individual FV items and the fruit scale; however, the vegetable scale and collapsed FV scale were determined to be valid measures. Authors recommended the removal of one weak pictorial fruit item (halved peach) from the fruit and FV scales to improve validity. The final recommended measure included 19 high-quality, digital photographs presenting 12 FVs. The pictorial FV measure and subscales may be useful for assessing FV liking among groups of preschool-aged children within the studied population. Additional research is needed to further validate the use of the pictorial FV measures in a larger, more generalizable sample.

Introduction

Fruit and vegetable (FV) consumption is correlated with the prevention of many chronic conditions such as obesity, hypertension, diabetes, cardiovascular disease, and some cancers (Hung et al., 2004; Roberts & Bernard, 2005; Van Duyn & Pivonka, 2000); however, 50% percent of 5 year olds consume less than 1 cup per day of FV (Krebs-Smith et al., 1996; McPherson, Montgometry, & Nichaman, 1995). The United States' Dietary Guidelines recommend individuals 2–8 years old consume 2–3 cups of FVs daily, signifying young children are falling short of current recommendations (Dietary Guidelines for Americans, 2010). While FV consumption is influenced by a wide range of variables (e.g. knowledge, beliefs, attitudes, availability) (Nanney, Johnson, Elliott, & Haire-Joshu, 2007; Somerset & Markwell, 2007), research suggests that FV preferences have the greatest impact on intake (Bere & Klepp, 2005; Domel et al., 1996; Resnicow et al., 1997).

Preferences are developed through the exposure of a variety of foods, textures, tastes, and flavors (Birch, 1999). During the preoperational stage of development (2–7 years old), children often reject unfamiliar foods; children 'like what they know, and eat what they like' (Cooke, 2007). Methods for assessing children's FV preferences in a reliable and valid manner are needed (Guthrie, Raporport, & Wardle, 2000), as research has demonstrated that a child's preference for FVs is an indicator of consumption (Berg, Jonsson, Conner, & Lissner, 2003; Birch, 1979, 1999; Domel et al., 1996; Gibson, Wardle, & Watts, 1998; Resnicow et al., 1997). Measuring a child's food preference is considered to be a proxy for the actual behavior a child will display in a real life setting (Birch, 1979). To date, the most common method used to assess preferences ("taste and rate") (Birch, 1979; Birch & Sullivan, 1991; Wardle & Huon, 1999) is not practical outside of a laboratory setting or when assessing large populations, because it requires researchers to present samples of real food to children for tasting (Calfas, Sallis, & Nader, 1991; Guthrie et al., 2000; Olsen, Kildegaard, Gabrielsen, Thybo, & Møller, 2012; Sundberg & Endres, 1984).

Using photographs to assess FV preference is a promising method, as it allows for easier test standardization and assessment of large numbers of children (Calfas et al., 1991). Additionally, photographs can help researchers control for limited verbal abilities and timidity by allowing children to also communicate responses

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through pointing (Mobley, 1996). Guthrie and colleagues (2000) sought alternatives to the traditional "taste and rate" method for 3–5 year old children by exploring the relationship between Birch's method (1979), food models, and quality photographs of food. Outcomes revealed photographs were only slightly less reliable ($r = 0.75$) than an actual tasting experience ($r = 0.80$). Another study investigating the use of photographs to assess preference found substantial agreement between stated preference for healthy and unhealthy foods and actual choice in a group of 3–8 year olds (% agreement = 66, $\chi^2 = 8.4$, $p < 0.001$). However, when broken into age groups, the pictorial measure used was determined to be more reliable among older children (5–8 year olds). Preferences were less reliable among 3–4 year olds, and validity scores were lowest among 5–6 year olds (Calfas et al., 1991).

While pictorial methodologies have been shown to be an effective way to assess food preferences in older children (7–13 years) (Calfas et al., 1991; Kildegaard, Olsen, Gabrielsen, MØller, & Thybo, 2011; Olsen et al., 2012), Guthrie and colleagues call for more research to determine its effectiveness in younger populations of children (3–5 years) (Guthrie et al., 2000; Jaramillo et al., 2006). Two recent studies involving pictorial methods to assess food preference have produced encouraging results among young children. Jaramillo and colleagues (2006) developed a computerized tool to assess fruit, vegetable, and fruit juice preferences of African American and Hispanic preschool children. Outcomes of the study exhibited good test re-test reliability ($r = 0.37–0.73$) and predictive validity of the measure. Also, authors observed significantly higher mean FV consumption among children who reported more positive FV preferences. Comparatively, Vereecken, Vandervorst, Nicklas, Covents and Maes (2010) produced promising, but somewhat less favorable results among 4–6 year old children. Fruit and vegetable preference was assessed using similar computerized methods to Jaramillo et al. (2006). Researchers observed high reliability (ICC = 0.74–0.75); however, predictive validity comparing children's FV consumption with reported preferences revealed small correlations ($r_s = 0.19–0.25$).

While these studies demonstrate the use of photographs is a potential method to assess preference, to the authors' knowledge, only one study among preschool children appeared to take familiarity into consideration. Jaramillo and colleagues undertook intensive measures (e.g. provision of test photographs to kitchen staff for food preparation) to ensure the food presented in the photographs and in the mealtime environment were identical (2006). However, authors did not report assessing photographs with preschool children to ensure the foods pictured were being accurately identified. Familiarity is an important factor impacting young children's food choices. For example, past research has demonstrated that familiarity accounts for approximately 30% of the observed variance in children's preference for fruits (Birch, 1979). Pictorial methods assessing children's preference for foods should take this factor into account to ensure measured preference is not influenced by a lack of familiarity with the food item (Birch, 1979; Kildegaard et al., 2011).

The purpose of this study was to add to the limited body of literature surrounding the of use pictorial methods by developing a measure to evaluate liking of familiar FVs among preschool-aged children that is comparable to the "taste and rate" method. Asking children to rate liking of photographed foods (hedonic scaling) is considered a reasonable alternative to assessing preference using ranking methods (Baxter & Bower, 1999; Guinard, 2001; Jaramillo et al., 2006; Vereecken et al., 2010). The primary objectives of this study were to: (1) describe the multi-phase process of selecting familiar FVs for inclusion in a pictorial measure to assess liking among preschool-aged children; (2) describe the method for assessing test re-test reliability of the FV liking measure; and (3) describe the method for assessing concurrent validity of the FV liking measure.

Methods

Design

To evaluate preschool children's FV liking, researchers executed the development of a picture identification method in two phases. In Phase I, we formatively assessed a series of digital FV photographs to develop the content for the liking measure. In Phase II, we established the reliability (i.e., test re-test reliability) and concurrent validity (i.e., association between liking provided when shown a photograph versus a tasting experience) of the pictorial method (Fig. 1). There was approximately a 2-month period between Phase I and II. All research assistants (RA) received training in ethical methods when working with human subjects and standardized data collection protocol. Additionally, RAs participated in mandatory data collection training prior to the beginning of each phase, in which they practiced administering the measure to a small sample of preschool-aged children. In the current study, RAs were considered individuals that aided in participant recruitment and/or data collection. Additionally, the terms "researchers" and "authors" represent the authors included on this article, who were also considered members of the lead research team for all phases of the study. North Carolina State University's Institutional Review Board reviewed and approved study protocols and instruments.

Participants

RAs recruited all participating children (Phase I and II) from one private preschool center and six preschool centers serving low-income, low-resource families in the Raleigh-Durham metropolitan area. Participants were recruited by: (1) attending parent–teacher meetings, (2) sending home letters to parents describing the study, (3) and on-site recruitment during parent pick-up and drop-off times. Parental consent was obtained for all children participating in each phase of the study. In total, 147 children (private preschool children, $n = 58$; low-income preschool children, $n = 89$) were recruited and participated in various parts (sub-samples) of the pictorial FV liking measure's evaluation (Fig. 1). Researchers included children attending the private preschool in the Phase I *Preliminary Photograph Identification* sub-sample, but they were not included in any other sub-sample. Alternatively, researchers included children recruited from low-income, low-resource preschools as participants in multiple sub-samples within Phase I and II. Sub-sample sizes varied within each part of the study due to absenteeism on the day of scheduled evaluation resulting in dropout (e.g. failure of a child participant to complete required testing sessions for reliability within the evaluation time frame).

Phase I: development of FV preference assessment method

Fruit & vegetable photograph development

Authors developed a list of FVs (fruit = 13; vegetables = 10) potentially consumed by children, using published accounts as a foundation (Fox, Condon, Briefel, Reidy, & Deming, 2010; Jaramillo et al., 2006). A Registered Dietitian with culinary foodservice experience conducted preparation and presentation of each food for display in photograph form. Whole and transformed versions of each FV (e.g. whole potato, mashed potato, French fries) were included. Eighty high quality, color photographs were digitally