Measurement characteristics of dietary psychosocial scales in a Weight Gain Prevention Study with 8- to 10-year-old African-American girls

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Abstract

Few measurement instruments for children's eating behaviors and beliefs have been specifically validated for African-American children. Validation within this population is important because of potential cultural and ethnic influences. Objectives were to evaluate established and newly developed or adapted dietary psychosocial measures in a sample of 303 preadolescent African-American girls and their caregivers. Acceptable internal consistency (Cronbach's $\alpha \geq 0.70$) was found for measures of girls' self-efficacy for healthy eating, outcome expectancies for healthy eating, positive family support for healthy eating and household availability of low-fat food and fruit, juice and vegetables (FJV). Evidence for concurrent validity was found with significant associations between self-efficacy for healthy eating and lower intake of energy ($r = -0.17$) and fat grams ($r = -0.16$). Greater FJV availability was associated with greater FJV intake ($r = 0.14$) and lower body mass index (BMI) in girls ($r = -0.12$). Positive family support for healthy eating was associated with higher BMI in girls ($r = 0.41$). These results contribute to the de-

velopment of scales to evaluate prevention interventions related to dietary intake in African-American children.

Introduction

The prevalence of childhood obesity is increasing in the United States [1, 2], with a disproportionate rise among African-American girls [3, 4]. The long-term health consequences of obesity in African-American children are compounded by the fact that African-American adults are at elevated risk for obesity-related morbidity from diabetes, hypertension and cardiovascular disease [5]. To address the obesity epidemic and its health consequences, obesity prevention and intervention strategies have become a public health priority [6]. Development of programs for preventing accelerated weight gain in African-American children is a current research focus for this high-risk group [7, 8].

Understanding psychosocial influences that contribute to eating behaviors is essential to developing effective weight gain prevention interventions [9–11]. In particular, greater insight is needed into the psychosocial and environmental factors that influence eating behaviors in African-American children [12–14]. Social cognitive theory (SCT) [15] emphasizes self-efficacy and outcome expectancy as important behavioral mediators. Hence, these constructs are useful variables to consider in behavioral intervention efforts.

While assessing the efficacy and effectiveness of intervention programs, the quality of the measurement instruments themselves is crucial to drawing accurate conclusions [16]. Measures of children's

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eating behaviors and beliefs are available [17, 18], but few have been specifically validated for African-American children [8, 16]. Validation within this population is important because of potential ethnic and cultural differences in nutritional beliefs and behaviors [8].

This paper examines the characteristics of self-reported dietary psychosocial measures from both girls and their caregivers in Phase 2 of the Girls' health Enrichment Multi-site Studies (GEMS), an intervention designed to prevent excessive weight gain in 8- to 10-year-old African-American girls. Choice of psychosocial measures was guided primarily by the SCT framework. The objectives of this paper are (i) to evaluate pre-existing self-report instruments within this population and (ii) to evaluate instruments that were newly developed or adapted to this population during the GEMS Phase 1 pilot study.

Methods

Study design

The GEMS project is aimed at preventing obesity in preadolescent African-American girls. In Phase 2, field centers at the University of Memphis and Stanford University conducted separate interventions over two years. Detailed description of GEMS Phase 2 is available elsewhere [19, 20]. The current report is based on baseline data collected at the Memphis site from July 2002 through February 2004 after protocol approval by the University of Memphis Institutional Review Board, an external Data Safety Monitoring Board, and the National Heart, Lung and Blood Institute.

Participants

The target population was 8- to 10-year-old African-American girls whose body mass index (BMI) was more than or equal to the 25th percentile based on 2000 Centers for Disease Control and Prevention (CDC) growth charts [21]. Any girl who did not meet this criterion was eligible if their caregiver's BMI ≥ 25 kg/m². Further exclusion criteria were medical conditions or medications affecting

growth, conditions that would restrict participation in physical activity interventions, conditions affecting participation (e.g. two grade levels behind in reading/writing) and failure to give informed consent.

Of 463 participants screened, 303 (65%) girls and their caregivers were found eligible. Excluded were girls who did not meet eligibility standards or opted not to participate ($n = 107$). Girls related to a randomized participant ($n = 53$) were invited to participate as 'guests', but their data were not analyzed.

Measures

BMI

Anthropometric measures included girl's height, weight and BMI. Height was measured with a Shorr Height Measuring Board (Olney, MD, USA) and weight with a Scaletronix 5602 Model calibrated scale (White Plains, NY, USA). BMI was calculated as weight/height squared (kg/m²). BMI percentiles were generated with a SAS program for CDC 2000 growth charts available from <http://www.cdc.gov/nccdphp/dnpa/growthcharts/sas.htm>.

Sociodemographics

Potential covariates were girl's age, caregiver's education (1 = high school or less, 2 = some college and 3 = college graduate) and annual household income (categorized into five \$20 000 increments from <\$20 000 to $\geq$ \$80 000). Other information collected but not included was caregiver's age, other children and adults in the household, home ownership, household possessions and caregiver's cultural beliefs.

Child measures

Dietary recall

Dietary intake was assessed with three 24-hour dietary recall interviews and analyzed with Nutrition Data System for Research (NDS-R) 2005 software, developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, USA. Participants completed an initial face-to-face dietary recall interview. Subsequent recall interviews were conducted by telephone. Interviews occurred on non-consecutive days with attempts to include at

least one weekend day. Typically, the amount of time from the first to last recall was 2–3 weeks. Dietary intake was averaged across recalls to produce daily averages.

Variables of interest were total energy intake (kcal/day); total fat (g); percent energy from fat and average daily servings of sweetened beverages, fruit, juice and vegetables (FJV) (including legumes). These variables were based on previously established behavioral food coding methods [22].

Self-efficacy for healthy eating

A 19-item questionnaire, adapted from an instrument developed by Reynolds *et al.* [23], measured self-efficacy for healthy eating with statements such as ‘How sure are you that you can eat some fruits and vegetables each day?’ Response options were 1 = ‘not sure’, 2 = ‘sort of sure’ and 3 = ‘very sure’. Higher scores corresponded to greater self-efficacy. Cronbach’s α of 0.86 was reported in a sample of fourth grade schoolchildren [23].

Outcome expectancies for healthy eating

This 12-item instrument was developed and used in the ‘High 5’ study to examine the mediating influence of expectancy on dietary intake [23]. It was adapted for use in GEMS Phase 2. Girls indicated their level of agreement (1 = ‘disagree’, 2 = ‘sort of agree’ or 3 = ‘agree’) with statements that measured expected consequences of eating a healthy diet (e.g. ‘Eating healthy will make you smarter’). Higher scores indicated more positive expectancies. Internal consistency reported in the High 5 study was 0.67.

Beverage preferences

A 16-item questionnaire, modified from an 11-item measure developed in GEMS Phase 1, was used to assess preferences for sweetened (seven items) and non-sweetened beverages (nine items). Girls rated their preference for soft drinks (regular and diet), sports drinks (i.e. Powerade or Gatorade), punch, Kool-Aid (regular and diet), sweetened fruit drinks (i.e. Fruitopia, Sunny Delight and Capri Sun), Snapple (regular and diet), sweetened and unsweetened tea, 100% fruit juice, vegetable juice and

water. In GEMS Phase 1, Cronbach’s α for the entire scale was 0.71 with a 12-week test–retest intraclass correlation coefficient (ICC) of 0.79 [12]. Response options were 1 = ‘I do not like this’, 2 = ‘I like this a little’ and 3 = ‘I like this a lot’, so that higher scores reflected greater preference. Scores were calculated by dividing the sum of the responses by the total number of responses (e.g. rating all seven sweetened beverage items as ‘I like this a lot’ would yield a score of $21/7 = 3$).

Social desirability

Potential social desirability response bias was measured with the nine-item Revised Children’s Manifest Anxiety Scale (RCMAS) [24]. Girls answered 1 = ‘yes’ or 0 = ‘no’ to questions such as ‘I never get angry’. Higher scores reflected greater social desirability. In the first RCMAS validation report, internal consistency estimates for African-American girls were 0.59, 0.64 and 0.66 for 8-, 9- and 10-year-olds, respectively [24]. In GEMS Phase 1, internal consistency (excluding the first item of the original measure) was 0.78, with a test–retest ICC of 0.62 [25].

Parent measures

Availability and accessibility of fruit, 100% juice and vegetables

Caregivers completed a 44-item questionnaire on the availability (38 items) and accessibility (six items) of fruit, 100% juice and vegetables in their home. This instrument was adapted from a validated parent-report measure of FJV availability [26, 27], developed for school-aged children in the ‘5-A-Day’ project [28]. In GEMS Phase 1, internal consistency was 0.77, with a test–retest ICC of 0.50. The six items related to accessibility (e.g. cut-up fresh vegetables in refrigerator) were introduced in GEMS Phase 2.

Availability of low-fat/fat-free alternatives

Availability of high-fat and reduced fat foods was assessed with a questionnaire developed during GEMS Phase 1 [22]. Items in the scale derived from information acquired in focus groups with

elementary schoolchildren [29]. Caregivers indicated whether particular food items (e.g. milk) had been available at home in the past two weeks. For food items that had both high-fat and reduced-fat options, caregivers specified which items were available (e.g. whole milk and skim milk). Sub-scales corresponding to high-fat foods (15 items) and low-fat foods (17 items) were generated. Ratio scores (e.g. available high-fat items/total high-fat items) indicated relative availability. In GEMS Phase 1, internal consistency estimates for high-fat and low-fat food availability were 0.59 and 0.64, respectively.

Food preparation

Food preparation practices during the past month were measured with a 25-item instrument that was developed in GEMS Phase 1 and derived from existing measures for adults [30] and children [31]. Two factors were reported in GEMS Phase 1 that corresponded to high-fat and low-fat preparation practices but explained only 22% of the variance, with Cronbach's α values of 0.58 and 0.66, respectively. Response options were 1 = 'almost never', 2 = 'sometimes' and 3 = 'almost always' to questions such as 'How often did you serve bacon or sausage for breakfast?'

Family support for healthy eating

Caregiver support for healthy eating habits was assessed with an 11-item adapted measure originally developed by Sallis *et al.* [32], who reported internal consistency estimates >0.80 in an ethnically diverse sample of young adults. Caregivers indicated how often they engaged in behaviors such as 'Complimented her on changing her eating habits' and 'Ate high-fat or high-salt foods in front of her'. Response options were 1 = 'none', 2 = 'rarely', 3 = 'a few times', 4 = 'often' and 5 = 'very often'.

Statistical analyses

Analyses were performed with SPSS 15.01 [33]. Scales were scored by averaging across response

values. A scale score was set to missing if responses were missing for 25% or more of the items.

Descriptive statistics were examined for distributional normality. Significant outliers discovered for dietary intake were excluded (e.g. consumption of 22 heads of cabbage in one day was unlikely). For three measures (food preparation, family support for healthy eating and beverage preferences), factor structure was explored using principal components analysis.

Internal consistency analyses (Cronbach's α) were performed. For measures with acceptable internal consistency estimates (≥ 0.70), concurrent validity was assessed by comparing scale scores to dietary intake and BMI using two-tailed Pearson correlations. Significance level was set at $P < 0.05$.

Results

Descriptive statistics are presented in Table I. Average age for girls was 9.3 years and average BMI was 21.8 kg/m^2 . Average BMI percentile rank was the 77th percentile, with 16.5% of girls between the 85th and 95th percentile and 40.6% at or above the 95th percentile at baseline. About 31% of caregivers graduated college, 53% had some college or technical school training and 16% had a high school education or less. Fifteen percent of caregivers reported an annual income over \$60 000, 21% between \$40 000 and \$60 000, 40% between \$20 000 and \$40 000 and 24% $< \$20 000$.

Of 303 participants, 94% ($n = 284$) successfully completed all three dietary recalls. Among the remaining 19 girls, 17 completed two recalls. Two girls with only one recall were excluded. Most girls (82%) had at least one weekend recall ($n = 250$). Analysis of variance testing for differences in dietary intake between weekend and weekday recall indicated no significant differences ($P > 0.05$).

Measurement characteristics

Factor structure

Principal components analysis with varimax rotation was used to explore the factor structure of two caregiver questionnaires (food preparation and

Table I. Baseline characteristics of participants ($n = 303$) in Phase 2 of GEMS

Characteristic	Mean (SD)	n (%)
Girls' age	9.3 (0.9)	
Annual household income		
<\$20 000		73 (24.1)
\$20 000–39 999		121 (39.9)
\$40 000–59 999		63 (20.8)
\$60 000–79 999		25 (8.3)
≥\$80 000		21 (6.9)
Caregiver education		
High school or less		50 (16.5)
Some college/technical school		160 (52.8)
College graduate		93 (30.7)
Girls' BMI	21.8 (5.8)	
BMI < 85th percentile		130 (42.9)
BMI 85th to <95th percentile		50 (16.5)
BMI ≥ 95th percentile		123 (40.6)
Dietary intake per day		
FJV servings	2.1 (1.3)	
Total fat (g)	57.8 (20.5)	
Fat (% kcal)	35.9 (5.7)	
Energy (kcal)	1427 (454)	
Sweetened beverages servings	1.0 (0.8)	

SD, standard deviation.

family support for healthy eating) and one questionnaire completed by girls (beverage preferences). Preliminary tests were performed to assess whether data were appropriate for factor analysis, namely Bartlett's test of sphericity and the Kaiser–Meyer–Olkin measure of sampling adequacy. Table II shows a two-factor solution for food preparation (low-fat and high-fat preparation) that accounted for 29% of the total variance. Eight items failed to load significantly on either factor and were removed. This solution was similar to that reported in GEMS Phase 1 [12] although there were some individual item differences. Table III shows a two-factor solution for family support for healthy eating that closely corresponds to concepts of 'supportive behavior' and 'non-supportive behavior' described by Sallis *et al.* [32]. Total explained variance was 53%. One item (Ate the same foods as she ate) did not load on either factor and was removed. For the beverage preferences questionnaire, no clear factor structure emerged.

Internal consistency

Internal consistency coefficients are presented in Table IV. Among girls' measures, the self-efficacy for healthy eating and outcome expectancies for healthy eating scales had the highest internal consistency estimates, Cronbach's $\alpha = 0.82$ and 0.72 , respectively. In addition to no clear factor structure, the beverage preferences instrument showed poor internal consistency, Cronbach's $\alpha = 0.53$.

Among caregiver measures, FJV availability was the most internally consistent (Cronbach's $\alpha = 0.85$). Most frequently available items were corn (85%), green beans (85%), lettuce (79%) and orange juice (74%). One item (French fries) was excluded from calculations because it was not counted in the NDS-R vegetable servings calculation. Internal consistency of the six-item FJV accessibility subscale was low at 0.60 .

For the high-fat and low-fat food availability subscales, internal consistency was 0.67 and 0.72 , respectively. High-fat foods were generally more available than low-fat items. The most frequently available high-fat foods, which ranged from 80 to 85%, were cheese; snack chips; cookies, pies and cakes; and margarine or butter. Reduced fat (2%) milk was the most available low-fat alternative (48%). For the food preparation scale, internal consistency was 0.59 for high-fat preparation and 0.69 for low-fat preparation. Within the family support for healthy eating questionnaire, the six-item supportive behavior subscale had good internal consistency, with a Cronbach's α of 0.83 . The non-supportive behavior subscale was less reliable, with a Cronbach's α of 0.60 .

Intercorrelations

Potential confounding effects of sociodemographic characteristics and response bias were addressed before calculating scale intercorrelations for measures that showed acceptable internal consistency (≥ 0.70). Bivariate Pearson correlations and partial correlations controlling for girl's age, caregiver education and household income were examined. For girls' measures, associations were also

Table II. Factor structure for 'food preparation' questionnaire ($n = 301$)

			Mean (SD)	Factor loading
Factor 1: low-fat food preparation practices				
	When you served green salads, how often did you serve low-fat or non-fat salad dressing?		1.62 (0.71)	0.602
	When you served pasta, how often did you serve it plain or with meatless sauce?		1.45 (0.64)	0.539
	How often did you give your daughter part skim or reduced fat cheese?		1.22 (0.52)	0.599
	When you served dessert, how often did you serve only fruit?		1.83 (0.61)	0.530
	How often did you serve reduced or low-fat hot dogs?		1.22 (0.52)	0.502
	When you served snacks, how often did you serve raw vegetables or fresh fruit?		1.85 (0.53)	0.443
	When you served ready-made meals, how often were they reduced fat?		1.28 (0.54)	0.517
	How often did you give your daughter 1% or skim milk?		1.19 (0.51)	0.543
	When you cooked hamburger meat, how often did you buy an extra lean cut?		1.98 (0.80)	0.435
	How often did you give your daughter 2% milk instead of whole milk?		2.13 (0.89)	0.444
Factor 2: high-fat food preparation practices				
	How often did you serve meats (e.g. bacon or sausage) for breakfast?		2.07 (0.60)	0.636
	How often did you serve butter with bread, rolls, or muffins?		1.94 (0.73)	0.499
	How often did you serve doughnuts, sweet rolls, or Danish for breakfast?		1.29 (0.49)	0.513
	When you served potatoes, how often were they fried, like French fries or hash browns?		1.93 (0.64)	0.552
	How often did you serve potato, corn, or tortilla chips for a snack or side dish?		2.13 (0.58)	0.530
	How often did you serve regular hot dogs?		2.08 (0.70)	0.510
	How often did you serve your daughter eggs for breakfast?		1.96 (0.59)	0.448
	% variance explained	Cronbach's α	Mean (SD)	
Factor 1	16.5	0.69	1.36 (0.29)	
Factor 2	12.7	0.59	1.92 (0.34)	
Factor loadings <0.40:				
	How often did you serve fish or chicken instead of red meat?			
	When you served chicken, how often did you remove the skin?			
	When you served chicken, how often did you serve it baked or broiled?			
	How often did you serve two or more vegetables at dinner?			
	When you served vegetables, how often did you add butter, margarine, or other fat?			
	How often did you serve your daughter hot or cold cereal for breakfast?			
	When you cooked ground beef, how often did you rinse the meat with water after cooking to remove fat?			
	How often did you give your daughter cheese as a snack?			

Bartlett's test of sphericity = 664.58, $P < 0.01$. Kaiser-Meyer-Olkin measure of sampling adequacy = 0.71. SD, standard deviation.

examined for potential social desirability response bias. Examination of partial correlations showed that adjusting for demographics and social desirability did not substantially alter direction or strength of relationships, so unadjusted correlations are reported.

Among girls' measures, self-efficacy for healthy eating was positively associated with outcome expectancies for healthy eating ($r = 0.26$, $P \leq 0.01$). Among caregiver measures, low-fat food availability correlated both with FJV availability ($r = 0.38$, $P \leq 0.01$) and supportive behavior for healthy eating ($r =$

0.17 , $P \leq 0.01$). There were no significant correlations between girls' and caregivers' measures.

Concurrent validity

Only scales and subscales with acceptable internal consistency (Cronbach's $\alpha \geq 0.70$) were examined for their association with outcome variables. Table V shows that higher self-efficacy for healthy eating scores were significantly associated with lower total energy intake ($r = -0.17$, $P \leq 0.01$) and grams of fat intake ($r = -0.16$, $P \leq 0.01$). Caregiver-reported FJV availability was positively related to girls' FJV

Table III. Factor structure for 'family support for healthy eating' questionnaire ($n = 303$)

		Mean (SD)	Factor loading
Factor 1: supportive behavior (1 = none, 5 = very often)			
	Encouraged her not to eat unhealthy foods (cake, salted chips)	3.61 (1.2)	0.742
	Discussed eating habit changes with her	2.95 (1.4)	0.775
	Complimented her on changing her eating habits	2.73 (1.4)	0.738
	Commented if she went back to her old eating habits	2.02 (1.2)	0.529
	Reminded her not to eat high-fat, high-salt foods	2.74 (1.4)	0.771
	Offered her food that she is trying to eat	2.90 (1.5)	0.615
Factor 2: non-supportive behavior (1 = very often, 5 = none)			
	Got frustrated when she encouraged you to change your food habits	4.18 (1.2)	0.653
	Ate high-fat or high-salt foods in front of her	3.17 (1.2)	0.660
	Brought home foods that she is trying not to eat	4.18 (1.1)	0.674
	Criticized the food she eats	3.80 (1.2)	0.581
	% variance explained	Cronbach's α	Mean (SD)
Factor 1	32.3	0.83	2.82 (1.0)
Factor 2	20.7	0.60	3.84 (0.79)

Bartlett's test of sphericity = 910.19, $P < 0.05$; Kaiser–Meyer–Olkin measure of sampling adequacy = 0.86.
SD, standard deviation.

intake ($r = 0.14$, $P \leq 0.01$). A significant negative correlation between FJV availability and BMI ($r = -0.12$, $P \leq 0.05$) indicates that caregivers of girls with lower BMI reported greater availability of FJV. The significant positive correlation between supportive behavior for healthy eating and BMI ($r = 0.41$, $P \leq 0.01$) indicates that caregivers of heavier girls reported greater support.

Discussion

Findings from this study add to a small literature on dietary psychosocial scales validated for use among African-American girls and their families. The scales reported here were specifically adapted or designed to measure dietary attitudes and practices in African-American girls and caregivers participating in a weight gain prevention intervention.

Girls' measure of self-efficacy for healthy eating demonstrated strong internal consistency in this population, comparable to that found for the normative group evaluated by Reynolds *et al.* (>0.80) [23], and the measure of outcome expectancies for healthy eating showed slightly higher internal consistency than in the original High 5 study (0.72 versus 0.67) [10]. In addition, self-efficacy for

Table IV. Descriptives and internal consistency estimates (Cronbach's α) for girl and caregiver measures

	Mean (SD)	Cronbach's α
Girl psychosocial measures		
Overall beverage preference	2.4 (0.3)	0.53
Outcome expectancies for healthy eating	2.5 (0.4)	0.72
Self-efficacy for healthy eating	2.5 (0.4)	0.82
Caregiver psychosocial measures		
FJV availability	0.4 (0.2)	0.85
FJV accessibility	0.7 (0.2)	0.60
High-fat food availability	0.6 (0.2)	0.67
High-fat food preparation practices	1.9 (0.4)	0.59
Low-fat food availability	0.1 (0.1)	0.72
Low-fat food preparation practices	1.4 (0.3)	0.69
Family supportive behavior	2.8 (1.0)	0.83
Family non-supportive behavior	2.2 (0.8)	0.60

SD, standard deviation.

healthy eating was associated with lower total energy intake and fewer grams of fat intake. This finding for preadolescent African-American girls is similar to results that link self-efficacy with children's eating behaviors [34–36]. However, although significant, the proportion of variance explained for

Table V. Pearson correlations among dietary psychosocial scales, dietary intake and BMI

Predictor variables	Dependent variables					
	FJV servings	Total fat (g)	% kcal from fat	Energy (kcal/day)	Sweetened beverage servings	Girl's BMI
Girl psychosocial measures						
Outcome expectancies for healthy eating	−0.06	−0.04	0.05	−0.07	<0.01	−0.02
Self-efficacy for healthy eating	0.03	−0.16*	−0.04	−0.17*	−0.09	0.06
Caregiver psychosocial measures						
FJV availability	0.14*	0.09	0.01	0.10	−0.03	−0.12**
Low-fat food availability	0.10	0.08	0.04	0.08	−0.05	−0.01
Family supportive behavior	−0.02	−0.05	0.05	−0.09	−0.03	0.41*

* $P \leq 0.01$; ** $P \leq 0.05$.

these two criterion variables was quite low (3%). Moreover, self-efficacy for healthy eating was not significantly correlated with FJV consumption, a relationship that has been previously reported [37], nor was it related to sweetened beverage intake.

Among caregiver measures, high internal consistencies were shown for two adapted measures: FJV availability and the family support for healthy eating subscale corresponding to supportive behavior (Cronbach's $\alpha = 0.85$ and 0.83 , respectively). FJV availability had higher internal consistency than that reported in GEMS Phase 1 (0.85 versus 0.77) [22]. Moreover, the supportive behavior subscale mimicked Sallis and colleagues' findings of Cronbach's $\alpha > 0.80$ in ethnically diverse samples [32]. As supported by recent literature, children's dietary intake is influenced by what foods are available and accessible in the environment [28, 38–40]. FJV availability showed a positive association with self-reported FJV intake although the amount of variance explained was low (2%). No relationship was found between the supportive behavior subscale and girls' dietary intake. However, supportive behavior was positively associated with girls' BMI, so the question of construct validity arises with this measure. Some have speculated that parental concern over a child's weight status can lead to more restrictive child feeding practices [41]. With this in mind, it is conceivable that the caregiver-reported supportive behavior subscale is tapping other constructs, too, e.g. 'control' or 'restrictiveness' [42].

Research has shown that attempts to restrict children's food intake, however well intentioned, may promote the development of undesirable eating behaviors [39, 43] and impede development of dietary self-control [44, 45]. Overall, caregivers of heavier girls may verbally encourage healthier eating, yet perhaps inadvertently derail these efforts by attempting to exert control. Both the positive association of BMI with the supportive behavior subscale and the negative association of BMI with FJV availability suggest that this is a plausible explanation. In fact, none of the caregiver measures showed any significant relationship with girls' self-efficacy for healthy eating. Perhaps the child's perception of caregiver behavior, rather than the caregiver's perception, would have been a better predictor [37]. A family support measure from the girls' perspective may have proven informative, but was not used in this study.

One subscale from an instrument developed during GEMS Phase 1 showed some improvement in internal consistency. Low-fat food availability improved from 0.64 in GEMS Phase 1 to 0.72 in GEMS Phase 2. Internal consistency for the high-fat food availability subscale remained below an acceptable threshold of 0.70 .

Sweetened beverage consumption has been associated with increased energy intake and higher BMI in children [46–48], and preference has been reported as one of the strongest predictors of children's consumption [49]. However, no clear factor structure emerged for the beverage preferences

measure. One potential limitation for this measure is item selection in that the items may not have been adequately representative of separate sweetened and non-sweetened beverage constructs. A high percentage of girls had never tried some of the listed beverages and thus could not indicate preference. Further work is needed to develop a useful measure for beverage preferences in this population.

While these results provide unique information about dietary psychosocial constructs in a robust sample of preadolescent African-American girls, the study has limitations. First, although neither social desirability nor age was found to be influential, psychosocial measures may have been susceptible to unmeasured sources of variability such as lack of knowledge and developmental differences in cognitive ability, experience or cultural influence. Finally, results may have limited generalizability for other African-American populations (e.g. males and other age groups) or for Caucasian and other ethnic groups.

In summary, quality instruments are essential to identifying intervention influences on children's dietary beliefs and behaviors. Results of this study contribute to the development of scales to assess SCT-based prevention interventions related to dietary intake in African-American children. One of the girls' psychosocial measures and one caregiver measure show promise in assessing dietary psychosocial constructs in African-American girls. The measure of self-efficacy for healthy eating showed encouraging associations with total energy and grams of fat intake and the caregiver-reported measure of FJV availability appears to be a useful measure owing to the positive association with FJV intake in the girls. Further refinement of existing scales and development of new instruments will help improve the assessment of mediators in interventions targeted at obesity prevention in this understudied population.

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Conflict of interest statement

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