Construct Validation of Measures used for Assessing the Effect of Nutrition Education on the Lifestyles of Third Grade Children

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Abstract

This study investigates the construct validity of methods used to evaluate the effect of nutrition education on the lifestyles of third grade children from Iowa schools who participated in nutrition education lessons provided by the Iowa Department of Public Health's program in 2009, 2010, and 2011. The traits consist of respondents' knowledge about a healthy life style, self-efficacy related to respondents' confidence in their ability to adhere to a healthy lifestyle, and food preferences. Each trait was measured by four methods: children's assessment before program intervention, children's assessment after program intervention, parents' assessment before program intervention, and parents' assessment after program intervention. A multitrait-multimethod matrix and confirmatory factor analysis were used to assess construct validity. The results show that the assessments of knowledge, self-efficacy, and food preference were more valid when they were done by children than by parents, and that the assessments that were done after the program intervention showed more evidence of convergent validity than the assessments that were done before the program intervention.

Key Words: construct validity, confirmatory factor analysis, public health, nutrition education

1. Introduction

Overweight and obesity among children draw the attention of health care organizations and government agencies because the emergence of this problem at a young age leads to immediate health problems such as elevated lipid concentration, diabetes, and hypertension (Dehghan, Akhtar-Danesh, & Merchant, 2005). Childhood obesity leads to increased risk of adult obesity and related chronic conditions in adulthood (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). Consumption of high-calorie foods and insufficient physical activity contribute to weight gain (Brennan & Carpenter, 2009; Jeffery & French, 1998). The prevalence of BMI for ages at or above the 95th percentile has tripled among school-age children since 1980 (Ogden et al., 2010). In 2009–2010,

16.9% of U.S. children and adolescents aged 12-19 years were obese (Ogden, Carroll, Kit, & Flegal, 2012). Children from low-income and minority groups are especially vulnerable to the development of overweight and obesity. In 2004, 14.8% of children 5 and under from low-income families were obese compared to 10.4% of those from moderate- to high-income families (Dietz, 2009). The Centers for Disease Control and Prevention (CDC) supports the development of school programs to promote physical activity and healthy eating (Veugelers & Fitzgerald, 2005; CDC, 1996, 1997). For broader implementation of successful programs, it is important to establish their effectiveness (Veugelers & Fitzgerald, 2005; CDC, 1997).

This study investigates the construct validity of methods used to evaluate the effect of nutrition education on the lifestyles of third grade children from Iowa schools who participated in nutrition education lessons provided by the school-based child nutrition education program conducted by the Iowa Department of Public Health (IDPH) in 2009, 2010, and 2011. The IDPH has a goal to improve the health of children through the promotion of a healthy lifestyle. The Iowa Nutrition Network, housed in the Department of Public Health, coordinates the BASICS for Nutrition and Physical Activity Program that uses a social marketing model to encourage and empower children, parents, and caregivers to eat healthy and be physically active. The program's marketing campaigns and nutrition education resources convey and reinforce healthy eating and lifestyle behaviors to low-income children and their families. During the timeframe data were collected, the BASICS nutrition education program focused on three key behaviors: (1) eat fruits and vegetables for snacks, (2) eat calcium-rich, 1% or fat-free dairy products, and (3) daily physically activity.

BASICS provides nutrition education to over 20,000 children in low-income schools around Iowa. In school, children participate in lessons that provide the opportunity to taste different kinds of fruits, vegetables, and low-fat milk products, and demonstrations of simple recipes for snack preparation from these products. Newsletters and family BINGO-type cards provide parents with information on food resources and low-cost, practical ways to implement the programs' key behaviors.

Pick a better snack™ & Act is the Network's flagship campaign that promotes fruit and vegetable snacks, and daily physical activity. While the Health Belief Model was foundational in the formative design of the campaign, the classroom lessons are framed around Social Cognitive Theory (SCT). SCT was developed to understand human social behaviors (Bandura, 1986). According to SCT, a very important prerequisite for behavior change is self-efficacy because it depends upon the degree of the "person's confidence in performing a particular behavior and in overcoming barriers to that behavior" (Glanz, Rimer, & Lewis, 2002, p. 169). These barriers include insufficient knowledge about healthy ways of life, lack of money for healthy food and sports participation, lack of skills for cooking a low-fat meal, taste preferences in eating fast food, or other problems. Learning techniques, which include observation and active participation, improve self-efficacy about performing a targeted behavior (Glanz et al., 2002). This approach has been used in the BASICS project by providing school children the possibility to taste different kinds of fruits and vegetables, teaching them to prepare the snacks from healthy food products, and providing them information about a healthy lifestyle. Social support is very helpful for goal performance. This is related to SCT's principle of reciprocal determinism that proposes personal behavior and environmental events influence each other (Contento, 2007). According to this principle, the Pick a better snack™ & Act campaign helps create a social environment to support a healthy lifestyle. Children and

their family members receive information about a healthy lifestyle and influence each other by interactions and exchange of this information.

2. Data and Methods

Participants were third grade children and their parents. The children were from Iowa schools that participated in the BASICS program. BASICS provides nutrition education to over 20,000 children in low-income schools around Iowa by using a combination of federal SNAP-Ed funds and local contributions. BASICS is a school-based program and has access to parents through the school. BASICS lessons and materials are primarily based on the "Pick a better snack™ & Act" campaign. Third grade students and their parents completed evaluation measures in a pre-post matched design in 2009, 2010, and 2011. Parents of third grade students are matched with their children. The surveys were completed by 283 children and 283 matched parents of these children in 2009; by 240 children and 240 matched parents in 2010; and by 334 children and 334 matched parents in 2011.

Data from completed pre and post questionnaires were used to assess changes in awareness about campaign materials, and about healthy lifestyle and changes in health-related behaviors of third grade children and their parents. The surveys include questions about the awareness of "Pick a better snack™ & Act" messages, logos, and materials, and various theoretical constructs or mediating variables related to the program's key behaviors (acceptance of healthy food, children's initiative toward healthy lifestyle, and parents' supportive behaviors).

The questionnaire for children asks respondents to indicate their gender (boy or girl); it includes behavior-related questions designed as three-point Likert-type items, with response options of "Almost Never," "Sometimes," and "Almost Always"; questions about the child's confidence to eat healthy food and be physically active were designed as "Not Sure," "Sure," and "Very Sure"; and questions related to preferences to eat certain fruits and vegetables provided visual response options with pictures of "happy face," "sad face," and a question mark. Children were asked to circle the happy face if they like to eat certain fruits or vegetables, to circle the sad face if they do not like to eat them, or circle the question mark if they do not know what the food is.

The questionnaire for parents includes demographic questions (parents' age and gender; and children's eligibility for free or reduced-price lunch) and five-point Likert-type questions ranging from "never" to "always" about how often they practice supporting behaviors (role modeling, offering, purchasing) and how often their children perform related behaviors (e.g., likes to try new fruits and vegetables, asks for milk at meals, asks me to buy his/her favorite fruit or vegetable).

Exploratory factor analysis and structural equation modeling were used to assess patterns in the survey data. The model "Fruits and Vegetables" was constructed to assess the effect of educational programs on health-related behaviors of school children and their parents. The model demonstrated changes of preferences toward fruits and vegetables after the program's intervention. Data analysis was conducted using SPSS and AMOS software. We present the results of analyses of data from the 2009, 2010, and 2011 surveys, separately for lower-income and higher-income families within the limits of federal requirements for participation in the program.

3. Results

According to Forsythe, McGaghie, and Friedman (1986), "Convergent validity is suggested by large loadings on the respective attribute factors. Discriminant validity is indicated by (a) small method-factor loadings, (b) small correlations among attribute factors, and (c) small attribute-method correlations" (p. 318). Consequently, we can suppose that the large correlation among the attribute factors is the evidence of Convergent validity and that the small correlation among the attribute factors is the evidence of Discriminant validity.

In the current study traits (attributes) are: Knowledge (Kn), Self-Efficacy (SE), and Food Preferences (Food Pref). Methods are: assessment of the same traits at Time1 and Time 2; assessment of the same traits by children and by parents separately. This can be conducted through application of the multitrait-multimethod matrix (MTMM) (Campbell & Fiske, 1959). "Analysis of MTMM matrices can be regarded as a special case of confirmatory factor analysis with a priori hypothetical factors corresponding to the attributes and methods under investigation" (Forsythe, p. 321). That means that MTMM matrix can be used as guideline for the subsequent Confirmatory Factor Analysis (CFA) (Brown, 2006; DiStefano & Hess, 2005; Harrington, 2009). **"**Confirmatory factor analysis of the MTMM matrix does the following: (a) estimates the factor loadings for each variable on each hypothesized attribute and method factor, (b) estimates the unique variance for each variable, (c) estimates the correlations among the latent variables, and (d) tests the overall goodness-of-fit of the model to the data" (Forsythe, p. 321).

3.1 Food Preferences toward Fruits and Vegetables, Higher Income, 2009

The model fits the data well. The chi-squared test is not significant ($p = 0.391$), $\chi^2 = 34.6$. NFI = 0.877; TLI = 0.981; CFI = 0.992; RMSEA = 0.024. These results indicate a good fit. Table 1 presents the estimates of pseudo R^2. However, this model has correlations > 1 between Parents Time 1 and Parents Time 2 and between SE and Food Pref.

Table 1: Pseudo R^2 Results for Higher Income, 2009

	Estimate
Parent Food Pref T2	.249
Parent Food Pref T1	.358
Child Food Pref T2	.722
Child Food Pref T1	.748
Parent SE T2	.017
Parent SE T1	.110
Parent Kn T2	.069
Parent Kn T1	.222
Child SE T2	.264
Child SE T1	.419
Child Kn T2	.685
Child Kn T1	.327

Table 2 shows that the following factor loadings are large and significant: Children's Knowledge T2 on the attribute factor Knowledge; Children's Food Preferences T2, Parent's Food Preferences T1 and Parent's Food Preferences T2 on the attribute factor Food Preferences; Children's Self-Efficacy T1 and Children's Food Preferences T1 on

the method factor Children's T1; Children's Self-Efficacy T2 and Children's Food Preferences T2 on the method factor Children's T2. These factor loadings confirm convergent validity. The nonsignificant factor loadings of Parent's Knowledge T1 and Parent's Knowledge T2 on the attribute factor Knowledge can be considered as evidence of discriminant validity, because the factor loading of Children's Knowledge on this attribute factor was significant. The CFA shows that the correlation between the assessment that was done by children at Time 1 and Time 2 was high (0.953). This result confirms convergent validity. The correlation between the attribute factors Knowledge and Self-Efficacy was 0.380. The correlation between the attribute factors Knowledge and Food-Preferences was negative (-0.424), but it was not large.

The following factor loadings do not confirm convergent validity because they are statistically not significant: Parent's Knowledge T1 and Parent's Knowledge T2 on the attribute factor Knowledge; Children's Self-Efficacy T2, Parents Self-Efficacy T1 and Parents Self-Efficacy T2 on the attribute factor Self-Efficacy; Parents Self-Efficacy T1 and Parents Food Preferences T1 on the method factor Parents T1; Parents Self-Efficacy T2 and Parents Food Preferences T2 on the method factor Parents T2.

On the basis of these results it is possible to conclude that the assessment of Knowledge, Self-Efficacy, and Food Preferences in 2009 is more valid when it was done by children than by parents. These results coincide with the results of the MTMM showing that the validity coefficients are always significant for children but not significant for parents' self-efficacy. Some of the correlations between the knowledge, self-efficacy, and food preferences were significant for children. However, no one of these correlations was significant for parents in the in the MTMM.

Table 2: Regression Weights for Higher Income, 2009

			Estimate	S.E.	C.R.	P
Child Kn T1	<---	Kn	1.000			
Child Kn T2	<---	Kn	1.657	.777	2.134	.033
Child SE T1	<---	SE	1.000			
Child SE T2	<---	SE	2.252	1.756	1.282	.200
Parent Kn T1	<---	Kn	1.040	.678	1.534	.125
Parent Kn T2	<---	Kn	.198	.397	.498	.618
Parent SE T1	<---	SE	1.096	.951	1.152	.249
Parent SE T2	<---	SE	.709	1.692	.419	.675
Child Food PrefT1	<---	Food Pref	1.000			
Child Food PrefT2	<---	Food Pref	1.131	.199	5.678	***
Parent Food Pref T1	<---	Food Pref	.619	.190	3.261	.001
Parent Food Pref T2	<---	Food Pref	.521	.177	2.953	.003
Child Kn T1	<---	ChT1	1.000			
Child SE T1	<---	ChT1	2.305	.758	3.040	.002
Child Food PrefT1	<---	ChT1	9.061	3.382	2.679	.007
Child SE T2	<---	ChT2	.720	.358	2.011	.044
Child Food PrefT2	<---	ChT2	6.390	2.258	2.830	.005
Child Kn T2	<---	ChT2	1.000			
Parent Kn T1	<---	PT1	1.000			
Parent SE T1	<---	PT1	.431	.543	.794	.427

			Estimate	S.E.	C.R.	P
Parent Food Pref T1	<---	PT1	-3.853	8.929	-.431	.666
Parent KnT2	<---	PT2	1.000			
Parent SE T2	<---	PT2	1.423	1.857	.766	.443
Parent Food Pref T2	<---	PT2	1.349	2.097	.643	.520

3.2 Food Preferences toward Fruits and Vegetables, Lower Income, 2009

The model fits the data well. The chi-squared test is not significant (p = 0.324), χ^2 = 34.022. NFI = 0.858; TLI = 0.953; CFI = 0.981; RMSEA = 0.027. Table 3 presents the estimates of pseudo R^2. This result has a negative variance Parents Time 1= - 0.004, but this value is very close to 0 and it is not significant: t= - 0.300, p= 0.764).

Table 3: Pseudo R^2 Results for Lower Income, 2009

	Estimate
Parent Food Pref T2	.948
Parent Food Pref T1	.130
Child Food Pref T2	.440
Child Food Pref T1	.304
Parent SE T2	.925
Parent SE T1	.081
Parent Kn T2	.064
Parent Kn T1	.081
Child SE T2	.483
Child SE T1	.338
Child Kn T2	.178
Child Kn T1	.193

Table 4 shows that the following factor loadings are large and significant: Children's Knowledge T2 on the attribute factor Knowledge and Children's Food Preferences T2, on the attribute factor Food Preferences. These factor loadings confirm convergent validity. The nonsignificant factor loadings of Parent's Knowledge T1 and Parent's Knowledge T2 on the attribute factor Knowledge can be considered as evidence of discriminant validity because the factor loading of Children's Knowledge on this attribute factor was significant.

The correlation between the attribute factors Knowledge and Self-Efficacy was high (0.819). This is evidence of convergent validity. The correlation between Self-Efficacy and Food Preferences of 0.498 can be considered as evidence of convergent validity. The low and negative correlation between Knowledge and Food Preferences (-0.104) did not confirm convergent validity. However, it is low and can be considered as not an indication of a negative relationship between Knowledge and Food Preferences. The correlation between the method factors Children T1 and Children T2 (-0.719) can be considered as evidence of discriminant validity, which indicates that a difference exists between the assessments that were done by children at Time 1 and Time 2.

Table 4: Regression Weights for Lower Income, 2009

			Estimate	S.E.	C.R.	P
Child Kn T1	<---	Kn	1.000			
Child Kn T2	<---	Kn	.842	.298	2.826	.005
Child SE T1	<---	SE	1.000			
Child SE T2	<---	SE	1.066	0.992	1.074	.283
Parent Kn T1	<---	Kn	.549	.361	1.521	.128
Parent Kn T2	<---	Kn	.244	.296	.824	.410
Parent SE T1	<---	SE	3.043	2.893	1.052	.293
Parent SE T2	<---	SE	11.095	10.402	1.067	.286
Child Food Pref T1	<---	Food Pref	1.000			
Child Food Pref T2	<---	Food Pref	.962	.259	3.719	***
Parent Food Pref T1	<---	Food Pref	.761	.687	1.106	.269
Parent Food Pref T2	<---	Food Pref	2.051	1.292	1.588	.112
Child Kn T1	<---	ChT1	1.000			
Child SE T1	<---	ChT1	-33.364	191.396	-.174	.862
Child Food Pref T1	<---	ChT1	-160.870	987.917	-.175	.861
Child SE T2	<---	ChT2	5.214	3.254	1.602	.109
Child Food Pref T2	<---	ChT2	23.125	14.794	1.563	.118
Child Kn T2	<---	ChT2	1.000			
Parent KnT1	<---	PT1	1.000			
Parent SE T1	<---	PT1	6.404	11.287	.567	.570
Parent Food Pref T1	<---	PT1	5.167	11.418	.453	.651
Parent Kn T2	<---	PT2	1.000			
Parent SE T2	<---	PT2	10.556	9.600	1.100	.271
Paren Food Pref T2	<---	PT2	1.344	3.629	.370	.711

3.3 Food Preferences toward Fruits and Vegetables, Higher income, 2010

The model fits the data well. The chi-squared test is not significant (p = 0.423), χ^2 = 33.930. NFI = 0.845; TLI = 0.984; CFI = 0.993; RMSEA = 0.023. Table 5 presents the estimates of pseudo R^2. Two nonsignificant paths were removed from the model: the factor loading of Parents' Knowledge T2 on the attribute Factor Knowledge and the factor loading of Parents' Food Preferences on the attribute factor Food Preferences.

Table 5: Pseudo R^2 Results for Higher Income, 2010

	Estimate
Parent Food Pref T2	.015
Parent Food Pref T1	.008
Child Food Pref T2	.390
Child Food Pref T1	.380
Parent SE T2	.161
Parent SE T1	.464
Parent Kn T2	.151
Parent Kn T1	.176
Child SE T2	.516
Child SE T1	.783

	Estimate
Child Kn T2	.329
Child Kn T1	.731

Table 6 shows that the following factor loadings are large and significant: Children's Knowledge T2 on the attribute factor Knowledge, and Children's Food Preferences T2 on the attribute factor Food Preferences. These factor loadings confirm convergent validity.

The nonsignificant factor loading of Parents' Knowledge T1 on the attribute factor Knowledge can be considered as evidence of discriminant validity, because the factor loading of Children's Knowledge on this attribute factor was significant. The nonsignificant factor loading of Parents' Food Preferences T1 on the attribute factor Knowledge can also be considered as evidence of discriminant validity, because the factor loading of Children's Food Preferences on this attribute factor was significant.

The high correlation between the attribute factors Knowledge and Self-Efficacy was (0.880) is evidence of convergent validity. The correlation between Knowledge and Food Preferences was 0.350 can be considered as evidence of convergent validity. The negative correlation between the method factors Children T2 and Parents T1 was (-0.288) indicates discriminant validity.

Table 6: Regression Weights for Higher Income, 2010

			Estimate	S.E.	C.R.	P
Child Kn T1	<---	Kn	1.000			
Child Kn T2	<---	Kn	.529	.200	2.646	.008
Child SE T1	<---	SE	1.000			
Child SE T2	<---	SE	1.722	1.434	1.201	.230
Parent Kn T1	<---	Kn	-.021	.162	-.131	.896
Parent SE T1	<---	SE	1.869	1.575	1.187	.235
Parent SE T2	<---	SE	2.109	1.927	1.094	.274
Child Food Pref T1	<---	Food Pref	1.000			
Child Food Pref T2	<---	Food Pref	.549	.211	2.604	.009
Parent Food Pref T1	<---	Food Pref	.058	.150	.386	.699
Child Kn T1	<---	ChT1	1.000			
Child SE T1	<---	ChT1	-4.169	19.274	-.216	.829
Child Food Pref T1	<---	ChT1	-1.555	3.395	-.458	.647
Child SE T2	<---	ChT2	-33.684	164.231	-.205	.837
Child Food Pref T2	<---	ChT2	-128.631	635.102	-.203	.839
Child Kn T2	<---	ChT2	1.000			
Parent Kn T1	<---	PT1	1.000			
Parent SE T1	<---	PT1	1.323	.938	1.410	.158
Parent Food Pref T1	<---	PT1	.833	1.643	.507	.612
Parent Kn T2	<---	PT2	1.000			
Parent SE T2	<---	PT2	-1.889	1.381	-1.368	.171
Parent Food Pref T2	<---	PT2	1.479	1.513	.977	.328

3.4 Food Preferences toward Fruits and Vegetables, Lower Income, 2010

The model fits the data reasonably well. The chi-squared test is borderline ($p = 0.046$), $\chi^2 = 44.154$. NFI = 0.852; TLI = 0.833; CFI = 0.936; RMSEA = 0.056. These results indicate a moderate fit. Table 7 presents the estimates of pseudo R^2. Although this model has two negative variances, these values are not significant.

Table 7: Pseudo R^2 Results for Lower Income, 2010

	Estimate
Parent Food Pref T2	.061
Parent Food Pref T1	.162
Child Food Pref T2	.537
Child Food Pref T1	.637
Parent SE T2	.575
Parent SE T1	.186
Parent Kn T2	.013
Parent Kn T1	.012
Child SE T2	.561
Child SE T1	.217
Child Kn T2	.469
Child Kn T1	.468

Table 8 shows that the following factor loadings are large and significant: Children's Knowledge T2 on the attribute factor Knowledge; Children's Self-Efficacy T2 and Parent's Self-Efficacy T1 on the attribute factor Self-Efficacy; Children's Food Preferences T2 on the attribute factor Food Preferences; Children's Self-Efficacy T1 and Children's Food Preferences T1 on the method factor Children's T1; Children's Self-Efficacy T2 and Children's Food Preferences T2 on the method factor Children's T2. These factor loadings confirm convergent validity. The following factor loadings do not confirm convergent validity because they are statistically not significant: Parent's Knowledge T1 and Parent's Knowledge T2 on the attribute factor Knowledge; Parents Self-Efficacy T2 on the attribute factor Self-Efficacy; Parents Self-Efficacy T1 and Parents Food Preferences T1 on the method factor Parents T1; Parents Self-Efficacy T2 and Parents Food Preferences T2 on the method factor Parents T2.

The nonsignificant factor loadings of Parents Food Preferences T1 and Parents Food Preferences T2 on the attribute factor Food Preferences can be considered as evidence of discriminant validity, because the factor loading of Children's Food Preferences T2 on this attribute factor was significant. On the basis of these results it is possible to conclude that the assessment of Knowledge, Self-Efficacy, and Food Preferences is more valid when it was done by children than by parents.

The CFA shows that the correlation between the assessment that was done by children at Time 1 and Time 2 was high (0.793). This correlation confirms convergent validity. The negative correlation between the assessment that was done by parents at Time 1 and Time 2 (-0.771) can be considered as evidence of discriminant validity, which indicates that differences exist between the assessments done by parents at Time 1 and at Time 2.

Table 8: Regression Weights for Lower Income, 2010

			Estimate	S.E.	C.R.	P
Child Kn T1	<---	Kn	1.000			
Child Kn T2	<---	Kn	.558	.188	2.973	.003
Child SE T1	<---	SE	1.000			
Child SE T2	<---	SE	1.470	.455	3.232	.001
Parent Kn T1	<---	Kn	.109	.111	.977	.329
Parent Kn T2	<---	Kn	.263	.139	1.887	.059
Parent SE T1	<---	SE	-.606	.272	-2.228	.026
Parent SE T2	<---	SE	-.362	.521	-.695	.487
Child Food Pref T1	<---	Food Pref	1.000			
Child Food Pref T2	<---	Food Pref	.993	.394	2.522	.012
Parent Food Pref T1	<---	Food Pref	.021	.134	.154	.878
Parent Food Pref T2	<---	Food Pref	.082	.127	.648	.517
Child Kn T1	<---	ChT1	1.000			
Child SE T1	<---	ChT1	.885	.345	2.567	.010
Child Food Pref T1	<---	ChT1	5.378	1.853	2.903	.004
Child SE T2	<---	ChT2	1.935	.532	3.637	***
Child Food Pref T2	<---	ChT2	5.891	1.714	3.438	***
Child Kn T2	<---	ChT2	1.000			
Parent Kn T1	<---	PT1	1.000			
Parent SE T1	<---	PT1	-4.340	6.943	-.625	.532
Parent Food Pref T1	<---	PT1	-17.148	27.894	-.615	.539
Parent Kn T2	<---	PT2	1.000			
Parent SE T2	<---	PT2	13.172	18.667	.706	.480
Parent Food Pref T2	<---	PT2	7.604	11.379	.668	.504

3.5 Food Preferences toward Fruits and Vegetables, Higher income, 2011

The model fits the data well. The chi-squared test is not significant (p = 0.322), χ^2 = 33.001. NFI = 0.877; TLI = 0.959; CFI = 0.984; RMSEA = 0.031. Table 9 presents the estimates of pseudo R^2. Although this model has a negative variance, this value is close to 0 and not significant. The model also has a correlation that is >1.

Table 9: Pseudo R^2 Results for Higher Income, 2011

	Estimate
Parent Food Pref T2	.503
Parent Food Pref T1	.968
Child Food Pref T2	.901
Child Food Pref T1	.480
Parent SE T2	.210
Parent SE T1	.006
Parent Kn T2	.007
Parent Kn T1	.012
Child SE T2	.312
Child SE T1	.738
Child Kn T2	.261

	Estimate
Child Kn T1	.035

Table 10 shows that the following factor loadings are large and significant: Children's Self-Efficacy T2 and Parent's Self-Efficacy T2 on the attribute factor Self-Efficacy; Children's Food Preferences T2 on the attribute factor Food Preferences. These factor loadings confirm convergent validity.

The nonsignificant factor loadings of Parents Food Preferences T1 and Parents Food Preferences T2 on the attribute factor Food Preferences can be considered as evidence of discriminant validity, because the factor loading of Children's Food Preferences T2 on this attribute factor was significant.

The high correlations shown in the CFA between the attribute factors Self-Efficacy and Food Preferences (0.992), between the assessment that was done by children at Time 1 and Time 2 (0.684), between the assessment that was done by parents at Time 1 and Time 2 (0.969) confirm convergent validity. The low and negative correlation between the assessments that were done by children at Time 2 and parents at Time1 was (-0.099) confirms discriminant validity, because the assessments were done by different methods (different people at different times).

Table 10: Regression Weights for Higher Income, 2011

			Estimate	S.E.	C.R.	P
Child Kn T1	<---	Kn	1.000			
Child Kn T2	<---	Kn	-2.050	3.289	-.623	.533
Child SE T1	<---	SE	1.000			
Child SE T2	<---	SE	.538	.205	2.628	.009
Parent Kn T1	<---	Kn	-.448	.712	-.630	.529
Parent Kn T2	<---	Kn	-.068	.330	-.205	.838
Parent SE T1	<---	SE	.034	.085	.402	.688
Parent SE T2	<---	SE	.804	.335	2.397	.017
Child Food Pref T1	<---	Food Pref	1.000			
Child Food Pref T2	<---	Food Pref	.662	.237	2.794	.005
Parent Food Pref T1	<---	Food Pref	.412	.235	1.752	.080
Parent Food Pref T2	<---	Food Pref	.346	.213	1.628	.104
Child Kn T1	<---	ChT1	1.000			
Child SE T1	<---	ChT1	.106	.895	.118	.906
Child Food Pref T1	<---	ChT1	10.214	12.603	.810	.418
Child SE T2	<---	ChT2	.467	.538	.869	.385
Child Food Pref T2	<---	ChT2	6.398	3.853	1.661	.097
Child Kn T2	<---	ChT2	1.000			
Parent Kn T1	<---	PT1	1.000			
Parent SE T1	<---	PT1	.450	1.065	.422	.673
Parent Food Pref T1	<---	PT1	27.710	22.166	1.250	.211
Parent Kn T2	<---	PT2	1.000			
Parent SE T2	<---	PT2	6.037	8.990	.672	.502
Parent Food Pref T2	<---	PT2	45.325	58.909	.769	.442

3.6 Food Preferences toward Fruits and Vegetables, Lower Income, 2011

The model fits the data well. The chi-squared test is not significant (p = 0.295), χ^2 = 35.795. NFI = 0.905; TLI = 0.969; CFI = 0.987; RMSEA = 0.026. Table 8 presents the estimates of pseudo R^2.

Table 11: Pseudo R^2 Results for Lower Income, 2011

	Estimate
Parent Food Pref T2	.276
Parent Food Pref T1	.111
Child Food Pref T2	.839
Child Food Pref T1	.617
Parent SE T2	.799
Parent SE T1	.268
Parent Kn T2	.898
Parent Kn T1	.110
Child SE T2	.406
Child SE T1	.543
Child Kn T2	.085
Child Kn T1	.020

Table 12 shows that the following factor loadings are large and significant: Children's Food Preferences T2 and Parent's Food Preferences T2 on the attribute factor Food Preferences; Children's Self-Efficacy T2 and Children's Food Preferences T2 on the method factor Children's Time2. These factor loadings confirm convergent validity.

The CFA shows that the high correlation between the methods factors Children's Time 1 and Children's Time 2 (0.912) confirms convergent validity. The moderate correlation between the attribute factors Knowledge and Self-Efficacy (0.233) confirms convergent validity. The low correlation between the assessments that were done by children at Time 2 and parents at Time1 (0.168) confirms discriminant validity.

Table 12: Regression Weights for Lower Income, 2011

			Estimate	S.E.	C.R.	P
Child Kn T1	<---	Kn	1.000			
Child Kn T2	<---	Kn	-1.504	3.356	-.448	.654
Child SE T1	<---	SE	1.000			
Child SE T2	<---	SE	17.189	115.729	.149	.882
Parent Kn T1	<---	Kn	2.206	14.600	.151	.880
Parent Kn T2	<---	Kn	16.137	92.640	.174	.862
Parent SE T1	<---	SE	19.959	136.814	.146	.884
Parent SE T2	<---	SE	43.174	295.367	.146	.884
Child Food Pref T1	<---	FruitsPr	1.000			
Child Food Pref T2	<---	FruitsPr	1.106	.548	2.017	.044
Parent Food Pref T1	<---	FruitsPr	.133	.130	1.025	.306
Parent Food Pref T2	<---	FruitsPr	.251	.119	2.102	.036
Child Kn T1	<---	ChT1	1.000			

			Estimate	S.E.	C.R.	P
Child SE T1	<---	ChT1	7.817	5.615	1.392	.164
Child Food Pref T1	<---	ChT1	25.066	17.616	1.423	.155
Child SE T2	<---	ChT2	3.431	1.306	2.627	.009
Child Food Pref T2	<---	ChT2	12.303	4.737	2.597	.009
Child Kn T2	<---	ChT2	1.000			
Parent Kn T1	<---	PT1	1.000			
Parent SE T1	<---	PT1	.096	.586	.165	.869
Parent Food Pref T1	<---	PT1	5.164	10.172	.508	.612
Parent Kn T2	<---	PT2	1.000			
Parent SE T2	<---	PT2	-11.943	8.295	-1.440	.150
Parent Food Pref T2	<---	PT2	-12.838	9.729	-1.320	.187

4. Summary

The Lower Income group shows more evidence that supports construct validity than does the Higher Income group. The results of the MTMM and CFA show that the assessments of Knowledge, Self-Efficacy, and Food Preference were more valid when they were done by children than by parents. The assessments that were done at Time 2 showed more evidence of convergent validity than the assessments that were done at Time 1.

The CFA for the Higher Income group in 2009 showed a moderate correlation between Knowledge and Self-Efficacy (0.380) and a strong correlation between the method factors Children's T1 and Children's T2 (0.953). The CFA for the Lower Income group in 2009 showed a strong correlation between Knowledge and Self-Efficacy (0.819); a moderate correlation between Self-Efficacy and Food Preferences (0.498); and a low and negative correlation between Knowledge and Food Preferences (-0.104). The strong and negative correlation between the method factors Children T1 and Children T2 (-0.719) is evidence of discriminant validity, indicating that a difference exists between the assessments that were done by children at Time 1 and at Time 2.

The CFA for the Higher Income group in 2010 showed a strong correlation between Knowledge and Self-Efficacy (0.880), a moderate correlation between Knowledge and Food Preferences (0.350), and a negative correlation between the method factors Children's T2 and Parents' T1 (-0.288). The negative correlation is evidence of discriminant validity. The CFA for the Lower Income group in 2010 showed a strong correlation between the method factors Children's T1 and Children's T2 (0.793) and a negative correlation between the method factors Parents' T1 and Parents' T2 (-0.771). The negative correlation is evidence of discriminant validity, which indicates that a difference exists between the assessments that were done by parents at Time 1 and at Time 2.

The CFA for the Higher Income group in 2011 showed a strong correlation between Self-Efficacy and Food Preferences (0.992); a moderate correlation between the method factors Children's T1 and Children's T2 (0.684); and a strong correlation between the method factors Parents' T1 and Parents' T2 (0.969). The CFA for the Lower Income group in 2011 showed moderate correlation between the Knowledge and Self-Efficacy (0.233); and strong correlation between the method factors Children's T1 and Children's T2 (0.912).

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