Research Article

Psychosocial Measures Used to Assess the Effectiveness of School-based Nutrition Education Programs: Review and Analysis of Self-report Instruments for Children 8 to 12 Years Old

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ABSTRACT

Objective: To identify the psychometric properties of evaluation instruments that measure mediators of dietary behaviors in school-aged children.

Design: Systematic search of scientific databases limited to 1999–2010.

Main Outcome Measures: Psychometric properties related to development and testing of self-report instruments for children 8–12 years old.

Analysis: Systematic search of 189 articles and review of 15 instruments (20 associated articles) meeting the inclusion criteria. Search terms used included children, school, nutrition, diet, nutrition education, and evaluation.

Results: Fourteen studies used a theoretical framework to guide the instrument's development. Knowledge and self-efficacy were the most commonly used psychosocial measures. Twelve instruments focused on specific nutrition-related behaviors. Eight instruments included over 40 items and used age-appropriate response formats. Acceptable reliability properties were most commonly reported for attitude and self-efficacy measures. Although most of the instruments were reviewed by experts (n = 8) and/or pilot-tested (n = 9), only 7 were tested using both rigorous types of validity and with low-income youth.

Conclusions and Implications: Results from this review suggest that additional research is needed to develop more robust psychosocial measures for dietary behaviors, for low-income youth audiences.

Key Words: nutrition education, evaluation measures, youth, validity, school (*J Nutr Educ Behav*. 2013;45:392-403.)

INTRODUCTION

Childhood obesity is a serious public health issue in the United States (US) that affects a greater proportion of children from lower-socioeconomic families and from minority groups.[1,2] In 2009–2010, the prevalence of obesity among school children aged 6–11 years was 18%.[2] To combat this problem, many federally and non-federally funded school-based nutrition education programs promoting healthy eating and physical activity behaviors have been implemented. Effective school-based nutrition programs have 2 components: They must be behaviorally focused and they must include theory-driven educational strategies.[3,4] Research suggests that in addition to knowledge, youth nutrition intervention programs should target essential mediators of behavior change (psychosocial constructs), such as outcome expectations, behavioral skills, habits, self-efficacy, and environmental and social support.[5-7] Unfortunately, there is little evidence that assesses the extent to which these mediators of behavior are implemented into school-based nutrition education programs; therefore, it is unclear how these programs promote behavioral change.

To produce consistent and correct information about the quality, accountability, and effectiveness of nutrition education, youth nutrition interventions need a comprehensive evaluation component with appropriate (ie, theory-driven, age/culturally appropriate), valid, and reliable measures.[8-10] Despite this need, a review conducted by Contento et al[6] in 2002 on nutrition education intervention studies found that overall, nutrition evaluation measures used and reported in the literature between 1980 and 1999 had significant limitations. The analysis revealed that psychometric properties were not reported and the scope of the measure was often mismatched with the program's

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objectives, duration, and intensity. Sample sizes were often not large enough either to report validity and reliability by ethnicity or other factors.[6]

The purpose of this article is to review psychosocial measures of potential mediators of behavior change used with school-aged children, published between 1999 and 2010. The specific aims were to identify and describe self-report evaluation instruments that assess psychosocial measures related to dietary behaviors in school-aged children, and to assess the psychometric properties of such evaluation instruments. Results from this study will attempt to inform nutrition educators and researchers about quality measures and useful evaluation instruments to be considered for the evaluation of school-based nutrition education programs.

METHODS

Evaluation instruments that aimed to evaluate psychosocial measures of dietary behavioral change for children were systematically reviewed. Searches of electronic databases were limited to 1999–2010 and included Ebsco, PubMed, Scholar Google, and Web of Knowledge. Search terms used were: children, school, nutrition, diet, nutrition education, evaluation, measures, questionnaire, survey, instrument, questionnaire development, survey development, instrument development, psychometric, validity, reliability, psychosocial constructs, and mediators of behavior and theory. The combination of search terms followed the same order: (1) study population terms (ie, children), (2) intervention terms (ie, nutrition), (3) psychometric terms (ie, validity), and (4) theory-based terms (ie, psychosocial constructs). Reference lists of selected studies and relevant published reviews were also searched.

The initial database and references search revealed 9,810 articles. One of the authors scanned titles and abstracts across sources and across electronic databases for relevancy and duplicates. After this initial screening, 2 authors independently reviewed the full papers of relevant articles (n = 189) against the inclusion/exclusion criteria. Instruments were selected for review if they met all of the following inclusion criteria: (1) published in a peer-reviewed journal; (2) designed for outcome evaluation of nutrition education programs; (3) assessed psychosocial measures of dietary behavioral change for children ages 8–12 years old; (4) written in English; (5) paper-and-pencil self-report instruments completed by youth (not parents); and (6) reported psychometric properties. Instruments were excluded if they were used for descriptive studies of correlates of dietary intake, and for the evaluation of overweight and obesity treatments, clinical studies, or physical activity interventions. Evaluation instruments or measures that had multiple publications were counted as 1 study. Using this method (Figure), 15 instruments (20 associated studies) were selected for review.

Descriptive information from each selected instrument was extracted and tabulated. Variables of interest included name of the instrument; name of the school-nutrition program associated with the instrument; details about how the instruments were conceptualized (including type of selected outcome measures, theoretical framework used to design the instrument, and whether it was curriculum-based); details about the instruments' construction (whether the items or instruments were new or adapted, type of topics covered, number of items, response options format, and completion time); information on reliability, validity, and scope of pilot testing (ie, cognitive interviews); and gene-ral characteristics of the participants (ie, sample size, age group, gender, socioeconomic status, race/ethnicity).

For reliability, researchers reviewed only those studies that reported acceptable internal consistency (Cronbach $\alpha > .6$) and test-retest reliability (intra-class correlation [ICC], κ statistics, or Pearson/Spearman correlation [r] $> .6$).[11] For validity, researchers reviewed whether the instrument was tested for content and face validity, which are less rigorous types of validity (designated as type 1 validity in the current review), and/or for construct, convergent, concurrent, and predictive validity, which are more rigorous types of validity (designated as type 2 validity in the current review).[12]

This was a literature review and human subjects were not used; therefore, human subjects approval was not sought.

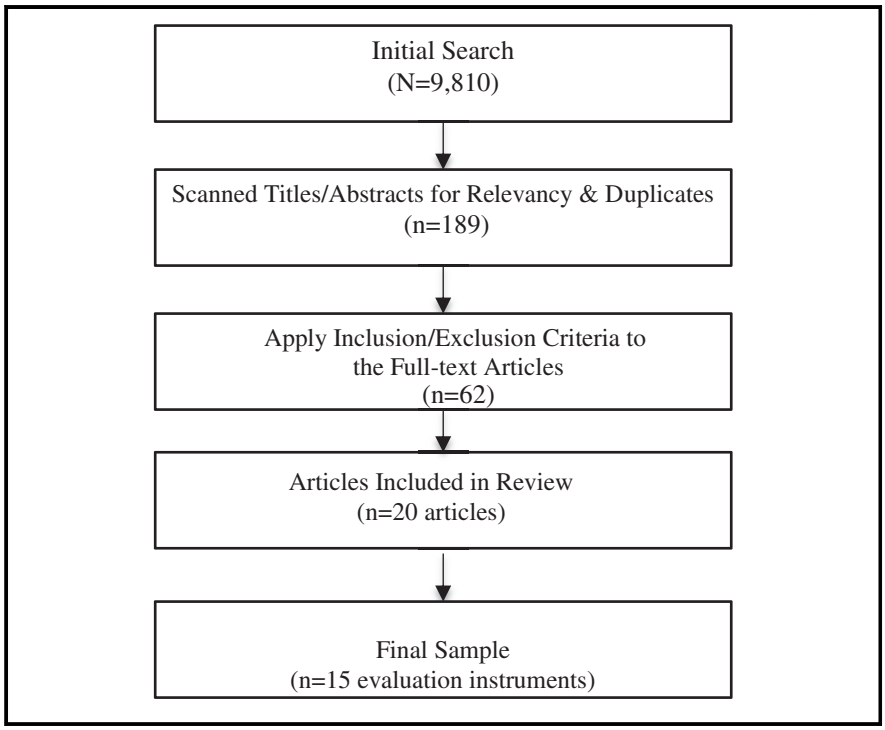

Figure. Flowchart depicting systematic literature for identification of evaluation instruments used in school-based interventions.

RESULTS

More than 20 types of outcome measures of potential psychosocial mediators of dietary behavior change were identified, including individual, social, and environmental (Table 1). Besides nutrition-related concepts, content areas such as physical activity and food safety were also included in some of the reviewed instruments (Table 1). Several approaches were used to develop and test the reviewed evaluation instruments (Table 2).

Methodological Practices to Develop the Identified Instruments/Measures

Only 14 of the 20 studies reported designing evaluation instruments based on explicit theories.[13-27] Social Cognitive Theory (SCT) was the most commonly used theoretical framework (n = 9). The instruments attempted to assess several theoretical components; however, knowledge (n = 12)[13-25,28-31] and self-efficacy (n = 11)[13-23,26,27,31,32] were the most frequently assessed individual-level psychosocial measures. Only 3 instruments reviewed included curriculum-specific content.[13,25,28]

To examine nutrition-related psychosocial measures, most studies either developed new items for their evaluation instruments (n = 6)[17,25,27,28,30,31] or included a combi-nation of new items with items from other questionnaires (n = 5).[18-24,26] In terms of topics covered, the majority of the instruments included psychosocial scales/items that focus on specific nutrition-related behaviors (n = 12) rather than general nutrition. Psychosocial measures related to fruits and vegetables were the common targets of most of the reviewed instruments.[17,21-24,32]

Most of the questionnaires included over 40 items (n = 8) and several types of response options. Overall, multiple choice was the response option most frequently employed (n = 10); 3- and 4-point ordinal scales were also used (n = 10). Among studies that reported the estimated questionnaire completion time (n = 6), the length varied widely: 3 reported between 30 and 60 minutes and 3 reported < 20 minutes (many did not report completion time).

Methodological Practices to Test the Identified Instruments/Measures

In terms of reliability, results indicated that the majority of instruments had several subscales with an adequate level of internal consistency (n = 13) and test-retest reliability (n = 9). In terms of psychosocial constructs, acceptable levels of internal consistency (Cronbach $\alpha > .60$) were most commonly reported for attitude (n = 5)[15-18,30,32] and self-efficacy (n = 7)[15,16,19-24,26,27,32] scales. Similarly, scales testing attitudes[17,18,30,32] (n = 5) and self-efficacy[17,19,20,24,27] (n = 3) most frequently reported acceptable test-retest reliability.

In terms of validity, 8 instruments were tested for type 1 validity (expert reviews) and 7 were tested and/or had established type 2 validity (more rigorous types of validity).[17,18,21-24,26,29,32] In addition, there was little specific information on type 2 validity analysis (Table 2 notes specific associations between measures and topics), in that the authors did not provide the correlation coefficients between subscales.

Most (n = 9) of the reviewed instruments were pilot-tested[16,17,19,20,25,28,29,30-32] and intended with use for third to sixth graders, or 8- to 11-year-olds. Seven instruments were tested with ethnic groups other than non-Hispanic white children,[13-18,24,26,27] and 4 of the instruments were tested with low-income participants.[25,26,31,32] For both of these characteristics, less than half of the instruments were tested with ethnically diverse, low-income samples.

DISCUSSION

This review demonstrated that although a wide variety of self-report, written instruments have been developed for school-based interventions to evaluate psychosocial measures related to dietary intake, few were tested with rigorous psychometric procedures and/or with youth from low-income, ethnically diverse families.

Strengths

A major strength of most of the studies was that the researchers used a theoretical framework to guide the instrument development process. Specifically, SCT[33] was the theoretical framework most commonly reported. Although there is not 1 reference standard behavioral theory upon which nutrition education programs and interventions should be based, a review of nutrition intervention literature has shown that self-efficacy/perceived control, outcome expectations/attitude, habit, and behavioral intention are significant correlates of dietary behavior in children.[4] Social Cognitive Theory incorporates multiple mediators mentioned, including self-efficacy and outcome expectancies, and is therefore a strong framework upon which to build nutrition education programs and evaluations, particularly for children and youth.

A second strength of the reviewed studies was that most of the instruments provided evidence of content validity and/or face validity through expert reviews and pilot studies (ie, cognitive interviews), respectively. However, cognitive interviews are particularly important when developing instruments for low-income, ethnically diverse populations, because they allow researchers to identify language and wording that is not culturally appropriate. Overall, both expert reviews and pilot studies are considered fundamental aspects of the instrument development process, because they help assess the quality of the items and address limitations of the instrument before it is rigorously tested for psychometric properties.[34,35]

The third strength of the majority of the reviewed studies was the use of age-appropriate response formats. For example, some instruments measuring food choice intentions paired food choices with pictures of the food. For the other types of psychosocial measures, most instruments reduced the typical number of Likert scale items from ≥ 5 to 3- or 4-point scales. More response options create a larger burden for children because of cognitive demands, whereas more response options are desirable for adult populations, to increase reliability.[36]

Table 1. Conceptualization and Construction Characteristics of Instruments Used to Evaluate the Effectiveness of Nutrition Education Programs in School-aged Children

	Conceptualization					Construction		
Name of Instrument/ Program	**Selected Outcome Measures**	**Theoretical Framework**	**Curriculum-based**	**New, Adapted, or Both**	**Topics Covered**	**Items, n**	**Response Options**	**Completion Time**
After School Student Questionnaire/CATCH Kids Club[13,14]	Previous dietary intake, sedentary lifestyle and participation in sport activities, dietary knowledge, dietary intentions, self-efficacy for healthy food and for physical activity.	SCT	Yes	Adapted	Behaviorally focused: low-fat and low-sodium foods/physical activity	58	Multiple choice/paired food choices/3-point scale	NR
Knowledge, Attitudes, and Behaviors Questionnaire/ Pathways[15,16]	Physical activity self-efficacy, social support, barriers, self-perception. Dietary knowledge, self-efficacy, social support, intentions, food frequency, weight-related attitudes, cultural identity.	SLT	No	Adapted	Behaviorally focused: low-fat foods and sugared beverages/physical activity/weight/cultural identity	65 core items + 5 knowledge questions	Multiple choice/paired food choices 4-point scale/3-point scale	Two sessions of 30 min
Kids Kartoon/California Expanded Food and Nutrition Education Program—Eating Right Is Basic[28]	Nutrition and food safety knowledge, food selection and preparation skills, and food safety practices.	NR	Yes	New	General nutrition (ie, variety of foods, food selection, food preparation, and safety skills)	16	Multiple choice	NR
Nutrition Knowledge, Attitudes and Practices questionnaire/Healthy Lifestyle in Children[29]	Nutrition knowledge, attitudes, and practices.	NR	NR	Adapted	General nutrition (ie, Food Guide Pyramid,[a] breakfast, fast foods, healthy snacks, high-salt food, high-sugar foods, high-fat foods, calcium, nutrients, grains, V)	44	Multiple choice/3-point scale/4-point scale	30–60 min
Questionnaire/Pro Children Project[17]	Self-rated for F&V intake, knowledge, attitudes, liking, subjective norm, parental encouragement, self-efficacy, intention, habit, preferences, family rules, availability at home, availability away from home, and perceived barriers.	SCT, TTM, TPB	NR	New	Behaviorally focused: F&V	104	3-point scale/4-point scale	NR

(continued)

Table 1. Continued

	Conceptualization					Construction		
Name of Instrument/ Program	**Selected Outcome Measures**	**Theoretical Framework**	**Curriculum-based**	**New, Adapted, or Both**	**Topics Covered**	**Items, n**	**Response Options**	**Completion Time**
Questionnaire/Adequate Calcium Today Study[18]	Calcium attitudes and preferences subscales: convenience, health benefits, preferences, temperature, tolerance, taste and weight; calcium social and environmental subscales: availability and social influence; calcium knowledge.	SCT	NR	Both	Behaviorally focused: calcium-rich foods	55	Multiple choice/5-point scale	< 10 min
Psychosocial Measures for Whole-grain Intake Among Children/NR[19,20]	Whole-grain knowledge, intention, availability, self-efficacy.	SCT	NR	Both	Behaviorally focused: Whole grains	14	Multiple choice/paired food choices/3-point scale	NR
Nutrition Questionnaire for Students in Years 5, 6, 7/ Eat Well Be Active[30]	Dietary patterns related to childhood obesity. Nutrition behaviors, attitudes, environment, and knowledge.	NR	NR	New	Behaviorally focused: Non-core foods, sweetened beverages, F&V, and water	NR	5-point scale/choice of frequencies	20 min
Mediating Variables of a School-based Nutrition Intervention/High 5[21-23]	F&V availability, knowledge, positive outcome expectancies, negative outcome expectancies, self-efficacy, peer norms, family norms, and teacher norms.	SCT	NR	Both	Behaviorally focused: F&V	77	Multiple choice/true–false/ 3-point scale	NR
Fruit and Vegetables Attitudes, Self-efficacy, and Social-Environmental Influences/NR[32]	F&V scales: general attitudes, health and physical ability outcome expectancy, social outcome expectancy, preferences, self-efficacy in difficult situations, self-efficacy to choose F&V, self-efficacy on selecting F&V over other items, peer support, perceived peer support, perceived parental behavior, socialization-	NR	NR	Adapted	Behaviorally focused: F&V	NR	4-point scale/5-point scale/ 7-point scale	NR

	encouragement, permissive eating practices, obligation rules, and availability.							
Questionnaire to Assess Applied Nutrition Knowledge/After School Cookery Club[31]	Knowledge of applied nutrition and food preparation. Perceived confidence in cooking skills.	NR	NR	New	General nutrition (ie, healthful food choices, food preparation, and cooking)	36	Multiple choice/4-point scale	< 15 min
FJV Children's Psychosocial Measures/ Gimme 5 Fruit, Juice, and Vegetables for Fun and Health Program[24]	FJV knowledge, snack preference, positive outcome expectations, asking and shopping self-efficacy, social norms, and asking behaviors.	SCT	NR	Both	Behaviorally focused: F&V	44	Multiple choice/paired food choices/3-point scale/4-point scale/5-point scale/ dichotomous scale	30–60 min
Nutrition Knowledge Questionnaire and Food Preference Survey/ Nutrition to Grow On[25]	Nutrition knowledge and V preferences.	SCT	Yes	New	General nutrition and behaviorally focused (ie, V)	30 and 36	Multiple choice and dichotomous scale 5-point ordinal	NR
Dietary psychosocial scales/Weight Gain Prevention Study[26]	Self-efficacy and outcome expectancies for healthy eating, and beverage preferences.	SCT	NR	Both	General nutrition and behaviorally focused (ie, sweetened and unsweetened beverages)	47	3-point scale	NR
Self-efficacy questionnaires/After-school program for urban Native American youth[27]	Self-efficacy.	SCT	NR	New	General nutrition (ie, sweetened and unsweetened beverages, F&V, low-fat foods)	NR	3-point scale	NR

CATCH indicates Coordinated Approach to Child Health; F&V, fruits and vegetables; FJV, fruits, juices, and vegetables; NR, not reported; SCT, Social Cognitive Theory; SLT, Social Learning Theory; TPB, Theory of Planned Behavior; TTM, Transtheoretical Model; V, vegetables.
[a]Now referred to as MyPlate.

Table 2. Questionnaire Testing, With Information on Subscales With Acceptable Reliability and Validity, Pilot-testing Information, and Participants' Characteristics

	Reliability Assessment		Validity Assessment						
Name of Instrument/ Program	**Cronbach α**	**Test-Retest Reliability**	**Type 1**	**Type 2**	**Pilot Tested**	**Sample Size**	**Country**	**Participant Age or Grade**	**Participant Ethnicity/ Gender/ Socioeconomic Status**
After School Student Questionnaire/CATCH Kids Club[13,14]	NR[a]	NR[b]	NR	NR	NR	NR	US	Third to fifth grades	White, Hispanic, African-American/both/NR
Knowledge, Attitudes, and Behaviors Questionnaire/ Pathways[15,16]	Subscales: Diet self-efficacy, diet intentions, attitudes toward attempts at weight loss	Subscales: Body image attitudes, diet intentions	Yes	NR	Yes	516	US	Third to fifth grades	American Indian/both/NR
Kids Kartoon/California Expanded Food and Nutrition Education Program— Eating Right Is Basic[28]	Instrument as a whole	NR	Yes	NR	Yes	120	US	9- to 11-y-olds	None specified/both/low-income
Nutrition Knowledge, Attitudes and Practices questionnaire/Healthy Lifestyle in Children[29]	Subscale: nutrition knowledge	NR	Yes	Construct validity: factor analysis correlation between scales. Factor analysis yielded 5 factors for knowledge scale; 4 factors for attitudes and practice scales. All scales significantly correlated.	Yes	335	Malaysia	8-y-olds	Malay, Chinese, Indian/ both/NR
Questionnaire to measure personal, social, and environmental correlated with F&V intake/Pro Children Project[17]	Subscales: F&V self-rated intake, F&V attitudes, F&V liking, F&V active parental encouragement, V perceived barriers, V subjective norm, V availability at home, F knowledge	Subscales: F&V self-rated intake, V knowledge, F attitudes, F&V liking, F&V subjective norm, F&V parental encouragement, V self-efficacy, F&V intention, F&V habit, F&V preferences, F&V availability away from home, F&V perceived barriers	NR	Predictive validity: Spearman correlations between F&V subscales, V, F intake. Correlations with intake significant except for "allow family rule" with F intake. Moderate to good ($r = -.16–.54$) for personal determinants, lower predictive validity for social and environmental determinants.	Yes	326	Belgium, Denmark, Norway, Portugal, Spain	10- to 11-y-olds	None specified/both/NR
Measures of Psychosocial Constructs Associated With Adolescents' Calcium Intake/ Adequate Calcium Today Study[18]	Subscales: attitudes and preference factor, social and environmental factor, knowledge factor	Subscales: attitudes and preference factor, social and environmental factor	Yes	Factor structure: cluster analysis. 3 constructs: attitudes and preference factor; social and environmental factor; knowledge.	NR	206	US	11- to 14-y- olds	White, Asian-American, Native Hawaiian, Pacific Islander/girls/ NR

Psychosocial Measures for Whole-grain Intake Among Children/NR[19,20]	Subscale: self-efficacy to choose whole-grain foods	Subscales: availability of whole-grain foods in home, self-efficacy to choose whole-grain foods, whole-grain food	NR	NR	Yes	150	US	Fifth grade	None specified/both/NR
Nutrition Questionnaire for Students in Years 5, 6, 7/Eat Well Be Active[30]	Subscales: V attitude, F attitude	Subscales: healthy behavior, V attitude, sweetened beverages intake, F intake, V intake	NR	NR	Yes	141	Australia	Fifth to seventh grades	Predominately whites/both/NR
Mediating Variables of a School-based Nutrition Intervention/High 5[21-23]	Subscales: availability, positive outcome expectancies, self-efficacy, peer norms, family norms, teacher norms	NR	NR	Construct validity: factor analysis for each potential mediator; 8 factors.	NR	1,676	US	Fourth grade	None specified/both/NR
Fruit and Vegetables Attitudes, Self-efficacy, and Social-Environmental Influences/NR[32]	Subscales: F&V general attitudes, F&V health and physical ability outcome expectancy, F&V preferences, F&V self-efficacy in difficult situations, self-efficacy for selecting F&V over other items, F&V perceived parental behavior, F&V socialization-encouragement, permissive eating practices, F&V obligation rules	Subscales: F&V preferences, F&V general attitudes, selecting F&V over other items, V perceived peer behavior, F parental behavior, F&V availability, F&V obligation rules	NR	Predictive validity: Spearman correlations. Correlations were significant ($r = 0.15$-0.45) for F preferences, F self-efficacy, F perceived peer behavior, F perceived parental behavior, F&V availability, V preferences, V perceived peer behavior, V perceived parental behavior, F&V obligation rules, permissive eating practices.	Yes	207	Belgium	11- to 12-y-olds	None specified/both/NR
Questionnaire to Assess Applied Nutrition Knowledge/After School Cookery Club[31]	Subscale: food preparation knowledge	Assessed, but subscales were not above threshold	Yes	NR	Yes	98	Scotland and England	10- to 13-y-olds	None specified/both/low-income
FJV Children's Psychosocial measures/Gimme 5 Fruit, Juice, and Vegetables for Fun and Health Program[24]	Subscales: F&V knowledge, F&V preference, snack preference, F&V positive outcome expectations, eating F&V self-efficacy for asking and shopping self-efficacy, social norms, asking behaviors	Subscales: outcome expectancies and self-efficacy	NR	Construct validity: principal component analysis for each potential mediator.	NR	1,250	US	Third to fifth grades	African- and Euro-American/both/NR

(continued)

Table 2. Continued

	Reliability Assessment		Validity Assessment						
Name of Instrument/ Program	**Cronbach α**	**Test-Retest Reliability**	**Type 1**	**Type 2**	**Pilot Tested**	**Sample Size**	**Country**	**Participant Age or Grade**	**Participant Ethnicity/ Gender/ Socioeconomic Status**
Nutrition Knowledge Questionnaire and Food Preference Survey/Nutrition to Grow On[25]	NR	Instrument as a whole	Yes	NR	Yes	213	US	9- to 10-y-olds	None specified/both/low-income (25%)
Dietary psychosocial scales/Weight Gain Prevention Study[26]	Subscale: healthy eating self-efficacy and outcome expectancies	NR	NR	Food beverage preferences scale with no clear factor structure. IC: self-efficacy/ outcome expectancies ($r = .26$, $P \leq .01$). Concurrent validity: higher self-efficacy correlated with lower total energy intake ($r = –0.17$, $P \leq .01$) and grams of fat ($r = .16$, $P \leq .01$).	NR	303	US	8- to 10-y-olds	African-Americans/girls/ low-income (24.1%)
Self-efficacy questionnaires/after-school program for urban Native American youth[27]	Subscale: self-efficacy scale	Subscale: self-efficacy scale	Yes	NR	No	53	Minneapolis, US	NR	Native Americans/NR/NR

ASSQ indicates After School Student Questionnaire; CATCH, Coordinated Approach to Child Health; F, fruits; F&V, fruits and vegetables; IC, intercorrelation; ICC, intraclass correlation; NR, not reported; US, United States; V, vegetables.

[a]This instrument was based on the School-based Nutrition Monitoring Student Questionnaire and the Health Behavior Questionnaire, which have validity and reliability tests associated with them. Test-retest for nutrition knowledge questions, which the ASSQ covers, ranged from 0.14 to 0.52 for all items for fourth grade, which is part of the targeted audience of ASSQ. In addition, content validity was established through an expert panel; [b]There is a parent component to this instrument, but only the youth component was reviewed.

Note: For reliability, only those studies that reported acceptable internal consistency (Cronbach $\alpha > .6$) and test-retest reliability ICC, κ statistics, or Pearson/Spearman correlation ($[r] > .6$).

Weaknesses

Few studies reported whether their psychosocial measures were curriculum-based. Studies should report this information more often, because instruments should not only be theory-driven, but also incorporate the program or curriculum's goals, objectives, intensity, duration, and content.[4,9] General nutrition education measures may be beneficial and practical for national- and state-level programs to ensure data comparability and program justification. However, general measures may also represent a threat to validity because they may not be sensitive enough to capture the effects of specific behavioral situations within the program or curriculum use. Future research on nutrition education curriculum specific measures vs general measures is warranted.

In terms of practicality, results indicated that most instruments did not have a reported completion time, and only half of those had a likely practical completion time (< 20 minutes). In fact, most of the reviewed instruments included over 40 items. Lengthy, time-consuming questionnaires create a response burden on participants, and this burden becomes compounded when dealing with young respondents. The majority of these instruments are intended for use with children who are still only capable of concrete operations (n = 8) (children ages 7–10).[37] Only 2 instruments were intended for use with children ages 11 and older, and 11 is the age at which children can move beyond concrete experiences and engage in logical reasoning and abstract thinking.[37] Children in the concrete operational stage cannot easily understand hypothetical concepts. Requiring them to perform many of these operations may be taxing and may ultimately lead to poor data quality.[38]

Another major concern is that researchers did not report whether the instruments were tested with youth from low-income, ethnically diverse families. Low literacy levels, language diversity, and contextual factors such as limited opportunities to make affordable and healthy food choices, are critical factors among this population, and may significantly affect the way a survey question is understood, interpreted, and/or answered. There is a great urgency for validating evaluation measures that are understandable and applicable for this population, because ethnically diverse, low-income children experience greater health disparities related to obesity and nutrition compared with their counterparts,[1] and they also are the target audience of 2 US Department of Agriculture national nutrition education programs.

In terms of reliability, 9 of 15 instruments had acceptable test-retest reliability scores for subscales within the instrument or as a whole.[15-20,24,25,27,30,32] In addition, it was difficult to draw conclusions or comparisons across studies because there was no standard parameter to establish acceptable levels of test-retest reliability. Some studies reported using Spearman or Pearson coefficients,[18-20,31,32] whereas others used ICCs[17,30] and/or Cohen κ coefficient.[15,16,24] Because the purpose of test-retest reliability is to assess the temporal stability of measures between test-retest and not associations, researchers suggest that ICC is the most appropriate reliability parameter for continuous measures, weighted κ coefficient for ordinal measures, and un-weighted κ coefficient for categorical measures.[39]

IMPLICATIONS FOR RESEARCH AND PRACTICE

The process of dietary behavior change, particularly among children, is still not well understood. As mentioned previously, a review of nutrition intervention literature has shown that self-efficacy/perceived control, outcome expectations/attitude, habit, and behavioral intention are significant correlates of dietary behavior in children.[4] These results underscore the fact that components of behavioral health theories are applicable to dietary behavior change, but no theory can adequately explain behavior.

One possible explanation for this is that the field of nutrition is broad and complex, and cannot be reduced to singular activities and behaviors. For example, SCT, a theoretical perspective used frequently in the instruments reviewed, has been widely used in public health campaigns related to human immunodeficiency virus prevention.[40,41] From a health promotion perspective, human immunodeficiency virus prevention involves few, targeted behaviors. Dietary behavior change, however, encompasses a vast scope of behaviors—increasing fruit and vegetable intake; reducing calories, fat, or sodium; or any other dietary message that is taught. A child receives many messages in relation to positive nutrition behavior, many of which are out of her control. For example, for a child to increase her intake of fruit, she must have access to more fruit (ie, it is offered to her by her family or is incorporated into her school lunch).

Future studies should continue to be more precise in parsing behaviors that fall under the umbrella of dietary behavior change, and testing them in terms of a psychosocial theory. Fruit and vegetable intake is 1 dietary behavior that has frequently been tested with psychosocial theories.[42] Reducing fat and sodium or increasing lowfat sources of calcium, whole grains, or water among youth, however, have not been frequently tested with psychosocial theories; yet, the federal dietary guidelines encourage these behaviors. Disaggregating dietary behavior as a whole into more specific and testable behaviors may lead to more accuracy in determining how these psychosocial theories really cause behavior change in the nutrition field, which in turn, would allow researchers to develop more accurate instruments to test their programs.

The current study has important implications for the program evaluation of national nutrition education programs in the US. Specifically, findings from this review provide useful insights for conducting future research to develop and rigorously test evaluation instruments that are appropriate for more diverse audiences and can be embedded into federal nutrition education programs such as the youth Expanded Food and Nutrition Education Program.[43]

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