



Research report

Exploratory validation of the Fruit and Vegetable Neophobia Instrument among third- to fifth-grade students[☆]David Hollar^{a,*}, Amy Paxton-Aiken^b, Phyllis Fleming^b^a Department of Medicine, University of North Carolina at Chapel Hill, School of Medicine, 410 Berryhill, CB 7530, Chapel Hill, NC 27599, United States^b UNC Center for Health Promotion and Disease Prevention, University of North Carolina at Chapel Hill, 1700 Martin Luther King Jr. Boulevard, CB 7426, Chapel Hill, NC 27599, United States

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ABSTRACT

Children's unwillingness to try new foods, or food neophobia, may impact dietary behaviors. As part of an effort to evaluate Farm to School programs, the Fruit and Vegetable Neophobia Instrument (FVNI) was developed to measure student attitudes toward new fruits and vegetables. A self-administered, paper/pencil, 18-item questionnaire, the FVNI was adapted from the Food Neophobia Scale. The FVNI has two subscales: a fruit subscale that asks about a child's willingness to try new fruits in different circumstances and an analogous vegetable subscale. The FVNI was administered to 1485 third-through fifth-grade students (ages 8–10 years) from nine schools in two states at the start of the 2009–2010 school year. Data analysis used factor analyses, reliabilities, and LISREL structural equation models. The FVNI exhibited a two-factor structure and strong measures of model fit ($\chi^2/df = 5.36$; *Goodness of Fit* = 0.92; *Adjusted Goodness of Fit* = 0.89; *Non-Normed Fit Index* = 0.97; *RMSEA* = 0.07; and *RMSR* = 0.052). In this exploratory analysis, the FVNI proved to be internally consistent in assessing third-through fifth-grade students' fruit and vegetable neophobia.

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Introduction

Childhood obesity in the United States remains high at nearly 17% (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). This condition, which poses both short and long-term health consequences, is associated with high blood pressure, Type 2 diabetes, and other adverse health outcomes (Daniels, 2006; Dietz, 1998; Freedman, Dietz, Srinivasan, & Berenson, 1999; Schwimmer, Burwinkle, & Varni, 2003; Sinha et al., 2002; Steinberger, Moran, Hong, Jacobs, & Sinaiko, 2001; Weiss et al., 2004). Overweight and obese children are also at risk of experiencing depression, poor self-esteem, and a lower quality of life (Erickson, Robinson, Haydel, & Killen, 2000; Schwimmer et al., 2003). In addition, a diet low in fruits and vegetables is associated with being overweight and obese (Ennis, Mickels, & Goldman, 2003). Children, like most Americans, do not meet the minimum USDA recommendations for fruit and vegetable intake (Casagrande, Wang, Anderson, & Gary, 2007; Guenther, Dodd, Reedy, & Krebs-Smith, 2006). Because dietary habits form at young ages and often carry into adulthood, low fruit and vegetable intake in childhood can have negative long-term health consequences

relating to weight and disease in adulthood (Lytle, Seifert, Greenstein, & McGovern, 2000; Magarey, Daniels, Boulton, & Cockington, 2003).

For these reasons, improving fruit and vegetable intake among children is an important task with potential long-term health benefits. However, children's negative attitudes toward fruits and vegetables may interfere with consumption. Negative attitudes toward and non-acceptance of new foods has been conceptualized as food neophobia, defined as a reluctance to eat and/or avoidance of or unwillingness to try novel foods (Pliner & Hobden, 1992). Food neophobia has been found to affect the quality and variety of foods in children's diets (Falciglia, Crouch, Gribble, Pabst, & Frank, 2000; Knaapili et al., 2007), for unfamiliar foods may be omitted in favor of foods high in fat, sugar, and salt (Dovey, Taylor, Stow, Boyland, & Halford, 2011; Knaapili et al., 2007). As a result, when fruits and vegetables are unfamiliar, there is concern that children with high levels of food neophobia will not eat them (Dovey et al., 2011; Knaapili et al., 2007). With increasing evidence indicating the importance of fruits and vegetables in a healthy diet (Horne et al., 2004; Nanney, Haire-Joshu, Elliott, Hessler, & Brownson, 2005; Vanhala, Laitinen, Kaikkonen, Keinänen-Kiukaanniemi, & Korpelainen, 2010), there is a need to evaluate children's willingness to try and eat new fruits and vegetables in order to develop effective interventions targeting fruit and vegetable consumption.

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A food neophobia assessment tool has been developed and studied, but there is no known assessment tool that specifically evaluates children's fruit and vegetable neophobia. [Pliner and Hobden \(1992\)](#) developed a ten-item paper and pencil instrument to measure food neophobia among college students, the Adult Food Neophobia Scale. Internal and test–retest reliabilities and criterion validity correlations for these ten items were satisfactory ([Pliner & Hobden, 1992](#)). The food neophobia instrument has not been tested with children; however, [Pliner \(1994\)](#) further explored the measurement of food neophobia in children ages five, eight, and eleven years by evaluating a correlation measurement between parental food neophobia and their children's demonstrated willingness to try foods when presented with new foods ([Pliner, 1994](#)). Pliner's work resulted in an observational measure of children's neophobic behavior, that is, children's willingness to try familiar and unfamiliar foods when presented with them, and a parental paper and pencil questionnaire describing a child's neophobic behavior.

Grounded in [Pliner and Hobden's \(1992\)](#) work, the Fruit and Vegetable Neophobia Instrument (FVNI) was developed to fill the need for a self-administered questionnaire to assess fruit and vegetable neophobia among children. The Adult Food Neophobia Scale (1992) provided initial guidance for item content. The items were revised to ask about fruits or vegetables and, on the basis of face validity, to be read at third-through fifth-grade reading and comprehension levels.

The purpose of this study was to assess the internal validity of the FVNI using data collected from two Farm-to-School evaluation studies with third-through fifth-grade students. Among other goals, Farm to School programs seek to connect school nutrition programs with local farmers to provide local fruits and vegetables to students through school meals ([Vallianatos, Gottlieb, & Haase, 2004](#)). The FVNI was administered within this context, and these data were used to assess the psychometric properties of each subscale examined factor structure, levels of internal consistency, and measurement model properties.

Methods

The Institutional Review Board at the University of North Carolina at Chapel Hill approved this study. Data were collected from third- to fifth-grade students from six schools in California and three schools in Oregon during the 2009–2010 school year. At all nine schools, either food service professionals or Farm to School program volun-

teers followed written instructions to administer the evaluation data collection instruments, including the FVNI, after lunch during the school day. Of the participants in the Farm to School evaluation, 1485 (61%) completed the FVNI at the start of the school year.

Instrument

The FVNI was designed with input from nutritional professionals, researchers, and elementary school teachers not involved in the Farm to School evaluation studies. Questions from Pliner and Hobden's Adult Neophobia Scale were used to design the FVNI and to fit the needs of the Farm to School evaluation ([Pliner & Hobden, 1992](#)). From the Adult Neophobia Scale, two subscales each consisting of nine items were created in which “fruit” and “vegetable” replaced “food”, respectively. The items dealing with food from other countries and “constantly trying new foods” were not used because children in the study sample had limited control over exposure to varied cultural foods. [Pliner's \(1994\)](#) behavioral measure of children's food neophobia guided the development of additional items that asked about tasting or trying fruits and vegetables (i.e., FAV) in a variety of settings ([Pliner, 1994](#)).

Response options for the first three questions (i.e., FAV3, FAV4, and FAV5 for the fruit subscale; FAV13, FAV14, and FAV15 for the vegetable subscale; [Table 1](#)) on each subscale of the FVNI included “a lot,” “a little,” “not very much,” and “not at all.” Response options for the remaining six questions (i.e., FAV6–FAV11 for the fruit subscale; FAV16–FAV21 for the vegetable subscale; [Table 1](#)) on each subscale of the FVNI included “definitely,” “probably,” “probably not,” and “definitely not.” Response options for the last question (i.e., FAV12 and FAV22) on each subscale of the FVNI included “never,” “1 time,” “2 times,” “3 times,” and “at least 4 times.” These last questions and other questionnaire items (e.g., FAV1 and FAV2 that asked the student's first name and grade level) not directly related to neophobia were not included in the analyses for this study. All items on the FVNI were measured on a 1–4 agreement scale, where the higher the score the more neophobic the respondent. Negatively worded items were reverse scored to maintain similar attitudinal polarities.

Analysis

This analysis used SPSS, version 14.0, and LISREL, version 8.80. A combination of strategies was used to examine the psychometric

Table 1
Oblique GLS rotated factor pattern for all items.

#	Item	Factors and communalities (C) separate (n = 1485)			Factors and communalities (C) combined (n = 1348)	
		1	2	C	1	C
FAV3	How much do you like fruit?	.535		.377	.410	.432
FAV4	How much do you like fruits that you have never tried?	.582		.375	.447	.426
FAV5	How much do you like tasting new fruits?	.671		.544	.492	.513
FAV6	Will you taste a fruit if you do not know what it is?	.641		.544	.495	.521
FAV7	Will you taste a fruit if it looks strange?	.551		.444	.508	.585
FAV8	Will you taste a fruit if you have never tasted it before?	.675		.483	.532	.516
FAV9	When you are at a friend's house, will you try a new fruit?	.552		.326	.480	.553
FAV10	When you are at school, will you try a new fruit?	.639		.437	.584	.633
FAV11	When you are at home, will you try a new fruit?	.580		.398	.480	.587
FAV13	How much do you like vegetables?		.724	.591	.671	.628
FAV14	How much do you like vegetables that you have never tried?		.801	.679	.766	.699
FAV15	How much do you like tasting new vegetables?		.818	.690	.780	.701
FAV16	Will you taste a vegetable if you do not know what it is?		.731	.600	.728	.638
FAV17	Will you taste a vegetable if it looks strange?		.698	.568	.698	.688
FAV18	Will you taste a vegetable if you have never tasted it before?		.789	.636	.771	.650
FAV19	When you are at a friend's house, will you try a new vegetable?		.723	.542	.727	.679
FAV20	When you are at school, will you try a new vegetable?		.740	.590	.749	.745
FAV21	When you are at home, will you try a new vegetable?		.693	.539	.689	.678
	Eigenvalue	3.85	5.42	–	7.44	–
	Coefficient of determination (R ²)	.428	.603	–	.413	–

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