Measurement of Mealtime Behaviors in Rural Overweight Children: An Exploratory Factor Analysis of the Behavioral Pediatrics Feeding Assessment Scale

Ann M. Davis,1,2 PHD, MPH, ABPP, Kimberly S. Canter,1,3 MA, Cathleen Odar Stough,1,3 MA, Meredith Dreyer Gillette,1,4 PHD, and Susana Patton,1,2 PHD, CDE
1 Center for Children’s Healthy Lifestyles and Nutrition, 2 Department of Pediatrics, University of Kansas Medical Center, 3 Clinical Child Psychology Program, University of Kansas, and 4 Developmental and Behavioral Sciences, Children’s Mercy Hospitals and Clinics

All correspondence concerning this article should be addressed to Kimberly Canter, MA, Clinical Child Psychology Program, The University of Kansas, 2008 Dole Human Development Center, 1000 Sunnyside Avenue, Lawrence, KS 66045, USA. E-mail: kimberly.canter@gmail.com

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Objective The current study presents results of an exploratory factor analysis (EFA) of the Behavioral Pediatric Feeding Assessment Scale (BPFAS) in a sample of rural children with overweight and obesity. Relationships between mealtime behavior and health outcomes are also explored. Methods EFA was used to assess the fit of the BPFAS in a group of 160 treatment-seeking children (Mage = 9.11, SD = 1.77) living in rural Midwest communities. Correlations were also computed between factor scores and select health variables (child body mass index z-score and diet variables). Results The EFA identified a 5-factor solution as the best fitting model (Tucker–Lewis Index = .96, root mean square error of approximation = .05), although several items (i.e., 7 of 25) did not load on any factor. 2 factors were correlated with health variables of interest. Conclusion Study results suggest that certain items on the BPFAS may not be appropriate for use with rural children with pediatric overweight or obesity. Implications for future research and practice are discussed.

Key words health behavior; obesity; weight management.

Introduction Childhood obesity is a national concern with a wide reaching impact across numerous domains of a child’s life. Recent prevalence rates of childhood obesity indicate that almost 12% of children and adolescents have a body mass index (BMI) above the 97th percentile, with 17% at or above the 95th percentile, and 32% at or above the 85th percentile (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010). National data indicate that children living in rural areas have higher rates of pediatric overweight and obesity than their urban peers, and are also more likely than their urban peers to be impoverished, be sedentary, be uninsured, and have limited access to preventive care (Lutfiyya, Lipsky, Wisdom-Behounek, & Inpanbutr-Martinkus, 2007). Given these statistics, it is important to consider factors that may contribute to the development of childhood obesity, particularly in groups of children at high risk for becoming obese, such as children living in rural areas.

Child mealtime behaviors (e.g., refusing certain foods, taking bites when asked by parents) are one factor that has been associated with childhood obesity. Greater child compliance with parental commands has been associated with greater energy intake (Koivisto, Fellenius, & Sjoden, 1994). Additionally, parent mealtime behaviors, such as parental control, monitoring, and restrictiveness, have been associated with child health outcomes, including child BMI and diet (Faith, Scanlon, Birch, Francis, & Sherry, 2004; Lumeng & Burke, 2006; Marshall, Golley, & Hendrie, 2007).
problems). Therefore, it is possible that differences in actually advantageous in others (e.g., children with feeding some populations (e.g., children who are overweight) but case that items such as “Enjoys eating” are problematic for (Napier-Phillips, 2001; Patton et al., 2006). It may be the pediatric populations, few articles have examined the va-

gastrostomy feedings [Byars et al., 2003], and children Dolan, & Powers, 2006], children dependent on Phillips, 2001], children with type 1 diabetes [Patton, (BPFAS; Crist & Napier-Phillips, 2001), which examines frequency of child behaviors (e.g., will try new foods) and frequency of parent feelings and strategies for dealing with eating problems (e.g., frustration when feeding a child, cajoling or threatening in response to frustration when feeding) using a 5-point Likert scale from “never” to “always.” Parents are also asked to rate whether each item is a problem by answering with a “yes” or “no” re-

response. The BPFAS was originally designed for comparison of mealtime behaviors in healthy children and children with cystic fibrosis between the ages of 1 and 8 years (Crist et al., 1994). Since its original validation, the BPFAS has been used with additional pediatric populations (e.g., children with eating problems [Crist & Napier-Phillips, 2001], children with type 1 diabetes [Patton, Dolan, & Powers, 2006], children dependent on gastrostomy feedings [Byars et al., 2003], and children with autism [Martins, Young, & Robson, 2008]).

Despite the application of this measure to additional pediatric populations, few articles have examined the va-

lidity of the BPFAS within specific populations (Crist & Napier-Phillips, 2001; Patton et al., 2006). It may be the case that items such as “Enjoys eating” are problematic for some populations (e.g., children who are overweight) but actually advantageous in others (e.g., children with feeding problems). Therefore, it is possible that differences in

factor structure and subscales of the measure may be seen across pediatric patient groups. Some research sug-
gests that the patterns of mealtime behavior problems seen in children with feeding problems, for which the measure has been validated, are similar to those seen in other pop-

ulations (e.g., diabetes; Patton et al., 2006); however, it is necessary to examine whether this pattern generalizes to additional groups.

The current study seeks to assess the fit of the BPFAS in a sample of rural children with overweight and obesity. Although the BPFAS is frequently used to assess mealtime behaviors in pediatric populations, it has yet to be vali-
dated in this unique group. The current study also extends the age range of the BPFAS beyond age 8, which may pro-
vide additional useful information about the measure’s utility. While many measures of childhood mealtime behaviors exist (e.g., About Your Child’s Eating-Revised; Gerhardt et al., 2006; Zeller et al., 2007), the BPFAS is unique in that it has been used with a wider range of pediatric pop-
ulations rather than a limited number of disease, illness, or health condition-specific groups. Given its use across many groups, the BPFAS may be a measure that can be used in studies specific to pediatric obesity, or in studies that include other illness populations for whom the instrument is valid.

As a secondary aim, the current study seeks to explore if and how these mealtime behaviors relate to child health outcomes. More specifically, it is expected that factors rela-
ting to food consumption will be related to both BMI z-
score and diet variables. Additionally, it is hypothesized that factors assessing mealtime behaviors will relate to BMI z-score and food consumption, given previous re-
search that associates mealtime behavior with child health outcomes (Koivisto et al., 1994).

Methods

Participants

One hundred sixty children seeking weight management treatment and living in rural Midwest communities participated in this study with their parents. Inclusion criteria included attending an elementary school in a rural area, BMI percentile ≥85th for age/gender, and parent ability to speak English. Exclusion criteria included having a develop-
mental disability that would prevent the child from par-
ticipating in the group, or being immobile, which would prevent them from increasing exercise. Participating chil-
deren were between the ages of 5 and 13 years (M = 9.11, SD = 1.77) and in grades prekindergarten to sixth grade. The distribution of children’s grade in school was as fol-

ows: 15.00% prekindergarten or kindergarten, 10.00%
first grade, 14.38% second grade, 17.5% third grade, 25.63% fourth grade, 16.25% fifth grade, and 6.88% sixth grade. They had an average BMI z-score of $M = 1.74$ (SD = .46), corresponding to an average BMI percentile of $M = 94.39$% (SD = 4.32). Participants’ race/ethnicity was representative of the population from which they were drawn (88.13% Caucasian, 3.13% Native American, 1.88% African American, 6.86% another race/ethnicity, and 2.50% of participants chose to not complete this variable), and both sexes were represented (56.25% male). Parent report of annual family income was available for 121 participants, and ranged from $0 to $170,000 (M = $59,640.63, SD = $35,322.86). Of the 156 participants for whom information about free and reduced school lunch was available, 37.8% received free or reduced lunch ($N = 59$).

**Measures**

**Behavioral Pediatric Feeding Assessment Scale**

Parent report of parent and child mealtime behaviors was obtained using the BPFAS (Crist and Napier-Phillips, 2001). The measure includes 35 items that ask parents to report the frequency of mealtime behaviors using a Likert scale (1 = never to 5 = always) and use a dichotomous scale (0 = no and 1 = yes) to report whether they feel the mealtime behavior is problematic. Therefore, higher scores on the subscales signify more frequent mealtime behaviors. Given the measure includes items for both positive (e.g., eats vegetables) and negative (e.g., tantrums at mealtimes) behaviors, positive behavior items are reverse scored (i.e., items 1, 3, 5, 6, 8, 9, 16, 18) so that higher scores reflected greater presence of mealtime problems and greater absence of positive mealtime behaviors. Each item concerns a specific mealtime behavior (e.g., my child has problems chewing food, my child will try new foods). The scale produces scores for the Frequency of Child Behaviors, Number of Problematic Child Behaviors, Frequency of Parent Behaviors, and Number of Problematic Parent Behaviors. Previous research indicates adequate reliability for the measure (Cronbach’s $\alpha = 0.76$; Crist and Napier-Phillips, 2001). Good reliability was found for the measure in the current sample (Cronbach’s $\alpha = 0.80$). Frequency scores were used in the current analysis.

**Twenty-Four–Hour Diet Recall**

The 24-hr diet recall is a standardized three-pass method developed by the U.S. Department of Agriculture for use in national dietary surveillance. This approach aims to improve accuracy of diet recall by having participants respond to several prompts or passes about food consumption. Participants are first asked to list foods and beverages consumed during the 24-hr period, and in the following second pass, participants provide details about the foods listed (e.g., portion size, brand of food). In the final step, the information provided is reviewed with the participant for accuracy. This approach is used to minimize participant underreporting of foods and beverages consumed. This measure has been shown to be a valid and reliable representation of a child’s overall diet (Crawford, Obarzanek, Morrison, and Sabry, 1994). Dietary recall data were gathered by trained Master’s and PhD-level researchers who were found to be reliable in diet recall procedures by a registered dietitian. All dietary data were analyzed using Nutrition Data System for Research software version 2005 developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, USA. Daily intake of calories, percent calories from fat, fruit and vegetable servings, sugar-sweetened beverage servings, and servings of “red” foods (foods with >12 g of sugar and/or 7 g of fat [Epstein & Squires, 1988]) were assessed.

**Anthropometric Data**

Trained school nurses measured child weight and height in triplicate in light-weight clothing using standard procedures with Holtain Harpenden stadiometers (Model 603; Holtain, Crymych, UK) and portable SECA digital scales (SECA, Hamburg, Germany) that were calibrated as necessary throughout the study. Child BMI, BMI percentile, and BMI z-scores were calculated from height and weight using the Baylor College of Medicine BMI graph calculator according to age and gender norms (http://www.bcm.edu/cncr/bodycomp/bmiz2.html). BMI scores for height and weight recorded before initiation of the weight management program were used in current analyses, and BMI z-scores were used as the primary outcome measure for body composition, as they are standardized for height, weight, and gender.

**Procedures**

Schools were recruited for participation through flyers mailed to every elementary school principal and nurse in towns or counties that had <20,000 residents in a specific Midwestern state. A school staff member, such as a gym teacher, school nurse, or principal, was designated at each school to be the onsite study staff member. The study was designed to target third–fifth-grade children, but smaller rural schools included lower elementary grades as well (i.e., first and second grade). Recruitment letters were sent home with all children at the school by the designated school staff member at each location. Interested families were screened for inclusion criteria. Parents and children who chose to participate and met inclusion criteria gave
informed consent and assent, respectively, and then they completed baseline measures. Families meeting inclusion criteria and completing baseline measures were randomized to one of two studies. Both studies targeted pediatric obesity intervention programs to rural children and their families; the first was a randomized controlled trial of a structured physician visit compared with a family-based program delivered via telemedicine (Davis et al., 2011; Davis, Sampilo, Gallagher, Landrum, & Malone, 2013; Gallagher, Davis, Malone, Landrum, & Black, 2011), and the second was a randomized controlled trial of telemedicine compared with telephone for the delivery of family-based behavioral groups. More information about the interventions is available elsewhere (Davis et al., 2011, 2013; Gallagher et al., 2011), but the current study only uses baseline data from these two studies. All study procedures were approved by the institutional review board at the University of Kansas Medical Center.

Data Analyses

Exploratory factor analysis (EFA) was used to determine the factor structure of the BPFAS in a population of rural children with pediatric overweight and obesity. EFAs have been conducted to validate the BPFAS in other populations (Crist & Napier-Phillips, 2001; Patton et al., 2006), and therefore, the current study extends this methodology to rural children who are overweight. An EFA examines correlations among individual measure items to identify underlying latent factors or item subscales. This procedure has advantages over techniques such as principal component analysis because it controls for measurement error to identify latent factors underlying the manifest variables, rather than simply condensing information provided by the manifest variables. The EFA was conducted using maximum likelihood estimation and oblique quartimin rotation. This rotation method allows the factors to correlate within one another, and therefore improves the model and interpretability. Factor loadings >.40 were considered significant. The squared factor loading represents the amount of variance shared between that item and the factor or the amount of variance in that item explained by that factor. This criterion was set given the large number of factors present on the BPFAS and to minimize the number of nontrivial cross-loadings and enhance interpretability. Items were allowed to cross-load on multiple factors, given that the analysis was exploratory in nature. Using past research with the BPFAS and pediatric populations as a model (Patton et al., 2006), parent items were excluded from the EFA, as they are dissimilar from the child items comprising the majority of the measure.

The distribution of individual items was also examined to assess for adequate variability in participant response. Similar to other factor analyses of mealtime behavior measures (Hendy et al., 2009), items endorsed as “never” or “always” by ≥75% of the sample were considered to have inadequate distribution. Given that the BPFAS has been used in a range of pediatric populations (including pediatric overweight) without deletion of specific items, all items were included in the EFA regardless of item variability.

Correlations were computed between factor scores for individual participants and the following variables: Child BMI z-score and diet variables from the 24-hr diet recall (daily calories, fruits and vegetables servings, red food servings). Although all children participating in the study had a BMI >85th percentile, BMI percentile ranged from 85 to 99.80%. Therefore, variability to assess the relationship between BMI z-score and measure factors was present.

Results

An EFA using maximum likelihood estimation and quartimin rotation identified a five-factor solution on the child items of the BPFAS in the sample of rural children who were overweight. A chi-square test failed to reject the null hypothesis that five factors was a sufficient solution for explaining covariance between items (χ² (185) = 203.41, p = .17). The Tucker and Lewis’ Reliability Coefficient was .96, exceeding the .94 cutoff for close fit. Root mean square error of approximation was .05, fitting with the .05 cutoff for close fit. The five factors were defined as Food Refusal, Unwillingness to Eat, Lack of Healthy Foods and Food Variety, Disruptive Behaviors, and Texture and gastrointestinal (GI) Problems. Seven of the 25 items did not load on any factor, meaning some items were not appropriate for this sample. See Table I for complete factor loadings. Cronbach’s alpha values for individual factors ranged from 0.65 (Factor 5: Texture and GI Problems) to 0.78 (Factor 3: Openness to Healthy Foods and Food Variety). Additionally, results from the item analysis indicated that nine items (i.e., items 2, 4, 11, 12, 14, 15, 17, 20, and 25) had inadequate variability in participant response and were not appropriate for usage with this sample.

Correlational analyses investigated the relationship between the five factors of child mealtime behavior and child BMI z-score and diet variables. Greater child BMI z-score was related to more problems with Lack of Healthy Foods and Food Variety (r = .20, p = .02), meaning children who do not eat healthy foods and who have a restricted food...
variety have a higher BMI. Fruit and vegetable servings were negatively related to Unwillingness to Eat \((r = -0.27, p < 0.01)\), meaning children who eat less fruit and vegetables display more unwillingness to eat. Total number of child daily calories and red food servings was not related to any child mealtime behaviors. See Table II for all correlations between child mealtime behavior factors and health variables.

### Discussion

There is a lack of previous research examining mealtime behaviors among rural children with overweight or obesity, as well as the relationship between child mealtime behaviors and child health outcomes in this population. Thus, the current study makes an important contribution to the literature by exploring the factor structure of a commonly used measure of mealtime behavior in a unique 

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**Table I. Factor Loadings**

<table>
<thead>
<tr>
<th>Item</th>
<th>Factor 1: food refusal</th>
<th>Factor 2: unwillingness to eat</th>
<th>Factor 3: openness to healthy foods and food variety</th>
<th>Factor 4: disruptive behaviors</th>
<th>Factor 5: texture and GI problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Takes longer than 20 minutes to finish a meal</td>
<td>0.47</td>
<td>0.05</td>
<td>0.15</td>
<td>0.05</td>
<td>-0.16</td>
</tr>
<tr>
<td>Eats junky snack foods but will not eat at mealtime</td>
<td>0.61</td>
<td>-0.15</td>
<td>-0.15</td>
<td>-0.14</td>
<td>0.13</td>
</tr>
<tr>
<td>Gets up from table during meal</td>
<td>0.64</td>
<td>0.04</td>
<td>0.01</td>
<td>-0.04</td>
<td>0.06</td>
</tr>
<tr>
<td>Delays eating by talking</td>
<td>0.45</td>
<td>0.02</td>
<td>0.04</td>
<td>0.06</td>
<td>0.01</td>
</tr>
<tr>
<td>Refuses to eat but requests food immediately after the meal</td>
<td>0.68</td>
<td>-0.09</td>
<td>-0.23</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>Enjoy eating</td>
<td>-0.03</td>
<td>0.67</td>
<td>-0.08</td>
<td>-0.04</td>
<td>0.14</td>
</tr>
<tr>
<td>Drinks milk</td>
<td>0.13</td>
<td>0.43</td>
<td>0.00</td>
<td>0.03</td>
<td>-0.03</td>
</tr>
<tr>
<td>Comes readily to mealtime</td>
<td>-0.14</td>
<td>0.50</td>
<td>-0.10</td>
<td>-0.11</td>
<td>0.04</td>
</tr>
<tr>
<td>Eats starches</td>
<td>-0.07</td>
<td>0.48</td>
<td>0.11</td>
<td>0.17</td>
<td>-0.01</td>
</tr>
<tr>
<td>Has a poor appetite</td>
<td>0.31</td>
<td>-0.45</td>
<td>0.38</td>
<td>0.12</td>
<td>0.10</td>
</tr>
<tr>
<td>Eats fruit</td>
<td>0.12</td>
<td>0.48</td>
<td>0.53</td>
<td>-0.03</td>
<td>0.06</td>
</tr>
<tr>
<td>Will try new foods</td>
<td>0.04</td>
<td>0.41</td>
<td>0.50</td>
<td>-0.26</td>
<td>-0.01</td>
</tr>
<tr>
<td>Eats vegetables</td>
<td>0.08</td>
<td>0.47</td>
<td>0.52</td>
<td>-0.21</td>
<td>-0.02</td>
</tr>
<tr>
<td>Tries to negotiate what he/she will eat and what he/she will not eat</td>
<td>0.36</td>
<td>0.02</td>
<td>-0.44</td>
<td>0.35</td>
<td>-0.02</td>
</tr>
<tr>
<td>Tantrums at mealtimes</td>
<td>0.22</td>
<td>-0.14</td>
<td>0.12</td>
<td>0.45</td>
<td>-0.10</td>
</tr>
<tr>
<td>Whines or cries at feeding time</td>
<td>0.21</td>
<td>0.01</td>
<td>0.06</td>
<td>0.77</td>
<td>-0.11</td>
</tr>
<tr>
<td>Vomits just before, at, or just after mealtime</td>
<td>0.07</td>
<td>0.09</td>
<td>-0.03</td>
<td>-0.03</td>
<td>0.37</td>
</tr>
<tr>
<td>Eats only ground, strained, or soft food</td>
<td>0.00</td>
<td>-0.07</td>
<td>0.27</td>
<td>0.12</td>
<td>0.95</td>
</tr>
<tr>
<td>Has problems chewing food</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.15</td>
<td>-0.01</td>
<td>-0.02</td>
</tr>
<tr>
<td>Chokes or gags at mealtimes</td>
<td>-0.12</td>
<td>0.02</td>
<td>-0.07</td>
<td>0.26</td>
<td>0.08</td>
</tr>
<tr>
<td>Eats meats and/or fish</td>
<td>-0.11</td>
<td>0.34</td>
<td>0.28</td>
<td>-0.09</td>
<td>0.00</td>
</tr>
<tr>
<td>Lets food sit in his/her mouth and does not swallow it</td>
<td>0.05</td>
<td>-0.01</td>
<td>0.04</td>
<td>0.35</td>
<td>0.06</td>
</tr>
<tr>
<td>Spits out food</td>
<td>0.33</td>
<td>0.02</td>
<td>0.04</td>
<td>0.25</td>
<td>0.09</td>
</tr>
<tr>
<td>Would rather drink than eat</td>
<td>0.37</td>
<td>-0.07</td>
<td>-0.07</td>
<td>0.19</td>
<td>-0.01</td>
</tr>
<tr>
<td>Has required nasal-gastric feeds to maintain proper nutritional status</td>
<td>0.16</td>
<td>0.00</td>
<td>-0.23</td>
<td>-0.08</td>
<td>0.03</td>
</tr>
</tbody>
</table>

The bold numbers are the factors loadings that were considered significant.

**Table II. Associations Between Child Mealtime Behaviors and Health Variables**

<table>
<thead>
<tr>
<th>Health variable</th>
<th>Food refusal</th>
<th>Unwillingness to eat</th>
<th>Lack of healthy foods and food variety</th>
<th>Disruptive behaviors</th>
<th>Texture and GI problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMIz</td>
<td>(r = -0.14)</td>
<td>(r = 0.05)</td>
<td>(r = 0.20^*)</td>
<td>(r = 0.15)</td>
<td>(r = -0.12)</td>
</tr>
<tr>
<td>Fruit and vegetable servings</td>
<td>(r = 0.02)</td>
<td>(r = -0.27^{**})</td>
<td>(r = -0.15)</td>
<td>(r = -0.14)</td>
<td>(r = -0.06)</td>
</tr>
<tr>
<td>Total calories</td>
<td>(r = -0.04)</td>
<td>(r = -0.13)</td>
<td>(r = 0.13)</td>
<td>(r = -0.08)</td>
<td>(r = 0.01)</td>
</tr>
<tr>
<td>Red food servings</td>
<td>(r = 0.01)</td>
<td>(r = 0.07)</td>
<td>(r = 0.10)</td>
<td>(r = 0.06)</td>
<td>(r = 0.03)</td>
</tr>
</tbody>
</table>

\(^{*}p < .05, ^{**}p < .01\)
population, and by examining the relationship between mealtime behaviors and health outcomes.

Past work with the BPFAS in a population of children with chronic illness (Patton et al., 2006; type 1 diabetes mellitus [T1DM]) found several factors were consistent with Crist and Napier-Phillips’ (2001) original factor structure; however, two unique factors emerged (i.e., Dietary Burden and Disruptive Behaviors), likely reflecting the unique challenges faced during mealtime when a child has T1DM (Patton et al., 2006). Although pediatric overweight and obesity and T1DM are very different chronic illnesses, both likely involve some degree of stress for families surrounding mealtime. Just as children with T1DM must carefully track and manage what they consume, leading to the unique “Dietary Burden” factor found by Patton et al. (2006), children with pediatric overweight and obesity must often adhere to a strict diet if trying to lose weight. As such, the “Lack of Healthy Food and Diet Variety” factor that emerged in the current study may reflect the unique challenges faced by families managing pediatric overweight and obesity.

Study results suggest that some specific items of the BPFAS may not be appropriate with regard to measuring mealtime behavior for rural children with pediatric overweight or obesity. The BPFAS was originally used with groups of children who struggle to obtain enough calories, and greater food or caloric intake is seen as a positive behavior. In contrast, these same behaviors may be maladaptive and problematic for children who are overweight. For example, frequently eating starches or dairy may be a positive health behavior for a child who needs to gain weight, but is likely a problem for an overweight child with regard to weight management. Similarly, the item “enjoys eating” on the BPFAS reflects a positive behavior for a child with feeding problems who is struggling to gain or maintain weight. When this same item is applied to a sample of children with overweight and obesity, the function of the item may change and should thus be considered differently. There were several items with nontrivial loadings on multiple factors, suggesting that the subscales of the BPFAS do not assess unique aspects of mealtimes in this population. Further, the limited variability in participant response on several items indicates that the measure is not accurately capturing behaviors that are relevant for this population. It will be important for future research to examine whether the items that were found to be potentially inappropriate in the current study are also inappropriate for overweight nonrural children, and whether additional items are needed to assess mealtimes in this sample. Alternately, there may be underlying aspects or considerations that extend across multiple factors.

Feedback from focus groups and expert panels would likely be helpful in terms of generating ideas about problematic mealtime behavior specific to overweight and obese populations.

Although the BPFAS was originally developed for assessing mealtime in children 1–8 years of age, the current study extends use of this measure to children >8 years of age. The fact that many items did not function appropriately or load on factors may be partially attributable to the extension of the measure to a broader age range. Certain items such as “whines or cries at feeding time” or “tantrums at meals” may be more developmentally appropriate for only children of younger ages. However, many of the items assess eating habits such as “eats starches,” “gets up from table during meal,” or “will try new foods” that are not as related to developmental stage and may be appropriate for children of all ages. Future research should identify whether certain items on the BPFAS are appropriate for use with children of only certain developmental levels.

Related, it will be important for future research regarding mealtime behaviors to consider measures that apply across illness groups, as opposed to specific measures for a particular population. The merit of illness-specific and generic measures of health-related variables, such as quality of life, has been highlighted in the literature as an important contribution to research and clinical practice (Palermo et al., 2008). Given the broad applicability of mealtime behavior to a wide range of illness populations, it will be important to consider developing, validating, and using measures that can capture both within- and between-group differences.

The current study also examined whether specific categories of mealtime behaviors were associated with health outcomes. “Lack of Healthy Foods and Food Variety” was positively related to BMI z-score. This is logical, as children who are flexible with regard to eating healthy foods and eating a variety of foods may eat more, in general, than other children. Additionally, “Unwillingness to Eat” was negatively correlated with number of fruit and vegetables servings eaten. The “Unwillingness to Eat” subscale includes items that assess problems with eating fruits, eating vegetables, and trying new foods. This indicates that parent report of problems in these areas on the BPFAS was related to objective measures of fruit and vegetables from a 3-day diet diary. No correlations were found between factor scores and consumption of “red” foods or total calories, limiting our ability to form conclusions regarding behavior and these specific health outcomes. The lack of relationship between subscales of the BPFAS and these health outcomes may indicate that the items on the BPFAS are not related to these health outcomes.
The current study may have clinical implications for health professionals working with children with obesity. First, the EFA provided valuable information regarding assessment of mealtime behavior in this population. Specifically, some behaviors that present as clinical problems in other pediatric populations may not be as relevant to pediatric overweight and obesity. Second, the study provided some support for the relationship between certain mealtime behaviors, BMI \( z \)-score, and fruit and vegetable consumption in children who are overweight and living in rural communities. However, given the BPFAS may not be the most suitable measure for assessing mealtime behaviors in overweight children in rural communities, our results should be treated as tentative until further replicated. This is especially true in light of the sample age range; it is possible that the BPFAS would perform better in a sample of younger rural children. Our results suggest that it may be important for weight management interventions to include strategies to help parents increase the variety of food their children are exposed to, given the association between decreased food variety and BMI. This might include innovative cooking techniques or healthy ways to add preferred flavors to new foods. Future intervention may also want to consider ways to disseminate such interventions to rural communities. Past research has indicated that parents and health care providers are receptive to telehealth interventions targeting rural populations (Davis et al., 2011). Future research will want to examine the feasibility of family-based and/or group-based behavior modification interventions provided remotely. Such remote dissemination could also include cooking- and nutrition-based components, such as healthy cooking demonstrations or psychoeducation around building healthy and tasty meals.

The current study has several limitations. We were only able to present correlational data regarding relationships between factor scores and health outcomes; as such, causal interpretations were not possible. Our data (other than child BMI \( z \)-score) were also restricted to parent-report data, which creates the possibility of inflated correlations between certain variables. This was also a study of rural children, and therefore, the findings may not be representative of urban or suburban children. Additionally, because school staff was ultimately responsible for recruiting participants, study participation was not limited to a particular age-group or grade level, which may have impacted findings. As such, future studies should seek to test the factor structure of the BPFAS in nonrural populations, as well as the predictive and concurrent validity of the measure. Future researchers may also need to explore new methods of data collection, such as observational data, and should include children from different geographic groupings.

Despite these limitations, the current study contributes to the literature in several important ways. First, we have assessed the factor structure of a popular measure of mealtime behavior, and have suggested methods of overcoming shortcomings of the measure with this population. We have also found associations between certain factors, BMI \( z \)-score, and fruit and vegetable consumption. By doing so, we are able to suggest several important directions for future work in the field.

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**References**


