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Short communication

Measuring family food environments in diverse families with young children

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ABSTRACT

This study reports the development and validation of the 20 item Family Food Behavior Survey, a measure designed to assess broad components of the family food environment that may contribute to child overweight. In a diverse sample of 38 parents, factor analyses verified 4 domains: (1) maternal control of child eating behavior; (2) maternal presence during eating; (3) child choice, and (4) organization of eating environment. All domains achieved acceptable internal reliability (αs = .73, –.83), and test–retest reliability. Mothers of overweight children scored significantly lower on maternal presence and somewhat higher on maternal control than mothers of normal weight children.

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Introduction

Overweight and obesity among U.S. children have risen in the last decade, with elevated rates among low-income and some minority children (Polhamus et al., 2009). While the mechanisms leading to overweight have biological and environmental roots, observers agree that environmental factors play a prominent role in the current child obesity epidemic (c.f., Kumanyika, 2008). Growing evidence suggests that family food environments may influence child diets and weight gain (Faith, 2005), yet methods to assess food environments are relatively new and have produced contradictory findings regarding which factors may contribute to child overweight.

Studies of family food environments often examined maternal control of the child's eating, with conflicting findings. A 2004 review concluded that parental feeding restrictions consistently predicted overweight status (Faith, Scanlon, Birch, Francis, & Sherry, 2004), though the potential mediating effects of family income could not be examined. Newer studies utilizing low-income populations have reported no association between maternal control with child overweight (Hughes et al., 2006), or intake of problematic food in preschoolers (Kroller & Warschburger, 2008). In fact, Larios and colleagues found an inverse relationship, with lower maternal control leading to higher child BMIs, in an economically mixed sample of Latina mothers of primary school children (Larios, Ayala, Arredondo, Baquero, & Elder, 2009).

Cultural practices around child involvement in the family food environment may contribute to weight disparities among children. Low-income Latino mothers of preschoolers reported allowing their children to take food from the refrigerator whenever they were hungry (Kaiser, Martinez, Harwood, & Garcia, 1999). Kaufman and Karpati (2007) hypothesized that such practices reflected low-income Latino parents' efforts to nurture their child with one of the few resources available to them, which may explain higher rates of overweight among Latino children. The few studies directly assessing child involvement in the family food environment have produced mixed results, possibly due to measurement differences. Melgar-Quinonez and Kaiser (2004) found that child access to food in between meals reduced the likelihood of overweight among low-income, Mexican American children. Using a broader measure, Hughes and colleagues reported that an indulgent feeding style, emphasizing child-centered strategies, led to an increased likelihood of child overweight among low-income, Hispanic families (Hughes, Power, Fisher, Mueller, & Nicklas, 2005).

The family meal functions as an important component to child health (Fiese & Schwartz, 2008), with fewer meals linked to child obesity (Gable, Chang, & Krull, 2007). Both minority status (Flores, Tomany-Korman, & Olson, 2005) and low-income among working mothers (Blake et al., 2009) have been linked to a fewer meals eaten as a family. Studies also suggest that maternal presence during the meal may improve the child's self-regulation (Fiese & Schwartz, 2008), thereby enabling children to moderate their food intake.

The organization of the family's eating environment also may explain increases in child overweight. Eating while watching

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television has been associated with obesity (Hendy, Williams, Camise, Eckman, & Hedemann, 2009), and is more prevalent among low-income children as compared to higher income children (Lin, Huang, & French, 2004). Consumption of fast food has been linked to childhood overweight in Hispanic families (Duerksen et al., 2007). Access to fast food restaurants in low-income neighborhoods (Reidpath, Burns, Garrad, Mahoney, & Townsend, 2002) may increase parental likelihood of substituting fast food for home-cooked meals, especially as limited meal preparation time represents a barrier to providing dinner among low-income parents (Snethen, Hewitt, & Petering, 2007).

While the above studies suggest that the food environments in some low-income and minority families may contribute to obesity among young children, most measures assessing food environments were developed on middle class populations (Birch & Fisher, 1998), focus on narrow dimensions such as parental use of authoritative versus authoritarian feeding styles (Birch et al., 2001; Patrick, Nicklas, Hughes, & Morales, 2005), or fail to assess important attributes such as maternal presence during mealtimes or the family's fast food consumption (Hendy et al., 2009; Larios et al., 2009). This study addresses these shortcomings by reporting the development and validation of the Family Food Behavior Survey (FFBS). The study aims to examine the psychometric properties of the FFBS, a measure designed to systematically identify family food strategies used among diverse families with young children.

Methods

Procedures and sample. From October 2007 to January 2008, a convenience sample of parents were recruited from 2 preschools, primarily serving low-income families, and 2 food assistance programs in urban areas of Rhode Island. Parents were asked to participate if they had children within the target range (2–11 years) and spoke English. About 85% of eligible parents agreed to participate. After obtaining informed consent, 38 participants completed interviews either in person or by telephone. The first 5 parents also completed a cognitive interview component, while the subsequent 33 parents were invited to participate in a second interview during the following 60 days. Of these 33 parents, 28 (85%) completed a second interview. Interviews lasted 20–30 min. Parents received a $10 grocery card for participating in the research.

The 38 parents came from diverse backgrounds. The majority (58%) were single parents; 42% were white, non-Hispanic, 21% Hispanic, 18% black, non-Hispanic, and 18% other race/ethnicity. Two-thirds had less than a college education; 29% had 12 or fewer years of education. On average, mothers were 32 years old (SD = 8), had 2 children (SD = 0.9), and lived with 1 other adult. The majority of mothers (60.5%) worked fulltime; 47% received some type of public assistance and 57% lived on less than $30,000 per year. Children ranged in age from 2 to 11, with a median age of 4.1 years (SD = 1.7).

Measures. The FFBS assesses the ways adults monitor and participate in the child's eating behavior. Initial survey items were adapted from versions 1 and 2 of the Preschooler Feeding Questionnaire (PFQ; Baughcum et al., 2001; Powers, 2005), a measure of maternal and child food practices and beliefs within the home. In the original (PFQ1) study, the structure during feeding interaction scale (e.g., regularity of meals, presence of mother, TV viewing during meals), significantly correlated with maternal obesity ($p < .001$) and had a trend relationship with child overweight ($p < .06$), but low internal reliability (Cronbach's $\alpha < .55$). Powers (2005) revised this questionnaire into the PFQ2 and administered it to 299 low-income, African-American mothers. Three relevant indices emerged: (1) child involvement in food preparation, (2) eating environment, and (3) maternal presence during the meal, though the indices had internal reliabilities <.70.

Six items from the PFQ1 and 10 items from these three PFQ2 indices were adapted for the FFBS. Recent studies also supported the inclusion of 4 additional items related to weight status in some at-risk populations: (1) eating at a fast food restaurant (Duerksen et al., 2007), (2) taking food from refrigerator or pantry between meals (Melgar-Quinonez & Kaiser, 2004), and (3) two items measuring child involvement in food purchasing (Davis, Young, Davis, & Moll, 2008). For each of the 20 items in the final survey, participants selected a response from a 5 point Likert scale ranging from never true (0) to always true (4). Relevant items (see Table 1) were summed to construct the 4 hypothesized constructs: (1) maternal control of child feeding behavior (maternal control); (2) maternal presence during eating (maternal presence); (3) child involvement in consumption (child choice), and (4) organization of eating environment (organization). Higher scores on maternal control, and maternal presence indicate greater involvement by the mother; higher scores on child choice indicate greater child control. The fourth scale, organization, is reversed scored such that higher scores indicate a less organized environment.

Participants completed the family record which gathered information on socio-demographic variables (e.g., maternal age, education, race/ethnicity). Parents also provided their child's height, weight, sex, and birthdate. Child height, weight, birthdate, and sex were entered into the Center for Disease Control's computerized program to produce sex-specific BMI-for-age percentiles. Children were placed into the following categories: (0) "underweight" = BMI-for-age <5th percentile; (1) "normal weight" = BMI between the 5th and 84th percentile; (2) "overweight" = ≥the 85th percentile and <the 95th percentile; (2) "obese" = ≥the 95th percentile, based on the sex-specific BMI-for-age growth charts (American Academy of Pediatrics, 2003).

Cognitive interview. Because respondents vary in their understanding of survey questions, cognitive interviews are used to assess instrument comprehension (Jain, Sherman, Chamberlin, & Whitaker, 2004; Jobe & Mingay, 1989). In this study, a series of verbal probes were posed to the initial 5 participants after answering an item or a set of related items, including: (1) were any of these questions difficult to answer; (2) did the wording make

Table 1
Principal components factor analyses with varimax rotation for 4 factor solution.

Survey item	Factor loadings > .40			
	1	2	3	4
(3) Child chooses foods from what is served	**0.795**			
(16) My child eats snacks/meals whenever s/he wants	**0.743**	−0.437		
(1) I decide how many snacks child has	**−0.737**			
(13) I allow child to eat snacks whenever s/he wants	**0.704**	−0.454		
(9) My child wanders during meals	**0.634**			
(11) I decide what child eats between meals		**0.821**		
(8) I decide my child's snacktime		**0.803**		
(17) I decide the time when child eats meals		**0.673**		
(6) Child has regular snack and mealtime routine		**0.568**		
(5) I allow child to take food between meals		**−0.486**		
(20) My child and I sit and eat together			**0.882**	
(12) When child eats I am another room			**−0.741**	
(15) I sit down with child when s/he eats			**0.720**	
(10) I eat dinner with child			**0.530**	
(14) Child shops for food with me			**0.527**	
(18) My child and I watch TV while eating meals				**0.901**
(4) Child eats and watches TV at mealtimes	0.436			**0.693**
(19) My child and I eat at fast food restaurants		−0.514		**0.585**
(2) Child chooses food items while shopping				**0.520**
(7) Child chooses which food to have for meals				**0.429**

Note: factor 1 = child choice; factor 2 = maternal control; factor 3 = maternal presence; factor 4 = organization.
Bold items indicate highest loading.

sense; (3) what came to mind when you were asked about [specific word, name or phrase]; and (4) if i asked you these questions next week, do you think you would give the same answer? For the Likert response sets, participants were asked how they chose a specific response (e.g., sometimes true) and how this response varied from another (e.g., sometimes true versus often true). These methods have been found to increase the reliability and validity of survey instruments (Jobe & Mingay, 1989; Willis, Royston, & Bercini, 1991).

Data analysis. The cognitive interviews were examined to identify independent and common concerns raised by participants, prior to administering the FFBS to the second sample. Quantitative data were entered into SPSS 16.0. Principal components factor analysis (PCA) with varimax rotation was used to verify the underlying domains and determine item retention, with a specified 4 factor solution to reflect the *a priori* hypothesis of 4 domains: maternal presence, maternal control, child choice, and organization. Items with factor loadings >.40 on a domain (convergent validity) and a higher loading on the hypothesized scale than on other scales (discriminant validity) were selected for scale inclusion. Cronbach's α was used to test internal consistency. Individual items were excluded if their item-scale correlation was <.30. To assess whether domains were related but not measuring the same construct, scale correlations were examined. The Spearman–Brown coefficient and the intraclass correlation coefficient (ICC) were calculated to assess the correlation between each of the T1 and T2 scales. Scores of .70 or more indicate adequate test–retest reliability (Fayers & Machin, 2000). Independent samples *t*-tests were conducted to determine if scores on the FFBS scales varied by child weight status.

Results

As the cognitive interview analyses indicated that respondents had little difficulty understanding the survey questions or Likert response scale, no substantive changes were made to the FFBS or the family record. Given these results, time 1 data from the 5 initial respondents and the subsequent 33 participants were combined to explore domain structure and internal reliability. PCA with a specified 4 factor solution showed that items tended to group together along the hypothesized dimensions with acceptable factor loadings (Table 1). Item 2, child chooses food items while shopping, and item 7, child chooses food for meals, however, loaded onto organization though they were hypothesized to load onto child choice. Taken together, the 4 hypothesized domains demonstrated a good fit with the data, explaining 62% of variability.

Examination of each domain's reliability indicated that all items on the child choice, maternal control, and maternal presence scales had acceptable item-scale correlations (>.30). Item 2, child chooses meal items while shopping, was eliminated from the organization scale due to its low item-scale correlation (.248). An analysis of inter-item reliabilities demonstrated acceptable levels of internal consistency for all scales. Maternal control had the highest reliability (α = .831), followed by child choice (α = .798), maternal presence (α = .757) and organization (α = .731).

Next, the examination of between scale correlations revealed that all scales significantly correlated with at least one other scale. Child choice had a significant negative correlation with maternal control, $r = -.471$, $p < .01$, indicating that greater child choice corresponded to reduced maternal control of the eating environment. Child choice also correlated with organization, $r = .338$, $p < .05$, such that greater child choice was associated with a less organized eating environment. Lastly, maternal control significantly correlated with maternal presence, $r = .340$, $p < .05$. As maternal control over the eating environment increased, mothers were more likely to be present when the child ate.

On average, participants completed the second FFBS 36 days after the first (SD = 22.6). Of the 28 participants completing two surveys, 26 (93%) completed both within the 60-day timeline. Test–retest scores indicated good reliability for child choice, and organization (>.80) on both the Spearman–Brown coefficient and the ICC. Maternal presence achieved acceptable test–retest reliability on both coefficients (>.70) while maternal control had lower reliability (>.65), though still in the acceptable range for exploratory research.

Independent samples *t*-tests compared whether mothers of children classified as overweight or obese (BMI percentile $\geq$ 85) significantly differed on the FFBS scales as compared to normal weight children (BMI percentile < 85). Underweight children were excluded due to their small sample size (n = 4). At time 1, mothers of overweight children had somewhat higher scores on maternal control than mothers of normal weight children, $t(23) = 2.06$, $p = .052$. Scores on maternal presence and organization were elevated among mothers of overweight children, but did not reach significance (ps = .11). At time 2, mothers of normal weight children scored significantly higher on maternal presence than mothers of overweight children, $t(19) = -2.85$, $p = .01$. No other group differences were significant at time 2.

Discussion

Overall, the findings provide initial support for the reliability and validity of the Family Food Behavior Survey in a diverse sample of parents with young children. Cognitive interviews supported the face validity of the items. Factor analysis confirmed the presence of 4 hypothesized domains: (1) maternal control of child feeding behavior, (2) child involvement in consumption, (3) maternal presence during consumption activities, and (4) organization of eating environment. After deleting 1 item from the organization scale, tests for internal consistency demonstrated adequate to high internal consistency for all scales. Each domain was significantly correlated with at least one other domain, indicating that the scales measured related food domains. Test–retest reliability scores indicated acceptable congruence between initial and later survey responses, suggesting that the FFBS is stable across time.

Though tentative due to small sample size, the finding that maternal presence when the child ate appears to produce a protective effect on child weight status corroborates other research noting that frequency of family meals reduces a child's risk for obesity (Gable et al., 2007). The maternal presence scale, however, went beyond eating at meals, by assessing how often the mother was present whenever a child ate, including snacks. Further research is needed to confirm this association and investigate how the mother's presence influences the child's eating behavior.

In this diverse sample, greater maternal control and monitoring of the child's eating environment somewhat increased the likelihood of child overweight. This finding concurs with Faith et al. (2004) report that parental efforts to restrict their child's eating corresponded to increased body weight, though the FFBS surveyed broader aspects of maternal control. The direction of effects is unclear; however, as maternal perceptions of child overweight may foster the use of more controlling strategies (Crouch, O'Dea, & Battisti, 2007).

Several study limitations need to be discussed. Though the small sample size was sufficient to examine internal consistency and test–retest reliability, it reduced the power needed to accurately assess the relation between the FFBS scales and child weight status which may explain the failure to find significant effects of some scales. A small sample also precluded controlling for demographic characteristics in assessing the relationship between the FFBS and child weight status though *post hoc t*-tests revealed no significant differences in use of strategies by maternal

age, education, minority status, or public assistance status. The study relied on cross-sectional data and needs to be validated with longitudinal research to determine if specific food environments influences child weight status, or if child weight status affects the family food environment, or both.

Although factor loadings >.40 are considered significant (Stevens, 1996), recent work contends that practical significance is not reached unless items have factor loadings >.50 (Hair, Black, Babin, Anderson, & Tatham, 2006). Loadings on items 5 and 7 did not meet this threshold (−.486 and .429, respectively), indicating weaker shared variance as compared to other factor items. Thus, retention of these items may reduce the overall strength and stability of the related factors (maternal control and organization). It should be noted, however, that neither item crossloaded on a different factor (Costello & Osborn, 2005), and that elimination of the items from their respective scales reduced internal reliability.

Finally, the use of self-report data may not reflect the actual family food environment (Moens, Braet, & Sotens, 2007) though some argue that self-reports of feeding strategies are more accurate than observational data (Faith et al., 2004). Further, the use of parental self-report data to calculate child BMI decreased the sample size and power to find group differences as 23% of parents could not recall either their child's height, weight or both. This methodology also may be problematic due to inaccurate recall or parental desire to present the child in a positive light. At least one study, however, found no significant differences between parental report of child weight and height and measurements by trained staff (Lumeng, Gannon, Cabral, Frank, & Zuckerman, 2003).

Family food environments influence child energy intake (Johnson, 2000), with potential spillover effects on child weight status. Still, knowledge about the environmental components that may foster poor outcomes among families is in its infancy. The development of appropriate instruments that have been validated on the target population is critical to identifying food behaviors that contribute to childhood obesity. Although in need of further validation, the findings suggest that the FFBS may be one such instrument.

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