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Self-efficacy and Norm Measures for Lunch Fruit and Vegetable Consumption are Reliable and Valid Among Fifth Grade Students

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Abstract

Objective—To determine the reliability and validity of a questionnaire measuring fruit and vegetable (FV) self-efficacy and social norms during school lunch among 5th graders.

Design—In this cross-sectional study, students completed lunch food records and a psychosocial questionnaire measuring school lunch FV self-efficacy and social norms regarding consumption during the fall and spring semesters. Test-retest reliability was assessed between fall and spring semesters. The measurement model was cross-validated in the spring data.

Setting—One middle school in Houston, Texas.

Participants—275 fifth graders in the 1998 fall semester and 262 of these fifth graders in the 1999 spring semester.

Main Outcome Measures—FV consumption and psychosocial variables.

Analyses—Principal components analyses, confirmatory factor analyses and bivariate correlations.

Results—Three scales were identified: Fruit Self-Efficacy, Vegetable Self-Efficacy, and FV Social Norms. FV self-efficacy were positively correlated with low-fat vegetable and fruit consumption. Social norms were positively correlated with total vegetable, low-fat vegetable, fruit and total FV consumption.

Conclusions and Implications—Self-efficacy and norms for eating FV at school lunch are related to lunch FV consumption. Increasing self-efficacy and social norms about consuming FV at school appears to be important targets to improve FV consumption.

Keywords

fruit; vegetable; school lunch; reliability; validity

INTRODUCTION

Fruit and vegetable (FV) consumption decreases the risk for chronic diseases, including heart disease and several cancers^{1–4} and facilitates weight management.⁵ Despite these substantial health advantages, FV consumption among adolescents is less than recommended.^{6–8}

Moreover, nearly 25% of vegetables consumed by adolescents are french fries,⁹ which have high levels of dietary fat.

Nationally, the National School Lunch Program (NSLP) daily provides approximately one-third of calories consumed by all NSLP participants.¹⁰ Although the one serving of fruit and the one vegetable serving usually included in the NSLP meal^{10,11} provide a substantial percentage of the total FV consumed by elementary school students,¹² FV consumption declines with age, even in the school environment.^{13–17} This decline is partly attributable to the NSLP-competing alternatives, such as the snack bar line that becomes available when students enter middle school.^{16–17}

There are multiple influences on adolescents' eating behaviors, and the relationships can be complex.¹⁸ For the development of effective interventions designed to increase their consumption, identifying and understanding factors that influence FV consumption are necessary. Self-efficacy, or the belief in one's ability to engage in a behavior, plays a key role in behavior effort and persistence.¹⁹ Social norms are what is or is not expected as appropriate behavior. Subjective norms are based on one's judgment about whether or not others will approve of his or her behavior.²⁰ Self-efficacy¹⁹ and social norms for eating FV influence consumption.^{21,22} Although several investigations have examined the reliability and validity of questionnaires measuring self-efficacy and social norms for consuming FV in general, none has examined these variables specific to the school lunch setting, which poses substantial peer challenges and alternative food temptations. The present study examines the reliability and validity of a questionnaire that measured self-efficacy and social norms for consuming FV during school lunch among fifth grade students when they were first introduced to alternatives to the NSLP such as the school snack bar.

METHODS

This study was approved by the Institutional Review Board of the University of Texas M. D. Anderson Cancer Center.

Population

In this school district, elementary schools were kindergarten through fourth grade, middle schools were grades 5 and 6, and junior high included grades 7 and 8. The middle school environment included the snack bar, whereas the elementary schools did not. All fifth grade students (n=422) from one middle school in the Houston, TX area were eligible to participate in this study. Investigators obtained written parental consent and youth assent. At least 2 fruits and/or vegetables were offered at each meal. Students participating in the NSLP had to select 3 of 5 meal components (ie, milk, entrée, 2 FV, and bread); consequently, students could select a total of 2 fruits and/or vegetables (ie, offer vs. serve option) as part of their lunch. Students attending this middle school had access to a snack bar/à la carte line and the NSLP meal only. The district included 18% African-American (AA), 24% Mexican-American (MA), 57% Euro-American (EA), and 1% Asian/Other (AO) students. Approximately 24% of the students were eligible for free or reduced-price meals.

Data Collection and Instruments

Students completed 5 consecutive days of lunch food records in the fall and in the spring semesters, for a total of 10 days for the academic year. Students also completed the psychosocial questionnaire on one of the days each semester in which students completed the lunch food records.

The food records were completed in the cafeteria during school lunch or in the classroom after each lunch period. Trained data collectors instructed students on how to complete the food records. On food records, students listed each food item on a separate line and, with the assistance of the data collectors, students indicated the number of servings consumed as defined by the 1996 United States Department of Agriculture (USDA) Food Guide Pyramid and the source of the consumed food (NSLP, snack bar, home, or combination). Data collectors checked the food records for missing data and ensured that all food items were described properly. This method of data collection via food records has been shown to be valid.²³ The food records were coded for fruit, regular vegetables (not fried), and high-fat vegetables (eg, french fries and tater tots), in accordance with the Food Guide Pyramid serving sizes, by trained dietitians who used behavior-coding procedures.²⁴

Psychosocial questionnaire and food records

Participants completed a 27-item questionnaire relating only to school lunch. The overall Flesch/Kincaid readability score was 6.4. This high score may be attributable to sentence structure and polysyllabic words such as “vegetable.” The questionnaire to measure self-efficacy and social norms relating to FV consumption (Table 1) was adapted from existing self-efficacy and social norm measures and questionnaires^{25,26} and qualitative research.²⁷ Three-point and four-point response scales (Table 1) were used to measure self-efficacy and social norms, respectively. Only students who returned signed consent forms, who completed the questionnaire in the classroom immediately following lunch, and who provided 5 days of food records in the fall and spring semesters in the cafeteria during the lunch periods were included in this analysis.

DATA ANALYSES

Data preparation

Analyses were conducted on data from the same students collected in 1998 (n=275) and 1999 (n=262). To minimize the effects of using 3-category and 4-category response scales, questionnaire items were normalized by subtracting the item mean from the participant's item value and dividing the difference by the item standard deviation (ie, [participant's item value – item mean]/SD), and items within scales were averaged. Servings of FV were summed for each day, and the mean number of servings for lunch for each food group was calculated across days of collection for each child. The square root transformation was used to produce a normal distribution of scores for fruit consumption, the only variable exhibiting skewness > 2.0.²⁸ Less than 5% of the data were missing, and no obvious pattern existed among missing data.

Factors for self-efficacy and social norms were first derived by conducting principal components analysis (PCA) with varimax rotation using SPSS 11.0 (SPSS, Inc., Chicago, Ill.) on the psychosocial questionnaire items administered in the fall of 1998. The number of factors retained was determined from scree plots and the interpretability of resulting factors. Only items with a minimum loading of .40 on a factor were retained, with the exception of fruit and vegetable social norms. One of the 27 items did not load on any factor and was excluded from the analyses. Internal consistency reliability was analyzed using Cronbach α (Table 1). Test-retest reliability was assessed using Pearson correlations between the fall and spring scales (Table 1).

Measurement model

To confirm the PCA findings, confirmatory factor analyses (CFA) were conducted using the spring 1999 dataset (AMOS 5.0, SPSS, Inc., Chicago, Ill.).²⁹ The measurement models emerging from CFA determined how well the indicators loaded on the appropriate latent variable. The measurement model was illustrated using a path diagram with arrows leading

from the latent variables (represented in circles) to the measured variables (represented in rectangles).³⁰ Latent variables are similar to factors in factor analysis such that the indicator variables have loadings on their respective latent variables. One of the paths from the latent variable to one of its indicators was constrained by assigning it a value of 1.0.³¹ The fixed path helps in interpreting indicators with different response patterns.³¹ Interpretation of the association between the measured and latent variables was used to determine inclusion of variables in the measurement models. Based on the interpretation of these associations, 2 items were removed from the fruit self-efficacy scale, and 4 were removed from the vegetable scale.

The fit of the measurement models was examined using chi square, comparative fit index (CFI), and root mean squared error of approximation (RMSEA). For a plausible model, chi square should be equal to or less than twice the degrees of freedom and should not be statistically significant.³² Since chi square is often significant with populations >200,³² additional indices are used. The Bentler comparative fit index (CFI) compares the existing model fit with a null model.³³ The CFI should be 0.90 or higher to accept the model, indicating that 90% of the covariation in the data can be reproduced by the given model. Finally, the RMSEA expresses the fit per degree of freedom of the model and thus does not require complete independence of the latent variables. The RMSEA should be < 0.05 to be a good model fit, but 0.08 is considered adequate.³⁴ For clarity, error terms are omitted from the figures.

Construct validity

Using fall 1998 data, bivariate Pearson correlations were performed to measure construct validity between the factors and FV consumption. Unless otherwise noted, all analyses were conducted using SPSS 11.0 (SPSS, Inc., Chicago, Ill.).

RESULTS

The respondents (N=275) were 42% male, 13% AA, 27% MA, 49% EA, and 11% AO (Table 2). The percentages by ethnicity were similar to those in the population, but the percentage of males was lower than in the population. Descriptive statistics were generated for fall 1998 lunch consumption data (bottom of Table 2). Average student consumption of FV and total FV at school lunch was less than one serving per day.

Factor loadings, Cronbach α reliabilities, scale test-retest, and scale means and standard deviations are presented in Table 1. Except for FV social norms, internal consistency reliabilities for the scales were >0.80 (Table 1).

The CFA were performed with AMOS 5.0²⁹ on the 3 scales (ie, Fruit Self-Efficacy, Vegetable Self-Efficacy, and FV Norms). The measurement models evaluated the loadings of the measured indicators on the appropriate latent variable. Confirmatory factor analyses tested a 9-item factor for fruit self-efficacy as predicted from PCA. Estimation of self-efficacy for fruit yielded a $X^2_{df}(15)=18.7$, $P<.24$, CFI = 0.99, and RMSEA = 0.03. The 9-item loadings ranged from 0.55 to 0.82 (Table 1).

Confirmatory factor analyses (CFA) tested a 10-item factor for vegetable self-efficacy as predicted from PCA. Estimation of self-efficacy for vegetables yielded a $X^2_{df}(31)=56.5$, $P<.05$, CFI = 0.98, and RMSEA = 0.06. The 10-item loadings ranged from 0.64 to 0.79 (Table 1).

Likewise, CFA yielded a 7-item FV Norms scale. Estimation of FV norms among fifth graders yielded a $X^2_{df}(12)=25.9$, $P<.05$, CFI = 0.97, RMSEA = 0.07. The loadings ranged from 0.39 to 0.72 (Table 1). The item with factor loading of 0.39 was retained for its interpretability.

Construct validity

The Fruit Self-Efficacy scale was positively correlated with fruit ($P<.01$; $r=0.19$) and low-fat vegetable ($P<.05$; $r=0.12$) consumption. The Vegetable Self-Efficacy scale was positively correlated with low-fat vegetable ($P<.01$; $r=0.18$) and fruit ($P<.05$; $r=0.12$) consumption and negatively correlated to high-fat vegetable consumption ($P<.05$; $r=-0.13$). The FV Social Norms scale was positively correlated to total vegetable ($P<.05$; $r=0.17$), low-fat vegetable ($P<.05$; $r=0.14$), fruit ($P<.01$; $r=0.18$), and total FV ($P<.01$; $r=0.20$) consumption.

DISCUSSION

This study examined the reliability and validity of an instrument measuring self-efficacy and social norms for eating FV at school lunch among fifth grade students who were recently introduced to NSLP alternatives. Confirmatory factor analyses were used to cross-validate that the factors emerging from the 1998 PCA would appropriately load on the respective latent variables using the spring 1999 data. Future research should explore the changes in self-efficacy and norms over time in the adolescent population.

Consistent with previous investigations,^{26,35} test-retest reliabilities were not high, whereas internal consistency reliabilities were high.³⁶ Internal consistency and test-retest reliabilities were lowest for norms and highest for the self-efficacy scales. Typically, time intervals between the first and subsequent testings are a few weeks. With a 7-week separation between administrations, test-retest reliabilities have been shown to decrease.³⁶ Although the 2 administrations of the questionnaire were 8 months apart, test-retest reliability values were higher than expected, suggesting that student self-efficacy was relatively stable, but norms regarding FV consumption during school lunch were not as stable during the school year when students were introduced to NSLP-competing alternatives.

Self-efficacy and social norms for eating FV at school lunch were related to lunch FV consumption. Fruit self-efficacy was significantly related to fruit consumption. Vegetable self-efficacy was positively related to low-fat vegetable consumption, and negatively related to the consumption of high-fat vegetables. With the range of correlation coefficients from 0.13 to 0.22, other studies have documented significant, yet weak relationships between FV self-efficacy and consumption.^{19,36,38} Strategies to increase general FV self-efficacy should be investigated. As noted in Table 1, students reported higher self-efficacy for fruit than for vegetables. This finding is consistent with past research showing that children are more likely to prefer and consume fruit than vegetables.^{36–38}

Consistent with previous research, social norms for FV were related to consumption.^{21,22,39} The perceived social norms for FV at school could possibly influence FV consumption from the NSLP and snack bar. Note, however, that Cullen et al found no significant correlations between norms and FV consumption.⁴⁰ This discrepancy may be partly attributed to our use of a single-grade cohort (vs. grades 4–6), our focus on a single meal (vs. 24-hour intake), varying availability of NSLP alternatives among the grades in Cullen et al,⁴⁰ and our use of a more global assessment of norms (vs. peer modeling, peer normative expectations, and perceived norms).

The low internal consistencies may have been a result of inadequately addressing aspects of fifth grade student perception of their peers' FV consumption or to incomplete development of norms in fifth grade students. Peer responses to one another begin early and increase with age,⁴¹ modifying the extent to which they display certain behaviors,⁴² possibly even eating. Perhaps, if similar questions were asked of eighth grade students, norms might differ from this younger group simply because norms have been more developed. In alcohol research with adolescents, alcohol use and use onset were negatively associated with norms,⁴³ suggesting

that positive norms influence positive behaviors. Because norms were related to FV consumption, future research should investigate whether changing the perception of norms of target populations will promote FV consumption. Methods and strategies to influence norms, as well as questions that assess student perception of peers' FV consumption, should also be investigated with various populations.

Several limitations should be noted. This population may not be representative of the national population of fifth grade students, but it included various ethnic groups common in Houston-area public schools. Data were based on children's self-report and are thereby subject to possible comprehension, memory, and reporting errors. The dietary intake methods employed, however, have been shown to provide adequate reliability and validity compared with observation.²³

Not surprisingly, our large sample size yielded significant correlations. And although the reliability testing and results are exemplary, the correlation coefficients between the instrument and food records were low (<4%) and weak, with a range from -0.13 to 0.20. This is a major limitation that cannot be changed. This weak correlation may partly be attributed to the introduction of NSLP alternatives. We found no research among this age group examining the relationship of these psychosocial factors at school lunch and fruit and vegetable consumption, particularly when students first encounter snack bar lines and other NSLP competitors.

IMPLICATIONS FOR RESEARCH AND PRACTICE

Self-efficacy and social norms for eating FV at school lunch demonstrated acceptable reliability and validity among fifth grade students. Interventions to increase FV consumption should increase school lunch FV self-efficacy. Strategies to alter norms so that they reflect desirable behaviors should be investigated. Future studies should focus on testing these social norm questions in different age groups to determine how social norms develop over time, and how they impact consumption.

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Table 1

Scale Indicators and Factor Loadings for the 3 Factor Solution Using Principal Component and Confirmatory Factor Analyses

Leading Statements for Self-efficacy Scales: <i>Responses: I cannot=0, A little sure I can=1, Very sure I can=2</i>	PCA Factor Loadings (n=275)	CFA Loadings (n=262)	
<hr/>			
* At school, how sure are you that you can...			
† When you eat at the school snack bar, how sure are you that you can ...			
Questions from Fruit Self-efficacy Scale			
* ...bring fruit from home to eat every time you bring your lunch?	0.76	0.78	
† ...buy fruit once or twice a week?	0.75	0.68	
† ...buy fruit at every lunch?	0.75	0.55	
† ...buy fruit even if your friends are not?	0.73	0.68	
* ...bring a fruit from home to eat when you bring your lunch, even if your friends are not?	0.71	0.82	
* ...bring fruit from home to eat once or twice a week?	0.70	0.73	
* ...eat a serving of fruit at every lunch?	0.69	0.65	
* ...eat a serving of fruit once or twice a week?	0.61	0.65	
* ...eat a serving of fruit even if your friends do not?	0.60	0.63	
Questions from Vegetable Self-efficacy Scale			
* ...eat a serving of raw vegetables like raw carrot sticks once or twice a week?	0.81	0.72	
* ...eat a serving of raw vegetables like carrot sticks even if your friends are not eating raw vegetables?	0.77	0.74	
* ...bring a serving of vegetable from home to eat when you bring your lunch even if your friends are not?	0.75	0.79	
How sure are you that you can ask your mom to put a serving of vegetables like carrot sticks in the lunch she prepares for you?	0.75	0.74	
How sure are you that you can finish eating a serving of vegetable, even if your friend says something bad about vegetables?	0.70	0.77	
† ...buy a vegetable even if your friends are not?	0.67	0.71	
* ...eat a serving of cooked vegetable even if your friends are not eating a vegetable?	0.65	0.64	
* ...bring a serving of vegetable from home to eat every time you bring your lunch?	0.61	0.67	
† ...buy a vegetable once or twice a week?	0.58	0.67	
* ...eat a serving of cooked vegetable once or twice a week?	0.51	0.65	
Questions from FV Social Norms Scale			
‡ Most kids eat a serving of cooked vegetables at school lunch.	0.74	0.55	
‡ My friends eat a serving of cooked vegetables at school lunch when I am with them.	0.73	0.72	
§ How much do your friends encourage you to eat a serving of cooked vegetables at school lunch?	0.53	0.39	
‡ Most kids eat a serving of fruit at school lunch.	0.52	0.59	
‡ My friends eat a serving of fruit at school lunch when I am with them.	0.50	0.66	
§ How much do your friends encourage you to eat a serving of fruit at school lunch?	0.49	0.40	
‡ Most kids eat a serving of raw vegetables like carrot sticks at school lunch.	0.48	0.64	
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PCA Factor Structure and Scale Means	Fruit Self-efficacy (9 items)	Vegetable Self-efficacy (10 items)	FV Norms (7 items)
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<i>Self-Efficacy Responses: I cannot=0, A little sure I can=1, Very sure I can=2</i>			
<i>Norms Responses: Never=0, Sometimes=1, Often=2, Always=3; They tell me not to=0, Not at all=1, A little=2, A lot=3</i>			
Eigen Value	2.193	9.018	2.034
% Variance Explained	8.433	34.686	7.821
Cronbach α	0.90	0.88	0.67
Pearson Test-Retest	0.72	0.77	0.54
Scale Means (Standard Deviations)	1.36 (0.52)	1.04 (0.57)	1.07 (0.38)

Responses for FV Social Norms scale:

* Leading statements marked with an asterisk correspond to Questions marked with an asterisk.

[†]Leading statements marked with a dagger correspond to Questions marked with a dagger.

[‡]Never=0, Sometimes=1, Often=2, Always=3;

[§]They tell me not to=0, Not at all=1, A little=2, A lot=3

Table 2

Respondent Demographics and Fall 1998 Means (Standard Deviations) for Lunch Consumption

Respondent Gender and Ethnicity		n=275 (%)
Male		42
Euro-American		49
Mexican-American		27
African-American		13
Asian/Other		11
Consumption at Lunch		Mean (SD)/day
Total vegetables (servings)		0.47 (0.34)
Low-fat vegetables (servings)		0.22 (0.25)
High-fat vegetables (servings)		0.25 (0.23)
Fruit (servings)		0.11 (0.17)
Total FV including high-fat (servings)		0.59 (0.41)